CALIFORNIA ENVIRONMENTAL CONTAMINANT BIOMONITORING PROGRAM

(BIOMONITORING CALIFORNIA)

SCIENTIFIC GUIDANCE PANEL MEETING

CONVENED BY:

OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

STATE OF CALIFORNIA

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JAMES F. PETERS, CSR
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A P P E A R A N C E S

PANEL MEMBERS:

Megan R. Schwarzman, M.D., M.P.H., Chair

Carl Cranor, Ph.D., M.S.L.

Oliver Fiehn, Ph.D.

Eunha Hoh, Ph.D., M.S.E.S.

Ulrike Luderer, M.D., Ph.D.

Thomas McKone, Ph.D.

Penelope (Jenny) Quintana, Ph.D., M.P.H.

Veena Singla, Ph.D.

José R. Suárez, M.D., Ph.D., M.P.H.

OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT:

Lauren Zeise, Ph.D., Director

Allan Hirsch, Chief Deputy Director

Russ Bartlett, M.P.H., Senior Environmental Scientist

Sara Hoover, M.S., Chief, Safer Alternatives Assessment and Biomonitoring Section, Reproductive and Cancer Hazard Assessment Branch

Martha Sandy, Ph.D., Chief, Reproductive and Cancer Hazard Assessment Branch

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH:

Robin Christensen, M.S., Environmental Health Investigations Branch

Nerissa Wu, Ph.D., Chief, Exposure Assessment Section, Environmental Health Investigations Branch

A P P E A R A N C E S C O N T I N U E D

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL:

Anne Cooper-Dohert, Ph.D.

June-Soo Park, Ph.D.

I N D E X

P R O C E E D I N G S

MR. BARTLETT: Good morning. I am Russ Bartlett and I'd like to just gather everyone here.

Thank you for joining me -- thank you for joining us today. So today's meeting is available via webcast. So as a benefit to the folks on the webcast, please speak directly into the microphone, and introduce yourself before speaking.

The materials for the meeting were provided to SGP members and posted on the Biomonitoring California website. There are a small number of copies and meeting materials available at the table near the door. We will be breaking today at 12:10 for lunch, and then we'll have another short break at roughly 3:00 p.m.

Restrooms are located, if you go back towards the way you came, just turn left at the staircase all the way down the hall on your left. And in the event of an emergency, our emergency exit is to my right at the back of the door. And that will put us back onto 10th Street.

Thank you. And then at this point, I will introduce the Director of the Office of Environmental Health Hazard --

MS. HOOVER: We're going to pause.

MR. BARTLETT: Okay. My apologies. So we'll still going to be on a short pause and we'll start the

meeting shortly.

Thank you.

(Off record: 10:04 a.m.)

(Thereupon a recess was taken.)

(On record: 10:06 a.m.)

MR. BARTLETT: Welcome once again. And at this point, I'd like to introduce the Director of the Office of the Health Hazard Assessment, Lauren Zeise.

DIRECTOR ZEISE: Hi. Welcome, everyone on this blustery day. I know that some people are -- there's been a lot of traffic and accidents, and so it's great that we are just starting a little bit late and all together. I'd like to welcome the Panel and the audience to this meeting of the Scientific Guidance Panel for Biomonitoring California. Thank you all in your -- in advance for your participation and sharing your expertise.

So just recapping what occurred at our last meeting, which was November 8th, 2018. After an update on ongoing program activities, we delved into community exposures to metals. That was the focus of our meeting. Program staff provided detailed presentations on metals -- metal results so far from the Biomonitoring Exposure Study, and the Asian Pacific Islander Community Exposures Project.

In the afternoon representatives from county

health departments in Northern and Southern California presented their perspectives on exposure to metals in their communities. We heard about successful approaches to community engagement, as well as some of the challenges they face in addressing community exposure concerns.

So a summary of the input from the November meeting, along with a complete transcript is posted on the November SGP meeting page, biomonitoring.ca.gov.

So today, we're going to be examining our Program priorities in depth. The Panel and audience discussion of this topic will be informed by a detailed Program update, as well as presentations from our newest Panel members on their research.

So you'll hear more about today's agenda from Meg, and I'll pass over to Meg Schwarzman our Chair.

CHAIRPERSON SCHWARZMAN: Thank you very much. Having left home in Oakland four hours ago, I didn't really think I'd be waltzing in at the last minute. But when your train has mechanical problems, your train has mechanical problems, and there's nothing to be done.

But I'm glad to be here, and I'm glad to see all of you. So a brief overview of the meeting. The point of today's meeting is to think deeply about Program priorities, both short-term and longer term. So we will get our Program update and then provide some input on

priorities for the Program's upcoming submission to the CDC funding opportunity for State biomonitoring programs.

We'll hear, which I'm really excited about, three presentations from our newest Panel members, as Lauren just mentioned, Veena Singla, Eunha Hoh and José Suárez on some of their research, particularly targeting what's relevant to Biomonitoring California. And we'll have time for Panel questions, and also a discussion following each presentation.

In the afternoon in particular, we have an hour set aside to reflect on those presentations in light -- or Program priorities in light of what we've heard from Panel members about their research. And the last item of the day is an open public comment period.

So if anyone wants to speak, other than the Panel, during either of the more formal comment periods, the Program update comment period or the open public comment period in the afternoon, please fill out the comment cards -- are they on the back?

MR. BARTLETT: On the table.

CHAIRPERSON SCHWARZMAN: On the table near the door. Okay -- and turn it into Russ Bartlett. There he is.

And in other question and comment periods, we'll have them be more open, please either come to the podium

or raise your hand, and I will call on you.

And for the benefit of the transcriber, please clearly identify yourself before you speak and make sure your name and affiliation are on the sign-in sheet for an accurate transcript.

If you're joining the meeting via webcast and want to provide comments, please do so via email at biomonitoring@oehha.ca.gov. That's biomonitoring@ O-E-H-H-A .ca.gov, and we will read allowed and paraphrase as necessary any relevant comments. And I want to now introduce Nerissa who -- Nerissa Wu -- no.

MS. HOOVER: We're going to pause.

CHAIRPERSON SCHWARZMAN: Okay. We're going to pause for just a sec.

(Off record: 10:11 a.m.)

(Thereupon a recess was taken.)

(On record: 10:24 a.m.)

CHAIRPERSON SCHWARZMAN: Try again. Russell, is the webcast on again?

MR. BARTLETT: Mics are on.

CHAIRPERSON SCHWARZMAN: Okay. Then we will resume. And I will introduce and welcome Nerissa Wu, who is Chief of the Exposure Assessment Section in the Environmental Health Investigations Branch at the California Department of Public Health.

And she's the overall lead for Biomonitoring California, and she will give us an update on Program activities.

DR. WU: Hi, everyone. Good morning. I am so sorry that it took us so long to get here. Best efforts. And I'm glad I didn't miss anyone's talk, because I'm really excited to hear from our Panelists today. It's kind of a treat for us to be able to hear about your work.

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DR. WU: But I'm going to start with the Program update, starting with the California Regional Exposure Study, or CARE, our region by region statewide surveillance project. There are some details about the study here on the slide, but I'm actually not going to spend a lot of time going over the protocol, since we've done that quite a bit in previous meetings, but happy to answer questions if anyone wants to go over that again. For those of you listening, it's also available on our website, some details about the study, if you are curious about the protocol and out -- and our ongoing recruitment.

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DR. WU: So we are currently busy in two different regions. We have Los Angeles County, Region 1, and Region 2, which is Riverside, San Bernardino, Imperial, Mono and Inyo counties, where we're currently

live.

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DR. WU: And as we've reported in previous meetings, we completed sample collection in Los Angeles in June of this previous year. We have 430 participants total from L.A. County, 428 provided a urine sample, and 425 of whom provided a blood sample. Everyone provide at least one of -- one of those types of samples, and everyone was able to fill out the exposure questionnaires.

Of the 430, 160 participants were selected for additional analyses for 1-nitropyrene, the biomarker of diesel exposure. And we had 60 female participants selected for phenols analysis.

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DR. WU: So we just finished results return, the primary results return for L.A. Of the 430 participants, 99 percent of the participants asked for their results back. We give people the opportunity to ask for or to decline their results, and almost everybody asked for them. And the packets for metals, PFAS, and the 1-nitropyrene results went back to participants in early February. And this is within one year of us starting enrollment in CARE L.A., which is very exciting. And participants will often say, a year? Why does it take so long?

(Laughter.)

DR. WU: And it seems like a really long time. But between recruitment and lab analysis and crunching the numbers, and then assembling the packets, it's actually quite a hard push to even get the packets out within one year. So the Program, kudos to everyone who worked really hard to get those out within the year.

The phenols did not make it into this packet, so they will be sent in a separate mailing to those 60 participants. We have a public meeting planned for spring, probably May or June. We're still working out the date and location. And we'll post that information as soon as it's available.

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DR. WU: So what did we find?

Well, we're still really in a preliminary stage of looking through the data. So this is very high level preliminary overview of what we have. We measured 10 metals, including three metals that were looked at in both urine and blood, lead, arsenic, mercury, cadmium, cobalt, molybdenum, manganese, thallium, uranium, and antimony. I think I got them all. And most of those metals were found in 100 percent, or close to 100 percent, of participants. The exceptions being uranium, antimony, and then urinary manganese. And they were found in a smaller proportion of

participants.

We had 48 participants, or 11 percent, have a level of concern -- a metals level over a level of concern. And it was mostly inorganic arsenic or mercury. And so we reached out to them with the early notification and our follow-up protocol.

For PFAS, similarly we found PFAS in everyone. Every single participant had at least one of the PFAS compounds in their serum. And on average, participants had seven different compounds. So far, we're finding that the analyses are consistent with NHANES, even taking into account the temporal trend. And we're continuing to look at that data some more to see if there are any -- any other demographic trends.

For 1-nitropyrene, we looked at two different metabolites, 6-OHNP and 8-OHNP. And you can see the detection frequency for both of those were quite high. Everybody, with the exception of two participants in this group, had at least one of the metabolites in their system. So only two of the hundred and -- it turned out to be 159 samples analyzed had some biomarker of diesel in their urine.

We are looking more thoroughly at that data. As you know, air pollutant, there's a seasonal trend to it, and we did collect samples between February and May, which

is a time during which air pollution is really going to change. And I think that will affect our ability to analyze the data, but we will have more for you in the coming meetings.

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DR. WU: So CARE data is exciting, because it gives -- because it gives us something sort of geographically and temporally appropriate to compare to. And what -- we're already having other researchers come to us and ask for data sets as a comparison as a baseline for California. And I think that will actually grow as we have more data and we make it publicly available. So that's a really exciting outcome from the CARE study already.

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DR. WU: Here we are in Region 2. This is just a reminder of what Region 2 looks like, what the zones are, and what our goals are for sampling in the different zones of region 2.

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DR. WU: And before we went live, we put a lot of thought into how we could streamline the study. We need to be as -- as efficient as possible, both from a budget standpoint, but also so it's a sustainable protocol that doesn't drive our field staff into fits.

So we spent a lot of time thinking about region 1, and looking at the participant management database. One of the benefits of our system is that we can look at how participants went through the system, see what took a lot of management, took a lot of time. And we made some changes based on what we found.

And one of our goals was to have a shorter field presence. It's very expensive and very labor intensive to move our office to another site. But having a shorter field presence means that we need to be really efficient. From the point people are interested in the study to the point that we have their sample, we need to be super tight and keep people in the study.

Part of that is having higher utilization of the internet tool, because it's so much faster to get people's informed consent and their study documents back, if they can do it via the internet. So we made some changes in how we -- how we recruited people into the internet portion of the study.

We also had a stationary field office this time around. Last year in Los Angeles, our sample collection site was mobile, meaning that every one or two days, our field collection -- our field staff would have to break down the site, pack everything back up, and then set up the next day. And we did this, because we wanted to be as

convenient for participants as possible. We wanted many sites across L.A., but it was very, very labor-intensive. A huge burden to staff, both in coordinating the field part of it, but also just having to make all those contacts in the community to set up all these different field sites.

So this year, we have a stationary field site that's located about half an hour away from the great majority of our participants. So it's pretty convenient to people -- for people to get to. We also have a mobile team that will go around and do home visits, as well as do those community-based events, but just less frequently. And having two field teams instead of one just helps us be a little more efficient and get our samples collected without our field crew having to work very long days.

We also spent a lot of time tweaking our participant management system. And as I referred to, this is the online system that participants log into. They activate their account. They fill out their informed consent and their survey. And then they can go ahead and schedule their appointment themselves.

We use a system on the back end to manage our participants and send out reminders and also track how participants are doing in the system. So we spent a lot of time streamlining data entry, but also making it a

little more user friendly. And again, we've tried to encourage people to use that instead of using the paper packets.

The participant incentive was another change. We gave participants in L.A. $20. And we heard back from a lot of people that that was not very much money. We know that people have to sometimes take off from work, sometimes drive some distance. They might need child care, and since $20 is -- is just not a lot of money in compensation.

We also wanted to make sure that the study is accessible to people across the socioeconomic spectrum. And so the incentive this year is $50. And we hope we see the result of that expediting recruitment and also in our ability to recruit across the population.

And finally results return, it's not part of our field presence, but the same people who are running our results return are also the people managing the participants. So the more automated our field -- our results return can be, the more available staff is to go on to CARE 2.

The packets are fairly laborious to put together. But this year, we were able to automate the assembly process through some SAS code that was put together by one of our staff. And this allowed us to get the packets

assembled more quickly, and also eliminated a lot of human error -- or the potential for human error. So we were able to get those packets turned around and out to the participants.

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DR. WU: So we're live. We have a field office set up. It's near Loma Linda. And we have our field staff. You see our mobile team and our -- our office team pictured there. We officially launched recruitment in mid-January. We sent postcards out to 79,000 households in randomly selected mail codes across the Region. And as for Region 2, we also then supplemented recruitment through Craigslist and by reaching out to Rotary Clubs, churches, libraries, universities, all sorts of community organizations.

And the response has actually been kind of overwhelming. As of March 4th -- so we launched -- so we sent out the postcards in mid-January. As of March 4th, we had almost 700 people filling out the prescreening form. And this is a short form that you can fill out online or on the -- on the phone, or sometimes we're at a community event and we fill it out in person.

And we collect eligibility criteria, some demographics, county of residence. And it's the people's way of letting us know that they're -- they're interested

and want to participate. It's preliminary, but we think about half of those have come in from the postcard, and the others have come in from Craigslist, a handful from community groups, lots of word of mouth through friends and colleagues, just a handful from social media. Those are our significant sources of people coming into the pre-screen.

We also use the pre-screen data to select our participant pool. It helps us determine where we need to focus our recruitment, if we need to boost participation across the region. And then we pull people taking race and ethnicity, gender, and their sampling zone into account. And then we select people for invitation into the study.

At this point, the pre-screening is skewing -- it's skewing female, it's probably 60 percent female. Not unexpected. It's often seen in recruitment. Pretty good distribution across race and across the different sampling zones. The median age is a little older than the median age of the region. Again, not unseen in other studies. But recruitment has been so quick that we've actually closed the pre-screening down early. It closed as of Sunday.

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DR. WU: Enrollment into the study has

correspondingly also been really quick. And this is enrollment status as of Sunday. So we have -- as I mentioned, we picked the people to enroll. And then we send out a packet. And that might go out on the internet, through an email -- sorry, looking through my notes here -- through the internet, and you get an email with all the directions on how you activate your account, or you might get a paper packet. As of Sunday, we had invited 414 people to enroll. And of those, 81 percent had elected for internet participation. So that's considerably higher than the 60 plus percent in L.A., which is great, because it helps us move people through much quicker.

And what I have shown here are status as shown in our tracking system. So it's just where people are in the study. They're not subsets of each other. And the numbers are really fluid, because people are constantly logging on or calling in to make an appointment. So they're going between those -- those different statuses. But it gives you an indication of how things are going.

So of the 336 people who are on the internet participation group that we've invited to enroll, all of them, except for 34, so 90 percent of them have actually activated their account and done something to get into the study. It's an extremely high uptake rate.

And, of those, very few are stuck in the activated account, completed informed consent, or completed exposure survey group. That's -- it's 40 or so people in those -- in those groups, but 173 people made it all the way to sample collection. And as of Sunday, 86 of them had already completed the study. They'd already made an appointment and shown up and had their samples collected. So again, super high uptake and showing up for their appointments.

If people make an appointment and then they cancel or miss it for some reason, they go into this missed canceled appointment category. And for this region, we've seen far lower missed and canceled appointments. Probably a function of the higher incentive. I'm sure that's helping.

I think the field office, because it's -- it's there at the same place all the time, it's much easier to make a replacement appointment. And our participant management tool, our staff is using it really efficiently. So if somebody misses an appointment, they're getting back and making a new appointment so they're back on the schedule.

There are many fewer paper people. As you see, the 78 people invited by paper packet. These invitations first went out February 14th. And it takes at least a

couple weeks for those to turn around and come back in. They have to fill out the packet and mail it back. It's usually about three-week turn around on average, based on our L.A. experience. So we have started to get packets back, but these numbers reflect that a lot of people are still in that invitation sent category, where we're waiting for their packets to come back.

I had to get these slides finalized, but as of yesterday, I think 12 more people had moved from invitation sent, and now they're somewhere in the pipeline. So those numbers are starting to go up.

And as of last night, when I looked at the updated sample collection, we're up to 104 samples collected already, and there are about 200 people in the sample, in the scheduled category. So we're really very close -- if those people all show up, we're very close to our goal for this region already.

We did do an additional round of invitations yesterday. So 62 more people will be added to this invited-to-enroll category. And so things are actually going great in Region 2.

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DR. WU: We are going to ship samples to the lab on an ongoing basis. The first boxes will be coming out next week. And that's so the labs can get a jump starting

to analyze those. We'll be in the field until May. And then after we pack things up, there's a lot to do, lab analysis, sample management, cleaning the data, and then we're back in results return mode with Region 2.

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DR. WU: And then we are prepping for Region 3, which is San Diego/Orange County. So we've already started to get inquiries, both from Region 3 and from around the state about when are you coming to my region. So that's really exciting. The word about CARE is obviously getting out. We're getting a little more just public recognition, which is exciting, and hopefully will help us in our recruitment efforts.

So, I mean, it is really exciting to report back on the second year, and that it's gone so successfully. And it's really exciting to see the -- that we can still improve, that we're able to make changes that help the whole -- the process go more smoothly. It's a huge testament to Robin who coordinates the study and to the whole staff that's putting a lot of work into this.

Statewide surveillance has been our aspirational goal for -- for the life of the Program. So it is really great to be out in the field and reporting back on actual work. And we're committed to keeping this going.

There are some uncertainty to be -- uncertainty

about our funding in the future. And as our funding changes, we may have to make some choices about what we can and can't include in the CARE protocol. And we've already had to go through that, right? We've already had to change our recruitment. We've had to go down to one region per year. But the hope is that we won't have to chisel away more at that -- at that protocol. I think we have something that's pretty robust. And we're generating data that is and will be useful to the state.

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DR. WU: So on to other studies. The East Bay Diesel Exposure Project. This is just a reminder of what EBDEP is. The child-parent pairs in San Francisco East Bay looking at the biomarker of diesel across households and age groups.

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DR. WU: The field work was completed February 1st. Forty child-parent pairs enrolled, including 15 families that were taking daily urines over the whole week. So that will be really interesting data to look at. The samples are currently all at University of Washington. And we're planning individual results return and community meetings for the spring/summer. And Duyen and Sara are both here if you have questions about that.

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DR. WU: Just a quick follow-up on the Asian/Pacific Islander Community Exposure Project. Last time we met, we presented data on both PFAS and metals levels, including the very high percentage of participants with at least one metal over the level of concern. And if you remember Karen Cohn from the San Francisco DPH was here. And she was very interested in taking the data and having it inform the work that they do. So we have followed up and met with APA Family Services, who is our community partner, and with San Francisco DPH together, and we've talked about ways that we can -- what do we do next? How do we use this data for educational work, for outreach work to their affected communities? And we're hoping that we -- that we continue this relationship and help bring some change to those communities.

We're also hoping still that we will be able to plan a community meeting for the San Jose region to present our ACE 2 data. And we're hoping that our continued collaboration with the San Francisco and APA will help us get that planned.

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DR. WU: And just a quick update on a few additional studies, the Foam Replacement Environmental Exposure, or FREES, Study. This is the intervention study looking at changes in flame retardant levels after home

furnishings were replaced. Kathleen Attfield will be presenting that data at the July SGP meeting comparing our FREES study with a control group. So that will be interesting.

We have the Measuring Analytes in Maternal Archived Samples, or MAMAs, where we use the Genetic Disease Biobank samples to look at POPs and PFAS levels over time. And I believe that data should be going up on the web in the next month or two.

And then we have the Northern California Firefighter Study. This is biomonitoring of the firefighters who were part of the strike team in the Tubbs Fire in Sonoma County last year. And those results should be going out to participants in the next month as well.

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DR. WU: So I want to turn to this issue of Program priorities. Last time we talked, we did talk about this. This is a little bit in philosophical terms about what our priorities were and what we could be doing as a Program to be most useful. And I want to continue that discussion but with a slightly different lens on it. I think you all know that our CDC funding is coming to an end in August. It was a five-year cycle, ends August 2019. And there's a new funding opportunity for another five-year cooperative agreement with biomonitoring

programs. So we're currently working on a proposal in response to this.

And for this round, CDC is allowing states to focus on statewide surveillance as one component, but also targeted biomonitoring, or biomonitoring as part of rapid response, as a second component.

And as I said, we're committed to the CARE study. We're committed to statewide surveillance. And that will make up the bulk of our proposal. But what I would like to raise here is -- for a discussion is what are our some of the priorities that we could focus on for the targeted studies, what are California specific needs that we should be addressing, who are the vulnerable communities of -- that we should focus on, and what might be state-specific exposure.

So a match between populations and analytes of interest that we should -- that we would like to understand better. I mean, in the past, we've looked at flame retardants and the California specific flame retardant exposure, and how the regulations made us unique in that way. We've focused on our Asian population and the high mercury and arsenic levels that we're concerned about.

And in this forum, we've talked about wildfires, both as a wild -- as a workplace exposure to fire --

firefighters, but also as an impact to the general population, where different -- different exposures might be -- might be important to look at.

So in looking for a discussion and some guidance in ideas that we could put forward as priorities for the Program, again both population based, but also laboratory analytes of interest. And this is a discussion that's kind of focused on our CDC proposal. And the timeline of this is pretty short.

But just to put it out there, we'll also be having this discussion in July in preparation for our leg report, Leg Report 6, which is due at the end of this year, and we'll want to have some discussion of program recommendations going forward.

So with that, I --

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DR. WU: Oh, this is the slide I just described.

(Laughter.)

DR. WU: Okay. Well, why don't I leave it up here as part of the discussion. But before I do that, let me just -- I just do want to put this slide up, because we do have -- many of our staff couldn't make it. There are a lot of conflicts today in the schedule, but there are lots of staff people who don't come up here and present, but who have been working very hard on all of these

studies. So I just want to acknowledge them here. But let me go back and open it up for comment.

CHAIRPERSON SCHWARZMAN: Thank you so much, Nerissa. I want to start as usual just by inviting Panelists to ask Nerissa any questions about stuff that she's presented.

So, Jenny.

PANEL MEMBER QUINTANA: Hi. Thank you for that very impressive work. I had some questions on the CARE 2 study. And these basically have to do with diversity. So one question was on the slide that talked about the prescreening pool. And you said that they were skewed female and older. Are -- were they also skewed in terms of income? Were they skewed towards higher income that you recall?

DR. WU: I believe they were skewed towards higher education level as a proxy for education. So it is a challenge for us always how we recruit across that -- across the spectrum. I don't have really a good breakdown in my head. Kathleen Attfield, who will be here this afternoon, might have a better sense of that, because she's the person who's really taking a closer look at that data.

PANEL MEMBER QUINTANA: Another question was about the enrollment status slide, they had paper and

internet. And were these all in English language or there were some in Spanish?

DR. WU: No, the whole study --

PANEL MEMBER QUINTANA: Like what was the breakdown on that?

DR. WU: Okay. The whole study is available in English and Spanish from the recruitment materials, the packets, our phone service, everything is -- most of our staff is bilingual -- our field staff is bilingual. And we do outreach specifically to groups that -- that have a constituency that is bilingual or Spanish speaking. We have not been super successful. I think our enrollment rate at this point is nine percent Spanish speaking or primarily Spanish speaking.

So we could do a better job. We've tried by -- mostly through community groups to recruit in those demographics and haven't been entirely successful. One of the things we'll do as our study progresses is we'll take a look at the participation pool. And as we did last year, we may hold some targeted recruitment where we go and exactly sign people up and go through the whole process on site with a community group and boost our participation in that way.

PANEL MEMBER QUINTANA: Okay. So the nine percent is people that used Spanish for this form?

DR. WU: That's right.

PANEL MEMBER QUINTANA: Okay. Yeah, I was going to suggest that. So that was great. You already said that. Because certainly in some of the communities I can think of out there, that would be a little low for the -- in terms of community representation. And then we already discussed this, but I just want to make sure, this whole process is completely mobile friendly, is that correct?

DR. WU: Yes.

PANEL MEMBER QUINTANA: Because that would be important too.

I have more questions about the other part, but I'll leave it for here about CARE 2.

CHAIRPERSON SCHWARZMAN: Other questions?

Yeah.

PANEL MEMBER LUDERER: Kind of a related question regarding, you know, to be able to increase the diversity, socioeconomic status-wise, ethnicity, do you offer participants the ability to be able to come in at kind of non-traditional hours, weekends, evenings? You know, is it -- is that possible for them to be able to come in those hours?

DR. WU: Yes. Our office hours are Tuesday through Saturday, and we do have some evening hours. And we offer home visits, which are actually -- Robin could

speak to this. I don't know if the home visits are limited in their hours or if somebody has...

MS. CHRISTENSEN: Robin Christensen, Environmental Health Investigations Branch.

The home visits are limited to the same schedule. We have our staff working Tuesdays through Saturdays, and they are all asked to work late on Wednesdays to accommodate people who would like later on appointments.

CHAIRPERSON SCHWARZMAN: Is that your only question?

PANEL MEMBER LUDERER: Yep.

CHAIRPERSON SCHWARZMAN: Any other questions?

And, Jenny, if you want to go beyond CARE, please feel free to.

Yeah.

PANEL MEMBER QUINTANA: So I just want to get it back to your grant, which I'm sure is pressing, if it's due in April. That was the Program priorities timeline and the California-specific issues slides. So you're thinking of rapid response as one of your pieces for the grant -- a rapid response portion, is that what you said?

DR. WU: Well, CDC allows where they broke it down into two different components, one being surveillance and the other being targeted. And they actually use the phrase rapid response -- biomonitoring for rapid response.

PANEL MEMBER QUINTANA: It has to be one or the other or it can be both?

DR. WU: It can be either/or.

PANEL MEMBER QUINTANA: Okay. Good.

So, I mean, obviously, wildfires would be something where rapid response would be necessary, because they aren't predictable. I'm sure you're thinking about that.

But I was just wondering, is it appropriate here to talk about the California-specific issues and perhaps adding some items on that slide?

DR. WU: Sure.

CHAIRPERSON SCHWARZMAN: Yeah. Well, we're going to -- let me just make sure that there aren't other questions, because that's going to be the topic of our discussion.

PANEL MEMBER QUINTANA: Okay. I'll wait for that.

CHAIRPERSON SCHWARZMAN: Anything -- any other questions about the Program update, including beyond CARE?

I thought Oliver was sitting on something.

No. Okay.

Yeah. José.

PANEL MEMBER SUÁREZ: Yes. Okay. Good. Just a very quick question. Could you remind me about CARE 3

when you're planning on launching that?

DR. WU: It kind of makes me tired just to think about CARE 3. We will be starting our outreach -- just our general outreach and kind of figuring out the lay of the land there - and though I know some of you are from that region and we'll be talking to you I hope - and making connections in the region starting in the fall -- actually, probably starting in the summer, and really getting more serious about it in the fall after CARE 2 winds down.

I think we're going -- we're kind of on a 13-month cycle, so we'll probably start recruiting, I want to say February/March, and then run through -- through May. And we're kind of the same schedule now, but shifted by a month.

PANEL MEMBER SUÁREZ: And what do you think, are there some things that -- of course, you have learned a lot of stuff over these CARE 1 and 2, now coming CARE 3, are there any substantial differences that you might think when it comes to recruitment of participants or the way everything is carried out?

DR. WU: I don't know. Do you want to address that?

PANEL MEMBER SUÁREZ: Well, I'm not sure if you've gotten to that piece yet of thinking forward in

that regard, but if you have.

DR. WU: Well, yeah, not as an overview. But I think -- I'm turning to Robin, because she is really out in the field and can speak more to just like the ins and outs of the study, and things that have worked well in CARE 2. And they're very different regions, just in terms of how people move around, the presence of community groups. So some of that is some of the surveillance we need to do in San Diego/Orange to understand like what are best ways to communicate with people. But did you have anything to add?

MS. CHRISTENSEN: So Robin Christensen. Briefly, the -- what we're trying to do is make sure that our recruitment is fairly similar across regions, so that there is some sense of cohesion across the CARE study as a whole. But within that, we are able to tweak things around the edges to adjust to the region.

So, for example, for CARE 2, we increased the incentive. We definitely spent time improving our outreach materials. And we will do so again working with groups that are local to each of the subsequent regions.

One of the things that I think we would like to do is better figure out for ourselves a sense of timing, in terms of how to release that recruitment information to best encourage people to rapidly get through our cycle,

because this is repeated year, after year, after year. So we're trying to condense the recruitment and field work as much as possible.

CHAIRPERSON SCHWARZMAN: I wanted to ask as maybe a segue to the discussion, you mentioned about some of the ways that -- you know, I feel like the Program has been incredibly nimble and inventive about how to proceed with the study that was originally intended to be, you know -- maybe not this study, but at least the focus of the Program was to do a representative sample across the state. And that would presumably be more or less simultaneous, as opposed to sequential.

And I've just been impressed by how the Program has adjusted to the limitations of the budget to still produce very meaningful studies that -- that will be meaningful and useful in their own right, even though they're not what was originally envisioned.

And I guess I was just wondering if you could reflect for a minute, as we move into discussion, on -- so for clarification, the CDC grant, if California was awarded it, would not necessarily be significantly more funding over what's available now, it would just be to replace the CDC funding that's ending.

DR. WU: That's correct. So we currently have one million a year from the current cooperative agreement.

What is on the table now is up to one million per year, but an average of 750,000. So it's unclear whether CDC will choose to go with -- you know, whether they'll go with numbers of grants or dollar amounts in those grants, but it's up to a million. So it could replace or continue on the work that we're doing now. It will not be more.

CHAIRPERSON SCHWARZMAN: But it won't build on it. Okay. So that's an important frame maybe for our conversation. And it sort of obviates the need for my second question.

(Laughter.)

CHAIRPERSON SCHWARZMAN: Which was if there was possible for increased resources, some -- some reflection on priorities about -- just trade-offs about simultaneity versus number of analytes and that kind of thing. But I don't think those trade-offs are yours to make right now.

DR. WU: Yeah. We don't have either of those. So, I mean, we have made our case for -- we've tried to make our case for increased funding. I mean there are two different scenarios. If we don't have CDC funding, we run into a lot of problems, because there are lots of things that we can't do with purely State funding, not only in the volume, but because State funding is somewhat inflexible.

But to put things in context, we referred back to

our original conception of this Program, when we looked at sort of CalHANES kind of thing, where we'd be doing -- or even if CARE when we first proposed it, as a two- or three-year cycle, we'd cover the state in two or three years, we were looking at like a 10 to 14 million dollar budget to do that. It's just very costly to do this work.

So we have introduced a temporal bias. We have maybe -- there's some inefficiencies with doing it spread across the state. And to be frank, there is some discussion about whether doing this kind of quota-driven sampling over regions is -- if that is representative, there's definitely a push to harmonize the kind of statewide surveillance that's being done at -- sponsored by CDC and APHL.

And we have looked at the methods like probabilistic sampling that are generally seen as the gold star of surveillance. But when you look at the implementation of those, particularly in a place like California, we could check a box saying, yeah, we've done probabilistic sampling. But if the reality is you get a completely biased sample, I don't think that's serving us well.

And so we've -- I think what we have is the best representation we can get for the money we have to spend. And it's a little dissatisfying perhaps, but I think it

still will be useful and ultimately, you know, we're just doing the best we can.

CHAIRPERSON SCHWARZMAN: Okay. Any other questions, or I will use that to sort of segue to discussion. Let me just maybe make a quick check first for public comment, either in the room or online?

Nothing. Okay. Thank you.

So then we have time set aside, another 25 minutes or so, for discussion. And there -- rather than just staying -- there's two sides that we were going to show, if you wouldn't mind.

So this is where the Panel gets to reflect for the Program's benefit on ideas about priorities, particularly relevant to the CDC proposal -- funding proposal. So if you would just go to the first slide, just to reiterate what some of Nerissa talked about. This is the CDC funding opportunity that is targeting -- targeted at states to increase use of biomonitoring for state-specific exposures hoping to fund collaborations around biomonitoring, increase awareness of biomonitoring.

And their guidance to this proposing states is that proposals can focus on either of these -- well, they were lumped in Nerissa's slides, but here there are three -- these three areas, statewide surveillance, targeted biomonitoring, or rapid response studies.

So I think we've seen examples of Biomonitoring California doing all three of those. We have three of those even in this update from Nerissa. And so I think this is a chance to reflect a little bit on those.

If you want to go to the next slide, Russ.

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CHAIRPERSON SCHWARZMAN: Just to reiterate some of what Nerissa just talked about, the California specific issues that have been targeted and are potential targets in new funding are communities that are specific to California like immigrant populations or particular occupational cohorts. You know, we certainly have more pesticide exposures than most states, I would say. Are there issues that are particular to California like agriculture or other industry, elements of our population diversity that make us stand out, the significance of our air pollution, and, of course, wildfires, which overlap into the rapid response topic as is already being discussed.

And apart from kind of looking at it from a topic or a location lens likewise, are there particular lab panels, particular analytes to highlight that are priorities to maintain? Essentially is, I think realistically if we think about it, the emphasis on this slide should be on maintain.

So with that introduction, I'd like to open it to comments?

Ulrike, did you --

PANEL MEMBER LUDERER: Yeah.

CHAIRPERSON SCHWARZMAN: Yeah, please.

PANEL MEMBER LUDERER: So, you know, I think it's -- just looking at the CARE study so far, obviously, the metals panels and addressing the exposures to mercury and arsenic that vary quite a bit in -- higher in the immigrant communities, as we saw with the ACE study, I mean, that's -- I think that's really important, and I really want to commend the Program on doing that.

Another kind of California, not specific, but that is a bit different in California, is the flame retardant exposures. And that's something that the Panel has been concerned with since its inception, and the changes in -- well, in the phase-out of the PBDEs, but then also the change in the California regulation about flame -- how long materials have to withstand and be able to withstand an open flame.

Those things -- those changes, I think, are one of the pro -- things that the Program has been able to do is show changes over time as a result of those types of policy changes. And so I think that should be a priority to continue and maybe to bring into the CARE Study,

because that is a statewide exposure. I mean, we're really -- all Californians are exposed to that. And I think showing the effects, hopefully, of the changes in the regulation, as well as the phase-out of some flame retardants, and then potentially tracking emerging flame retardants. And that the Program has developed analytical panels for, for the organophosphate flame retardants for example, I think that that should be a -- continue to be a priority.

CHAIRPERSON SCHWARZMAN: Thank you. I want to point -- I should have pointed you, as I flagged the lab panels question, we all have in our packets this list of lab analytes that are a current list reported by biomonitoring and what studies they are -- appear in. And then also in the packets are the two lists of Biomonitoring California chemicals, both the priority chemicals and the designated chemical lists. And those have both been updated recently. So take another look, if you haven't seen them recently.

Jenny.

PANEL MEMBER QUINTANA: Hi. This has to do with just maybe throwing out some ideas. I'd like to echo what Ulrike said about flame retardants being very important, and especially as the exposures may be going to the lower income population if the older furniture is degrading and

exposing people, the new furniture doesn't have it.

But also I'd like to perhaps throw out that we've seen a lot in the news about rural water supplies. The large Central Valley community, many of whom have very small water supply utilities, or have their own private wells. And that may be an issue, I think, of particular interest to California.

And the other one I don't see there is also perhaps military populations since -- especially in San Diego, we have a large military presence. They have exposures in other countries and also exposures on base, and a very big population, at least for the San Diego region.

And then under the issues particular to California, it's not completely particular to California, but you already mentioned the metals in the Asian/Pacific Islanders, some of which may be due to dietary practices. And so I think in California, I see a lot of interest in how diet might protect us from environmental exposures.

So not just cultural practices in diet, but in general benefits of organic diets or any evidence that we can reduce exposures in the population through diet. And I'd like to throw that out as an idea of a priority. At least, I see that very much a strong interest for Californians.

And I'd also like to reiterate the importance of air pollution on the list. I think we should be thinking of biomonitoring, not only to uncover high exposures, but to demonstrate the effectiveness of public health policies. And I think in California that the push towards clean diesel is going to be one of the greatest public health successes of our time. And showing that effectiveness I think is important, just like everyone here has seen the huge drop in blood lead that happened after they banned lead in gasoline. It's a very famous graph about the importance of public health policy. So I'd like to reiterate that air pollution too.

Thank you.

CHAIRPERSON SCHWARZMAN: Yeah, Tom.

PANEL MEMBER McKONE: Again, these are thoughts. First of all, it's really -- it's great to see this work, and see numbers coming in. And I guess it's sad to see that there's things really showing up. But, I mean, we expected that.

So just sort of expanding. And I agree with what's been said so far. And I want to push it like on wildfires, and rapid -- mixing that with the rapid response. I'm sure there were a lot of people would -- really would have liked to have known during the two, three weeks when the air quality in Southern California,

and in the Bay Area, we -- I mean, I'm more familiar, because I was watching it so closely, the very high exposures to particulate matters -- particulate matter -- fine particulate matter and all the things associated with that.

And we really don't know it very well. We didn't -- we really could only monitor that with the Bay Area Air Quality Management District monitors, which aren't very many, and some modeling. And we really didn't know -- we could do some epidemiology, but we didn't really know what exposures were happening in people.

And, you know, I think if we have some protocols, like the diesel protocol, might be useful to just look for the types of combustion products that would be in wood smoke. I mean, unfortunately, this is going to happen again. I mean, it would be great if what was an isolated event last summer, where we had two to three weeks of really bad air quality.

Probably another one similar to that, that nobody has really brought up that I have often wondered about, is heat waves. Because when you get severe heat waves, a lot of other things happen, you trap chemicals, there's more volatilization indoors and outdoors of products. I mean, that might be one to focus on. But probably the wildfires would be a higher priority.

And then I had one other thought is Cali -- with something unique to California, probably mostly unique to California, is that the Office of Environmental Health Hazard Assessment invested a lot of time and effort into CalEnviroScreen, which is a projection -- it kind of projects where we expect the most impacted communities to be.

And it would be very interesting to over -- to make sure the biomonitoring provided some sufficient ground truthing -- not ground truthing, but some -- does -- what happens in the communities, what do we -- do we see differences in exposures? Because a lot of those communities are -- that come up high in CalEnviroScreen come up for the reason that they are close to a lot of pollution emission sources, agricultural releases. I mean, it's got built into it a way of saying these are factors that should increase exposure and health burden.

And this -- with some -- it may not even involve new biomonitoring, just learning to read the biomonitoring in the context of CalEnviroScreen. And that might be interesting hopefully to somebody at CDC that we have this tool that helps us map out problem areas in the state. And wouldn't it be great to just enhance or just better use the biomonitoring data that we're collecting to make sense of CalEnviroScreen.

Just thoughts.

CHAIRPERSON SCHWARZMAN: Please, Eunha.

PANEL MEMBER HOH: Yes. I think for the rapid response that I was thinking about, I mean, the wildfire is definitely really important. And we hear about like at Paradise, you know, the California that their dust -- currently even they're suffering from all the dust, you know, made from the fire last year. I think their exposure is almost close to the 9/11 the dust at the time of the New York City. And I think we may probably learn something from the 9/11 study. They're continuously working on their exposure study over there. It could be that chemicals could be also found in the -- those wildfires causing maybe similar chemicals as well.

Another point. I think there are some groups are studying like this -- the chemicals associated wildfires. And I'm in part -- I'm involved in a very little study. The water stream from the -- waters collected right after -- I mean, probably first storm and second storm events after the Napa Valley wildfires.

So -- and then there was also Santa Rosa there is a big fire. So we collected water and currently analyzing those waters samples. But I heard that other groups, like UC Davis, has like NIH rapid response kind of a grant about the air pollution, air quality stuff. And they

actually measuring some -- even conducting some non-targeted analysis for the air particulate matters in there. So I think we can probably learn something from their NIH study.

Yes. I think that's about it.

CHAIRPERSON SCHWARZMAN: If I could insert one thought. It's a small thought, but it's along the lines of Jenny's thought about organic diets as being health protective. And I've often felt like there's a gap in how well we're communicating who pesticide-intensive farming hurts. You know, we think about the health benefits of eating organically grown food, but I mainly think of it in terms of not poisoning the people who are growing the food.

And -- and I -- I think it may be powerful to study workers who are working on an organic -- in organic farm fields. We have a lot of data from CHAMACOS about farm workers who -- and their families who are in pesticide-intensive fields. And I don't know if there's -- this is a small and focused study. I'm not thinking of like putting this in CARE or something. But if there's a way to work with CHAMACOS and identify, in some region, coming up if there's -- it's such a targeted study, it's -- you lose anonymity. And I don't know how feasible it is from all those kinds of ways.

But just in terms of throwing out ideas, I've been -- I've always been interested if we cannot just demonstrate high exposures from an activity that we suspect to be risky, but also demonstrate the ability to lower exposures by and through an intervention, right?

So this would be -- it would be pretty striking. If you start to take the data on health impacts that comes from biomonitoring studies like CHAMACOS and then show that not only farm workers but surrounding communities and their families are not exposed that way around less pesticide-intensive operations, there could be some public policy power in that.

So I don't know where that fits in the priorities for the CDC grant, but it's a topic that has interested me.

Other -- Veena.

PANEL MEMBER SINGLA: Thank you so much for that great presentation. It's super exciting to see how well CARE is proceeding.

So I wanted to second some of the comments that were made earlier about the metals, and flame retardants, and the utility there, and also add on about the PFAS and support maintaining that, which is -- there is a national conversation going on right now in relation to PFAS drinking water standards, and amongst many states,

including California. And I think this data is going to be very valuable, both to inform that conversation about drinking water standards, and then also potentially to track changes once drinking water standards hopefully are enacted.

And thinking about issues that are particular to California, and thinking about some -- maybe some of the more emerging issues, one that came to my mind was -- was cannabis, which I think is of interest to California and a number of other states that I think is -- is going to be more and more widespread, as more states legalize, both in terms of cultivation and exposures that may result from intensive cultivation.

I don't know if there's specific practices or pesticides, especially related to cannabis cultivation, but I think that's -- there is going to be more and more of that in California and other states. And it would be good to know -- understand more about potential exposures related to cultivation, as well as exposures from consuming various preparations, because we -- we really don't know much at all about contaminants in cannabis preparations, whether it's pesticide residues or other additives. So trying to get a better understanding of if there may be exposures of concern there.

And then also thinking about emerging

technologies. I think that's something that California is very famous for. So being early adopters -- actually, innovators and adopters of emerging technologies. So things like 3-D printers, or wearable electronics that may be resulting in higher indoor or, you know, direct exposures to users of some of these emerging technologies to get ahead of maybe exposures of concern around those.

PANEL MEMBER LUDERER: Yeah. I wanted to also suggest that cannabis workers in the cannabis industry, both agricultural and the retail-related work, that that's a potential emergent -- occupational exposure group that the Program might want to continue -- to consider looking at.

And then regarding the wildfires, I completely agree that that's another California, not unique, but certainly a big issue in California. And so in that -- considering that, I think that in terms of thinking about which panels should be maintained, obviously PAHs is -- polycyclic aromatic hydrocarbons, is important because we know that they're generated during wildfires in large quantities.

CHAIRPERSON SCHWARZMAN: Maybe could I press that point for just a sec too, since lots of people have flagged wildfires as a rapid response topic for obvious reasons. But I think there's a significant nuance in that

about what one would want to study and when. Because certainly, there's the acute smoke exposure events that happen both for wildland firefighters and for residents in highly affected areas.

But then there's the long tail, right, and the clean-up period. And I think there's -- a lot of people are probably hinting at there's significant occupational exposures during that sort of clean-up and mop-up, and then reinhabitation period.

And that's probably a very different set of analytes. And I -- so maybe I would just elicit some thoughts from the Panel about that.

Eunha, were you --

PANEL MEMBER HOH: Yeah. Yeah. I think the metals are definitely important for the clean-up time. And I think also some industrial chemicals related to the building materials are probably important ones to be checked.

CHAIRPERSON SCHWARZMAN: Like benzene.

PANEL MEMBER HOH: Yeah. Yeah.

CHAIRPERSON SCHWARZMAN: Just to be specific, I'll insert that.

Any others?

PANEL MEMBER HOH: Definitely flame retardants. Yeah, but there are a lot of like plasticizers and also,

you know, a lot of things are used for building materials.

CHAIRPERSON SCHWARZMAN: Yeah. Well, I guess one of my questions is are you thinking combustion by-products of those materials or that the materials themselves are sort of liberated because of the destruction?

PANEL MEMBER HOH: (Nods head.)

CHAIRPERSON SCHWARZMAN: And maybe it's both.

PANEL MEMBER HOH: Probably both, yeah. Yeah. But I think it's probably more -- building materials are more like a settling that -- maybe the dust, not necessarily highly volatile, you know. Those are probably -- probably lingering for a long time.

CHAIRPERSON SCHWARZMAN: And with regard to benzene, just to sort of close that loop since I raised it, there's the, I think, an issue emerging now in Paradise with the water supply contaminated with benzene, right, which is presumably because of combusted building materials, plastics, and things. I don't know if anyone had anything else to add to that.

Carl, were you...

PANEL MEMBER CRANOR: Actually, the point was just raised. But let me -- two seconds or ten.

The combustion by-products that settle to the ground of flame retardants and, I don't know, whatever is in the building materials. I don't know if anybody

understand the chemistry of that, but that -- that would be a place to look to see what had been found there.

CHAIRPERSON SCHWARZMAN: Yeah. José.

PANEL MEMBER SUÁREZ: So I have a couple of comments and questions that I also wanted to turn back to the Biomonitoring Program.

So we were asked to think about the panels -- prioritizing which panels to maintain, more so than the expansion. And my understanding is the expansion mainly because of the funding situation that would be decreasing. Is that a fair assumption just, first of all.

CHAIRPERSON SCHWARZMAN: (Nods head.)

PANEL MEMBER SUÁREZ: So -- okay. So I have a good amount of thoughts what additional chemicals we could add. Let me just briefly talk about that, just to lay it out there.

One of the important pieces is with agriculture in California. Of course, California is one of the main producers for the country for agricultural products. And something that a class of pesticides that we -- that has been increasing substantially since the 90s, depending on which ones and some other ones since the mid-2000s are fungicides.

So now, it is estimated that about 40 percent of all crops are sprayed with fungicides. And since 1997,

there's been -- depending on the type of fungicide, there's been substantial increases. Even since 2007, there -- for example, with azole fungicides, there's been a five to six hundred percent increase in the use. And these are chemicals that we don't know very little about, and a little bit of the biomonitoring starting -- and actually with Dr. Hoh, we have this funded project in which we're going to be developing methods to measure these. And they have been successful at measuring some of those.

Another important class are QOI inhibitors. These are quinone outside inhibitors. Again, massively introduced in the mid-2000s. And we know nothing about, these from the toxicological data. They're finding all these epigenetic changes related to autism in rats, and also attention deficits.

And again, this is something that is very widely used. And yet, the biomonitoring of these is very rare throughout the world. So these are very emergent pieces that -- something that we should start thinking about.

When we compare it with other types of pesticides, we see that, for example, insecticides, the use does increase, but it hasn't been increasing at the rate of fungicides say in this case.

And then another piece that's important is the

use of glyphosate, which is very widespread. It is considered to be a probable carcinogen. And, of course, the methods for biomonitoring of this, my understanding is that it's pretty complex. But now, they're starting to do it in a couple of different labs. Very expensive to develop the methods, but also something that we know so little about, and yet it may have tremendous repercussions, especially seeing reports that glyphosate is now present in serial boxes in a lot of different products that people are eating.

So this is kind of to the adding piece of it. But, of course, we can add a lot of different things. So the part that I also wanted to kind of change and ask a question back to the Panel was, well, looking at the biomonitoring that you have been doing, and there is a very nice list of chemicals that there are there, are there perhaps some that you might be thinking, based on the trends that you're -- or that you're observing or potential health effects, that you would consider perhaps discontinuing to allow for new additional emergent chemicals to be measured?

DR. WU: You're asking of that of staff?

MS. HOOVER: He's asking that of us.

DR. WU: That is a really difficult question. I think it is, yes. It's a really difficult -- I think we

have raised that question here before, and we almost always conclude that we have to do everything. Because there are the new emerging chemicals, there are the legacy chemicals that we want to continue to track the trends, and it's a diverse group of researchers and everyone has like how could you discontinue PAHs. They're so important. The flame retardants are so important. I mean, every has got their pet chemical, I guess.

So I don't have an answer to what we would discontinue. There's certainly some methods that we have prioritized. And I do think that's an important discussion to have, because if you try to maintain everything, you end up not -- you end up not maintaining everything well.

And it's hard for us to have -- we went down this path in our last meeting. You end up not being able to deliver results rapidly, because, you know, you have to get back up to speed, because you've kind of let a method be inactive for a little while.

But we need help with that prioritization, because as a Program, we keep getting pulled in different directions as well. As far as the emerging chemicals, my understanding from CDC is it's not out of the question that they would fund development of a new method, but the real focus of the funding is to produce data. They really

want us -- if there's a method that we have to tweak because we know it's irrelevant and because we think it's -- you can apply it right away and generate relevant data, that's fine, but that's not really the emphasis of the funding, so we have to look somewhere else to -- if we do want to add methods, we would have to look somewhere else for funding.

CHAIRPERSON SCHWARZMAN: I want to just note, because it's time to move on to our presentation from -- is that okay? We're making up time. I don't know how you feel about that.

I just want to note that we have a significant time for discussion in the afternoon, also. So please keep these ideas percolating and we'll return to them, including sort of -- we can return to more of the longer term priority ideas in the afternoon.

MS. HOOVER: This is Sara Hoover of OEHHA. I'll just add one thing to Nerissa's comment, and also say that a lot of the things that are revolving around the discussion this morning will come up in Veena's talk, and Eunha's talk, and José's talk. So you will be -- have plenty of time to talk about it again.

Just to comment on the panel. So we prepared, you know, as Meg pointed out, this laboratory analytes reported by. And the reason why we narrowed it down was

exactly this reason, we're -- we already de-emphasized certain panels. So this is less than the full lab capability on this list. So that's already reflected. There's been a shift, for example, in the phenols we're measuring, so we're capturing some new ones. Our lab EHL is looking into measuring glyphosate, looking into expanding the PAH panel, looking into measuring VOC metabolites.

So we're always kind of making that calculation. And it's true, like -- as Nerissa said, we're not really dropping things. We're evolving them. So that's been the approach.

In terms of CARE, as you know, we prioritize metals and PFASs, but we have been able to add panels, you know, to different regions, and that's something we'll continue to look at. Like in the Central Valley, obviously pesticides seems like a really good candidate to try to add. So that's another way you can look at it in terms of targeted as well. Instead of just a whole brand new study separate from CARE, it could be kind of a nested study in a region of CARE.

CHAIRPERSON SCHWARZMAN: Great. Thank you.

So maybe that was particularly useful in just sort of getting us to start thinking. And we will have -- we're going to now move into the portion where we'll hear

from some of our newer Panelists, and we'll return to discussion this afternoon with that having had that input.

So in the next three talks, we will be hearing from our newest SGP members about some of their research and how -- then we'll want to reflect on how it can inform Program priorities. We'll hear from Veena before lunch. And then after lunch, Eunha and José. After each talk, we'll have time for some questions for the Panelists, and later in afternoon an hour for discussion to talk more in depth about both sort of near-term and longer-term priorities.

So I'm going to start by introducing Veena Singla. She's Associate Director of Science and Policy at the Program on Reproductive Health and the Environment at University of California, San Francisco. She was appointed to the SGP by the Senate Rules Committee in May of 2018. And she's here to present her research on Chemicals in the Indoor Environment and their Implications for Human Exposure and Health.

(Thereupon an overhead presentation was presented as follows.)

PANEL MEMBER SINGLA: Thank you so much, Meg. Good morning, everyone. I'm delighted to be speaking today.

So I wanted to start by telling you a little bit

about the Program on Reproductive -- yeah, is that better?

MS. HOOVER. Yeah.

PANEL MEMBER SINGLA: -- a little bit about the Program on Reproductive Health and the Environment, or PRHE for short. Our mission is to create a healthier environment for human reproduction and development through advancing scientific inquiry, clinical care, and health policies to prevent harmful environmental exposures.

And our model is somewhat unique in that we connect research and fundamental biology, exposure science, and epidemiology to informing evidence-based changes in clinical care and public policies with the ultimate goal of having healthier moms and kids.

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PANEL MEMBER SINGLA: So today, I'm going to talk about why the indoor environment is so important for public health in my research on consumer product chemicals in indoor dust. I'll briefly discuss some of the implications for human health and then finish up with some highlights for the Program.

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PANEL MEMBER SINGLA: So in developed countries, we spend about 90 percent of our time indoors. So that's thinking about in homes, offices, schools, the gym, transportation. And the indoors is really a unique

microenvironment compared to outside.

So there's a wide variety of substances that are found typically at greater levels indoors compared to outdoors. So these could be things like radon, mold, allergens related to unwanted pests, pesticides used indoor in buildings, and lead. And for many of these substances, it reflects the migration of chemicals from outdoors to indoors, or the presence of unwanted organisms.

There's also chemicals found at higher levels indoors like formaldehyde, benzene, flame retardants, phthalates. And these kinds of chemicals are linked to consumer products and building materials, and again found at significantly higher levels indoors compared to outdoors typically.

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PANEL MEMBER SINGLA: And that's because indoor sources, consumer products and building materials, like furniture, electronics, wall coverings, paints, adhesives, beauty products, all of these chemicals can be primary sources for -- all of these products, excuse me, can be primary sources for some of these chemicals, like formaldehyde, toluene, fluorinated chemicals, phenols, fragrances.

And these product-associated chemicals fall into

two kind of overarching categories: Volatile organic chemicals and semi-volatile organic chemicals.

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PANEL MEMBER SINGLA: So this 2013 study was really interesting. They investigated what characteristics of chemicals could be used to predict human exposure patterns. They looked at about 2,000 different chemicals and looked at characteristics like the annual production volume, releases to the outdoors, application volumes for pesticides, and was it used indoor or in consumer products.

And that last criteria that was it used indoor or in consumer products turned out to be the best predictors of what chemicals are detected in human biomonitoring studies. So it's kind of, in short, telling us that what's indoors tends to get inside of us.

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PANEL MEMBER SINGLA: And how does this happen? So this is my partner. He's a software engineer. This is his typical setup with his multiple computers. And, you know, when I show this slide at occupational medicine conferences, the first thing people want to say is the ergonomics are terrible.

(Laughter.)

PANEL MEMBER SINGLA: I know, but he won't listen

to me, so --

(Laughter.)

PANEL MEMBER SINGLA: All the chemicals in the -- in the products around us and in our building materials can off-gas, migrate, and abrade from products. And then these emissions can lead to human exposures by inhalation, ingestion, and dermal contact. And for volatile organic chemicals, for VOCs, inhalation is really the primary exposure pathway.

But for these SVOCs, these semi-volatile chemicals, they have a much more complex behavior in the indoor environment, where they partition between air, dust and surfaces, and products. So SVOCs, inhalation can also be an exposure pathway, but also air to skin, so air to dermal can be an exposure pathway, and from contaminated dust. So inhalation of contaminated dust particles, ingestion by hand-to-mouth contact, direct dermal contact dust to skin, and also direct product contact with products containing these chemicals.

And that direct product contact is especially important for products that could be applied directly to the body, like personal care products.

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PANEL MEMBER SINGLA: So dust in the indoor environment can kind of give us a snapshot of what SVOC

chemicals are present and circulating in that environment. So chemicals can migrate from products and building materials, from furniture paint and flooring, and partition between air and particles and dust. And this results in human exposure by inhalation, ingestion, absorption of this contaminated air and dust.

So we can look at dust to kind of get that picture of what SVOC chemicals are in the indoor environment, and also as a way to estimate human exposures.

So I wanted to understand more about what this picture looked like for current use consumer product chemicals in the U.S.

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PANEL MEMBER SINGLA: In collaboration with George Washington University and Silent Spring Institute and others, we undertook a quantitative meta-analysis of data on consumer product chemicals in U.S. indoor dust.

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PANEL MEMBER SINGLA: So overall, our approach was to conduct a systematic literature search to find U.S. data on chemicals of interest in indoor dust; and then compile descriptive statistics from the relevant data sets and assess their comparability; and then pool the data and conduct a meta-analysis of the chemical dust

concentrations; and then use those dust concentrations to estimate human exposures; and then finally to understand more about potential health implications to use authoritative lists to identify chemical health hazards.

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PANEL MEMBER SINGLA: So in conducting our literature search and finding relevant data, we used the following -- inclusion or exclusion criteria. So we were specifically interested in SVOC consumer product chemicals. So we excluded pesticides, pharmaceuticals, and metals. We were also interested in current use chemicals, so we limited our search to samples that were collected in 1999 or later, and excluded legacy or banned chemicals, like PCBs or PBDEs.

We also focused on dust collected indoors in the U.S. and collected with a vacuum cleaner. So in our initial literature search, we identified five classes of SVOC consumer product chemicals that had been measured in U.S. indoor dust, and that met these criteria.

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PANEL MEMBER SINGLA: So those five classes of chemicals were phthalates and their alternatives. They're used as plasticizers, especially in vinyl and PVC materials, upholstery building materials, environmental phenols and -- like bisphenol A, parabens, nonylphenol and

ethoxylates use -- also used in plastics, cleaning products, personal care products, fragrances used to scent a wide variety of everyday products.

Replacement flame retardants. So this -- because we were excluding PBDEs, we focused on non-PBDE flame retardants that were mostly being used as replacements found in furniture, children's products, electronics, building materials, and then PFASs, which we've already heard about used in stain and water repellant treatments, non-stick cookware.

So we con -- then conducted our systematic literature search for studies that met our criteria with these five classes of chemicals.

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PANEL MEMBER SINGLA: So we identified 31 studies that met our criteria that measured 172 unique chemicals. And -- there we go -- phenols and flame retardants were the classes with the most unique chemicals. And I think the proliferation of replacement flame retardants, 47 different unique flame retardants measured here really shows the proliferation after the PBDE phase-out of the different types of flame retardants being used as replacements.

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PANEL MEMBER SINGLA: So next then we compiled

descriptive information and statistics on chemicals that were measured in two or more data sets. So here, you can see significant attrition here. There was a lot of chemicals that were only measured in one data set. Especially for fragrances, 96 percent of the fragrances were measured in only one data set.

And so for -- then for each of these studies, we looked to compile quantitative data on the sample size, the year of collection, the chemical detection limit, the detection frequency, and the chemical concentration, the percentiles, minimum/maximum concentration standard deviation.

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PANEL MEMBER SINGLA: Then for the meta-analysis, we focused on chemicals that were measured in three or more data sets. So now we're down to 45 chemicals total, and we're seeing significant attrition, especially in the replacement flame retardant and phenol classes.

So there was a lot of those chemicals that were measured in only one or two data sets. So for each of these 45 chemicals, we compiled the geometric mean and geometric standard deviation of each chemical's concentration from each data set, and then calculated the pooled geometric mean and the 95 percent confidence interval.

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PANEL MEMBER SINGLA: So a little bit more about these 45 chemicals and the data sets. So the samples in these studies came from 14 different states, and the -- here, the size of the circle represents the number of studies in that location.

So we see that kind of clustering of the samples on -- on the coasts, and especially around research universities for the flame retardants. So it's a limitation that our data may not be nationally representative.

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PANEL MEMBER SINGLA: And where did the samples come from in terms of indoor environments?

The vast majority were from home environments, single-family homes, apartments, condos, other residential environments. And there were -- so there were over 1,500 samples from homes. Some of the non-residential environments included day care, schools, fire stations, gyms. So our results are likely much more reflective of the home or residential environment.

So one of the first questions we had was across all these studies different environments and different locations was there anything in common between all these places?

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PANEL MEMBER SINGLA: And indeed there was 10 chemicals that were consistently detected across all of these data sets. So 10 chemicals from four classes were detected in at least 90 percent of the samples tested. So there was four phthalates -- ortho-phthalates specifically, one fragrance, three flame retardants, and one paraben.

So this suggests that there's very likely common sources of these chemicals that are pretty ubiquitous or widespread in almost all indoor environments. This could be things like wires and cables, building insulation, other electronics, furniture that could be contributing these chemicals to all indoor environments.

So the next we wanted to look at the concentrations of chemicals in dust.

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PANEL MEMBER SINGLA: So here, we're looking at the pooled geometric mean in nanograms per gram with the 45 chemicals there along the bottom.

So first, we see in blue the general pattern that the phthalates are found in the highest concentrations in dust, followed by phenols in green, replacement flame retardants in red, and our lone fragrance there all at somewhat similar concentrations, and then PFASs in purple

at the lowest concentrations in dust.

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PANEL MEMBER SINGLA: So next we used these dust concentrations to estimate human exposure. So we started with that average concentration in dust, and then used partitioning theory to estimate the levels in air. And we looked at the estimated total residential intake for an adult female and a young child. And this does not account for other sources of exposure to those chemicals, such as product use or from foods. It's only looking at the indoor residential intake.

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PANEL MEMBER SINGLA: So here is the intake assessment results for the child looking at the chemicals there along the bottom. And what we see is that here there on the order of estimated intake with the chlorinated flame retardants and some phthalates there on the right standing out as having the highest estimated residential intakes.

When we look at the exposure pathways contribution, what we see is that the contribution from dust can vary actually quite considerably, based on the chemical.

So here in red is the contribution from dust ingestion. And the dark blue and light blue are air

inhalation and dermal from air. So some significantly different patterns based on the physical chemical properties of the chemicals, where they partition differently between air and dust, and make inhalation a more dominant exposure pathway for some of them.

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PANEL MEMBER SINGLA: So then finally, we wanted to understand more about what we know about the toxicity of these chemicals. So to do this, we used the California Safer Consumer Products Candidate Chemical List, which I think many of us are very familiar with.

This has hazard traits for chemicals which have been identified by selected authoritative bodies. So here, we're down to 35 chemical. There were six of our chemicals that weren't on the list. And for some of the substances that are typically found as a chemical mixture, like the flame retardant hexabromocyclododecane, the hazard data was for the mixture, not for the individual isomers.

And for the six chemicals that were not on this list, it likely reflects more of a lack of data than necessarily that we know there's a lack of toxicity, because our searches of toxicology databases turned up very little information on those particular six chemicals. These were more emerging chemicals.

So here's what we found.

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PANEL MEMBER SINGLA: We're looking there at the hazard traits identified by the list, so for reproductive or developmental toxicity. And then at the bottom, the chemicals are ordered in the order of estimated intake with the highest at the right.

So we can see for the high intake chemicals some trends. The ortho-phthalates there in blue, the -- it's a class based on some common structural elements, and see some consistency with multiple hazards in that class, and see some similar trends for some of the other chemicals, like the PFASs as well with, again, common structural elements, which could contribute to toxicity there.

The phenols in green are kind of somewhat diverse structurally, but they -- we do see some commonality there with endocrine and reproductive toxicity, which is -- could be related to that common toxicity of estrogenic activity often found in the phenols.

And then flame retardants are also quite a diverse class structurally. We do see some trends of neurotoxicity with the brominated flame retardants and carcinogenicity with some of the chlorinated flame retardants.

I think the other feature here of note is that

looking across the rows at the hazard traits, we see that multiple chemicals are associated with the same hazard trait. And reproductive endocrine and developmental toxicity is the most common hazard trait we see here.

So this raises concern for cumulative effects, and how the effects from exposures to multiple of these chemicals in the indoor environment could add up. So there is concern for cumulative exposures, but we also wondered if there was any information on how risky anyone of the individual chemical exposures might be.

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PANEL MEMBER SINGLA: So we did an analysis looking at sort of the best health based risk level we could find. There's no health based risk levels for indoor dust, so we used EPA soil screening levels as -- as sort of a proxy. And so here we're looking at the chemical concentration in dust for these four different chemicals where we could do the comparison with EPA soil screening levels. And the -- so the circles are the average level in dust, and then with the triangles showing the highest concentration in dust found in each study that measured that chemical. And then our black bar is the EPA soils screening level. And the red fill indicates where there's dust levels that exceed the EPA soil screening level.

So for the phthalate DEHP, the average level exceeded the EPA soil screening level. And for some of the other chemicals, some of the highest concentrations found exceed the EPA soil screening level. So there could be concerns for a portion of the population with those higher levels.

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PANEL MEMBER SINGLA: So overall in summary, looking at these five classes of SVOC consumer product chemicals, phthalates kind of stood out as having the highest levels in dust, the highest estimated intakes, and multiple hazard traits.

And there is concern for daily co-exposure to multiple chemicals in the indoor environment. So this -- this kind of profile that we see, again, is likely representative of a residential environment. And we're -- we're not sure how generalizable it is, but it does indicate concern for the potential for multiple co-exposures to chemicals from each of these five classes.

And some of the levels of the individual chemicals in dust do raise concern as they exceed the EPA screening benchmarks.

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PANEL MEMBER SINGLA: So some highlights for the Program. I think that again dust is really interesting

because it presents this snapshot of what's happening in the indoor environment. So we see that longitudinal dust samples can kind of track policy changes, as well as human exposure trends.

So here, we're looking at PBDEs in repeat California house dust samples. The researchers went back to the same households in two different time periods, and we see a significant decrease in PBDEs reflective of California State bans, as well as national phase-outs there with the levels going down in dust.

And we can also see that trend in biomonitoring data. So this is a study looking at PBDEs in pregnant California women, specifically seeking care in San Francisco. And we can see the trend again over time significant decrease in PBDEs reflecting those policy changes.

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PANEL MEMBER SINGLA: So a couple things to think about, which were already actually raised some this morning in our discussion, is there, the last one, thinking about tracking exposure trends to flame retardants. So last year, a Assembly Bill 2998 restricts flame retardants in select children's products, mattresses, and upholstered furniture. That's going to go into effect in 2020.

So I think there -- it could be very interesting to try to track exposures to some of the most common replacement flame retardants that are used in these particular products to understand what the trend looks like as this policy goes into effect.

I think studies to explore how indoor sources are contributing to exposures for some -- for some of the priority chemicals we talked about, the PFASs, the flame retardants, would be really interesting, whether it's an interventional study design, like the -- the foam replacement study or other types of designs that could help us better understand how some of these very common indoor sources like electronics, flooring or textiles might be contributing to exposures for some of these specific chemicals.

And I also think it would be interesting to think about the potential for dust sampling to complement the human biomonitoring data. So whether that's researcher collected, which is certainly more resource intensive, to have, you know, researchers go to participant's home to collect dust samples and would likely require additional funding, or whether there's information that could be gained from participant-collected dust samples, like from vacuum bags, which have more limitations in terms of the quantitative information you could collect, but could

perhaps generate some useful qualitative information on kind of chemical profiles, and the presence or absence of specific chemicals.

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PANEL MEMBER SINGLA: Thank you very much.

(Applause.)

CHAIRPERSON SCHWARZMAN: Thank you so much, Veena.

We have until 10 past 12:00 for questions for Veena. And a reminder that this will all, along with our two other Panel presentations, feed into a discussion later in the afternoon.

So, Tom.

PANEL MEMBER McKONE: Thank you. Really interesting.

I had a question or some comment maybe about the -- I don't know the slide number, because they don't show up on my printout, but the one showing the concentration ranges.

PANEL MEMBER SINGLA: Um-hmm.

PANEL MEMBER McKONE: So it's way back, maybe in the middle. It comes in just -- there. So what's -- so these are the means and the variance of the observations?

PANEL MEMBER SINGLA: Yeah. So it's the pooled geometric means and the 95 percent confidence interval.

PANEL MEMBER McKONE: Okay. So what struck me on this is the phthalates. I mean, there's a lot of variability here, but the phthalates, it's almost like almost everybody has the same source of phthalates. Whereas, you know -- which you would expect. Not everybody is using the same phenols at the same rates. There's going to be a lot of variability household to household.

Is that -- I mean, is that -- is there an underlying understanding is that we all just have phthalates in our houses --

PANEL MEMBER SINGLA: Yeah, that's --

PANEL MEMBER McKONE: -- so consistently that you don't see a lot of variance?

PANEL MEMBER SINGLA: I thought that was interesting as well for a couple of reasons. One is that in thinking about human exposure to phthalates, food and diet tends to be the thing we think about the most, and not necessarily the indoor environment.

And what this -- what this is suggesting is that there is something very con -- appears to be something very consistent across the indoor environment that could also be contributing fairly consistent -- consistently to phthalate exposures.

And I would -- my hypothesis around the -- around

these particular phthalates would be focused on building materials, because they're very commonly used in vinyl and PVC building materials, which are very widespread.

PANEL MEMBER McKONE: And flooring. Now so much of flooring now is actually synthetic. It works better than real world for a lot of people.

PANEL MEMBER SINGLA: Yes.

PANEL MEMBER McKONE: Now, you didn't look at any phthalates that are in beauty products or health care products and hair.

PANEL MEMBER SINGLA: Yeah, so a number of --

PANEL MEMBER McKONE: I mean, I don't know how big it is.

PANEL MEMBER SINGLA: -- these phthalates are used -- they are very multi-functional in term -- in terms of their uses, so they're used both in building materials as well as personal care products. So DEP, for example, is one that's typically more used actually in personal care products, cosmetics, to carry fragrance. And DBP and BBP are both used in kind of -- both, like they're used in vinyl products, as well as things like nail polishes and other -- other kinds of paints.

So they're -- phthalates are interesting, because they're kind of like the PFASs. They're very multi-functional and have such a broad range of uses.

CHAIRPERSON SCHWARZMAN: Eunha.

PANEL MEMBER HOH: Very nice presentation. Very nice work.

I'm just wondering -- I'm just curious, you know, for even interpretation of my study too, I just want to hear your thoughts on it. You know, we use always the concentration based on weights per, you know, the gram of dust or gram of the sample size. Have you thought about like using more like a molar-based kind of concentration, which may be beneficial in some ways. I'm sort of like also thinking about, you know, when I'm looking at my data. You know, I'd like to hear about your opinion about it.

PANEL MEMBER SINGLA: That's a really good question. We -- in thinking about our intake assessment, we thought a lot about the fact that when you're looking at the concentration in dust, that doesn't speak to the bioavailability or any of the factors other than, you know, just the level in dust that could influence absorption uptake and the ultimate exposure.

So, you know, ultimately, we'd -- we decided it was a little too complicated to go down that route, and we kind of presented it as an estimate, right, like a general estimate of potential human intake. But I think to really understand the contribution of what's in the dust versus

some of the other pathways, you would need to understand some of those bioavailability issues.

CHAIRPERSON SCHWARZMAN: I'm curious if you have any reflections on the -- on the chemicals that weren't highly represented enough to make it through to the end of the study, because it's such an interesting project. And I really appreciate your presentation, pulling together all of these data that are from disparate studies and giving us a sense of what they tell us -- the story that they tell us when pulled together. And, of course, in that process you lose things. And it points us this kind of -- especially once you get to the point of meta-analysis, reduces the field of inquiry to those chemicals that are most frequently studied, not necessarily those that are most important, right?

And so I'm just curious for any reflections that you have on some of the chemicals that fell out along the way, because they weren't -- didn't appear in very many studies, if there are things that you would be interested in looking at more? Like I think it was -- even just creating the criteria of replacement flame retardants rather than looking at the same old flame retardants was really interesting and helpful in this. And are there other categories like that that you might create from these high numbers of chemicals in the early

descriptions -- like 47 different replacement flame retardant chemicals and 62 phenols, where there wasn't sufficient representation across the literature to see -- to do meta-analysis on it, but are there chemicals there that we should be interested in?

PANEL MEMBER SINGLA: Yes. I think the fragrances certainly stood out in that regard, where we saw quite a large number that had been measured in one study, and then we're down to one, and -- by our meta-analysis. And we had -- we had a few different thoughts about that.

One is that amongst these -- so for all consumer product chemicals, there's challenges with knowing what chemicals are in products. That's -- that is a general challenge. However, it's -- for fragrances, it seems to be an -- a special challenge with even knowing what chemicals to look for. So one of our thoughts was that that could be a contributor here, where there is just so little information on what fragrance chemicals are used at all that even doing the targeted analysis is difficult.

So I think the fragrances are a category where that could be targeted for more research, in terms of which chemicals and their patterns are in the indoor environment. I think the phenols also stood out. Even though we did have a good number make it through, there --

they were one of the classes that initially had the largest number, and many fell out. They were measured in only two data sets.

And, you know, as I understood it from some of the analytical chemists that we spoke to, that there -- some of them can be particularly difficult in terms of the methodology -- the analytical chemistry methodology to measure them. Maybe that's -- that's a contributor. But I think the phenols are really interesting in the sense of -- similar to the replacement flame retardants there is a number of phenols that are -- that have been and are being targeted for phase-out and replacement, and that we're going to see kind of a proliferation of replacements there. We're already seeing it with the bisphenols and the replacements for bisphenol A. We're seeing it a little bit with the parabens, with, you know, methyl-, ethyl-, butylparaben and the replacements for those.

I think the -- some of the nonylphenol and octylphenol, and those ethoxylates, there may be similar trends happening in the future. So I think the phenols are also of very interesting class in that regard with those -- there are probably going to be a lot of emerging chemicals.

CHAIRPERSON SCHWARZMAN: Thank you. Jenny, did you have a question?

PANEL MEMBER QUINTANA: Yes. Do we have time?

CHAIRPERSON SCHWARZMAN: One more, yes.

PANEL MEMBER QUINTANA: I'll try to make it short. We've done some work with house dust. And what I'm really struck with was some chemicals are quite fairly small variability, and you're seeing here the 95 percent confidence interval I believe on the mean, but there's some chemicals where most people are very low, and then one, or two, or three households will have 10,000 times more, 1,000 times more, or 100 times more. And so I was just thinking back to some articles some years ago that someone said in environmental health we should be looking at the top 10 percent exposed, not the mean exposures, because really that's who's going to be getting ill.

And so it made me think about if you had thought about looking at -- if you had the same order of chemicals, if you looked at the highest exposed, for example, as opposed to the average? I know you did show in the other graph the high levels in the dusts.

Any thoughts?

PANEL MEMBER SINGLA: That's super interesting. That's very interesting. I mean, we -- we kind of thought about those -- you know, those more highly exposed populations, more in the context of kind of health risk assessment, and that we should be -- and when we're

thinking about assessing health risks, and -- but, you know, potential actions to manage those risks, we should be thinking about those highly exposed populations.

But that's -- now, I want to go look at that data and see what that looks like if we looked at that -- you know, those -- some of those top-of-the-max levels and looked at the order of chemicals then what we would see. Because there is -- I'm thinking of a couple of studies on the flame retardants in particular that find like very high levels.

When there's large numbers of, for example, children's products in the home, they see, you know, 100 to 1,000 times higher levels of some of the chlorinated flames retardants that are commonly used in children's products. So I think there's probably factors like that that influence the indoor levels of all of these chemicals. So it would be really -- it would be really interest to look at that. Thanks for that idea.

CHAIRPERSON SCHWARZMAN: Thank you, Veena.

And we'll do more discussion after lunch. I'm sorry. We have to break for lunch. Is it a very quick question?

PANEL MEMBER CRANOR: Very quick.

CHAIRPERSON SCHWARZMAN: Okay.

PANEL MEMBER CRANOR: Given what you've just

said, this is just to suggest another item for the agenda, if building materials are the source of many of these things you're talking about, would it be worthwhile for the Biomonitoring Program to look at the people that build the houses and work with these products that go into the walls and so forth?

PANEL MEMBER SINGLA: Definitely. And I don't want to stand between people and lunch, so I will say let's put a pin in that for the afternoon discussion, because I -- yeah, I have more to say about that.

(Laughter.)

CHAIRPERSON SCHWARZMAN: So we're going to break for lunch, and we will -- we have an hour and 15 minutes, and we'll reconvene promptly at 1:25. There's -- for Panel members, there's a hand out in your folder about some close -- nearby places. And a reminder to the Panel members before we conclude please, to comply as usual with Bagley-Keene requirements and refrain

MS. HOOVER: Carl.

CHAIRPERSON SCHWARZMAN: Sorry. We haven't quite concluded the meeting. I'm obligated to remind you to comply with Bagley-Keene requirements and refrain from discussing Panel business during lunch and the afternoon break.

Thank you.

(Off record: 12:12 p.m.)

(Thereupon a lunch break was taken.)

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

(On record: 1:25 p.m.)

MR. BARTLETT: Okay. Great. Welcome back. And at this moment, we will reconvene into our afternoon.

Thank you.

CHAIRPERSON SCHWARZMAN: Okay. So as we reorient to the afternoon, we're going to continue with our Panel member presentations of their work.

Next up is Eunha Hoh. She is professor of Environmental Health in the School of public Health at San Diego State University. And she was appointed to the SGP by Speaker of the Assembly Anthony Rendon in September 2018.

She is going to present her work on Non-Targeted Screening of Marine Organisms and Drinking Water; Newly Identified Persistent Pollutants.

(Thereupon an overhead presentation was Presented as follows.)

PANEL MEMBER HOH: Thank you. Thank you for giving me opportunity to give a presentation. And also I really especially thank you. Thanks to Sara for guiding me to make a proper presentation to the audience today.

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PANEL MEMBER HOH: So a little bit of introduction that how I got into more like discovery of the new contaminants, you know, new bioaccumulative contaminants, persistent organic contaminants was -- it was the same time that I kind of discovered -- at the time, it was a quite new flame retardants. It's called dechlorane plus. I found it in the Great Lakes.

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PANEL MEMBER HOH: That was really a thrilling moment. My last project of my Ph.D. work. And then that was published in 2016 -- 2006. But at the same time, there was another kind of paper, like this paper that they're talking about. Like, are there other persistent organic pollutants, a challenge for environmental chemists, which exactly I kind of felt that like -- after I finding a couple of new compounds, and I say like what about -- what about, you know, we're missing. How we're going to be more proactive.

So this paper I just introduced is kind of a inspiring me to continue the study. Yeah.

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PANEL MEMBER HOH: And then -- so the -- you might have thought was why is that certainly like marine organisms. You know, we're doing all this human biomonitorings, you know, discussion. One of the thought

was that, you know, we kind of found more signals in the wildlife sometimes earlier than actual human samples. So we kind of thinking about like what could be the alternative or could be the sentinels, you know, to give us early warning, you know, system for contaminants.

And what -- what are the marine -- what are the sentinels? What species could be good for us, you know? There's multiple sentinels, you know, people proposed.

One of the sentinels we have been working on is marine mammals. So marine mammals have their top predators, and they're primarily eating all those seafood. And then they're also mammals. So they kind of -- also, they have a kind of interesting body system, like have thick blubber. So they accumulated quite a bit of contaminants in their blubber.

So it's kind -- also, it's easy to get those blubber samples, which is huge amount, you know, that we can look at what chemicals are accumulated in the -- their blubber tissues.

Of course, there are -- also, another thing is where they -- their habitats. Also, they're living more in the coast, which are also humans -- or Californians, we're living a lot people in the coast. This is something kind of similarity there.

Also, you know, geographically the several

literature shows that difference of those mammals exposure to contaminants, really consistent with the use of the chemicals, you know, close to their terrestrial lens.

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PANEL MEMBER HOH: Another thing is the detection factors. So we know that they're an audience that, you know, if several people are working on the measurement side, and then -- you know, measurement is -- it's quite comprehensive, great -- quite challenging subject, because it has a lot of factors in it, like which instrument do we have to use, you know, what matrix is the best sample for detecting certain chemicals, and do we know about the chemicals actually we're going to measure?

So there are several factors really affect detectability, you know. So the ideal world, the instrument can probably detect a wide range of chemicals, and then sample matrix is actually really good sample, like a high -- accumulating a lot of chemicals in high concentrations, so we can detect the contaminants. And also, what if we are completely like, remote areas? We are completely clean area in it geographically. And maybe that samples may not really show a lot of chemical profiles.

But where the sample is coming from is also very important. I should say, you know, the

instrumentation-wise, all this detectability, single instrument cannot do all things, you know. So here, my study is just one of the case studies that I'm showing, you know, based on my publications.

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PANEL MEMBER HOH: So I've been working on like non-targeted analysis using GCxGC with time of flight mass spec. One of the great benefits of that instrument is the separation -- really high separation thing. Of course, non-targeted analysis, a lot of -- everybody is all agree that the huge amount of data. So what is the data reduction? Is that data reduction system? We should have it.

So we've been working on all the data reduction, specifically for halogenated organic compounds, because compounds contained halogens, like I'm talking about, even chlorines and bromines, now fluorines, and make the chemicals much more stable, more persistent, also bioaccumulative.

So something that, you know, we considered, the chemicals contained halogens. It's kind of a red flag. You know, there's something that interest chemicals. So we are able to isolate the chemicals containing chlorines and bromines, after we get the raw data, like a basically all the signals of the detection of the compounds.

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PANEL MEMBER HOH: I'm going to make it very short about these objectives of non-targeted analysis that people already know that, you know. We want to try to look at everything as possible, not only looking at the few target analytes. Targeted analytes is very important, because it really gives us the certain toxic chemicals that we needed to follow up, you know, and also the method -- like a method has to be developed very sensitive enough, you know, for the toxic chemicals.

Non-targeted is more likely, like what if we're missing? What about the total burden of the exposure? You know, so what if we're missing certain chemicals that we completely ignored or completely unintentionally, you know, missed?

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PANEL MEMBER HOH: So one of the also important of non-targeted analysis is the identification. So we pretty much based on the mass spectra matching. So we're using the database. For example, for this instrument, we're using the NIST EI Mass Spectral database, which contains about 250,000 chemicals of mass spectrum. So we basically use that for the match.

But also the best way of the confirmation definitely we have to use the authentic standards to

confirm the identity. So the bottom of the figure is basically like one of the just examples, like what about the -- what about the concentration? What about the quantitation?

So we were able to identify them. What about the concen -- what about the concentration quantitations? It's always a very important question. So what we do here that we kind of made it more like relative abundance within the samples. So basically, we're using the internal standard, adjusting the relative response. And the comparison is more like within the samples, like relative abundance order.

But once we found, once we prioritized the chemicals important, and then we actually performed the actual quantitation analysis for the -- more like a targeted way.

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PANEL MEMBER HOH: This is one example that we did like Southern California Bight. It's -- you can see the -- like, it's only eight dolphin blubber samples, but we were very excited about the results. We found about 327 unique halogenated organic compounds in the dolphin blubbers, which exclude PCBs and DDT and DDE.

So what we found was this enormous amount and number of halogenated organic compounds. The left panel I

just put that some listing the anthropogenic halogenated organic compounds. You can kind of see the PBDEs there, PCB there, mirex is there, you know, triphenyl is on the bottom, you know, DDE there.

On the right panel is also interesting compound that we found that these chemicals are naturally occurring in the ocean. And if you look at closely the chemical structures, they kind of have a little bit of similarity with the anthropogenic halogenated organic compounds in the left panel. So it's very interesting that those in the ocean actually producing the chemicals similar to the anthropogenic halogenated organic compounds.

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PANEL MEMBER HOH: And we kind of compiled that, what about this whole 327 compounds that -- what we know about it. So we kind of made it like anthropogenic, natural products, or some compounds actually made both ways, naturally or also anthropogenically. And then some compounds we have no idea where they come from. And you can see though those blue -- blue bar represents more like a typically monitored compounds, which means like a lot of literature, a lot of regulations, what they regulate, what they're measuring chemicals.

But the orange -- the red colors means like not really monitored, not much is studied halogenated organic

compounds. We pointed out, which is kind of important, like we're missing that part of the halogenated organic compounds.

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PANEL MEMBER HOH: Very important thing we thought was very interesting thing is that when we compared the relative abundance, and then, of course, we are -- it's coming from the Southern California Bight, DDT was huge. It's like really, really abundant -- most abundant in terms of the class among all the halogenated organic compounds.

When we're looking at those chemicals and identify them, and then we found a lot more DDT-related chemicals. We're talking about here with as in the table, is 23 compounds, or DDT-related compounds, which includes very well known DDT and DDE and also DDD.

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PANEL MEMBER HOH: But we also found a lot of degradation compounds of the DDT in the dolphin blubber. So we are -- we, of course, we banned the use of DDT. But now we're living in the -- now dealing with the degradation of the DDT chemicals, which I thought was pretty interesting.

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PANEL MEMBER HOH: The next thing was we found

was tris(chlorophenyl)methane, the TCPM. There are about 12 compounds of TCPM. You can see the structure is three benzene rings. So basically DDT, and they have another phenyl ring there, okay?

And we found several isomers, and then also there -- the TCPM with a different number of chlorines as well. We also found TCPM hydroxy-TCPM as well. There's several isomers as well.

So where are they coming from?

We -- it's -- we found a very -- a couple literature they mentioned about it. It's a by-product of the technical DDT product. And we also actually analyzed the technical DDT product, and we found these chemicals in the technical DDT product as well.

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PANEL MEMBER HOH: Another category of the DDT-related compounds was hexa to octa-chlorinated diphenylethylene. So the left two mass spectrum is an example of those compounds, is we couldn't -- there's no standard available, so we couldn't really confirm. But the -- based on the mass spectrum, which is pretty consistent mass spectrum with para-para DDE.

So basically DDE similar have a structure -- chemical structure bond, but it has different number of chlorines. So basically five chlorines, six chlorines.

We found like seven chlorines, you know, attached to this chemical structure bond.

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PANEL MEMBER HOH: So one of the thing was we were very interested in this TCPM, and then hydroxy-TCPM isomers in these marine mammals from the Southern California Bight.

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PANEL MEMBER HOH: What about the concentration? So is that -- are they abundant?

These are the DDT-related compounds. We quantified it in the eight blubber samples. As you can see, the DDE is highest -- para-para DDE is the most abundant, which is not surprising. And then DDD. And then those TCPM is actually fourth abundant compare -- you know, among the whole DDT-related chemicals.

And then we can see the other TCPM isomers next to it. And then hydroxy-TCPM also next to it. So they are actually more abundant than DDT in our analysis con -- in our analysis. And then we -- even also another degradation product at DDM. So we kind of see that TCPM and hydroxy-TCPM as pretty high.

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PANEL MEMBER HOH: And there's another study that we also looked at the short-beaked common dolphin blubbers

from the Southern California Bight again. We also found that you can see that on the bottom of the graph, the TCPM was quite abundant. So TCPM was quite abundant compared to other known anthropogenic halogenated organic compounds.

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PANEL MEMBER HOH: And this is another study we're currently in publication. This is more like a dolphin blubbers from currently live bottlenose dolphins in Southern California Bight. You see that the order of the abundant, that TCPM was pretty high. It was just next to the DDE.

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PANEL MEMBER HOH: And then this is another study that we recently published. It's more like a different marine mammal species. We used the five different marine mammal species. So one class is more like a dolphin species. The other is more pinnipeds like a sea lion, that kind of species.

The reason that I'm showing this result is that within the marine mammals, their chemical -- halogenated organic compounds, their -- the body burden, the chemical profiles are quite different. That means that probably -- they're living in the quite similar same habitats.

Of course, the food intake could be different,

but we think it's probably metabolism related. So the dolphins has a much more accumulated those chemicals in their blubber, compared to the pinnipeds. But both species, both classes species, we see that TCPM are quite abundant, both dolphins and pinnipeds.

So this is the -- the study was actually was more talking about discussing about which marine mammal could be the best sentinel species for us to know, you know, what chemicals we are also exposed. Like, why largest range of the chemicals what the species can tell us. You know, maybe that we have to choose.

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PANEL MEMBER HOH: This is the bird, not necessarily mammals. But this is the bird egg study in the San Diego Bay. Black skimmers are not necessarily top predators, but you can see that TCPM was also found in the -- in black skimmer eggs as well. So there was -- in the bottom, you can see the TCPM.

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PANEL MEMBER HOH: So we currently are working also California condors. They have a different habitats in the California coast and California inland, that their blood samples have very different chemical profiles in terms of the halogenated organic compounds. And we see that coastal condors definitely have a lot more

halogenated organic compounds. And then TCPM and hydroxy-TCPM were also found in the coastal California condors.

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PANEL MEMBER HOH: So I'm switching subject to the drinking water study. The original study was more focused on the efficiency of the advanced water treatment system in one of the water districts in California.

And then for comparison for reference points, we also measured -- analyzed the tap water. We collected tap waters at the same location as well. So their treatment products -- water products, and then we collected tap water just in the same site. They're not necessarily from the same water.

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PANEL MEMBER HOH: We did a five times sampling events, but we actually did -- the study focus was more like the water treatment efficiency. So we only collected tap water just twice out of five sampling events.

All the sample was triplicates collected. And then the water volume size, one liter. And we used the GCxGC time of flight mass spec. And then we kind of used this -- some -- it's called a statistical compare. It's a kind of data analysis tool.

The result was that in our an analysis -- our

non-targeted analysis, which is not focusing only halogenated organic compounds, in this case, we look at everything, okay? And we found about 28, 29 compounds in this tap water.

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PANEL MEMBER HOH: And then among these two sample sets, each has a triplicate. So here is 28 compounds and 29 compounds. That means they're all found in triplicates at 100 percent, okay? And then among these compounds, only five compounds actually were detected in both sampling events. Okay. So we're kind of wondering like what are those five compounds?

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PANEL MEMBER HOH: Those five compounds were detected in both sampling events. And then we tentatively identified. And then we're able to confirm four compounds out of the five compounds. The one compound was not matched with the authentic standard, which was suspected by the mass spectrum search, but it was not the compound. But the four compounds were confirmed through the authentic standards.

We also looked at this compounds, whether they were detected in their -- their treatment system. Just for curiosity, they were not detected in their treatment water system.

And the two confirmed com -- among the four, the two confirmed compounds contained halogens. So we're looking at the structures.

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PANEL MEMBER HOH: The one compound was parachlorobenzotrifluoride, and then the other compound was basically hydroxy -- the same compound, but has a hydroxy function.

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PANEL MEMBER HOH: So what we learned from these studies regarding this human biomonitoring. So one of the things that we learned from the multiple marine mammals, and wildlife studies, and especially from California, DDT is still very, very abundant, extremely abundant. And then now, we've been -- we've been working on the DDT measure compounds of the DDT, but we actually more maybe towards thinking about more DDT degradation products, because those marine mammals show that exposure to high DDT degradation products.

Another thing is that TCPM and then hydroxy-TCPM. Literature is very thin, almost very, very few studies reported these chemicals. But according to our studies, they're abundant -- they're quite abundant, and we -- we tested their technical product -- DDT technical product. These chemicals are very low concentration. So what does

that mean that we found these are very highly abundant in the marine mammals? That means these compounds are possibly -- especially TCPM is possibly biomagnifying, so -- which is something that we may have to think about.

Another thing is a recent -- very recent publication, probably within two days or something, ES&T actually published a study that TCPM was found in the sediment samples in California, which is the first study actually confirmed that TCPM was present in the sediments in the California coast.

And also a more interesting finding of that study, they found that the dumped barrel of the DDTs in the ocean, which was not -- it was the first -- first discovery. So there's quite media attention I think is happening.

So I -- my group -- my colleague, co-worker was contacted by the L.A. County, and also he kind of helped that group to -- about the paper not necessarily co-authored, but supported in some data analysis part.

So anyway, so that was kind of interesting part that we found all these chemicals in the top predators of the food chain in the ocean -- California ocean, but another group found them in the sediment samples.

What about this kind of monitoring implication? So we probably like also non-targeted screening of

chemicals in tap water. We only tested two samples, you know, but we felt like those chemicals were not -- you know, those are legally drinkable water, you know, and those chemicals were never reported in the drinking water.

So the current regulation of the EPA regulation or currently regulated list of chemicals didn't include those chemicals as well. So it's something about -- we have to think about the drinking water, tap water in different reasons and then different seasons in California.

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PANEL MEMBER HOH: Okay. So these are my acknowledgments, and then I'm happy to take some questions.

(Applause.)

CHAIRPERSON SCHWARZMAN: Thank you. We have time for questions.

Carl.

PANEL MEMBER CRANOR: Just a quick question. And I think you may have mentioned it, but I didn't hear it clearly. There was a lot of DDT dumped off Southern California. It looked to me as an outsider that your method for detecting these was a good method, but I wonder if you oversampled DDT in that region because of the long ago dump that you wouldn't find elsewhere? Do you have

any thoughts about that?

PANEL MEMBER HOH: Very good question. Yeah.

So we actually -- these marine mammals are not just living -- of course, it's Southern California, so that probably passing the area of the huge dump area -- dump sites. But we also studied like marine mammals from Brazil too. And then we found TCPM and hydroxy-TCPM quite abundant as well. So we think it's probably -- of course, regionally, we think it's important, but also it's quite abundant -- ubiquitous in the environment.

PANEL MEMBER CRANOR: Thank you.

CHAIRPERSON SCHWARZMAN: I want to clarify too that we're welcoming questions from the audience as well. It's not just Panel questions. And this is not a formal comment period, so you don't have to fill out a comment card. You can simply raise your hand and I'll call on you.

DR. SHE: I'm Jianwen She, California Biomonitoring Program.

Very exciting presentation. Just one question. You use the water to monitor the HOC giving the log Kow the very small for this organic -- persistent organic compound in the water. Maybe not a good sentinel metrics. That's maybe one comment. I'm sure you're already aware. So my guess maybe we should use water to monitor some

compound with the smaller Kow.

PANEL MEMBER HOH: Yeah, definitely. Yeah. So it was quite an eye-opening experience that I always thought was, of course, a particles, and that sediments, and more like a high Kow chemicals, you know, that we probably looking at certain -- you know, not really necessarily water samples.

But it -- my experience from this kind of water project it's -- we actually didn't focus only halogenated compounds at this project. And it was -- it was very interesting kind of thing, you know, that -- sometimes, you know, the chemicals do not behave exactly what we expect, you know.

CHAIRPERSON SCHWARZMAN: Question.

PANEL MEMBER LUDERER: Just a -- thank you very much for that presentation. It was very interesting. The question I had is about the TCPM and the TCPMOH. Are there -- what's known about the toxicity of those, anything?

PANEL MEMBER HOH: There's no toxicity data there. Yeah.

MS. COOPER-DOHERTY: Anne Cooper-Doherty, DTSC.

Just curious minds of what the other two chemicals were in tap water.

PANEL MEMBER HOH: Yeah. I think Martha

actually -- let me check the slides. The left compound that you kind of informed me that you found on document or something about the carcinogenicity or something.

MS. COOPER-DOHERTY: The other two.

PANEL MEMBER HOH. Oh, the other -- I'm sorry. I misunderstood. The other two are -- there's some hydrocarbons, but I couldn't remember. I cannot remember what they are. I can tell you later.

DR. SANDY: This is Martha Sandy from OEHHA.

Thank you very much for this presentation. I wanted to follow up on -- I can't remember the acronym, TCPM and the hydroxy. I'm not aware of them being biomonitored in people. Has anyone looked? Have -- I assume you've looked in the literature, are there any reports?

PANEL MEMBER HOH: No. No. There is a couple of studies they found in -- similarly like in some marine mammals or something, but not really human samples at all.

DR. SANDY: Thank you.

MS. HOOVER: Thank you so much, Eunha, and for being so flexible and doing so much updating. Great talk.

We actually did some poking around on TCPM, because we were very curious. And we found that NTP has done a tox profile of those. Did you -- have you seen that profile?

PANEL MEMBER HOH: No.

MS. HOOVER: Yeah. I mean, they also are finding that there's very little data. They were nominated to be looked at. But one question I had in terms of what they said, and we haven't delved into this, but in addition to being associated with DDT, as you said, they said that they are also reportedly used in the production of synthetic high polymers light fast dyes for acrylic fibers and agrochemicals.

Okay. So that's news to you. So we haven't looked into this at all, but I just wondered if you knew of other sources. I understand they're quite widespread in the environment.

PANEL MEMBER HOH: Um-hmm. Yeah. That's actually pretty good -- new information to me, yeah.

DR. WU: Hi. Nerissa Wu from Biomonitoring California. And thanks that was really interesting. Following up on Martha's comment about biomonitoring in humans. You were looking in blubber and in eggs or were you also --

PANEL MEMBER HOH: Yes, I did. Yeah, we did.

DR. WU: So are -- can you measure them in serum or are the detection levels not --

PANEL MEMBER HOH: Definitely I think so, yeah, but we -- we haven't had a chance to look at the serums

yet.

CHAIRPERSON SCHWARZMAN: Oliver.

PANEL MEMBER FIEHN: Yeah, great. How much material was needed. And, you know, if that is the sentinel, can we perhaps also use human fed biopsies?

PANEL MEMBER HOH: That's a very good question. I was thinking exactly about it. I'm using -- I use the marine mammal blubbers about one gram of the blubber. And then some of the studies I even like 0.3 gram or something, you know.

CHAIRPERSON SCHWARZMAN: Carl.

PANEL MEMBER CRANOR: I have a question. It seems to me that your sampling method might or might not generalize to other water systems, if you had long enough lived fish that transversed up and down them and so forth, and you could -- and they preserved enough blubber to store the material, so that would be one possibility. Maybe used in the Great Lakes even where -- where you have fish that travel around.

PANEL MEMBER HOH: Yeah, definitely.

PANEL MEMBER CRANOR: And then, of course, and to some extent this has been done how about predator birds, but that's been done. But I like your --

PANEL MEMBER HOH: Yeah. Yeah, definitely. That's what we do the California condors. Those are the

whole blood, not any fat tissue. But we're able to -- oh, actually, we're able to find the TCPM in the blood samples from condor -- California condors. We also collaborated with June-Soo -- June-Soo Park. And he shared his samples some like bird predators or birds eggs as well. And then we also found the TCPM quite abundant as well. We haven't reported it, but yeah.

PANEL MEMBER CRANOR: Those are really widespread then. Yeah, that's interesting.

PANEL MEMBER HOH: Um-hmm.

CHAIRPERSON SCHWARZMAN: I wanted to ask about you mentioned that you weren't only screening for halogenated compounds. You said when you did this it was non-targeted screening. And I'm assuming that you zeroed in on the halogenated, because that was where some of the interesting findings and surprises came out. Was there anything else that you would want to highlight about -- because non-targeted screening is something that we've talked about in here as an interesting way to step away from the problem of the -- focusing on the highly studied compounds and looking at what else is there.

PANEL MEMBER HOH: Um-hmm.

CHAIRPERSON SCHWARZMAN: Is there anything else that you would highlight from your non-targeted screening that -- not down this line of the halogenated.

PANEL MEMBER HOH: Oh, absolutely. So we -- we started with the halogenated organic compounds, because it's -- it's kind of -- it's relevant in terms of the persistence of bioaccumulation. But now we're -- it's more like bioaccumulated things. You know, so we're looking at the high food top predators, you know, the high -- the -- more like humans or something.

But we're looking at those environmental samples, even human samples as well probably. And we are actually expanded the non-targeted analysis for non-halogenated compounds as well, which requires more data analysis. But we made it quite streamlined that -- for the data reduction. So we're using like classic groups of chemicals -- groups of samples. So, for example, like I just showed a table that water samples. We always include fill blank water samples, which is the LC-MS grade highest purity water, you know, as a comparison, you know, the water. So that we're -- statistically we can find out what chemicals are there.

CHAIRPERSON SCHWARZMAN: I think I probably was confusing in my question.

PANEL MEMBER HOH: Okay.

CHAIRPERSON SCHWARZMAN: I was mainly asking if there was -- other than the details that you gave us here on the halogenated compounds you identified, were there

others that rose to the top of interest that were not halogenated when you were --

PANEL MEMBER HOH: Oh, were not halogenated.

CHAIRPERSON SCHWARZMAN: -- as the results of the non-targeted screening.

PANEL MEMBER HOH: Oh, results of that.

Very good question. We kind of found some -- the -- more like a UV filter-related chemicals. Yeah, so there's like a -- like a sunscreen related chemicals, yep.

CHAIRPERSON SCHWARZMAN: Great. Thank you. Other questions -- yes, please.

DR. SHE: Ask a question about data reductions. So sound like halogenated compound is not early because toxicity bioaccumulative and characteristics attract us. Also, analytical chemist we know it's easy to analyze, because isotope profile features.

So we use this unscreened technology to do other elements. Will be slight challenge. You already mentioned possible you need different data reduction technology. Can you talk about beyond isotope profile mass deficiencies as a feature you can use to identify, for example, UV filters, how you get data redacted to easily find them?

PANEL MEMBER HOH: Okay. So I think your question is using the mass deficiency.

DR. SHE: For the halogenated compound, you have the chlorine 35, you have chlorinated 37.

PANEL MEMBER HOH: Right, right, right.

DR. SHE: You have the bromine 79 --

PANEL MEMBER HOH: Right.

DR. SHE: -- bromine 81, which have strong --

PANEL MEMBER HOH: Right.

DR. SHE: -- isotope profile, easily to do the untargeted analysis.

PANEL MEMBER HOH: Right.

DR. SHE: But for other element, for like sulfur, harder a little bit, because 32, 34 is not typical strong.

PANEL MEMBER HOH: Yeah.

DR. SHE: Fluorines only one isotope --

PANEL MEMBER HOH: Right, right.

DR. SHE: So how you handle the other group of chemical without chlorine and bromine?

PANEL MEMBER HOH: Very good question. That's what I kind of tried to answer to Megan. So we don't necessarily use that -- the isotope patterns for other compounds. So when we're looking at -- when we widen this non-targeted analysis, we're basically using the mass spectrum and GCxGC retention times. So the peak alignment and mass spectrum comparison. So basically, we all -- one very important thing is we always have to have -- a good

study design is very important. So something to compare. You know, for example, like if we have tap water samples, we should have another group of samples to be compared.

So, for example, that's what I was talking about LC-MS grade high purity water, you know, as a baseline. And then what else chemicals we can see, you know. So the -- there is a kind of a add-in feature can kind of detect those -- isolate those chemicals.

DR. PARK: That was a nice talk. June-Soo Park, DTSC.

(Laughter.)

DR. PARK: A simple technical question about the -- some -- more acts of the chemicals with hydroxy group. I missed a few -- first few slides. Have you done any treatment to make them more volatile to see para signals? So, if not, is it possible you might have underestimated their detection, relatively, I mean?

PANEL MEMBER HOH: Absolutely. Absolutely.

We have -- that's why I'm saying that not single instrument can cover whole chemicals, you know, so I'm -- I'm still looking at one segment of the probably whole range of chemicals using the instrument -- my data analysis part.

June-Soo's point is that more polar compounds probably definitely underestimated by this approach. And

we -- that's why we are always talking about the liquid chromatography based non-targeted analysis is important as well.

One interesting thing is that we found it's really depending on the matrix type too. So we're -- we are using very clean matrix, like water is -- if treated, water is pretty clean. But we are talking about something like blubber. Blubber is such a complex matrix. So quite hydroxy, some polar compounds survive through the -- because of the aid of the matrix.

So what happens is that it's like the matrix is pretty much cover the own active sites of the GC side. So those chemicals actually survive through the system. We also found that similar thing in the house dust as well. So we've -- we -- we found all these chemicals quite polar compounds in the house dust extracts using this approach.

But then when we got the standards, they're not surviving through the system, you know, so there is a matrix issue definitely.

CHAIRPERSON SCHWARZMAN: Go ahead.

DIRECTOR ZEISE: Great talk. Just thinking in terms of some of the toxicity characterizations we do. You know, there's a number of compounds that aren't taken into account when we try to do a fish advisory and so forth, because we aren't measuring. We don't have data on

them. Probably don't have toxicity data either.

But it is interesting that DDE is relatively high. So the question is how much -- if you had a few indicator chemicals like DDE and DDT, what volume of the -- over the mass of the DDT-related compounds would you be capturing?

PANEL MEMBER HOH: Very good question. So, you know, the DDT is one of the chemicals heavily studied, you know, for many years. So my -- what I'm suggesting is that now we may need to look at it again, you know, because it's not going away. And then in the old studies, good studies, but it's reflecting the time -- at the time. So maybe certain -- certain chemicals are much more abundant compared to the others. So that's why it concludes -- we conclude -- the studies concluded let's measure these six chemicals, which will cover maybe majority of the DDT.

But now, I'm thinking maybe that's not really true. Now, there are all these -- DDTs are degrades, and through multiple ways. And then maybe those measured DDT compounds may not cover the whole majority range. That's what I'm sort of like thinking, based on our studies. Yeah.

DIRECTOR ZEISE: And some of the relative toxicity can vary.

PANEL MEMBER HOH: Yeah.

DIRECTOR ZEISE: So that's another element to look at.

PANEL MEMBER HOH: Right. Exactly. That's definitely an important part of relative toxicity as well, yeah.

CHAIRPERSON SCHWARZMAN: Thank you so much, Eunha. Well, any other questions for Eunha Hoh?

Okay. Thank you. I appreciate it.

And I am going to introduce our final speaker from the Panel, José Suárez, who is an assistant professor in the Department of Family Medicine and Public Health at the University of California, San Diego. He was appointed to the SGP by Governor Brown in April of 2017, and José will describe his findings on Persistent Organic Pollutants, their Metabolic Effects and Dietary Interventions to Reduce Body Burdens.

(Thereupon an overhead presentation was presented as follows.)

PANEL MEMBER SUÁREZ: Okay. Good afternoon, everybody.

So I will be continuing on the theme of persistent organic pollutants building on Eunha's presentation. So I'll be talking about POPs. And I brought a mouse, because I realized that you can't see a

pointer. So let me know if this actually works, okay? So I'm going to turn this on. Laser pointer. It's on your screens, you can see this?

(Yeses.)

PANEL MEMBER SUÁREZ: Great.

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PANEL MEMBER SUÁREZ: All right. Apparently, I can't -- I'll have to use both, anyways.

(Laughter.)

PANEL MEMBER SUÁREZ: Okay. So there we go. I'll be doing this two-handed.

So I've been asked to talk about some of the metabolic effects associated with exposures to the different POPs.

So the first half of my talk will focus on that and then second half, it will be mainly about existing interventions aimed at enhancing the excretion of POPs.

And so then we'll have a little bit of a discussion. We can talk more about it at the end of the presentation than during the discussion section, more about continuing or not POPs biomonitoring. And also talking now beyond regulation, now that there have been a good amount of efforts to regulate persistent pollutants, and then now also transitioning into whether we can start having public health messages aimed at people finding ways

to reduce their exposures or enhance the excretion. And that's part of what I'll be talking about in the second half.

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PANEL MEMBER SUÁREZ: So the POPs that I'm talking about here are primarily organo -- organochlorine pesticides, PBDE flame retardants and PCBs. And we know that these are very stable chemicals that have very long half-lives. And in human tissues, it has been found that they can stay for many years, and including decades.

So in this case, the half-lives -- if you don't know what a half-life is, it's just the time required for the concentration of a substance to be reduced by 50 percent. And so, for example, here, you see PCB-52 having a half-life of 2.6 years in human tissues, or PCB-170 of 15.5 years. So these are present in our bodies. We continue to accumulate these. And, of course, we're finding that one of the strongest predictors for concentrations in blood is age.

So the older we are, the more we accumulate these chemicals. And really, we don't have a very efficient way of excreting them.

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PANEL MEMBER SUÁREZ: And there has been a good amount of experimental data. And I'm not presenting those

data right now, but I can show you some of the epidemiologic data here from two large surveys. One is the Catalunya Health Survey. And then the other one is NHANES here in the United States, in which here you can observe the associations between PCB exposures - In here, it's categorized as quartiles, so higher levels here - and their relationship with, in this case, the outcome is diabetes. So these are odds ratios.

So we see that even across any of the weight categories, that increasing levels of PCBs are associated with very substantial increases in the risk for development of diabetes.

In NHANES, it was a very similar picture was observed. In this case, what's shown here is insulin resistance. And the exposure here measured were organochlorine pesticides. So it's the same type of analyses across different categories of waste circumference. And the picture is very similar to that. And then when looking at diabetes outcomes, the figure is very similar to this.

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PANEL MEMBER SUÁREZ: Worth mentioning that in addition to this, there have been also investigations finding associations with hypertension, cardiovascular disease, and thyroid hormone alterations.

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PANEL MEMBER SUÁREZ: Additionally, another cohort that has been studied a good amount are -- is the PIVUS study, which are 70 year olds in Sweden. And so they recruited participants where they were 70 years of age, and then they measured POPs levels then, and see how many of those developed diabetes.

So firstly, they found that participants that had the highest levels of POPs, if you -- it's equivalent to the upper 60th percentile had seven to eight times the risk of developing diabetes by year -- by age 75.

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PANEL MEMBER SUÁREZ: And then they also looked at other components like lipid components. Finding associations between PCBs and organochlorine pesticides with total cholesterol and LDL cholesterol, and weak or no associations with HDL cholesterol. And that's what this figure here is showing us the association of, in this case PCB-194 with LDL cholesterol.

Excuse me.

And so there are certain issues of course to try to disentangle the associations between POPs exposures and lipid levels, given that these persistent organic pollutants are very fat soluble. So we can talk a little bit more about that too.

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PANEL MEMBER SUÁREZ: And so I wanted to present a little bit of some of the latest work that we've been doing within the CARDIA study about this topic in particular, which is Coronary Artery Risk Development in Young Adults Study. So this is a study that started in 1985 and 1986, when participants were between 18 and 30 years of age. And these participants lived in different parts of the country, including Minneapolis, Oakland, Chicago, and Birmingham.

And so from within this longitudinal cohort, we conducted a case control study -- a nested case control study in this case, which included 90 cases, in the cases were defined as having developed diabetes or diagnosed with diabetes through year 20 of follow up, and then 90 controls that were matched on BMI category who did not have diabetes through year 20 of follow up. It's worth mentioning that none of the participants had diabetes at baseline, so this would be a true incidence within the cohort. But in this case we're looking at a nested case control study.

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PANEL MEMBER SUÁREZ: So as for exposures, so we measured 55 different POPs at the CDC laboratories. This was in serum collected again on year two. And this was

collected and stored. This -- so this in 1987 and 1988. But included in this study, we only included the information of 32 POPs that were present in more than -- or detectible in more than 75 percent of participants.

So that left us with eight organochlorine pesticides, 23 PCBs, and 1 PBB. Remember, this is the time -- this is before there was a mass introduction of PBDEs, so that's why we did not really detect many PBDEs at that time point.

And it's worth mentioning, so you keep this in the back of your mind, that the concentrations of POPs in CARDIA at that time were about three to five times higher than similar aged people in NHANES now 2003 to 2004. And so finally, we are looking at glucose lipid metabolism markers for years 2 - that's when the POPs were measured - and also at follow-up years 7, 10, 15, 20, and 25. So these would be a prospective analyses of what happens after the exposure measurement -- or the exposure assessment.

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PANEL MEMBER SUÁREZ: So the first part with POPs glucose metabolism.

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PANEL MEMBER SUÁREZ: Now, I talked about diabetes. But now, I'll be getting specifically into the

different markers of glucose metabolism. So again, this is divided by participants that did not have diabetes and participants that did have diabetes. And it's worth looking at the figure here. So these are the different age groups. So the same participants just at different stages of their lives, so keep that in mind.

And here, we have a POPs summary score. And I will not go into the details of how that was calculated, but you have access to the papers, I think, on the website.

So here on the X axis, we have the POPs summary score. And then the Y axis we have fasting glucose. So there is no association that we are observing up until participants start reaching the fifth decade of life. And then when they -- and the group that's older than 48 years of age, we see an even stronger positive association. So this association here among those that were 40 to 47 is significant, but you can see how much stronger this association is in the participants older than 48.

So the same story among participants with diabetes, exactly the same. We see this very strong positive association. And what's interesting is that right around this time is when we started to see that there is an increased risk for a lot of chronic conditions in people. So right after 40, 45, years of age, the risks

for cardiovascular disease increases substantially, the risks for cancer, for diabetes, overall mortality. So there's something that happens right around this time period that may be in a way interacting with these different exposures.

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PANEL MEMBER SUÁREZ: So then we looked at other components of glucose regulation like hemoglobin A1C. And we only have information for follow-up years 20 and 25. But you see that same association -- very strong positive associations with greater levels of PCBs having higher levels of hemoglobin A1C.

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PANEL MEMBER SUÁREZ: Then we looked at beta cell function. This is estimated with the HOMA 2 model. And we saw inverse associations, again in this older age group, with lower levels of beta cell function. So the beta cells are the pancreatic cells that would be producing insulin for those non-clinicians. And we see the same associations in participants with diabetes.

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PANEL MEMBER SUÁREZ: So for this part just to summarize, we observed that there were these associations of POPs exposures with glucose metabolism where participants reached to the fifth decade of life. So we

observed the associations with fasting glucose HbA1C. Beta cell that I showed you, it didn't show you the insulin sensitivity.

So it followed that kind of a similar picture that -- is that of the beta cell function. And we didn't observe any associations with BMI. So this wasn't an obesogen-related alterations in glucose metabolism.

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PANEL MEMBER SUÁREZ: So then we looked within the same study at lipids.

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PANEL MEMBER SUÁREZ: So for lipids -- so first of all looking at associations of POPs in lipids is challenging, because of how lipophilic POPs are. So we analyzed things in two different ways. We truly avoid adjusting for lipid levels in the model, because then you're adjusting for your outcome variable, right, even though you're maybe adjusting for a year two level.

So instead, we approached it through the other way to typically analyze these compounds, which is to compare either the wet weights or then lipid standardized levels of POPs. So the lipid standardization is simply the wet weight divided by the total lipid content at that time point. So we did both analysis.

So here, we can observe that the higher

concentrations in this case of PCBs were strongly positively associated with cholesterol. And there was no age effect as we observed before. So it's pretty homogeneous over time what we're observing there with associations.

The same with triglycerides. So the stronger blue line here is the average overall. And again, these are the same participants over -- just at different points in their lives.

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PANEL MEMBER SUÁREZ: For LDL cholesterol very strong positive associations. But not so for HDL cholesterol. And this was also observed in the PIVUS study, where there was no association -- perhaps a U-shaped association with the exposure.

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PANEL MEMBER SUÁREZ: So additional pieces that I did not show is that also oxidized LDL was very strongly associated, very similar so as LDLs were. And then the cholesterol HDL ratio, which from -- at least from the lipid point of view is one of the constructs that more strongly predicts cardiovascular disease. So it's worth highlighting that as well.

And so we did not observe any associations with BMI, but we did observe that participants that had higher

BMIs had stronger associations, so there is BMI effect modification that we did notice.

And finally, we did the same analysis with organochlorine pesticides. The associations were only present in the wet weight analyses and not in the lipid standardized. So for that reason, I think that they're probably not related to the lipid outcomes as PCBs were.

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PANEL MEMBER SUÁREZ: So now this is the beginning of the second part of the talk, which is about interventions to reduce body burdens of POPs, which I think is very exciting concept in itself, very understudied in the field. Really, and you'll show that -- you'll see that all of the data that I presented here come from pilot studies, and very small pilot studies too. But I think this is something that we need to start focusing on.

And currently, it is not really understood. There's not like a standard regime as to what we can do to reduce levels of these persistent organic pollutants.

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PANEL MEMBER SUÁREZ: So some of the pilot studies include bile acid resins, like cholestyramine. So these types of medications were first introduced as cholesterol-lowering medications. And before statins,

these were some of the main tools that were used to decrease cholesterol levels in participants.

So what they do is they bind to bile acids, and do not let the reabsorption of these bile acids that have a high content of cholesterol. And so somebody thought that maybe this could be a way to -- a way in which POPs may be excreted from the body through bile.

So they did a brief trial with cholestyramine for 48 to 72 hours. And what they did was they measured chlordecone, which is an organochlorine pesticide, and see if there were differences in the excretion. And they found that after just for 48 hours to 72 hours, the excretion -- the fecal excretion increased 7-fold.

And also they observed that the output of chlordecone was between 10 and 20 times greater in bile than it was in feces. So this indicated that perhaps some of the bile -- some of the POPs would be -- then reabsorbed in the small intestine. And so that's something that then shed light to further work later on.

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PANEL MEMBER SUÁREZ: Then with colestimide, which is another bile acid resin, they did a six-month trial in this case. Again, this is a very small study. You can see this -- these are actually the data. These are the nine participants that they did this upon. And

you can see here the rate of reduction, if you want to look at that later on.

But overall, there was a decrease in -- of 17 percent in the concentrations after using. So this is not a control trial. It's just a pre-post with the same individuals. Again, this is a pilot study, but it provides a good amount of information of things that we could potentially be targeting. Now, that was for dioxins. For PCBs, there was an overall decrease of 14 percent after this trial.

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PANEL MEMBER SUÁREZ: And then there was another interesting trial that was -- that used olestra, which is a synthetic fat that does not get absorbed. And so what -- what -- this was a -- I thought this was an interesting approach to try to find dietary ways in which people can find -- could potentially reduce their POPs exposures.

And so this trial was a one-year trial, in which they compared a group that was treated with olestra. This was administered as chips. I don't know if you recall, we used to be able to buy fat-free chips. And so they used the Pringles brand. And then they also fed the placebo control with just standard chips that taste exactly the same.

So they did this intervention for one year. This was announced in Alabama. This was a location of which there was manufacturing of PCBs for over 40 years. So they recruited participants of 60 years of age, and 62 percent were female.

And overall, they found that the concentrations of POPs as would be expected was higher than those of NHANES, because of the PCB manufacturing plant.

So again, the intervention were 12 Pringles in one year -- per -- excuse me, 12 Pringles per day for one year, just to clarify, not the other way around.

(Laughter.)

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PANEL MEMBER SUÁREZ: So then here I think this figure says a lot, right? So this is the standard that received just the regular placebo, or regular chip. And here is the group, the concentrations of PCBs for the olestra group. So for PCBs, there was twice the decrease in the levels over this one-year period. So there was a decrease of four percent in the placebo group versus an eight percent in the Pringles group.

And for DDE, there was a three times the decrease. So it was a five percent decrease in the placebo versus 16 percent in the olestra group.

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PANEL MEMBER SUÁREZ: So this was interesting. And then the other piece -- of case, there's another way that we, by accident, have found that we -- that we can excrete POPs is through breastfeeding. But, of course, you can think about where those POPs end up going to our most vulnerable. So this is an issue -- societal issue that we continue to accumulate these chemicals that we've been producing, and now we're passing it onto our children.

And so some of these studies - in this case is one in Mexico - where they measured POPs levels in breast milk, finding that the breast milk for the first child had substantially higher concentrations of DDE than that -- than the breast milk for the second child, and the breast milk for the third child.

So it seems like this works, but not necessarily something that we want to be doing as a society. But yet, the message is still that it is good to breastfeed nonetheless.

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PANEL MEMBER SUÁREZ: So a little bit of the work that I've been doing in this regard, so we started -- we wanted to do a replication of the olestra piece and add an additional component which I have been very excited about, which was nuts. So we -- in 2016, we carry on this

clinical trial, which we called the "No-POPs Trial, the Nuts and Olestra for Persistent Organic Pollutant Reduction Trial" at UCSD.

And we did this at the Moores Cancer Center. And here are our co-investigators, and collaborators, and some of the students in the project.

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PANEL MEMBER SUÁREZ: And so the objectives were to compare three different groups. So we had a nut intervention group, compare that to an olestra again with chips, and that compared to a placebo group. And I'll tell you what the mechanism is of action in just a minute, if you're thinking about.

But the main objectives here were to see if there would be, first of all, increases in the fecal excretion. And the way that was conceived was that we would be measuring -- collecting stool and asking the participants to send us their stool samples before the intervention. And then four days later, because we knew that the compliance would be highest at that point, that we expected, if there would be an effect, that we would be able to see it just after four to five days.

And then the other endpoint, we're looking at decreases in levels of POPs in plasma, which would be measured at baseline, and then after six months of this

intervention. And so our dosage was higher than that of the previous -- the Jandacek publication by about 25 percent. But at the same time, it was a shorter intervention. So having a six-month inter -- dietary intervention is long enough. And it could be tiresome for participants too, right, if you're having to consume a good amount of nuts or a good amount of chips.

So we recruited and included in the study 46 healthy adults between 50 and 70 years of age in San Diego.

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PANEL MEMBER SUÁREZ: So the main mechanism of action would be that POPs are fat soluble. So they're present everywhere -- anywhere pretty much where there is fat. And so bile salts, as I mentioned earlier, have a high amount of cholesterol. And so while they get excreted -- the bile salts get excreted, and they have POPs attached to it too, and that's what some of the earlier research showed.

And then as the bile salts go down the small intestine, it continues to be reabsorbed to the point that only five percent of bile salts are actually lost in feces. That means that 95 percent is reabsorbed. So there's this enterohepatic circulation. So the whole point is how can we break this enterohepatic circulation?

So at least with the olestra, because it is a synthetic fat that does not get reabsorbed, the thought is that the POPs that would be present in the bile salts would then start attaching to the olestra. And the olestra does not get absorbed. It gets excreted in the feces.

Now, the nuts, I can't really remember when I had a moment of, wow, let's study nuts. But I recall that with nuts, we know that -- well, at least the ones that we selected for this particular study have a high fat content, and about 20 to 25 percent of the calories do not actually get absorbed.

So the thought was that maybe it could follow a similar mechanism as olestra. But, hey, even better, not having olestra, let's have nuts, so that can have a more profound message that could be more accepted by the general population.

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PANEL MEMBER SUÁREZ: And so for this study, we collected a bunch of biospecimens. And the measurements of POPs in serum and in stool were done at Eunha Hoh's laboratory in San Diego State. So she was terrific in developing the methods to measure this in stool, which is not an easy thing to do.

And so these are the different organochlorine

PCBs and PBDEs, at least the numbers that we have here, that were being measured. And we did a few different measurements over multiple points in time. We even did DEXAs to look at body fat changes. And I can talk to you a lot more about that. But given the time constraints, I will not get into the reasons why we did these measurements.

But unfortunately, I -- we are very close to publishing these findings, so we're not releasing these yet. Stay tuned. I think they're very interesting findings. And later this spring, we hopefully will have a publication that we can share.

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PANEL MEMBER SUÁREZ: So in conclusion, and a little bit of the discussion now of the whole presentation, a couple of things is that, at least from the experimental data that I did not show, but from the epidemiological data that I did present, that there is evidence that POPs can alter glucose and lipid metabolism in adults.

I think there's still rationale to continue the biomonitoring of POPs, even though these have been banned for decades in some of the cases like organochlorine pesticides, or within the last 10 years the phase-out of PBDEs. Yet, we still continue to find these. And in

fact, in NHANES, they just released the latest update to their tables of the biomonitoring a few weeks ago, and they found that for brominated flame retardants, like PBDE-47, it was present just about in everybody in NHANES.

So I think that this -- it still make sense that this is present in the food webs that we continue to have this recirculation of these chemicals.

Then the next piece, of course, is the importance to continue the regulation of persistent organic pollutants, and not just these, but any other persistent pollutants. And I think that there -- there is a pretty good -- that the interventions, I should say, or regulations have been pretty successful, as we can see that the concentrations of POPs in blood, and also in breast milk have been decreasing ever since the ban in 2006 with the letter has been happening. At least here in California, there's been a decrease in the last decade or so.

And then the last piece is I think one that's needed. As you saw, there were a lot of pilot studies about how we can help people excrete these POPs. And maybe we can start thinking about other ones, perfluorinated compounds for example. Again very, very pervasive. A lot of people have them, and we don't really know how to -- what to do to excrete these chemicals.

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PANEL MEMBER SUÁREZ: So I will leave it at that. Here's the acknowledgements to our funders and some of our collaborators for the work that we've been doing at the No Props Trial and the CARDIA study.

Thank you.

(Applause.)

CHAIRPERSON SCHWARZMAN: Great.

Questions for José?

Sara.

MS. HOOVER: Sara Hoover, OEHHA.

Thank you so much for that talk. So my first question is what kind of nuts?

(Laughter.)

PANEL MEMBER SUÁREZ: Well, the two that we do have -- that have been studied a lot were almonds and walnuts. So those were the ones that we have information about, the non-reabsorption piece. So we're looking for nuts that have a higher fat content in that particular case. Walnuts is -- checks that box. But then almonds have also been studied. So both of these -- I think it's almonds about 24 percent of the calories are not absorbed, and for walnuts, 21 percent of the calories.

Like pistachios have also been looked at, but pistachios are mostly absorbed actually. I think it's

something like four percent is not absorbed.

MS. HOOVER: And is that related -- you were saying -- is it related to the relative fat content the absorption or are there other factors about the nuts that --

PANEL MEMBER SUÁREZ: No, there are other factors. Part of it could be related to the size of the particles. So they've looked at studies in which they ask participants to chew like 10 times literally, and then swallow it, so they're like bigger chunks. Or they asked them to chew it for like a whole minute and then see what happens to the absorption.

So they're finding that the more finely they chew, that the more it is absorbed. For that case, nut butters don't work, because they're completely -- don't work for this purpose, I would say. They get mostly absorbed because of how they're processed.

DR. SANDY: Martha Sandy, OEHHA. So you had a list of couple POPs that you were analyzing to see if the levels went down. And I just wonder if you see an effect with those you'd probably extrapolate to other POPs that are -- have similar lipid content probably. And I wonder if you were planning to do an exploratory measurement of TCMP?

(Laughter.)

PANEL MEMBER SUÁREZ: I'll think I'll defer that one to Eunha, because she's running the -- but I think for the time being no. So this was -- again, this was the pilot version, and then we're preparing for the larger version of that. So there are certain chemicals -- so the ones that would be more fat soluble would be the ones that we'd be, through an intervention like this, more likely to see an effect.

We would also be thinking about looking at perfluorinated compounds, but they're not fat soluble. So that could be more of a negative control. However, there may be other factors that may enhance the effect. So not just the fat solubility, but there's some research in which they're finding that nuts are high in polyphenols, and that may also alter the metabolism, enhance the degradation of some of the PBDEs in particular.

So it's still very in the fringes of what we know, in general, but I think it's something worth exploring, not just with these POPs, but with some other kinds and see -- maybe it works for some, and probably it doesn't work for others, but worth looking at for sure.

DR. SHE: Very, very interesting presentation about the intervention. And from analytical chemist point of view, like we use active carbon to absorb the 2,3,7,8-TCDD. And then because the carbon structure have

layer, so there's the coplanar TCD -- PCDD and the PCDF that tended to be retained very well by active carbon.

And then all coplanar ones are more toxic ones. So I'm not sure from clinic point of view this active carbon I saw them at toxic -- acute toxicities from dog animals. But for the chronic exposure like this is do you think they can rebalance or remobilize the POPs from lipid due to be absorbed by active carbon. Does it make any sense, because the structure that strongly absorb the co-planar dioxin.

PANEL MEMBER SUÁREZ: So if I understand correctly, you're talking about say activated charcoal, administration of activated charcoal as a way to excrete POPs, is that the question?

DR. SHE: Yes.

PANEL MEMBER SUÁREZ: Yeah. So I think they have definitely thought about that. And I think there's a group that has -- looked specifically at POPs in that -- showing that it did work a little bit. Again, this is all very small pilot studies.

But from just the theoretical point of view that you mentioned is right, so that's something that could work, of course. I don't know how many of you have tried activated charcoal.

(Laughter.)

PANEL MEMBER SUÁREZ: It is like you're drinking tar, right? It's something that's not the most exciting thing to take. But to your point, yes, I think it's a very exciting point right now is we should find different ways in which we can start having a public health message, right? So maybe if you want to reduce your exposure to pesticides, perhaps eat organic products, right? If you want to lower your concentrations of POPs, perhaps eat nuts or have olestra, or maybe other things. You know, we're finding that there are a lot of benefits of algae, for example. There may be a lot of other things that -- in the diet that may be helping us with this. So I think it's something worth exploring.

DR. SHE: Maybe overheat your wallet.

(Laughter.)

CHAIRPERSON SCHWARZMAN: Question. Oh, Sara.

MS. HOOVER: Please.

CHAIRPERSON SCHWARZMAN: No, go ahead. I was searching for questions.

(Laughter.)

MS. HOOVER: That was -- I'm really glad you're looking into nuts. That seems like a great end -- I'm just curious, was that your light bulb? Because that seems like -- that's really impressive. I mean, congratulations on that light bulb moment. That's really

exciting.

PANEL MEMBER SUÁREZ: Thank you. Thank you.

MS. HOOVER: So my question is I always -- I've heard about the olestra ideas before, and it was -- it gave me concern, because I think olestra itself could be potentially problematic health-wise. Do you have any concerns about olestra? I know, you're looking into nuts yourself, but just wondering about your perspective on that.

PANEL MEMBER SUÁREZ: Yeah. So for olestra, unfortunately, it got a pretty bad wrap when it came out, right? So it was released and the way Procter and Gamble wanted to market it was a substitute for oil, so that you would go and fry your own chips, or fry your chicken with olestra. But then they released it to the public and, of course, there was the bad side effect of diarrhea, which even worse was --

(Laughter.)

PANEL MEMBER SUÁREZ: The label said, this is verbatim, it was, "Anal leakage may happen." That's how it was --

(Laughter.)

PANEL MEMBER SUÁREZ: That's how it was framed. So, of course, that scared most people.

(Laughter.)

PANEL MEMBER SUÁREZ: But as anybody would be scared, right?

(Laughter.)

PANEL MEMBER SUÁREZ: But if you look at the products that are being used right now, for example, maltitol or xylitol, they have a very high -- or they're very strongly -- they could be inducing to diarrhea if you have a good amount of that too. So the way this has been perceived by society is a little bit different. Sadly, that was a failure of Procter and Gamble of doing it. So then what they did was they restructured olestra so it would be a solid at body temperature. And that eliminated all of the GI discomfort.

So at least in our study, participants from the regular chip versus the olestra chip had no differences with GI issues. If anything, it was the nut group. We had two of our participants drop because of GI issues, of high consumption of nuts. So in that regard, that would be one of the things.

The other piece is the amount of absorption with olestra. So it is a synthetic fat that does not get absorbed. So there are certain vitamins like A, D, E, K that are lipid soluble. And so that was the concern that maybe it would be a decrease in the absorption of this.

So what Procter and Gamble decided to do was then

to supplement everything with A, D, E, K, to reduce that. So -- but again, you know, this is one of those things that I'd be far more excited about the nuts piece than the olestra.

DR. WU: I wanted to follow up on that. This is Nerissa from Biomonitoring California. This is great. And, you know, there's always this question of what do you tell people, if they ask me what do I do if I am exposed? So this is an exciting direction to go in.

I did have a question about the volume of nuts. And with any intervention, you know, there's this whole idea of like how do you keep people in compliance, especially if it's over a long period of time. Did you have participant management? Like, did you have people checking in with them to make sure they're complying. You mentioned a couple people dropped out because of the volume of nuts. What volume of nuts are you talking about? And was there other, I guess, kind of coaching to get people through the intervention in tact?

PANEL MEMBER SUÁREZ: Yeah. So these are very good questions about the methodology in general. Where to begin?

So we had -- our research coordinator and dietician was fantastic. So we had measure -- we would be bringing in the participants to tell us if they had any

issues, and also to give them their three-week dosage. So we have them come every three weeks. And in that case, we would see how much they've been eating. And part of it also is that we wanted to make sure that they weren't changing their weight. So there was a lot of coaching. And you're getting these extra calories, but we want to make sure that that's being compensated. Now, it's -- there are a lot of internal compensation mechanisms if you -- if eat a lot of one thing, then you're going to reach satiety than if you were to be eating something else.

So that substitution wasn't much of an issue, and we didn't see much weight gains or weight losses in the participants. What we did see though were changes in the metabolic patterns among participants that were having the regular chips, versus the olestra chips, versus the nuts.

So the people taking nuts really benefited quite a bit in the lipid components, things like there were -- they had higher HDL levels. Cholesterol levels were about the same, maybe even a little bit higher, but the cholesterol was mainly driven by the increase in the HDL levels. Triglycerides went down. LDL cholesterols went down. And different effects were observed with the other groups.

So the compliance pieces are -- is a difficult

one. So you asked about how much, so we were administering about three-fourths of a cup of nuts. And for the olestra I think there were 24 chips, which equated to -- I can't remember the exact, but the publication is going to come up pretty soon. I will tell you that.

DR. WU: These will be daily doses.

PANEL MEMBER SUÁREZ: So, of course, there was a lot of interest in the chip group. People loved chips. So they were thrilled to be in either the olestra chip or the regular chip. There were some people that were just happy. The nuts -- you know, the healthier options, some people were excited, and some people were not. So we had to get really creative of how to do it. So we created different recipes. We, of course, asked participants not to turn them into nut butters, but --

(Laughter.)

PANEL MEMBER SUÁREZ: -- you know, you can have -- you know, prepare salads with that, or mix it with M&Ms to have a trail mix. And, you know, we're tying to get as creative as we could. Yeah. So compliance, of course, was -- is always an issue with a six-month dietary intervention.

DR. SHE: I have a quick question. So you always pre-screen the nuts, because nuts may be exposed to pesticide, right?

PANEL MEMBER SUÁREZ: Excuse me, lard?

DR. SHE: You use some nuts, right? Nuts?

PANEL MEMBER SUÁREZ: Oh yeah.

DR. SHE: And then -- I mean, when you do this intervention, you do prescreening, because they can have exposed to pesticide.

PANEL MEMBER SUÁREZ: Ah-ha, you're asking some wonderful questions. So we -- we did. We sampled some of the nuts. We froze them and then, at Dr. Hoh's lab, she measured the -- some of the walnuts and almonds that we administered. And so the findings were that there were no or very low levels, but maybe Eunha should answer this.

PANEL MEMBER HOH: Yeah. We tested them for the POPs though, not other pesticides though. It was undetectable. Yeah. So we actually had concerns about whether the nuts could contain those POPs, you know, and then could increase the exposure or something, yeah.

PANEL MEMBER SUÁREZ: We didn't do that systematically necessarily.

PANEL MEMBER HOH: Right.

PANEL MEMBER SUÁREZ: It was just at random. So we don't know if all the batches -- if that's representative of what we fed the people, but at least there was one attempt.

CHAIRPERSON SCHWARZMAN: We have two Panelist

questions, Ulrike and then Veena.

PANEL MEMBER LUDERER: One following up on that. Were they organic nuts or were they conventionally grown nuts?

PANEL MEMBER SUÁREZ: They were conventional. Yep.

PANEL MEMBER LUDERER: Okay.

PANEL MEMBER SUÁREZ: I don't know how many organic nuts -- how easily -- is it pretty easy to find?

PANEL MEMBER LUDERER: Yeah.

PANEL MEMBER SUÁREZ: I don't -- so then the next question is I don't know how different it is, even organic versus not, because remember this is -- so what you'd be looking would be at organochlorine pesticides primarily.

And I think, if I recall some of the studies that came out of comparing organic versus not for particular -- specifically for organochlorine pesticides was that there wasn't too much of a difference. Perhaps somebody else has some more updated research about these. But because these are more legacy ones, they would be present in the same area just about, so -- but worth looking at, I think, nonetheless. But somebody had looked at just regular diets, I don't know if they looked at nuts specifically, so I can't tell.

PANEL MEMBER LUDERER: My other question was

whether there are any epidemiological studies out there that suggest that diets higher in nuts that those people have lower concentrations of these legacy organochlorine pesticides in their bodies?

PANEL MEMBER SUÁREZ: Not that I know of. But at least in CARDIA, though, that's a very good point. In CARDIA, we do have food frequency questionnaires, at least in the earlier years, and we could look at that. And we have -- I mean, we can look at other things, not just nuts, but looking at fish consumption, for example. So that would be very interesting in itself. So we could potentially dig up some of that.

CHAIRPERSON SCHWARZMAN: Veena.

PANEL MEMBER SINGLA: Thank you for that presentation. Super interesting.

So my question is about what -- when you look at the -- like exposure patterns for like PCBs or PBDEs, at like -- following over time after, you know, bans and phase-outs you see an initial steep decline in exposures, which then kind of plateau off. We see that with PCBs. And we're starting to see it with PBDEs, because -- well, because they're POPs, right? And as long as there's environmental sources, they'll continue to circulate in the food chain. And with PBDEs, there's even still remaining indoor sources where people are exposed.

So I wondered what your thoughts were about if these interventions could be successful, which I think is really exciting, would people be able to maintain the lower levels if there's ongoing exposure sources in the environment?

PANEL MEMBER SUÁREZ: Right. I mean, that's a very good point. So we see that the rate of decline decreases -- the actual amount decreases over time, because of the very long half-lives. And then there's that renewing background information. These are very good points. And I don't know if -- perhaps an intervention like this could only be really successful in those people that have higher contents, which tend to be maybe occupationally exposed, or older people tend to have much higher levels. And that's one of the reasons why we focus on the 50 to 70 year olds. And perhaps the interventions become less and less effective the lower the concentrations are, you know, for sure, right.

CHAIRPERSON SCHWARZMAN: Other questions from Panel or audience?

If not, we can take our break early. And so we're going to have a 10 -- 15-minute break. We'll start at -- okay. We'll break as if -- so we have a 20-minute break, and we'll start back right at 3:15 with -- and this is our chance to have the full conversation that we've

been sort of promising all day the discussion of Program priorities based on the input from the Panel member presentations that we've had.

(Off record: 2:53 p.m.)

(Thereupon a recess was taken.)

(On record: 3:14 p.m.)

CHAIRPERSON SCHWARZMAN: All right. Thanks, everyone, for coming back promptly. And this will be the beginning of the end --

(Laughter.)

CHAIRPERSON SCHWARZMAN: -- of the final session of today's meeting. But it's the part where we get to have a conversation, which is fun, and reflect on the input we've had through the rest of the meeting.

So our main goal for this discussion session is to identify both near-term and longer-term Program priorities, in light of the presentations that we've heard today from the -- our Panel members about their research.

So we have a few discussion slides here that are meant to remind you of some of the key items that kind of arose in each of those research talks.

--o0o--

CHAIRPERSON SCHWARZMAN: And we'll talk through them, and then a little bit about chemical selection, and then have an open discussion. And I'm -- so if you have

thoughts -- if you're reflecting on the morning's conversation too, you can bring those in as well.

So from Veena Singla's talk, she looked -- considered options for studies to explore contributions of indoor sources to priority chemical exposures. The potential to add complimentary dust sampling to biomonitoring studies, and thinking about where biomonitoring studies can give us insight into the impact of -- sort of regulatory impact, for example, tracking trends and exposures to flame retardants after the implementation of AB 2 -- 2998.

And, you know, a question as always is, is there a way to build on existing Biomonitoring California studies or should we be developing new ones to target some of those ideas?

--o0o--

CHAIRPERSON SCHWARZMAN: From Eunha Hoh's talk some of the ideas that emerged from that are:

Using non-targeted screening in sentinel species, and in drinking water to inform the priorities; are there chemical selection and/or method development activities that are needed to capture other halogenated organic compounds that haven't been traditionally measured; can we identify collaborative opportunities to conduct paired biomonitoring and drinking water sampling projects, for

example, conducting non-targeted screening work on paired drinking water samples and examining seasonal differences.

And then to return to José Suárez's talk on the importance of continued monitoring of persistent organic pollutants and whether biomonitoring can help understand the link between exposure to POPs and effects on glucose and lipid metabolism; identifying ways to reduce POP exposures and body burden through intervention; and is there a way that California Biomonitoring can contribute to those efforts or those lines of inquiry.

And I think we have one more here -- slide here --

--o0o--

CHAIRPERSON SCHWARZMAN: -- about thinking about chemical selection. So there were several ideas that came out. Some of the -- there's been some -- so this is I think a pooling of ideas that has come from multiple sources. This isn't just from today's presentations. And some of today's presentations kind of reflected on them. For example, some of the other halogenated compounds that are coming to our awareness, are there -- should we be looking at other fragrance compounds or cosmetics compounds than what has been monitored already -- biomonitored.

The consideration of naming PCBs as a group,

which as I understand it, there are many PCBs on our current designated chemical list, but they are not actually named as a group, because they reflect how CDC has PCBs on the list. They're not actually listed as a class in the way that would include all of the PCBs that are showing up, for example, as contaminants of very synthetic processes and things, if I'm understanding that correctly.

Other suggestions that have been received including -- include some chemicals used as UV filters, which, of course, we heard about also in Eunha Hoh's talk, some alternatives to plasticizers, and quaternary ammonium compounds and some selected rubber compounds.

And the asterisks here indicating previously screened doesn't -- isn't meant to say that they've been treated exhaustively or studied comprehensively by Biomonitoring California, just that there have been times where those compounds have been targeted in studies.

One other thing I wanted to say just about the class notion, because of a conversation I had in the break with Carl Palmer, who couldn't be here because of all the competing meetings today, but sort of wanted to reflect specifically to our process on -- from the meetings that he was in today, he was reflecting on the power of Biomonitoring California having designated PFASs as a

class, and how -- he was reflecting how that has really enabled many other processes, including in the Safer Consumer Products Program, but also for the Water Board, and just wanted to highlight that even when naming PFASs as a class, it helps the Biomonitoring California Program, but it has these impacts that go far beyond it.

And so I think that's encouragement for thinking about the -- the sort of intellectually defensible way to name classes, irrespective of our ability as a Program to actually measure them all right now.

But if it makes sense to name a class, because it includes compounds that should be grouped together, then that's maybe something that we should be considering for all of its other potential impacts, even when we don't have the resources to assess them all right now.

So that's maybe the thought that I'll start us off on. And again, the point here is just to reflect based on today's presentations and other thoughts that you're having on Program priorities, and Sara has something to add.

MS. HOOVER: Thanks, Meg. Sara Hoover, OEHHA.

I just wanted clarify one -- actually two interesting things about this slide. One is this was prepared long before I saw the input from today's talk. And so it's really interesting to realize that things we

were interested in are also being fed in by others. And some suggestions I received from just other stakeholders. So that makes it even more powerful to realize that these are really important items.

The other thing I wanted to just clarify, and I'm sorry, I didn't make this clear on this slide, but the star "previously screened" means our preliminary screening process that we do for the Panel, which is we have not measured these in Biomonitoring California studies. All we've done -- I mean, some of them we have, right? So benzophenone-3, for example. But we've looked at them in the past as possible chemical selection items.

And as you already explained, that doesn't mean we've -- we're happy to look at them again. And that's why they're on this list.

CHAIRPERSON SCHWARZMAN: Thank you.

MS. HOOVER: Sorry, one last thing. I know I owe all of you also our class papers. So Gail Krowech and I had prepared with Gina Solomon and others an explanation of the class concept and that we kind of pushed forward, and pioneered, and implemented. And I'm going to send you guys all that paper, because that -- that is our intention as we go forward to always try to look at things as classes for efficiency purposes.

And we have that opportunity as biomonitoring,

because we're not regulatory. You know, that gives us a little bit more flexibility to be on the cutting edge with that sort of thing.

CHAIRPERSON SCHWARZMAN: Which I think -- the only reason I went into that is because I just wanted to reflect on how -- and I see this too. I see it reverberate through many other programs, and that the Program serves this scientific function that's very helpful beyond whether it results in biomonitoring.

Comments to get us started?

PANEL MEMBER QUINTANA: I had a question.

CHAIRPERSON SCHWARZMAN: Yeah. Jenny, go ahead.

PANEL MEMBER QUINTANA: So I know you said this earlier. I'm sorry. But the list that you passed around was a subset of all the analyses you can do, right? How was the subset chosen? Because some stuff -- I was disappointed not to see here like 1-nitropyrene. So could you comment on this. Am I looking at the wrong list?

MS. HOOVER: You're not looking at the wrong list. I had a brief -- sorry, I had a brief moment of brain gap there. So 1-nitropyrene is currently being measured for us and our studies by University of Washington. They are the lab that measures that --

PANEL MEMBER QUINTANA: I know.

MS. HOOVER -- as you well know.

And they're actually -- so they have shared their standards with Jianwen and they're looking at that, you know, as bringing that capability into Biomonitoring California. That's why that's not listed there, because we're talking about analytes. We're reporting from our laboratories. So that's the reason it's not on there.

PANEL MEMBER QUINTANA: So, I guess --

MS. HOOVER: It's being reported in our studies though.

PANEL MEMBER QUINTANA: So I guess my follow-on question would be I wouldn't be ready to think about brand new stuff until that was on the list, for example. So I guess how do we get a sense of what our priorities are for stuff that isn't on that slide, I guess?

MS. HOOVER: Isn't on --

PANEL MEMBER QUINTANA: On this --

MS. HOOVER: So just to clarify, this --

PANEL MEMBER QUINTANA: So yes -- so I'm just trying to figure out what we're doing here, I guess.

MS. HOOVER: This slide here -- so, yeah. This is a very big brainstorming session about near- and long-term priorities --

PANEL MEMBER QUINTANA: Okay.

MS. HOOVER: -- for SGP chemical selection, not method -- this is not about method development. This is

about getting something on our designated list and potentially on a priority list. So this is aspirational about what -- basically, what Meg was saying about also acting as a scientific resource for other programs by the kind of work we do on chemical hazard ID. So that's what this slide is about. So maybe move off this slide for now, you know. Move backwards, go somewhere else.

The methods has to do with -- so that -- the list that we provided to you about analytes reported, it pretty much is what we're saying. It was less than the full laboratory capability, because these are now the analytes we are maintaining as methods and could run and report. There are other -- if you look at our larger list from a couple years ago, the 10th Anniversary, there's a larger list of analytes that we're not necessarily maintaining.

So as Nerissa pointed out, it's -- you know, there's a certain amount of resource that involves -- that's involved in just maintaining a method. So these are the ones that could easily be chosen and reported in studies.

PANEL MEMBER QUINTANA: Okay.

MS. HOOVER: Does that help.

PANEL MEMBER QUINTANA: (Nods head.)

MS. HOOVER: Okay.

CHAIRPERSON SCHWARZMAN: Maybe while other people

are thinking up their brilliant comments, I would just say -- and I'll do Oliver first -- that one direction that I think Biomonitoring California would -- could really shed some light is on pesticide inerts. To me, I put them a little bit in the same category in terms of what we know about them with fragrance chemicals, because of the lack of disclosure.

And, of course, inerts everybody knows are not necessarily biologically inert. They're just not the chemicals that are designed to harm the bugs, or the herbs, or greenery, or whatever it is that's targeted by the pesticide or fungicide. And the inerts often make up 99.5 percent of the mixture. And there's so little known about -- so then that volume that's going into the environment and that people are exposed to is tremendously high. And we know very little about what those chemicals are. So, in fact, there's only one source that I know of then probably California DPR has a better source than this. But the U.S. EPA approved inerts as the only list that I'm very familiar with. But I would be curious to hear what DPR could direct us to in terms of the compounds to think about looking at it as pesticidal inerts.

But that's a category I'm very interested in that kind of runs in parallel only in this -- from this perspective with fragrance chemicals, which I'm also very

interested in, because of similar problems with disclosure and high exposure. Low disclosure, high exposure.

(Laughter.)

CHAIRPERSON SCHWARZMAN: Oliver.

PANEL MEMBER FIEHN: Yeah. So thank you for putting up that slide.

(Laughter.)

PANEL MEMBER FIEHN: Although, you wanted to get rid of it.

(Laughter.)

PANEL MEMBER FIEHN: I would like to endorse one compound class, these quaternary ammonium compounds, as a list of chemicals -- or class of chemicals. And the reason is the following.

In my laboratory, we analyze maybe 30,000 samples a year. We do it in an un -- non-targeted way, and we see those compounds all the time, right? So first, I thought somebody in my lab is not quite careful, and I tended to delete those. But the more we introduced quality controls, we saw that these are actual compounds that even show up in untargeted analyses, meaning they are highly abundant.

So -- and they have lots of effects. They're used in high tonnage. They're used in various applications. There are known health effects. They are

often not very biodegradable. So I think there's lots of reasons why these should be very carefully looked at and potentially looked into screening.

The other thing is just because you said it's a brainstorming, you know, sometimes I have the feeling that, you know, we try to get to cutting edge and so on, and we lack the funding. And sometimes -- I'm just saying there's lots of academics here. And, you know, a grad student can do wonders, and they don't cost a lot of money. So if the Assembly or California could be, you know, make some research funds available into that directions, that might be good. It's not biomonitoring by itself, but it would be research of maybe integrating classic monitoring with non-targeted screening, or for specific compound classes, and so on. I think that's something that California could do, and without millions of dollars, right, which is always hard.

CHAIRPERSON SCHWARZMAN: Yeah.

PANEL MEMBER LUDERER: I would like to actually agree with quaternary ammonium compounds. I mean, those are important causes associated with occupational asthma. There are -- many of them are sensitizers. So from an occupational perspective, and they're in lots of different cleaning agents, so there definitely are many exposures to those. So I think that would be a good one -- a good

class of compounds or group of compounds to look into.

I also had some -- I think, am I right, that the only fragrance kind of class of compounds that we have right now is the synthetic musks or is there -- I'm trying to remember what else was on the designated list.

And I wanted to ask Veena whether the -- any of those synthetic musks came up as -- among that big group of fragrance compounds that you found in your analysis?

PANEL MEMBER SINGLA: Yes, they did. And the HHCB was the one that was measured most often. But that's -- you are -- I was thinking very much along the same lines wondering if there was other classes of fragrance chemicals that we could think about.

MS. HOOVER: Yes, I can answer that. And I just noticed a formatting problem on the new designated list as a result. We have synthetic polymusks on as a class. As we were researching synthetic polymusks, one of which was in Veena's study, we came across another compound called OTNE. And we discovered there was a class of compounds related to OTNE. And that went on the list at the same time.

So we have tetramethyl acetyloctahydronaphthalenes as another class of fragrances on the list. At the time that we did the screening for synthetic polymusks, Gail Krowech did that work, and she

did a screening of other kinds of musks. At that point, there wasn't enough information to even meet our basic criteria.

But I also have a lot of concerns about fragrances just based on other information I know about, and that's one of the reasons that's on there. I agree that I think it's just worth doing more research. And I was already talking to Veena about getting her full list of -- to make sure also we capture everything that we already know about that would fit on the list.

PANEL MEMBER McKONE: I had a question about what are alternative plasticizers. Were you thinking of cyclic siloxanes or other things that we talked about in the past. I know there's a use for some types, but I don't know if that's what you had in mind or something else?

MS. HOOVER: Well, siloxanes are already on our list. So again, and just to clarify to Oliver, I didn't mean get rid of my slide. I love my slide.

(Laughter.)

MS. HOOVER: I meant that this is just one topic of discussion today. And this is the aspirational topic about what chemicals do we want to add to our list, knowing that we're not necessarily going to be able to measure them. But -- so Tom, siloxanes are already captured.

PANEL MEMBER McKONE: Right, I remember that.

MS. HOOVER: This is actually broader than that. So if you look at, like for example -- well, if you look at some of what Veena looked at, there's long lists of chemicals currently being used as alternative plasticizers. CDC has a couple on their list. So we just added another one from them, phthalate alternatives.

So they have -- if you pull out your handy designated chemical list. So there's DINCH, for example, DEHTP, but there's a whole other set. And I can send you -- well, I can send all of you the link to the previous screen also that Gail Krowech did about other types of alternative plasticizers when -- and you were at that meeting. It was many, many years ago.

But at that point again, we didn't have enough evidence to feel confident that it would meet our criteria to put it on the list. But it's, you know, something we could circle back and look at.

PANEL MEMBER McKONE: Yeah, it makes -- so what came up -- the reason I raise the siloxanes -- cyclic siloxanes was that it was a rising use, and I would say the same thing here. When you have something coming into the market, it would be interesting. I mean, you know, it's this argument that often we're looking backwards at what's happened, and we know it's there, and then we just

want to see how much is there. But it's also interesting to pick compounds that are just emerging into the market to see how fast they show up in the population and to what extent.

So I would -- I would -- I mean, I would make that argument that's why you want to pick some of these emerging classes. And people that argue against it say, well, they're not there yet, or there's not enough there to be of interest. But that's -- the point is that we -- if we know the market and the supply is growing, then we should be looking at these things.

I don't know if others feel that way, but it's a -- see, I would say if we had to choose -- and again, we don't have to, but if we had to choose between PCBs, which is -- I mean, nobody is making new ones. What we're doing is getting a better understanding of what's already out there. But it's also important to save resources to really look at emerging chemicals, because those are the ones that we can mitigate.

MS. HOOVER: Right.

PANEL MEMBER McKONE: I mean, really reduce the market, or say this was a bad choice of alternatives.

MS. HOOVER: So just a couple clarifications. One is, yeah, the SGP has given us very clear advice from the inception that we should look at emerging compounds.

So our whole chemical selection focus is pretty much on emerging compounds or capturing classes that we think could emerge. So I agree with you, and the SGP has agreed with you. And that's one of the criteria we use in choosing things.

The PCB thing is almost more like an administrative issue. There are -- and Meg, alluded to this, it's not just legacy compounds. There's PCBs that are unintentionally formed, like in the manufacture of dyes and pigments.

PANEL MEMBER McKONE: Yeah.

MS. HOOVER: And those that are biomarkers for that source of PCBs are not on our list. So if we were ever to, you know, want to do an investigation of a particular PCB exposure and decide is this legacy or is this coming from the newer products, we couldn't actually measure it. So that's really what that's about. I agree with you, it's not like a primary focus. But that would not be a big burden on us to deal with.

PANEL McKONE: Okay.

MS. HOOVER: So that's -- that's why it's further down on the list.

PANEL MEMBER McKONE: But if I -- well, let me -- I mean, if I can, just on the PCBs. So even on -- and other legacy compounds, what's interesting, and now

jumping to some of the other things like in our presentations, when something like that has clear health effects that we're still seeing, even if it's a legacy, the reason we might consider biomonitoring is not to find out whether it's there or not - we know it's there - but to inform about how it's distributed in the population, what are the mitigation strategies and what are the health benefits of doing that.

So again, I'm not saying PCBs are boring, because they've been around for 70 years. But when we think about it, what we think about is what's the question. I think for PCBs, and many other legacy compounds, there's still the question of the distribution among the population, mitigation, health protection. And you can't do that if you don't understand how it's really -- how and where it's distributed in the population, and how it gets there.

So again, that would argue for doing both legacy and some of the PCBs.

MS. HOOVER: Oh, yeah. I'm not saying abandon legacy. And I'm not even saying develop the methods for the non-legacy. I'm just saying we would have that option by putting it on the list. So again, this slide is about chemical selection. It's not about what are we actually going to go out and study.

PANEL MEMBER McKONE: Okay.

MS. HOOVER: And ECL is maintaining the POPs panel. That's on your list. That's something we can work on. And what you're alluding to about why is it useful also links with, you know, José's talk --

PANEL MEMBER McKONE: Yeah, that's what I --

MS. HOOVER: -- about, you know, what can we contribute?

So, you know, we might want to spend some time on some of the other slides just to clarify that we also want to talk about -- I mean, if people -- like Meg said, if people want to bring up again like what should our focus be over the next few years of the CDC. We also have some State money. You know, it's not just CDC money, so what would be the high priorities to build on from the past? So you might just -- I mean, happy to hear more chemical selection ideas. I love doing chemical selection, but other ideas are welcome.

CHAIRPERSON SCHWARZMAN: Eunha, go ahead.

PANEL MEMBER HOH: I just want to chime what Sara said was actually the new PCBs, you know, like PCBs created probably not from the old usage, you know, as by-product. I recently worked on some that -- the plastic wrap for food thing, you know. We found that a couple of PCBs there, too. But we didn't see the other abundant PCBs. So that really says that those PCBs probably could

be created from the manufacturing process. Yeah.

CHAIRPERSON SCHWARZMAN: Jenny.

PANEL MEMBER QUINTANA: I just had a question, and I'm not sure if I'm looking at the right lists. I've got all these piles of lists in front of me. But we had a conversation, and I forget how many years ago, about neonic pesticides. And I don't think I see them here, but maybe I'm just missing them. Did they ever get put on the list? At that time, we decided not to put it on, to put glyphosate on that one meeting.

MS. HOOVER: Glyphosate is on.

PANEL MEMBER QUINTANA: I know, but the neonic pesticides, because they are showing up in water, isn't that right, Eunha, that neonic -- neonic pesticides are coming in the water supply quite a bit?

MS. HOOVER: So -- yeah. So we screened a number of pesticide classes. We have a whole list of pesticide classes that we could pursue, and we could bring forward to the Panel as, you know, full documents. We started with organophosphorus pesticides maybe like a year or two ago.

We didn't go back, you know, to more pesticides partially because of the priorities, you know, that we're focusing on as a Program. However, you know, entering the Central Valley and so forth, you know, pesticides may

become a priority. So I think what you're saying to note is, you know, go back to the preliminary screen, keep those on the list, and I can certainly do that, yeah.

CHAIRPERSON SCHWARZMAN: Maybe I could use that as a way -- oh, were you done, Jenny?

PANEL MEMBER QUINTANA: (Nods head.)

CHAIRPERSON SCHWARZMAN: -- to bridge a little bit between this topic of chemical selection and recommendations for studies. Just to say, while we're on pesticides, I was going to ask José if he wanted to reflect a little bit on the pesticide list, and as the CARE study starts to approach the Central Valley, are there any recommendations that we want to make about including pesticides in the CARE study of that community? And if so, are there -- is there a -- are there categories of insecticides or herbicides that we should be pulling in that aren't here?

PANEL MEMBER SUÁREZ: Right. So I agree with what Jenny was mentioning about neonicotinoids so -- and this latest release by NHANES now. They are including the neonics which is a pretty new -- very new for their methods in biomonitoring.

And so the interesting thing about neonics is that they are -- have now become the most commonly used insecticide worldwide. They have taken over

organophosphates, which have been, for the longest time, the most prevalent. You can see the decline in organophosphates and the increase in neonicotinoids.

So I think including some of those would be very beneficial, you know, adapting to the new changes in the new chemicals that there are.

The other piece that I did bring up earlier were with fungicides. So I see that there are some fungicides here, and that's fantastic. Some of the ones that, if we're still brainstorming, talking about some of the newer ones. Some of the ones that I'm concerned about are the azole fungicides, triazole.

So these have a structure that is very similar to imidazoles, which are antifungals used in clinica practice. And some of the older ones like ketoconazole and fluconazole are known to be hepatotoxins. I mean, you have to be monitoring liver enzymes when you're administering some of these older ones.

And so that's one of the concerns. And the use of these, as I was mentioning earlier, since 2007 it's been five- to six-fold increase in the use. And now it's being used in most of the country. So there is -- if you look at the maps produced by the Geological Survey you can see the distribution over time too, and where they're using these pesticides. And it's really amazing the

dramatic increase with that.

So those are two classes that I would like to consider for inclusion. I see that pyrethroid pesticides are included, and that's great. With pyrethroids, there is still -- at least the epidemiology is trying to catch up with pyrethroids now. The measurements of these have been solid now for a few years. And so the epi studies are trying to catch up with toxicity related to pyrethroids.

So I think it's, for the time being, worth it to keep those on the list, but those would be my recommendations.

And if you really want to go to one more fungicide, that would be the quinone outside inhibitors that I was mentioning earlier as well. These are like quinone outside inhibitors. So things famoxadone or fenamidone. Anything obin, so pyraclostrobin. These have a particular mechanism of action. And at least from the toxicological -- so they've done some in vitro studies. And a lot of the toxicology that we have for most of these chemicals are really from in vitro studies, and some of them go up to the experimental level with rats, but not all of them. Then they're finding that they're really not the healthiest choice necessarily.

CHAIRPERSON SCHWARZMAN: Carl.

PANEL MEMBER CRANOR: This is more or less a procedural question, and it may already have been answered. But is there any point to looking at the toxicologic -- I mean, there is a point to looking at the toxicological research. And are the -- have the most -- are the most toxic substances on the list for biomonitoring or are there things that have come visible as more toxic in recent years that aren't on the list? So that would just be a way of checking the list, as it were.

MS. HOOVER: Are you talking about every toxic chemical that -- like, what do you mean looking at -- I mean, we always -- toxicity is one of our criteria. Every time we screen, we use toxicity --

PANEL MEMBER CRANOR: Right.

MS. HOOVER: -- so I don't know what you're --

PANEL MEMBER CRANOR: Well, you know, some of it's a question out of ignorance. But are there things that are potentially more toxic than what's on the list that aren't on the list? That's really the question. And is -- and can you talk to the toxicologists? What are they worried about?

MS. HOOVER: Yeah, I have a toxicology background too. I work with toxicologists.

PANEL MEMBER CRANOR: Yeah.

MS. HOOVER: That's one key factor. But, you

know, there's -- if you look at the law and the criteria for getting on the designated list, we evaluate a number of things in order to screen things for lists. So it's not just about is the most toxic chemical on the list? It's about, you know, what's the exposure?

PANEL MEMBER CRANOR: Right.

MS. HOOVER: Is it relevant to California? Is it biomonitorable? All of those things play into it.

I just want to circle back and say a couple things, and then hopefully we can discuss things other than chemical selection, although this is fascinating.

July 2016, we did a screen -- a preliminary screen on three classes of pesticides, organophosphorus pesticides, neonicotinoid pesticides, and aniline pesticides actually. So we'll definitely add the new ones that José mentioned to the list. We took care of organophosphorus pesticides. We postponed chemical selection for several reasons. One was funding driven, just burden on the labs, not -- it's not practical, you know, to do more chemical selection.

But I propose that we have a chemical selection item in 2019. Doing a designated chemical list for a class is a huge undertaking, if you look at some of our past documents.

So that's kind of maybe one last thing that would

be helpful off of this slide. There's many, many choices that we could tackle, including neonicotinoids. Lauren Zeise had raised fluorinated compounds other than PFASs. Interestingly, there's a link, you know, to some of Eunha's new non-targeted work. Is that of interest?

And then I added, after -- this was after seeing Eunha's work, other halogenated compounds. And the reason why I'm raising that is because the compound that she was focusing on, the -- is TCPM, Eunha?

PANEL MEMBER HOH: (Nods head.)

MS. HOOVER: That is a chlorinated compound that is not a flame retardant, as far as I can determine, which means it's not captured in anything on our list. So that's -- you know, because we captured fluor -- brominated and chlorinated organic compounds used as flame retardants, not all halogenated compounds, because that seemed like it was too large.

So that's one question. You know, that would be one angle we could take or we could go back and pick up, you know, neonicotinoid pesticides or some other class like that. So thoughts on those sorts of priorities.

I mean, I think partially we gravitated this because we are -- PFASs are a priority -- high priority in California, but PFASs are not the only important fluorinated compound. So that's how that rose to the top.

CHAIRPERSON SCHWARZMAN: Yeah, go ahead.

PANEL MEMBER LUDERER: So I guess in thinking about this whole class idea, I mean, the TCPM we think that's a breakdown product of -- do we have any idea?

PANEL MEMBER HOH: It's probably not.

PANEL MEMBER LUDERER: It's probably not. Okay. It's by-product during manufacture

PANEL MEMBER HOH: It's probably a by-product, yeah.

And then Sara found a document, yeah, it looks like a -- it looks like a by-product of the DDT manufacturing, yeah.

PANEL MEMBER LUDERER: So kind of one thing one could think about doing would be the class of compounds as defined as the -- you know, it could be manufacturing by-products and/or metabolites of those compounds, not just the compounds themselves, not the parent, in order on -- what's on the list currently.

MS. HOOVER: Yeah.

CHAIRPERSON SCHWARZMAN: Yeah. Veena.

PANEL MEMBER SINGLA: In the other halogenated compounds category and kind of going back to the conversation this morning about wildfires and other combustion by-products of concern, I wanted to mention brominated dioxins and furans as of interest in that

realm. Because the chlorinated dioxins and furans are currently on the list, but the brominated versions are produced as combustion by-products from a variety of flame retardants and other brominated compounds.

So I think there's a lack of information on toxicity and exposure for those, but certainly more information is needed.

CHAIRPERSON SCHWARZMAN: Other thoughts?

Sara has put back up the list of topics from this morning about -- thinking about specifics about inquiries that the Program might make that are specific to California, and that might be funded by the CDC state-specific biomonitoring funding, just to see if it brings up any other thoughts.

Jenny.

PANEL MEMBER QUINTANA: I was just looking at that list over the break, and thinking that we have it structured as issues of population, but we don't have a category of intervention studies or policy -- evaluating policy studies, which we might have as a type of study that might be useful. Just a thought brainstorming.

And the other thought I had was years and years ago - I was asking Sara - we had a discussion about biomonitoring breast milk, because you have the same methods, but a very interesting population, and there's

also breast milk banks. Because one thing I think that's obvious to everyone is that getting your own samples is super expensive, you know. So if we're trying to keep resources for the lab, maybe trying to focus on an approach which utilizes bank specimens, or utilizes already collected specimens as much as possible to save as much money to keep the important work of the lab going.

DR. WU: I'm glad you said that, because I actually wanted to bring up the MAMAs samples as well, the biobank samples. So we're talking -- we've talked a lot of -- about methods related to CARE or analytes we'd like to add to CARE.

So a couple things I wanted to say. One is that the timeline of method development is such that, you know, we're looking ahead to being in the Central Valley in a couple years. So getting a chemical panel designated and then having a method developed, there's -- we might have to think about what is realistic within that time frame, or we could rearrange our regions perhaps, in order to have method development in time for an agriculturally relevant region.

The other thing is that we do have sort of two different tracks going. One is our surveillance, where we're looking -- I think it makes more sense to be looking at chemicals that we know are in the environment, maybe

legacy chemicals, the PFASs, because we also have the results return side of things. So if we're doing things that are emerging chemicals that we're just learning about, some of that is harder to describe to a population. It's harder if we don't have a lot of information to say about what we know about their health effects.

But we do have this biobank resource, the Genetic Disease Screening Program, which is -- it's only serum and it's very low volume, but it's capturing about 70 percent of pregnant women in California. So for some of these more exploratory things like the newer PFAS, maybe some of these other compounds we can look at in serum, if we have some of these other halogenated things on the list, that might be the best place to be doing this kind of vanguard type of work.

MS. HOOVER: I just want to ask Nerissa a question. And is there room do you think for that to be part of the CDC proposal?

DR. WU: Well, Robin has this laptop that she's writing all this stuff down.

(Laughter.)

DR. WU: And as we talk, she's kind of sketching out these different scenarios. And, you know, we're trying to wedge as much as we can in -- the MAMAs are really cost effective, because the samples are already

there. We have to purchase them. Much cheaper than going out and getting them.

So we're -- we are trying to fit maybe every other -- maybe a couple years worth of targeted, and then experimental work in as we do our CARE work. But, yeah, I mean, you have to give something up in order to fit each one of those in.

MS. HOOVER: Yeah.

DR. SHE: Jianwen She, California Biomonitoring Program. Regarding -- I have a comment on some chemicals work we do -- we have experience with. For example, for halogenated compounds, laboratory learned polyhalogenated carbazoles was found in Great Lakes at very high levels. Some research from Giesy lab, An Li lab. Some people found it in California -- San Francisco Bay. The estimate is a level in the sediment is higher than -- is high as the -- five times high as the PBDE's release.

So then we use our lab resource, because structurally carbazoles is maybe from a by-product from the diurnal product -- diurnal plants. So we cannot find it in human samples. And so that means that sometime you find maybe in the environmental samples, not necessarily do we find it in the human samples. And we only have a limited experience.

Regarding also the polybrominated dioxins, if we

remember Zhousang Sho's paper, he monitored some firefighters. I think a very small study. He actually pick up the California peoples, firefighters. I remember 13 firefighters he found PBDF or PB -- poly-PBDF.

And in my 30 years doing my Ph.D., I look for this group of chemical I'm looking for, so that actually polychlorinated, lower brominated ones means mixed ones possibly need pay more attentions, because we find a lot of high chlorine, but mixed with very few bromine, because bromine bond with carbon is weaker. And so from the -- especially from the -- in traffic, car's exhaust, and also the incineration burn down the hospital's waste, not newly simple waste, but hospital waste in incinerations.

So and make these two comments.

Thank you.

And one more chemicals, because Sara also listed and -- one more chemical, and BP-3 groups laboratory also work hard. We find more than BP-3 or BP-1. That's also heard Dr. -- Professor Hoh's laboratory also look at BP-3. So we try to develop class-based method. So we move very slow, but we -- I think we come to the conclusion we can publish this paper. So we try to do a low-targeted group analysis. But we needed to bring the target with -- within certain chemical space, so by group them -- class them is one kind of the space methodology.

Also, very great presentation by Dr. Singla. So think what she presented like this morning, like thousand chemicals someone predicted can be monitored. That chemical actually can be think as low-targeted screening chemical space. Then your low target become semi targeted. So otherwise this low target idea that don't work, because you need to bring to the boundary low target, unknown, semi-low to the target. So I think that's a lot of comment we try to do in the laboratory use our limited resource.

I'd like to ask Sara a question. What's a rubber chemical compound really means?

MS. HOOVER: Yeah. I was intentionally vague about that, because I got -- I got some input from a stakeholder that is not completely shareable yet. So I can't give that information. But if you were interested in that, it could be a potential preliminary screen.

So just throwing out potential preliminary screen. So just throwing out ideas.

I'm wondering if we might want to take one last run through the first slides, if you go back to -- yeah. So just maybe run through the discussion questions from each of the Panel members and make sure there isn't anything that we want to focus on or comment on from those three. And just go one at a time.

CHAIRPERSON SCHWARZMAN: Yeah.

PANEL MEMBER QUINTANA: I guess I had a comment or question that maybe applies to all three of them, but maybe starting with Dr. Singla, which is this Biomonitoring California came about because of breast cancer activists. But the one group that hasn't been singled out for a special study has been the breast cancer, you know, recurrence or any other group. And so some years ago I think I forward a paper about chemicals associated with breast cancer. And I'm just wondering if we could even look at chemicals with that lens maybe for some kind of priority -- prioritization or something, because I feel like that's one thing that hasn't really come about at this point.

Just a suggestion. And I know that you had looked at different categories, especially you presented that slide about different risk factors, but maybe it could be refined further.

CHAIRPERSON SCHWARZMAN: I would just maybe add to that, that it's an area of research interest of mine. And I know that there's -- it's both promising and not promising in a sense that some of the research that California Breast Cancer Research Program has been supporting has been doing some non-targeted screening, looking at estrogenic compounds in the blood and serum of

women who have versus don't have breast cancer.

And it's hard. It's really hard. There's like a higher estrogenic load, but you can't necessarily tell where it's coming from is the bottom line of my understanding of someone else's research.

But I do think it's an interesting idea to come through sort of a disease relevant lens is what I hear you suggesting.

PANEL MEMBER QUINTANA: Um-hmm.

CHAIRPERSON SCHWARZMAN: And breast cancer is tricky, because there's both -- we're not just talking about carcinogens. We're also talking about mammary gland development toxicants, right? So there's sort of two -- there's carcinogenesis in a more classic mechanism, and then there's all the sort of disrupted development impacts that affect breast cancer risk.

Other thoughts?

Carl.

PANEL MEMBER CRANOR: A quick reminder, given Dr. Singla's talk, she detected a lot of building materials in the dust. And we did raise the possibility, and she seemed very excited about that, is there any point to the Program monitoring people that work and build with these materials? I think it's probably a very difficult group to study, because they move around, and they're hard to

keep track of, and all that sort of thing.

But if the building materials are showing up in the dust and they're worrisome, what about the people that are putting them up?

CHAIRPERSON SCHWARZMAN: One thing I might just say, and I don't know if, Veena, if you'll have additions to this, is I feel like exposure potential is very specific to the compound and the matrix -- I mean, not the matrix. That's not the right term here, but the material that it's in.

So, for example, I've seen studies about concentration of flame retardants in offices when they've just been built, when they've been populated with the electronics, and then when the electronic are running. And the exposure is not very low until the electronics are turned on, at which point the exposure goes way -- or the concentration in the indoor air goes way, way up.

So there, you have something where just handling the materials having them being present in the space isn't sufficient to cause the exposure, but use of them is. And I'm sure the opposite is true for some other, you know, components of the built environment, where when you're applying them, and installing them, and all that, the exposure is much higher than when you're in the use phase.

But I only say that to mean that there isn't, of

course, this direct correlation between if it's in the building material, then the people who are building the buildings are going to be more highly expose.

PANEL MEMBER CRANOR: Well, I just raised the question --

MS. HOOVER: Mic.

PANEL MEMBER CRANOR: I just raised the questions, because it came up, and whether -- didn't want it to drift away unaddressed.

PANEL MEMBER SINGLA: Thanks for bringing that up again. I think there's -- there is a few interesting angles in relation to that, specifically related to building insulation and flame retardants. Those flame retardants are used in multiple types of building insulation, spray foam insulation as well as polystyrene and polyisocyanurate. So various types of foam plastic building insulation which are very -- used very widely for energy efficiency purposes.

And California requirements for building energy efficiency are very stringent, so the insulation -- building insulation is a very important criteria for building new buildings, certainly in building remodels and rehabs. And some of the -- we don't have much data on occupational exposures for installers for folks that are installing building insulation. But one study from NIOSH

on spray foam installers did find higher flame retardant exposures to the installers.

And for some of the brominated flame retardants that are used in the other types of insulation, we have a little bit of data showing in manufacturing and cutting in the factory exposures. But again not much information on the installation piece, nor much information on how the -- in the installation process some of the dust or abraded material generated during that process might contribute to future indoor exposures.

So I think there is -- there's a lot of questions of interest. And I'll just mention that -- a few things. One that spray foam is on the Safer Consumer Products Priority Product List for the isocyanates, not for flame retardants. They're looking at it for different chemicals. And two, that the California Building Commission just recently passed a building code standard change that will allow flame retardant-free insulation below grade.

So I think there's something specifically of interest for California in this flame retardant building insulation question.

MS. HOOVER: I just wanted to -- this is Sara Hoover again. I wanted to ask actually a couple questions of Robin and Nerissa before we move off this slide. And

that is on the CDC proposal where they have -- we have a piece -- our surveillance piece, CARE, potentially MAMAs, the targeted/emergency piece, could you say anything about like the room to do some kind of targeted study, intervention study, you know, the emergency protocol for the firefighters? Do you have any thoughts about that related to CDC?

DR. WU: Well, I think I have spoken about this a little bit. And I've stay deliberately vague, because we are still working out those numbers. CARE will be the bulk of the funding, which I think is -- I mean, again, the CDC FOA is really focused on data generation, and having, you know, this massive data that can be compared with other states.

But within that, I do think there is room for probably every other year -- so maybe three sort of cohorts of targeted studies. And we're -- you know, it's this question of how do we want to prioritize?

We also want to highlight something that is very unique to California, because that's the whole thing -- that's the whole driving behind -- drive behind having, you know, supportive State programs, which is one of the reasons why wildfires is so compelling to us.

But the flame retardant story is also. I mean, it's very unique to California, and it's something that we

have a lot of experience with. So, I mean, this is what we're -- this is what the task is for us to really figure out how much we can fit in, and what really gives us both the most public health impact, but also what is going to be appealing to CDC.

We also, I think as a Program, need to look at other sources of funding. We can't just rely on CDC. And my hope is that this discussion will help kind of seed ideas for us looking for collaborations with some of you and others, but also other places we might look to supplement CDC.

MS. HOOVER: That's really helpful. And I think that means that all of this discussion we've had today about priorities and what everyone is interested in is really going to be a useful resource for us to draw on in figuring out where we go with the CDC proposal, which is due shortly.

I also just mention that the complimentary dust sampling I think that's always a possibility, but it's a different pot of funds, so not CDC or State biomonitoring funding.

I'm wondering if we -- you know, I just don't -- I don't want to miss the last two sides. So why don't you advance one more, and we'll just take a look at -- I think we've actually covered a lot of this as part of chemical

selection and method development.

I don't know if anyone has any last comments. I think we had a really robust discussion of this and how it informs our potential priorities. And then José, did you want to say anything else before we move forward.

Russ.

Did you want to say anything else about -- from your work and any other -- any other feedback to the Program before we end this session from your work?

PANEL MEMBER SUÁREZ: I think we've covered a lot talking about POPs in this case in particular. I guess something that we can think about is if there are interests in doing any intervention studies, how -- it could be on this topic or any other ways, it would be interesting to see what the role of the Biomonitoring Program may be in something like that, and how much of the efforts or resources could be involved. And this is, I think, when the partnering with other people, because doing interventions is very expensive.

But on the other hand, if there's an intervention ongoing, then maybe other types of chemicals can be then measured by the Program, then that's kind of a win-win for both sides. So something to think about.

MS. HOOVER: Last thing. It's 4:11. And we actually were supposed to start our wrap-up at 4:05. So I

wanted to just check, do we have any open public comment?

Any open public comment in the room?

Okay. So then we're going to use that time, and you can start the --

PANEL MEMBER HOH: Sara, can I have one comment?

CHAIRPERSON SCHWARZMAN: Sure. I just meant, you know, at some point, Meg is going to wrap-up, and you have time to still do that last piece.

PANEL MEMBER HOH: It's just my last comment, that during the break that I had a conversation with the group from UC Davis, Thomas Young, professor. And then the -- his group -- he brought two or three more guests together. And one of them -- two of them I think they mentioned about the native tribes communities, and initiate -- kind of express the high interest about the hoses -- the reduction and elimination of POPs, because their communities has huge, huge concerns about their body burden. It's all about like -- you know, all the foods and have high concentration of all the POPs. And, you know, of course, they have to change their culture, but they -- also, they want to keep their culture. You know, a lot of people already have high body burden, you know, so...

CHAIRPERSON SCHWARZMAN: Okay. Thank you. I was going to do the call for public comment, but you did it

for me. And I don't think we have anything online.

So we have the opportunity here to kind of pull together some ideas from the day. And I don't -- we don't need to be duplicative, but if anyone has additional thoughts or highlights that they want to add now, I guess what I would say is that I've heard some -- the things that are kind of sticking with me a bit, other than from all of the interesting ideas today, is the potential to use banked samples as -- to call it an intervention study wouldn't be right, because that assumes you have the same -- you're studying the same people before and after intervention. But the idea of using banked samples as -- where it's a relevant point of comparison to a later time period like banked breast milk or the Genetic Disease Screening Program that having that time lapse is so valuable, and being able to use banked samples.

So I'd be very interested in -- I think there's many potentially interesting studies that could be done with MAMAs-type samples, and even developing newer ones and comparing were past banked samples and also with the GDSP Program.

So I think there's potential rich studies there, in addition to sort of expanding and continuing CARE. I'm kind of excited about it all.

And also would be interested to hear what you

think might be possible with the rapid response sort of wildfire studies or wildfire clean-up studies.

Anyway, those are some of the things that stood out for me.

Does anyone want to mention any highlights or final ideas for the Program?

Please, Jenny.

PANEL MEMBER QUINTANA: I guess I was looking at that cut down list that you handed out of what you could do quickly. But I was kind of struck by the disconnect between how often pesticides were mentioned and how few were on that list. So maybe just -- that does -- pesticides do seem to be a high priority, maybe to bring that forward.

CHAIRPERSON SCHWARZMAN: Okay. And if there aren't other comments --

Yes. Sara has one more question.

MS. HOOVER: We actually never came to the point of what chemical selection item would you guys rate as the high -- we can do one in-depth chemical selection item for July. So you have to pick. You can't say do it all. Because that's what we often get is do it all. Yeah, it's all on our list. So, you know, we can do a preliminary screen of the other halogenated compounds that are not captured, including the fluorinated compounds that have

come up? We could -- we cannot do a -- the complete designated chemical document for neonicotinoids, but we could put that on our list and start working that, if that's a higher priority. So just think about --

CHAIRPERSON SCHWARZMAN: I heard quaternary ammonium compounds.

MS. HOOVER: That could be -- yeah, if that's the highest priority as a preliminary screen --

PANEL MEMBER FIEHN: Yes.

MS. HOOVER: So that's -- Okay. That's getting a lot of nods.

PANEL MEMBER SUÁREZ: So what I would suggest is if there are five different compounds that are of consideration, I think it would be good to have a description of the rationale of -- as to why it is important that this one, and maybe then we can have a vote on which ones. But it would be good to --

MS. HOOVER: Well, that's what a preliminary screen is.

PANEL MEMBER SUÁREZ: -- have a good well-informed rationale as to why it is that we think that chemicals ought to be included, just to make it more of a systematic and a well-informed decision.

MS. HOOVER: I'll send you a couple links of what we've done in the past. And that's exactly what I'm

asking you for. But just doing that preliminary screen is an effort in and of itself. So we're not going to do a preliminary screen of everything on the list. We'll do a preliminary screen -- which is where we take a look at the class of compounds, we look at our criteria for designated chemicals, and we do an initial screen to say exactly what you're saying, like why would this be important to go on the list?

So it sounds like actually of all the things, the most head nodding is quaternary ammonium compounds at this point to shift to a preliminary screen of that class of compounds.

PANEL MEMBER SUÁREZ: Just a question. By preliminary screen you're -- what are you talking about specifically?

MS. HOOVER: I'm going to send you some links.

PANEL MEMBER SUÁREZ: Okay.

MS. HOOVER: And I will share with the whole Panel. It's -- we haven't done one since you joined the Panel, I think. But essentially, it's a document that OEHHA prepares, where we take an initial look. So, for example, the pesticide document I mentioned, we took an initial look at three classes, and the Panel said, sure, do them all, but let's start with organophosphorus pesticides. And then we did a designated chemical

document.

And partially, it's exactly what you're saying, we don't want to embark on a huge effort of a potential designated chemical document without some buy-in from the Panel that, yes, we want you to do all this work, because it's a lot of work. So that's -- I'll send you some -- I'll send some examples to the whole Panel.

But am I hearing that quaternary ammonium compounds go above the halogenated proposals?

(Head nods.)

MS. HOOVER: Okay. Everyone is nodding.

All right. Great. Thank you.

CHAIRPERSON SCHWARZMAN: Great. Any final points before we conclude?

Okay. So I will -- we'll conclude the meeting. There will be a transcript posted on the Biomonitoring California website. And the next SGP meeting will be on July 25th in Oakland. And thank you all for attending the meeting, and for your thoughts, and particularly for -- to the presenters from today.

Thanks.

(Applause.)

(Thereupon the California Environmental Contaminant Biomonitoring Program, Scientific Guidance Panel meeting adjourned at 4:19 p.m.)

C E R T I F I C A T E O F R E P O R T E R

I, JAMES F. PETERS, a Certified Shorthand Reporter of the State of California, do hereby certify:

That I am a disinterested person herein; that the foregoing California Environmental Contamination Biomonitoring Program Scientific Guidance Panel meeting was reported in shorthand by me, James F. Peters, a Certified Shorthand Reporter of the State of California, and thereafter transcribed under my direction, by computer-assisted transcription.

I further certify that I am not of counsel or attorney for any of the parties to said meeting nor in any way interested in the outcome of said meeting.

IN WITNESS WHEREOF, I have hereunto set my hand this 15th day of March, 2019.

JAMES F. PETERS, CSR
Certified Shorthand Reporter
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