MEETING

STATE OF CALIFORNIA

ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

ENVIRONMENTAL CONTAMINANT BIOMONITORING PROGRAM

SCIENTIFIC GUIDANCE PANEL

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

RICHMOND CAMPUS AUDITORIUM

850 MARINA BAY PARKWAY

RICHMOND, CALIFORNIA

THURSDAY, JULY 28, 2016

10:04 A.M.

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

PANEL MEMBERS:

Asa Bradman, M.S., Ph.D., Chairperson

Scott Bartell, M.S., Ph.D.

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

Oliver Fiehn, Ph.D.

Marion Kavanaugh-Lynch, M.D., M.P.H.

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

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

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

OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT:

Lauren Zeise, Ph.D., Acting Director

Amy Dunn, Research Scientist III, Safer Alternatives Assessment and Biomonitoring Section

Sara Hoover, Chief, Safer Alternatives Assessment and Biomonitoring Section

Shoba Iyer, Ph.D., Staff Toxicologist

Frank Kammerer, Staff Attorney

Laurel Plummer, Ph.D., Staff Toxicologist, Safer Alternatives Assessment and Biomonitoring Section

DEPARTMENT OF PUBLIC HEALTH:

Robin Christensen, M.S., Biomonitoring California Grant Coordinator, Sequoia Foundation

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

DEPARTMENT OF PUBLIC HEALTH:

Michael J. DiBartolomeis, Ph.D., Chief, Exposure Assessment Section, Environmental Health Investigations Branch, Lead of Biomonitoring California

Jianwen She, Ph.D., Chief, Biochemistry Section, Environmental Health Laboratory

Nerissa Wu, Ph.D., Chief, Chemical Exposure Investigations Unit, Environmental Health Investigations Branch

GUEST SPEAKERS:

Benjamin Blount, Ph.D., Chief, Tobacco and Volatiles Branch, Division of Laboratory Sciences, National Center for Environmental Health, Centers for Disease Control, and Prevention (CDC)

Paul English, Ph.D., M.P.H., Branch Science Advisor, Environmental Health Investigations Branch, California Department of Public Health(CDPH)

ALSO PRESENT:

Nancy Buermeyer, Breast Cancer Fund

Shelley DuTeaux, California Department of Pesticide Regulation

Rachel Kubiak, Western Plant Health Association

Emily Marquez, Pesticide Action Network

Veena Singla, Ph.D., Natural Resources Defense Council

I N D E X

I N D E X C O N T I N U E D

P R O C E E D I N G S

DR. PLUMMER: We're going to begin the meeting now. And I just want to let everyone know today's meeting is available via webinar by going to our website and clicking on the July SGP meeting. And I would just remind everyone to please speak directly in the microphone and introduce yourself before you speak. This is for the benefit of the people on the webinar listening, and also for the transcriber.

So the materials for the meeting will be provided to the SGP members and posted on the Biomonitoring California website. And there are some folders with copies of the agenda, presentations, and documents at the table near the entrance.

And today, we'll have a break around 1:15 for lunch, and another short break at 2:45. And the restrooms are located right out the back, as well as the emergency exits.

And with that, I'd like introduce Dr. Lauren Zeise, Acting Director of the Office of Environmental Health Hazard Assessment.

Lauren.

ACTING DIRECTOR ZEISE: Thank you, Laurel. Good morning, everyone. I'd like to welcome everyone, the Panel and those listening in the room and on the website

to this meeting of the California Scientific Guidance Panel for the California Environmental Contaminant Biomonitoring Program, also known as Biomonitoring California. So thank you all for participating in this important meeting.

So our last meeting was held in Sacramento on March 3rd, 2016. And at that meeting, the Panel participated in a special session around biomarkers of diesel exhaust exposure. We heard from special guest speakers Dr. Chris Simpson of the University of Washington and, Dr. Vanessa Galaviz of California Environmental Protection Agency. And a key conclusion from this discussion was that metabolites of 1-nitropyrene are useful biomarkers for diesel exhaust. And I think we'll be hearing a lot more about that at future meetings of the Panel.

We also heard very interesting research from Dr. Luderer on polycyclic aromatic hydrocarbons. And we heard Program updates and laboratory updates. And the Panel provided lots of very useful information, input, and recommendations to Biomonitoring California. So there's a summary of the Panel's input and recommendations, and a complete meeting transcript on our website at www.biomonitoring.ca.gov.

So now, I'll turn the meeting over to the Chair

of the SGP, Dr. Asa Bradman.

CHAIRPERSON BRADMAN: Thank you very much. I also want to welcome all the Panel members to today's meeting. And also thank you all for attending both here in person and on the web. I think today is going to be a very interesting both in terms of the discussions and presentations this morning and also this afternoon when we talk about pesticides, a critical issue in California agriculture, which is so important to our economy, and also, you know, raises concerns around exposures and possible health concerns.

Just to announce the goals for today's meeting, this morning we'll receive Program updates and provide input on that to the Program. We'll also be discussing activities of the National Biomonitoring Program with Dr. Benjamin Blount. I look forward to his presentation. Dr. Blount is from the CDC and has been involved in biomonitoring for many years.

And again, this afternoon, we'll have a special session on pesticide biomonitoring and discuss strategies and practical next steps for Biomonitoring California.

We're hoping that the Panel and the public will provide input on possible pesticide classes for future consideration as potential designated chemicals. So that's going to be an important topic.

Just a reminder for each agenda topic, we have time provided for Panel questions, public comment, and Panel discussion and input. And just a reminder on how we handle public input for the meeting, which is really critical to the Program, and we want to make sure everyone feels welcome and is invited to provide comments. If you would like to comment on an agenda item, please fill out a comment card, which can be obtained from the table near the entrance. Turn the cards into Amy Dunn. There's Amy raising her hand over there. If you're joining the meeting via the webcast, you can provide comments via the email biomonitoring@oehha.ca.gov, OEHHA being O-e-h-h-a.

Emailed comments relevant to the topic under discussion will be read aloud during the meeting and entered in the record. Public comments will be subject to time limits, and if needed the time allotted will be divided equally among all the individuals wishing to speak on that agenda item, usually though we have plenty of time.

Please keep comments focused on the agenda topics being presented. There will be an open public comment period as the last item of the day for any comments related to biomonitoring concerns or issues that are important to you.

So now I want to introduce Dr. Michael

DiBartolomeis. He is Chief of the Exposure Assessment Section, California Department of Public Health, and lead of Biomonitoring California. And he'll provide a budget update, introduce our first speaker of the day, Ms. Robin Christensen. So thank you, Michael.

DR. DiBARTOLOMEIS: Is this on?

MS. CHRISTENSEN: No, it's not.

DR. DiBARTOLOMEIS: Now?

(Laughter.)

DR. DiBARTOLOMEIS: Now, I'm on.

So thank you, Asa, for that introduction. I'm sure glad you did that, because I'm sure people would have confused me with Robin. So I just wanted to -- that's good to know that.

And I want to say, you know, welcome to everybody on the Panel, everybody in the room, and a special welcome back to Megan. It's great to see you.

(Applause.)

DR. DiBARTOLOMEIS: So before I turn the podium over to Robin, I'm actually going to introduce somebody in the audience, and then as well as I will give a brief summary of the update on the status of our budget, one of your favorite topics. So the first thing I want to do is to point out Kristin Dortch, who's sitting right there. Kristin is the project officer for the State based Public

Health Laboratory Biomonitoring Cooperative Agreement for CDC, otherwise just our project officer. She's taken that position over from Lovisa Romanoff. So we welcome her. She's been in this world for a while, but she -- this is her first meeting, so...

And actually, she has a background in chemistry. So she's worked as an analytical chemist in the Organic Analytical Toxicology Branch in Tobacco and Volatiles Branch. I thought we had long names in State government.

(Laughter.)

DR. DeBARTOLOMEIS: Her research was on biomonitoring analysis of serum cotinine for the National Health and Nutrition Examination Survey, NHANES. She serves as the 2016 Women's Chemist Committee Chair in the Georgia American Chemical Society.

So, welcome. Ben will be introduced later.

So let me just go to the first slide after this one.

(Thereupon an overhead presentation was Presented as follows.)

DR. DiBARTOLOMEIS: Do I have that?

Oh, here it is

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DR. DiBARTOLOMEIS: I like being the first speaker because all the technical glitches get worked out,

you know.

(Laughter.)

DR. DiBARTOLOMEIS: There we go.

Thank you, Robin.

MS. CHRISTENSEN: You're welcome.

DR. DiBARTOLOMEIS: A little bit of -- just a little bit of an Update. Just as a reminder, for the past -- since 2007 or so, we've had core funding. That hasn't really changed much. And that core funding is from five special funds, which include the majority of funds, are coming from the Toxic Substances Control Act fund, TSCA fund. And we have about 13 -- I think, it's 13 State positions that are core positions in the three departments.

What's changed is that when the second CDC grant was granted or, you know, we're able to receive those funds, it was less than the original grant amount. And so you all know that history. And so there's been a series of budget change proposals prepared by the Program and approved by the -- approved and eventually inserted into the budget to allow for some partial compensation for the loss -- or the reduction, I should say, in federal funds.

But they have come at a -- in a kind of strange way that you would not normally want to do if you were the person running a program. They come in two-year cycles.

So you're getting some positions for two years, and then you have to re-ask for them again. And this has happened in two, two-year cycles, so every year we're asking for funds for the coming two years for those positions.

So we did successfully gain back two -- the positions that were from the first round of BCP, which is I think four total positions, two in CDPH, and two in DTSC. I may be wrong. There might be one in DTSC, but nobody is here from DTSC to probably correct me anyway.

And so we were successful to get another round of two-year funds, and the positions were made permanent. So we now have permanent positions, not limited-term positions. So at least we don't have to ask for position authority anymore.

The other thing that is really great news, thanks to our very efficient and great stakeholders, that support this Program, they were able to convince both the legislature and the Governor to include in this year's budget $1 million for the Program in -- out of the general fund, which in and of itself is news --

(Laughter.)

DR. DiBARTOLOMEIS: -- for environmental justice focused work. And this is a one-time allocation with the hope, I think, at least from our perspective, that if we do great things, that it will become more -- maybe a

continuous or annual funding.

But again, you know, this is -- we have one year to spend these funds. We are looking into ways to extend the spending period, not the amount of money, but the spending period for greater than a year. And later when Robin is on a slide like 7 or something, she'll be giving some more specific exploration ideas in how we want to use these funds for EJ, and then we definitely want to hear back from the Panel on if any ideas pop into your minds.

And finally, I thought -- well not finally, but in terms of State funds, I thought I would give you a little prognosis on 2017/18, which is now -- we're in that process now of requesting funds for that year.

We are interested in the second set of positions that were given to us that were of limited term. We're trying to get those to be permanent term, and we're hoping that we can get annual funding for those instead of two-year, so that's what our hope is.

So the prognosis, I think, is good. I just don't know how it's going to be for permanency. So we'll -- stay tuned for that. In terms of federal funds, it was announced we did receive notice that our CDC grant has been renewed for the coming -- it's actually not federal fiscal year really. Technically, it's the grant fiscal year. But nevertheless, the -- that we have another year

of funding which is great. So thank you, CDC.

So with that, unless there are any questions, I would like to introduce Robin. What the little thing here doesn't say is Robin has been my right-hand person since I started in this Program, almost four years ago.

And so I'm going to give you a very dry summary, but she does so much more than what I'm going to read.

Robin is the Biomonitoring California Grant Coordinator, and she administers -- in administering the CDC Cooperative Agreement. So her primary role is really ensuring that the CDC grant deliverables adhere to our Program's strategies, schedule, and budget. Prior to joining Biomonitoring California, she worked in community violence prevention for 10 years, with roles in surveillance and evaluation, research, and practice. She also managed a CDPH, California Department of Public Health, funded project to improve access to domestic violence services for people with disabilities.

So with that, I am turning the microphone over to Robin.

MS. CHRISTENSEN: Thanks.

MS. DUNN: If you haven't been able to look at the webinar, the slides are on the meeting page. So you can look at them that way.

MS. CHRISTENSEN: Okay. Can you hear me?

All right. Thank you, Michael, and good morning, everyone.

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MS. CHRISTENSEN: So I am going to start off with a staffing update, and also go into a few project updates. So I am very happy to announce that Dr. Crispo-Smith is now the Research Scientist Supervisor in the Biochemistry Section at the Environmental Chemistry Laboratory.

We are also very fortunate to be welcoming so many new staff to the Biomonitoring Program. Dr. Shoba Iyer has been working with OEHHA for some -- for a while now. And she is now 50 percent on Biomonitoring California. Dr. Juan VillaRomero is a new staff at the Environmental Chemistry Laboratory, and he was previously an EPA Star Fellow at Berkeley. Dr. ShiZhong Wang and Dr. Rosario Amado are both new to EHLB. And Dr. ShiZhong Wang is working on the PAH analyses. And Dr. Amado is working on our non-targeted screening program.

I also want to welcome Ms. Hiu-Mei Ma and Alex Nguyen. They are currently not here today. They are out in the field working the ACE Project. And I also really would like to thank Dr. Laura Fenster who retired in April, and Dr. Gail Krowech, who will be retiring in September. They've both helped this Program out quite tremendously, and we thank them very much and wish them

well.

Jeffrey Aduviso has been our sample manager, and he has left the Biomonitoring Program, but he's still within CDPH, so he hasn't gone too far.

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MS. CHRISTENSEN: Moving on to Program updates. I'm going to be providing you with an update of some of our existing projects, and then also move into a few projects that we're going to be looking forward to.

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MS. CHRISTENSEN: Starting off with the ACE Project. The Asian and Pacific Island Community Exposures Project. This is a partnership with APA Family Support Services. And the idea is to biomonitor Chinese adults living in the Bay Area for a panel of metals, which include lead, mercury, cadmium, total and speciated arsenic, and also PFASs.

I don't want to jinx anything, but this community-initiated project has been very successful. We started out in the field in June of 2016, and we are rapidly nearing our initial conservative enrollment goal. We plan on enrolling people through October, and we've increased our enrollment goal to now 80.

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MS. CHRISTENSEN: And Hiu-Mei Ma and Alex are not

here today, so we've provided you with a slide here. They're actually out in the field, and we are collecting -- we're doing phlebotomy and doing additional interviews and urine collection

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MS. CHRISTENSEN: Okay. Our FREES Study is also at a pretty exciting juncture. FREES is the Foam Replacement Environmental Exposure Study. And it's in partnership with Dr. Deborah Bennett of UC Davis. This study is comparing levels of PBDEs and OPFRs before and after foam furniture replacement. It's a baseline, and then six, 12, and 18-month follow up. We are sampling serum and urine for PBDEs and OPFRs. And UC Davis is analyzing the dust samples from those same households.

We have two different groups as a part of this FREES Study, San Francisco East Bay is a voluntary group that they volunteered to replace their furniture. We currently have 21 participants from 13 households enrolled. And we have returned their baseline results and we are in the process of collecting their six-month samples.

San Jose is a partnership with First Community Housing. We're recruiting from this First Community Housing. They -- we currently have three participants from three households, and the baseline sample collection

is complete. We don't anticipate to enroll anymore than the three.

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MS. CHRISTENSEN: So moving on to our next study, the Biomonitoring Exposure Study. I don't think we've actually updated on Expanded BEST in awhile. This is a project that measured environmental chemical exposures in 350 Kaiser Permanente residents in the Central Valley. And last August, we returned results to participants, and those results found that 30 of the participants had elevated inorganic arsenic levels. And we did our follow-up protocol, which involves a follow-up survey, and we tried to identify potential sources of exposure in these individuals.

And in some of them it was a little bit unclear. Our survey didn't find anything that was a clear pinpointed reason for the increased arsenic.

And so internally, we decided as part of clinical follow up, we would offer a retest. And so we contacted these participants, and 25 of the 30 expressed interest in having a repeat test and having their urine analyzed again.

And of those about half of them actually followed through and mailed us their samples. And those samples have been analyzed, and the data is currently under

quality review. They have not yet been returned to participants.

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MS. CHRISTENSEN: Moving on to the MAMAS Project. So we reported about a year ago that we had found metals contamination in the MAMAS samples. And since that meeting, EHLB has actually conducted subsequent experiments. And unfortunately, we've found that the metals contamination is not only widespread, but that it varies within lot and between lots. We also found that for some of the analytes the contamination actually increases over time, holding time within the vials.

So with no way to reliably control for the metals contamination, we have actually removed the metals from the scope of work. We will still be analyzing samples for PFASs, PBDEs, PCBs, and OCPs.

This map here depicts the geography of our MAMAS sampling. And the counties that are shaded in orange are the second batch of samples. Our labs are currently analyzing the samples for those analytes I mentioned. The third batch we've put in a request to GDSP, and we're currently in their queue. I do not have a projected date for when the samples will be transferred.

The Central Valley counties that are unshaded, these counties are part of biobank and we are un -- we

opted not to sample from those counties, because there's a two-year waiting period on the samples, and the sample volume is half as much as what we can get from the other counties.

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MS. CHRISTENSEN: Okay. A little bit about some of the additional Program work. And I feel a little bit bad, because both Myrto and June-Soo are not here. So this is -- this is -- this is a shorter slide than we would usually offer for our additional complementary Program work.

Jianwen's lab has been working on the Firefighters Occupational Exposure Study analyzing the archived samples from the prior grant period for organophosphate flame retardants. And those results are currently in QA and very near to release.

The -- his laboratory, EHLB, is also working on the Pregnancy, Environmental and Lifestyle Study, which is a partnership with Kaiser Permanente. And they are analyzing environmental phenols. And both laboratories continue to work on additional laboratory method development, including BPA alternatives and non-targeted screening.

So the next couple of slides are looking forward at our upcoming projects. And I really need to caveat

here that it's very preliminary. And so we're presenting this here for preliminary feedback. Unfortunately, I don't have too many details to share on either of the projects.

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MS. CHRISTENSEN: Now, because the MAMAS scope of work has changed, we were able to redirect funds to support a multi-regional surveillance study. We are currently in the planning phases of this. The goal is to approximate a statewide sample over time.

We will be moving into region by region, and expanding the -- starting with a pilot region hopefully in -- near -- in Contra Costa, Sacramento, a county something like -- near to us, and expanding out across the State as the idea is better developed.

We are currently in the project planning phase, and we feel that there are several benefits to this approach over MAMAS. And one is that we will be able to better control the sample collection. We will be able to -- we will be able to select samples from men and possibly children, in addition to women.

And we will be able to collect urine and whole blood in addition to the serum. And not to mention, we also will be able to collect exposure information. I don't have too many more details to share on this project

at this point, but what we've proposed to CDC is that we are likely to be collecting metals on all participants in this multi-regional surveillance study, and that we would target additional analytes to specific populations or regions or to answer specific questions.

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MS. CHRISTENSEN: Moving on to the environmental justice projects. Michael made reference to these new funds at the start of the presentation. We do have this one-year augmentation of funding. And because they are a one-year -- it's a one-year time frame here. We are on a very accelerated timeline. The Program has already started meeting internally to discuss how the funds might be used, and we are reaching out to potential partners -- or we will be reaching out to potential partners.

Currently, we're exploring both outreach and biomonitoring studies. In terms of outreach, we want to -- we are trying to explore ways that we could report back on our progress, and also reach out to community groups. That might include listening sessions, and news letters.

In terms of studies, we are currently entertaining two studies. One involves diesel exhaust exposure in children, which could compare exposures for those who live near to freeways or ports with children who

are further away. And we're also looking at contaminants in Asian and Pacific islander communities.

This would be similar to the ACE Project, although in a different linguistic and probably a different region of the State.

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MS. CHRISTENSEN: And that would be it.

So I want to thank everybody in the Biomonitoring California staff. They appear here. And I want to also point out that Michael DiBartolomeis has finally made it onto the thank-you staff slide.

(Laughter.)

CHAIRPERSON BRADMAN: Okay. Thank you so much for that presentation. Right now, we have about five minutes scheduled for Panel questions and then public comment.

So, Mr. Cranor.

PANEL MEMBER CRANOR: Yes. I noticed that you're picking up metals. Any idea why -- A, why you're looking -- you must have an idea of why you're looking for them, but what's your -- what do you anticipate is an explanation for a lot of metal contamination?

MS. CHRISTENSEN: Oh, I'm -- you're referring to the MAMAS project?

PANEL MEMBER CRANOR: Yes.

MS. CHRISTENSEN: Okay. So the MAMAS samples are actually collected by GDSP, and we are not in control over the collection materials or how the materials are stored. And the serum separator gel is suspected to be contaminated with a wide variety of metals. And we've contacted GDSP to try to figure out is there any option? Could we provide you with some suggestions of some like different material -- different vials.

And GDSP is a far larger program than we are. They were not super interested in changing their materials on our behalf.

(Laughter.)

MS. CHRISTENSEN: But, yeah, there's something in the serum separator gel that's just systematically causing problems.

PANEL MEMBER CRANOR: Not necessarily a problem in the population, but a problem in your testing process.

MS. CHRISTENSEN: It is -- there's metals in the gel, so there's no way for us to separate out what is in the serum versus what has been contaminating from the gel.

CHAIRPERSON BRADMAN: Are there any other comments on that particular issue or questions?

MS. HOOVER: Not that.

CHAIRPERSON BRADMAN: I was just -- we may as follow up on this issue of contamination. Are there any

other questions specific to that right now?

Because I had a couple. One, it might be worth publishing that, just because, you know, that's an important issue. I don't know if there's other states dealing with this issue. But, you know, just as a laboratory QA/QC issue, that might be worth getting out there.

And then, number two, I'm a little concerned about, and felt like the Program response was not as cooperative as it could be. I understand when you have a big program going and you have specific materials that you're using to meet those needs. But it seems to me there might be an opportunity here to work with them to solve a problem that would benefit biomonitoring and information about exposures in the State. So maybe there could be a little bit of encouragement for more cooperation to try to address that issue.

MS. CHRISTENSEN: Well, I don't mean to mischaracterize GDSP as being uncooperative, because they've been very cooperative with us overall in developing this project, and working with us.

Nerissa Wu may be able to speak more about -- she worked in GDSP prior to coming to biomonitoring. She may be able to speak a little bit to that.

DR. WU: It's more that they are selecting tubes

to maximize their utilities, so they are looking for optimum serum separation for the hundreds of thousands of serum samples that they're pulling. And it's just not a concern for their -- for the analytes they're looking for for prenatal screening.

So it's just not on their radar, or is an issue, and it would be a gigantic change for them in terms of changing vendors and replacing all of the vials for the clinics across the State that pull samples for something that's very small, that that's not really part of their mandate.

CHAIRPERSON BRADMAN: Right. Yeah, and I totally understand that, and the challenges of making changes like that. At the same time, there might be an opportunity here to, you know, meet two goals, perhaps even on a pilot basis, to kind of understand how to address it, and still meet their Program needs, and expand that.

But I -- I mean, I totally understand the challenge of making changes like that.

DR. WU: I do think there has been some discussion within our group of publishing some of the findings from our chemists, did some -- did systematic review of the tubes, looking at very different -- a bunch of different variables over time, different holding times within lots and between lots. And I think there was talk

of publishing those results, as you mentioned in a QA type of journal. And I think there are other researchers who use biobank samples who would be very interested to learn about this.

CHAIRPERSON BRADMAN: Exactly, yeah.

Okay. Dr. Schwarzman.

PANEL MEMBER SCHWARZMAN: I was just going to ask about the availability of alternatives. And, I mean, obviously, if we're collecting biological samples, there are alternatives that aren't contaminated with metals. But whether they do the serum separation adequately as required for the GDSP program, because I think that would determine a lot about the viability of suggesting alternatives or getting in on their program.

And I think I also was wondering that just for verification for the multi-regional surveillance study that you're proposing to do instead of the metals analysis in the MAMAS study that you have adequate methods for that.

DR. WU: Are you asking me?

PANEL MEMBER SCHWARZMAN: (Nods head.)

DR. WU: We do -- I mean, we take samples for -- we collect samples for metals analysis, and we have tested our serum separator tubes that we select specifically for our Program. So there are vials available for

environmental sampling or for biomonitoring sampling. I'm guessing they're more expensive, and they may not be optimal for GDSP's purposes, but it's certainly something we can look into further.

CHAIRPERSON BRADMAN: Dr. Quintana, you had a question.

PANEL MEMBER QUINTANA: Can I move to a different topic here?

CHAIRPERSON BRADMAN: Sounds good.

PANEL MEMBER QUINTANA: I had a question about the multi-regional sampling. And that's getting much more towards the original purpose of this Program, which was to be an NHANES for California, as a short way of saying it.

Is there interest in kind of adding some of the special populations that make California unique, oversampling for those populations in that multi-regional sampling. So California is very unique. It has lots of different water sources. Some people drink on untested wells in the Central Valley that might be contaminated with legacy pesticides. Some people drink municipal water in San Diego like I do, which tastes terrible, but it's pretty safe actually.

(Laughter.)

PANEL MEMBER QUINTANA: And we have the U.S. Mexico border. We have a lot of immigrants in San Diego.

We have something like the largest Iraqi population and many other immigrants. And that's just our region, let alone other regions.

And I'm just curious about how the sampling might look at what makes California unique in that planning process.

MS. CHRISTENSEN: Well, I can say that this is something that we will definitely think about. We are in the planning phases, and I mean very preliminary planning phases. What we proposed to CDC is actually that we're going to be designing this study over the course of the next year. And we hope to be in the field in about a year's time.

So we have time now to strategize and identify specific groups that we might want to focus on. And I think that this is a good opportunity for you to let us know what you would suggest that we focus more on.

DR. WU: Can I add to that?

We have also talked about the possibility of nesting specific cohorts within our statewide -- this multi-regional plan, so that forming partnerships on a regional basis with community groups or other potential partners, so that we can identify those special pockets that we'd like to nest within our broader statewide surveillance would be great.

And it really dovetails nicely with this environmental justice special projects augmentation that we have now, where we now have the ability to do some listening across the State to identify projects which might be appropriate for our EJ funding, but will also feed into our priorities that we can -- so that we can add to our statewide surveillance.

CHAIRPERSON BRADMAN: I'm going to say just one more question, then we have some public input scheduled, and then we have actually some more time for Panel discussion. So Dr. Fiehn, and then after that I know I have some more questions, but maybe we'll hold off until we have public comment. So we're a little bit behind schedule, right?

PANEL MEMBER FIEHN: All right. I also -- looking at these programs, I see that there's a lot of priority pollutants that have been tested. And that is good. But this Panel also includes a lot of more compounds every time we meet. And I always wonder a little bit like what happens to those compounds?

And, you know, you said that there's also initiatives to try to do untargeted screening, for example, in these two studies where you say it's additional Program work. And I wonder, you know, if any of those chemicals that we have designated or any other

progress has been made that could be informative to our Panel and to the public.

MS. CHRISTENSEN: I think generally the method development would be covered by the labs.

Sara will --

MS. HOOVER: I'm just going to say that we're going to hopefully have a very in-depth discussion of non-targeted screening and hear from the labs in November. We encountered, you know -- the two people that could speak to this at ECL actually are, one, Myrto is unexpectedly out of town because of a family emergency.

So just stay tuned. But definitely. And I know that DTSC is making excellent progress, for example, on non-targeted screening of PFASs, which was a group that the Panel added to the priority list. So that -- and, you know, you'll hear later -- I mean, that's obviously one of the drivers for when we bring chemicals to the Panel and we try to look by class, that's actually one of the drivers to allow that sort of broader non-targeted screening.

DR. SHE: I'd like to answer some comments to Oliver Fiehn's comment about untargeted analysis. And so actually both labs are so far working on the untargeted analysis. So like Sara already mentioned the class. If a chemical belong to same class that you probably easily to

use the same approach to solve it.

So generally, you have targeted analysis, suspected chemicals, unknowns. So we need to take approach I think for us -- first, we look at targeted, but there's many things that we do not know. But if we suspect metabolite, for example, we know the parents with suspected metabolite. This ones is relatively easy than the complete unknown.

So for suspected things, for example, EHLB -- EHLB is doing right now work around the BP-3, this group of chemicals, to see that over 70 BP-3 chemicals can we find all of them. So we made some progress.

And also a lot of ways to do the unknowns we think, if we can combine the current traditional panels, bundle the different panel together, and then that's -- we call it mass method. We have developed a mass method, we call it comprehensive method, to see we can see beyond the targeted analyte.

So that's a few approaches we are taking, and then we make some progress in it. And yesterday, we actually able to show our CDC program officer. I think very soon I hope the Program can publish some unknowns. But overall, we are taking the step like targeted, suspected, unknowns.

MS. HOOVER: Thank so much Jianwen. So let's go

to public comment.

CHAIRPERSON BRADMAN: Yeah. Thank you. Yeah. So now we have some time scheduled for public comment, and are there -- is there anyone that has requested?

MS. DUNN: Currently, we don't have any public comments for this period.

CHAIRPERSON BRADMAN: All right. So that means we can actually continue with our -- both perhaps clarifying questions and also Panel discussion. We have about 15 minutes scheduled for that.

I know I have a couple of questions related to your presentation. One on the Expanded BEST. You mentioned that 30 participants had elevated inorganic arsenic in the samples. That seems like, out of 350, that's, you know, just under 10 percent of participants. I think that's pretty dramatic. And I wonder if you could comment more on how elevated and were there concerns about potential health risks, and were there thresholds that were possibly crossed.

And you've mentioned there's been some follow-up testing, but I'm quite surprised at, you know, that frequency in terms of elevated arsenic exposure.

MS. CHRISTENSEN: Yes. There were thresholds that were crossed. That's -- our threshold is identifying them as having elevated inorganic arsenic. And is Duyen

here today?

I don't think so.

Sara is going to have to jump in and help. She worked closely with Duyen on contacting the participants.

MS. HOOVER: Yeah. So -- well, what would you most like to hear about, because we could talk a lot about the arsenic program. In fact, we're working on a paper, and it's going to be -- as Robin mentioned, it's going to be very interesting this second round of testing, and that's why we did a second round of testing.

CHAIRPERSON BRADMAN: Right.

MS. HOOVER: And I think actually Jianwen, at a previous meeting, presented our protocol. And the inorganic arsenic level, and actually I'm going to give a shout-out to Shoba Iyer too who is another colleague that worked on developing the protocol.

And what we did was we actually based it on a CDC paper where they had identified the 95th percentile of the combined inorganic species. And so that's what we did. It was a statistically based level of concern for inorganic arsenic. So that's what we were looking at.

So, you know, we're in a different region, and we know that there's some issues with arsenic in the Central Valley, so it wasn't hugely surprising that we saw that there, but we definitely want to follow up on it. We have

a really extensive questionnaire that we've been interacting with the participants on, collecting information about how they might have been possibly exposed. And like Robin said, Duyen Kauffman has been really amazing with her ability to interact with the participants, get information, provide information, and provide them help with how they might be exposed. So we should learn more once we get these results back.

CHAIRPERSON BRADMAN: So this is basically -- it's not a risk-based threshold, it's more the 95th percentile of NHANES.

MS. HOOVER: For inorganic arsenic, true. The total arsenic is a level of concern identified from CDC. But as you know, you might recall casting your mind back that no we're not actually using risk-based thresholds. However, as part of our paper, we might look into, you know, examining that issue.

I also want to mention as a last thing, which I didn't mention, that we've also worked very closely with Dr. Craig Steinmaus, who's an arsenic expert. He helped us with the protocol, the questionnaire, the follow-up, everything. And he's actually the physician who will speak to participants, if needed.

CHAIRPERSON BRADMAN: Okay. Thanks for that additional information. I think all of us, I know myself,

really look forward to hearing more about that.

Dr. Luderer.

PANEL MEMBER LUDERER: Is this on?

Yes.

I just wanted to get back just to ask a little bit more about the multi-regional surveillance study. I know it's just in the planning stages, but as far as the sampling methodology, is that -- you know, are you thinking of modeling it after the type of sampling -- the cluster sampling that's used for NHANES or is there any thought about that yet?

MS. CHRISTENSEN: So we're entertaining a couple different ideas. We have achieved a lot of success with ACE working with the community group. And we initially thought that working with community groups across the State might be a nice model that we could expand, but we're not ruling out other options.

And, for example, we're looking into adding on a question to an existing questionnaire, such as the CHIS or the -- another State is using the BFRSS survey to collect interest in participating in a biomonitoring survey. So we might explore those options as well. We are open to a number of options.

DR. DiBARTOLOMEIS: Hi. This is Michael DiBartolomeis. I just wanted to add on as memory recall

for you all, we have estimated what it would take to do an NHANES for California. And I just want to remind you what it would -- what it would -- what we would need. We think at least 2,000 samples every other year to make it statistically, and randomly, and -- you know, sound. And with the additional results returned, and laboratory efforts, et cetera, et cetera, we estimate somewhere around the order of 10 to 12 million dollars a year.

The current budget for this Program, with all things considered, doesn't go past five million, and that's to do other things as well. So we're not close to being able to do what the original intent of the legislation was, which was is a California HANES, or whatever.

So we do know that this multi-regional study is not what is intended, but it's -- we think it's approaching something that will at least give us some data on what you might expect from representative populations in California.

And as Nerissa pointed out, we can also nest maybe specific exposure concerns or particular environmental justice concerns or whatever in these kinds of things. But we are not anywhere near being able to do a California HANES.

So I just wanted to -- I know Robin is too, you

know, politically savvy to not say that, but I'm going to say it.

(Laughter.)

DR. DiBARTOLOMEIS: So thank you.

CHAIRPERSON BRADMAN: Dr. Quintana.

PANEL MEMBER QUINTANA: Just following up on that comment. Would it be possible to restrict geographically or by exposure -- let's say L.A. is a lot of people.

MS. CHRISTENSEN: Yes.

PANEL MEMBER QUINTANA: And a lot of it is pretty similar from a San Diego perspective where I live.

(Laughter.)

PANEL MEMBER QUINTANA: So who's here from L.A.?

Oh, all you guys.

(Laughter.)

PANEL MEMBER QUINTANA: But joking aside, I mean, could -- would it be possible to -- you know how the National Children'sStudy which was trying to get a representative sample. They randomly chose certain, you know, zip codes, and what have you. And then within that, I'm just wondering if there is some way to still have the random aspect of NHANES, and the careful sampling, instead of just who's volunteering, you know, maybe by restricting to certain areas or types of areas we're interested in. Let's say urban L.A., farmland in the Central Valley or, I

don't know, some -- I'm not -- I'm just brainstorming here, but some way to kind of capture the power of the sampling strategy without having to have so many people, I guess.

MS. CHRISTENSEN: I think these are very good suggestions, and things that we'll be considering as we're developing the study further.

CHAIRPERSON BRADMAN: Yeah, Dr. Schwarzman.

PANEL MEMBER SCHWARZMAN: This may be a little bit far out, and it touches on something that we'll be hearing a lot more about this afternoon, but I just wanted to kind of flag it in the context of talking about focuses for the multi-regional sample surveillance study, and also it dovetails for me with the budget for EJ studies.

Because it occurred to me as I was reading some of the materials in preparation for this afternoon about the California Environmental Health Tracking Program study of pesticide use near schools that we'll be talking about, how -- what excellent sort of initial information that is that could inform a biomonitoring study comparing the, you know, 15 highest use counties -- children in the 15 highest use counties, particularly looking at the schools where there was the most exposure -- or there was the most pesticide use if the vicinity compared to lower exposure counties or schools with the lowest pesticide use in the

surrounding areas.

Anyway, I just wanted to raise it now. We can talk about it more in the afternoon. But in the context, since there's these studies that are sort of funded but still being designed, about whether that might be a possible place to put further investigation of this pesticide use near schools.

MS. CHRISTENSEN: I mean pesticides is a great topic to bring up today. I mean, Shoba will also be discussing additional pesticide classes. Our lab currently has a pesticide panel, and it doesn't capture the most commonly used pesticides in California, so it's something that we're aware of and we're trying to address by designating additional classes.

And the labs are also exploring how they might be able to bring on additional methods or expand existing methods, but we're not there yet.

PANEL MEMBER SCHWARZMAN: So am I understanding you right in saying that's kind of premature for the uses of this study, and the EJ focused funds that need to be done kind of in the next year.

MS. CHRISTENSEN: (Nods head.)

PANEL MEMBER SCHWARZMAN: Okay. Thanks.

CHAIRPERSON BRADMAN: Is there any other?

Thank you, Dr. Schwarzman. That -- you know, one

of the questions that was brought up really to us in this presentation, I think we got a little -- we got focused on some details, but I wanted to take it back to the end of this environ -- you know, the promotion of -- the planning for some environmental justice related projects related to that funding that Governor Brown signed. So I'd be interested to hear more discussion about that in particular.

And I know probably people out in the public will want to comment on that too, and maybe we missed that this time. But I think that was an important point that was brought up in this presentation, and I hope later on today we can hear on that issue.

So, Dr. Luderer, did you have a comment on that?

PANEL MEMBER LUDERER: No.

CHAIRPERSON BRADMAN: Okay. Well, I know I do. And I think you kind of hit on that issue, both in terms of pesticide use as perhaps prioritizing regions for monitoring. And I think, in general, too, I think there's a lot of opportunities to look at issues around environmental health, and then actually taking the next step into epidemiology with EnviroScreen. And think perhaps to the extent that we can use EnviroScreen to guide perhaps choices around biomonitoring, that would be a way that really has been vetted by a lot of both

scientifically and has a lot of community input, an opportunity to perhaps use that as a way to prioritize biomonitoring.

I know there's been some talk about, you know, what it means for diesel exhaust, but perhaps other kinds of exposures we might consider with EnviroScreen and perhaps that can guide, you know, biomonitoring related to environmental justice issues.

MS. CHRISTENSEN: Yeah. Thank you for bringing that up. That has been part of our internal discussions. And Amy Dunn has actually been working closely with the CalEnviroScreen team to look at the data that they have available and see how it might complement our approach to environmental justice-focused projects.

CHAIRPERSON BRADMAN: Dr. Quintana.

PANEL MEMBER QUINTANA: Sorry, I don't want to monopolize the conversation here, but I just want to echo what you said about pesticides. I know that the two bullet points you had in the environmental justice slide were just projects currently under discussion. And I'm -- I just want to reiterate that I think pesticides is one of the areas very in need of looking into for environmental justice in general, and specifically very suitable for the expertise and the measurement opportunities provided, you know, by this Program.

But from a practical point of view I just wondered if you could comment about if you're going to be talking to people, or archive samples, how much -- could you use urine, do you want serum, and how much of it would you need, in general, if you were going to bring people to participate? Could you just comment on the practical issues a bit?

MS. CHRISTENSEN: Oh, in terms of sample collection?

PANEL MEMBER QUINTANA: In terms of how much you would need. You know, 2 ml of serum, and you want, you know, urine --

MS. CHRISTENSEN: I mean, it would depend entirely on the panels and how many panels we would be analyzing.

I'm sorry, Sara Hoover.

MS. HOOVER: Just to clarify, do you mean --

PANEL MEMBER QUINTANA: For pesticides specifically.

MS. HOOVER: Okay. For pesticides. So let's see, Jianwen, could you comment on the volume of sample for like the current pesticide panel?

DR. SHE: Currently, for the organophosphorus pesticide, our lab working on the urine samples, is about 1 to 2 milliliter of urine samples for DAPs, and for

specific OP pesticide, that's what we do.

But the pesticide, especially OP pesticide, our laboratory look for DAPs. We look for specific OP. We also look OPFR. From structurally, you see OPFR metabolite, also a DAP. That's what I talk about how we bundle them together. If we're able to bundle all of the classes this afternoon we talk about, because organic phosphorus pesticides tend to be very polar. They have some common features. If we're able to bundle them together, the volume will be changed.

So that's what when we -- I also comment on Dr. Oliver Fiehn's question what's the laboratory try to do, what's a comprehensive method to go a little bit beyond, which can reduce the requirement on the volume of samples, reduce the resource. That's the laboratory kind of working. We hire Dr. Amado continue working on it. We already combined over 35 chemicals together, but we still need to explore can these things be very practical.

Thank you.

PANEL MEMBER QUINTANA: So if we were talking to community groups, you could say they want urine -- am I hearing you say urine?

MS. CHRISTENSEN: Yes.

PANEL MEMBER QUINTANA: They don't need blood, which is easier sometimes. And then just a small like 10

ml, 20 ml.

DR. SHE: (Nods head.)

MS. HOOVER: Robin, can I?

This is Sara. And just to -- that was pesticide related, but as you saw, we're also looking at diesel exhaust exposure project, and we've been having conversations with Asa and Chris Simpson. And that volume is a little bit higher currently. I think you were collecting in a previous project 10 to 30 ml, something on that order?

CHAIRPERSON BRADMAN: Yes. Well, we collected more than that, but the analysis initially required 100 ml. And he's been able to reduce it to 30 for the diesel related metabolites.

PANEL MEMBER LUDERER: I just have a question, since I'm also very excited about the environmental justice projects and the funding for that. And I was wondering -- and I -- since I understand that there is a certain amount of time pressure for this, whether you've -- one of the -- or some of the reasons for choosing the communities or the exposure, the diesel exposure in the Asian and Pacific islander communities is because they're already ongoing community groups and -- or community-based outreach that's been going on, and if so if you could -- in those areas, that you could talk a

little bit more about?

MS. CHRISTENSEN: Well, certainly. So the environmental justice projects, focused projects, you know, we want to have community involvement. And as you know, getting the community involved is a long process.

With the original ACE Project, we've been working with the community group for probably about 10 years within CDPH. And we've been working with them for about a year on the ACE Project itself before even engaging formally with them.

So, yes, it is very helpful to work with groups that we currently have a relationship with, and who have already expressed an interest in biomonitoring, and using biomonitoring to help explain some of the exposures.

DR. DiBARTOLOMEIS: Can I just add a little bit more onto that? This is Michael D.

I didn't mention it as part of the funding. The money -- the $1 million for this year has a prescribed split amongst the three departments. And so I want to just point out there are a couple of things about that that I think are important to understand. So about a quarter of a million dollars went over to OEHHA, $600,000 came over to CDPH, which is to be split between the lab and the EHIB portion, and then $150,000 went over to DTSC.

We're still trying to figure out where the labs

fit into the spectrum, because our laboratory analyses will come -- would come later on, and more in support of the initial design -- study designs, et cetera. But one of the things that the Environmental Health Investigations Branch has identified as one of the top priorities is to hire an environmental justice coordinator.

And we're hoping we can do this over a two-year period instead of just a one year period. And part of the reason for doing that is to start the process of nurturing the relationship with the community. Because just as you were saying, it is true that one of the reasons why we can jump right onto the ACE Project is because a lot of that work over the past decade has already happened. We have built trust in those communities, and we have to do the same around the State for others.

So we're hoping that a coordinator with a specific task of one of them to do that would be a positive outcome so at the end of the year, we would be able to tell potential future funders that we have set it up, and we're really poised and ready to now do more studies in these areas, but we -- you know, we had to do the initial legwork.

CHAIRPERSON BRADMAN: So Dr. Cranor then Dr. Schwarzman.

PANEL MEMBER CRANOR: Following up the Asian

Pacific Islanders group, do you have antecedent reasons to think that there are unusual exposures there?

I mean, I probably missed the meeting where this started. So you just need -- I'm asking you to bring me up to date a bit.

MS. CHRISTENSEN: Yeah, yeah. So there are certain communities of have they have differential exposures of due to either diet, or they have a lack of access to information due to linguistic or cultural isolation. And so that's why we started engaging with APA in the first place. They are doing a lot of education surrounding fish consumption. They know that there's metals contamination in the fish. APA was actually -- they learned from this Program that they could also -- they might also be contaminated with PFASs or PFCs.

So biomonitoring is really a tool in which we can drive those messages home, and make it more real to the community. So, yeah, we do expect that there are certain communities we know that there are people who are -- are fishing for much of their diet. And some of the lakes, rivers, streams in California are polluted with metals.

CHAIRPERSON BRADMAN: So I'm going to have just one more question from Dr. Schwarzman, and then to stay on time, we want to move to hear Dr. Blount's presentation.

PANEL MEMBER SCHWARZMAN: Thanks. Just one more

sort of inquiry and potential suggestion around this environmental justice funding. I was very interested to hear that in the FREES Study, there's -- is this a public housing location?

MS. CHRISTENSEN: Yes.

PANEL MEMBER SCHWARZMAN: Yeah, for one of the sampling areas. And I'm very interested in the idea of incorporating public housing into -- and public housing residents, and, you know, the dust and all that, the way it's being done in FREES into the biomonitoring.

And so this strikes me as an area where you potentially have an existing collaboration, but it sounded like maybe that was a weak partner. You said it's kind of limited the number of households who've participated and you don't anticipated more. So I just wanted to hear a little more about that.

MS. CHRISTENSEN: Well, FREES is unique in that we are not the people who are reaching out to the participants. We -- our partner, UC Davis, is actually developing the pool of participants from which we can approach. So people are initially approached by UC Davis to participate in this study, and then we follow up with them to see if they also would like a biomonitoring component added on to the study. So our pool is small to begin with.

In terms of working with community housing, one of the options that we are considering -- it wasn't on the slide, but one of the things we are looking at is there's a housing -- it's a nonprofit low-income housing community in the Stockton area that largely serves an immigrant Cambodian population. And they are interested. They have been interested in working with us, and it's one of the groups that we actually approached in a similar project before that didn't work out. So they are on a long list of potential partners.

CHAIRPERSON BRADMAN: I'm going to cutoff the conversation right now, just so we stay on time. And thank you very much for your presentation and discussion that followed.

So I want to introduce Dr. Benjamin Blount now, who's going to be speaking about CDC. Dr. Blount is the Chief of the Tobacco and Volatiles Branch at the Division of Laboratory Sciences, at the National Center for Environmental Health at CDC. Over the last two decades, Dr. Blount has developed and applied numerous analytical methods for quantifying environmental toxicants and biomarkers of exposure and effect.

Dr. Blount's recent research focuses on assessing exposure to tobacco-related toxicants, volatile organic compounds, and toxic anions by measuring biomarkers of

exposure to these chemicals. And Dr. Blount will provide an update from the CDC's National Biomonitoring Program with a specific focus on perchlorate and tobacco-related exposures.

So thank you, Dr. Blount, welcome to California, and we look forward to your presentation.

(Thereupon an overhead presentation was presented as follows.)

DR. BLOUNT: Well, thank you, Asa and it's a pleasure to be here to speak to this distinguished Panel and to see so many past colleagues and collaborators. I'll be here representing CDC's biomonitoring lab, and specifically the Tobacco Volatiles Branch of which I lead. We're now over 100 scientists looking at people's exposure to environmental contaminants as well as, primarily now, tobacco and tobacco emissions and trying to characterize that through using biomonitoring.

MS. CHRISTENSEN: This isn't working.

DR. BLOUNT: Okay. I'll just say next slide.

I will start my talk by talking about what I won't talk about, but referring -- I do have some slides talking about targeted verse non-targeted analysis in the bonus section of my presentation --

(Laughter.)

DR. BLOUNT: -- just for reference. Feel free to

look in there. Today's presentation that I plan will focus exclusively on targeted analysis from within the context of CDC's Biomonitoring Program. But I agree that non-targeted analysis provides much promise from a systems biology approach, and from understanding holistic health impact of exposures in a variety of different angles.

But keep in mind the difference in approach and the differences in how that data can be used.

So next slide, please.

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DR. BLOUNT: So on my next slide, I will talk briefly about perchlorates, and I feel a little bit of coals to Newcastle here, in that California is very familiar with perchlorates. And, in fact, my introduction to perchlorate was through connections in California.

Perchlorate is a small inorganic molecule, one chlorine, 4 oxygens that's used as an oxidizer in solid rocket fuel. It also provides oxygen for other burning products, things like fire works and explosives. Very interestingly, it can also form in the atmosphere naturally when sodium chloride from sea spray is transported into the troposphere and can react with ozone. So there's a natural formation pathway as well.

Next slide.

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DR. BLOUNT: These different sources of perchlorate lead to perchlorate in the environment. Man-made leaching from industrial sites led to the contamination of the entire Lower Colorado River of course. That was characterized by the California state lab. Also, natural atmospheric formation that I mentioned can lead to accumulation of perchlorate over the millennia, especially in arid regions where soil microbes are not breaking that perchlorate down.

Lastly, formation of perchlorate can happen in sodium hypochlorite solutions where that hypochlorite can form chlorate and perchlorate, and that can also occur in some water distribution systems at trace levels from that same kind of reactive chlorine chemistry. Although that last pathways is thought to be fairly minimal for human exposure.

Next slide.

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DR. BLOUNT: So the story that was worked out over 15 years ago by the California state lab was characterization of the contamination of the lower Colorado River from a perchlorate manufacturing site outside of Las Vegas, leading to massive contamination of the Las Vegas wash, Lake Mead, and the entire lower Colorado River, which is a big deal from folks drinking

that water, including Jenny's water there in San Diego County, and impacting even more people, the value of that water for irrigation and food stuffs that are exported internationally as well as shipped around the country.

Next slide.

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DR. BLOUNT: So important agricultural districts to remember around Yuma, also very importantly the Imperial Irrigation District in Coachella Valley. And in this area, I had the pleasure of working with Paul English and Jianwen on a collaborative study looking at perchlorate exposure in the Imperial Valley several years back, and characterizing that individuals living in the Imperial Valley did indeed have a higher perchlorate exposure dose than the general U.S. population, likely coming from the downstream effects from that contamination of the Colorado River.

Next slide.

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DR. BLOUNT: So these potential sources of human exposure are leading to human exposure, either through direct consumption of contaminated matter or through crops grown with contaminated water or contaminated fertilizer or soil. The perchlorate being concentrated, especially via -- in the green leafy outpart of the plant.

Also, a very important source of exposure are dairy products, because those forage crops that are fed to dairy cattle lead to exposure of the cow. Perchlorates is actively transported into milk in mammals, and that can be passed on to consumers of those -- of that milk.

Next slide, slide 7.

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DR. BLOUNT: So the mode of action of perchlorate is shown in this graphic from the Utah Department of Environmental Quality. And it's basically inhibition of iodide uptake through a competitive mechanism, at the -- primarily at the sodium iodide symporter. Although in some work we did together with collaborators, we showed that both sodium iodide symporter and pendrin another transmembrane transporter, transport perchlorate at the expense of not transporting iodide.

So as an analytical chemist and a biomonitoring person, we wanted to improve the value of our perchlorate method by adding some more of the toxicologically relevant other ions that relate to the mode of action of perchlorate. So we added the biologically bioavailable form of iodine -- yeah, of I iodine, iodide, as well as three -- the three physiologically most relevant inhibitors, perchlorate, thiocyanate, and nitrate to that single assay, so we could have more information about the

iodide uptake inhibition milieu for the study participants at that point in time.

With this approach, we were able to show that perchlorate exposure was associated with decreased thyroid hormone levels in -- primarily in women with low iodide, and very interestingly also women with higher thiocyanate levels from smoking. So, I mean, health is a holistic endeavor. And I think it's quite interesting to see at this interface between environmental exposure, tobacco smoke exposure, and poor nutrition where we would see those compounding to lead to a link with less thyroid hormone levels in a target population.

And just a shout out to Craig Steinmaus for working with us on some of this important regression modeling.

Next slide, please.

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DR. BLOUNT: So on slide 8, I guess that's my introduction. So the question, what have you done lately? You know, what's really -- what's happening now with perchlorate. So just a brief update on that in two areas. One is some very exciting new work in collaboration with Neil Sturchio, and also with Craig Steinmaus, where we've looked at different sources of perchlorate exposure, looking at subtle differences that tell us whether it's

synthesized perchlorate or naturally-formed perchlorate.

And then lastly, building on the strength of NHANES, to look at trends of perchlorate exposure in the U.S. population now that we have a decade and a half and almost 30,000 individual study participant urines that we've analyzed for perchlorate.

Next slide.

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DR. BLOUNT: And with that first question of characterizing perchlorate exposure from synthetic versus natural sources, we looked at these subtle differences in chlorine-36 and -37 isotopes. Now, to do this, we need a lot of urine, because a typical person only has low part per billion concentrations of perchlorate in their urine. So for a typical U.S. resident, that's about 30 liters of urine.

(Laughter.)

DR. BLOUNT: So for our Atlanta study, we had a 144 full void volumes that we pooled from three dozen study participants and isolated the perchlorate from that. We also worked together with Craig Steinmaus with some of the residual urines he had from studies in northern Chile to collect and pool urine and isolate perchlorate from that population in a very different region with different naturally occurring perchlorates from the Atacama Desert,

very common in their drinking water and in their food sources.

And lastly, we compared the perchlorate we isolated from these different pools of urine with perchlorate isotope patterns specified based on synthetic perchlorates and perchlorate isolated from Chilean soils in groundwater water and perchlorates isolated from naturally occurring deposits in groundwater in the western and southwestern U.S.

Next slide.

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DR. BLOUNT: Our procedures are shown here. Just know that the -- the key -- two keys in this, one that we have a very selective resin for extracting the perchlorate from all that urine, and then two very sensitive methods, the secondary ion mass spectrometry followed by accelerator mass spectrometry to be able to quantify these subtle differences.

Next slide.

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DR. BLOUNT: So here's what we found. The circles are the environmental samples that define the isotopic pattern, the differences in chlorine-36 and chlorine-37 with red showing the western, southwestern U.S. isotopic pattern with a 95th percentile confidence

ellipse -- confidence interval ellipse drown around it. The turquoise color is the Atacama Desert-collected environmental samples, and the white synthetic industrial perchlorate samples from several different manufacturers.

The two squares are urine results from the urine pools.

Next slide.

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DR. BLOUNT: And you can see when we unblended these and identified them, that the Atlanta urine pools pattern -- the naturally occurring western, southwestern isotopic pattern, and the urine pool from Taltal, Chile matched, not surprisingly, the isotopic pattern of the Atacama Desert, which is the local perchlorate in their exposure sources.

So the Chilean result was definitely what we expected. The American result I think is very instructive, that it would argue that, at least for the Atlanta population, where there's no local sources of perchlorate, that the driving source of perchlorate exposure is from natural occurring sources, primarily those in the western and southwestern U.S.

Next slide.

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DR. BLOUNT: So just conclusions here on slide 12

restating what I just stated. I do want to underscore that we're very excited to have an opportunity with some residual NHANES urine samples, but we're pooling about 25,000 NHANES -- residual NHANES urines using the weights of those corresponding study participants so that the resulting pool is representative of the population, and then isolating the perchlorate from that and testing that, and doing the same kind of approach.

And lastly, collecting some urine pools from people who are handling synthetic perchlorate as part of their job, and having that isotopic pattern as well to kind of complete to connect all the dots for this kind of comparison. So stay tuned for that one.

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DR. BLOUNT: So with our perchlorate trend analysis, we looked at basically posing the question have urinary perchlorate concentrations decreased since 2001, as many proactive states have limited drinking water perchlorate levels, unlike the federal government, where, to my knowledge, there's still no MCL. There's been a movement in that direction, but it's late in coming.

There also has been no regulation of food perchlorate levels. And as results from my lab and other groups have shown, for the U.S. as a whole, we tend to get

our perchlorate exposure through food. And so not much action in some key areas, but definitely some action, some improvement in the lower Colorado River, for example, where the river is consistently under a part per billion for perchlorate. So we wanted to look at trends for the U.S. population to see if there had been a decrease.

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DR. BLOUNT: And this is what we see in slide 14, we're -- thank you -- the data are -- three of the age-stratified data is in three panels with children in the top panel with data from 2001/2002 through 2011/2012. And you can see basically perchlorate exposure in the U.S. has not changed significantly over the 12-year study -- the 12-year period study.

We do consistently see a pattern where children have higher perchlorate exposure levels than adults and adolescents, likely because they're consuming more perchlorate-rich foods per kilogram body weight.

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DR. BLOUNT: And on the next slide, let's see, I think I'm transitioning into, yes, biomarkers of tobacco exposure.

So a little bit of a harsh break, but I want to

cover what folks are interested in talking about. And certainly, for us, we -- with my group, we started looking at thiocyanate, because it's related to iodide uptake inhibition. It's also a good biomarker of exposure to smoke because of the cyanide levels in smoke, and thiocyanate is the primary metabolite of cyanide.

So I'll be talking about thiocyanate and a number of other biomarkers. But I think with biomarkers of exposure to tobacco and smoke, it helps us to answer many relevant questions, either directly related to tobacco smoke or tobacco product use as part of a study's design or to rule-out tobacco as a source of benzene, for example, in the fracking study, or other environmental exposures that can also occur from tobacco, because tobacco smoke contains a lot of harmful chemicals that are also of interest from completely environmental exposure routes.

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DR. BLOUNT: On slide 16, we have a lot of tobacco-related biomarker work now at CDC. Notably, our ongoing effort, started by Tom Bernert nearly 30 years ago to measure serum cotinine. We've added now hydroxy cotinine to that. We're also measuring nicotine and nicotine metabolites and minor tobacco alkaloids in human

urine. So these are, of course, excellent biomarkers of exposure to tobacco.

Also, tobacco-specific nitrosamines, as the name implies, are specific to tobacco and tobacco products, and so are an excellent way to identify exposure to tobacco products.

Most of the rest of the list is a listing of smoke constituents, primarily to answer the old adage that -- or to comment on the old adage that nicotine is the hook that brings the smoker back time and time again to the habit, but it's the smoke that kills.

So with understanding a rapidly changing set of tobacco products, and more and more people, not just exclusively smoking cigarettes, but rather the dual users of cigarettes and e-cigarettes or even poly-users, understanding the population harm related to that addiction and trying to advise policymakers on policies that can reduce population harm.

So certainly VOCs are important, both measured in blood as well as metabolites in urine, as well aromatic amines, such as forming a biphenyl, a variety of different aldehydes that we're measuring either as metabolites or adducts -- Schiff base adducts to albumin in a method that was developed in the Bruce Ames lab at Berkeley.

We're also looking at heterocyclic amines,

volatile nitrosamines, PAHs, thiocyanate as part of the toxic anion screen, and then a number of different toxic metals. And also to comment on an earlier comment, yes, our metals biomonitoring lab has grappled with some of those same issues. And I agree with the conclusions of the Panel, that this would be something useful to discuss in the methodological literature.

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DR. BLOUNT: So on slide 17 -- next please.

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DR. BLOUNT: -- just some -- given the specific question about tobacco exposure biomonitoring, yes, our recommendation is cotinine as an excellent measure for both active use as well as second and third-hand use with -- this work is -- I think the review, the table that I'm showing here was from the early 80s by Neal Benowitz and a group at UCSF. Also, Tom Bernert at CDC really pioneered some efforts in this area.

So nicotine and nicotine biomarkers whether in serum or in urine are quite valuable for detecting exposure to nicotine, and tobacco products. But we need to make sure -- also, it's very useful to include combustion products as well.

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DR. BLOUNT: Oh, yeah, and one methodological issue, just from the lab's perspective here on slide 18, analytical tools are improving over time, and we're able -- because of improvements in sample preparation and automation, improvements in chromatographic resolution, improvements in mass spectrometry, we're able to analyze more samples faster typically with greater sensitivity without compromising accuracy or precision, and to do so at less cost.

So just to note that your laboratories are constantly working to do things better, faster, cheaper.

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DR. BLOUNT: Also, toward the goal of interaction with Biomonitoring California, and the broader biomonitoring community, CDC is very interested in harmonization of methods, whether it be just beer napkin discussions of common sources of standards and issues, or more formal involvement with development, for example, with the National Institutes of Standards and Technology in development of reference materials, both certified reference materials, and standard reference materials, publications, and exchange.

We've had staff come to CDC for training, and

we've certainly learned a number of things from State labs. We also try to take advantage of the Phoenix Project at NIH as a way of exchanging methodological information.

And lastly, round-robin sample exchanges as a way to get a sense of the state of the science in laboratories that are measuring compounds of interest. The graphic is from Tom Bernert's round-robin for serum cotinine. Tom and Neal Benowitz are currently putting together a round-robin for urinary nicotine and nicotine metabolites. And we'd invite anyone who's interested in that to contact me, and I'd love to connect you with that in that process.

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DR. BLOUNT: So I've already commented on this, just the value of both serum cotinine and urinary nicotine metabolites. Keep in mind in the increased value of measuring different metabolites, so that you can get a functional assessment of nicotine metabolism, which are very important implications for addition and related exposures.

Also, of course, any time you're measuring a urinary biomarker, they need to adjust for dilution caused by variable hydration of the study participants. Creatinine is effective. We're exploring more and more

the use of urine flow rate as a way to get a creatinine-independent measure that's not affected by lean body mass or dietary factors.

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DR. BLOUNT: Next slide.

So here -- and one more click -- just clicking through the nicotine metabolites that we're measuring.

Next slide.

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DR. BLOUNT: And also the minor tobacco alkaloids, anatabine and anabasine, which provide a nice handle for -- quite often for looking at compliance for people who say that they are exclusively using pharmaceutical nicotine, a patch, or a gum, as opposed to continued tobacco product use, where the tobacco product contains the minor tobacco alkaloids and the pharmaceutical grade nicotine does not.

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DR. BLOUNT: So I mentioned the importance of combustion biomarkers for understanding the harm caused by the tobacco product use. Our leading candidate at CDC is the acrylonitrile metabolite CYMA. It's a phase 2 detoxification end-product, mercapturic acid, but there

are a number of PAHs. The amino naphthalenes look quite promising, 4-aminobiphenyl. Some heterocyclic amines we hope to be publishing on soon also look very promising. And 2,5-dimethylfuran was characterized two decades ago by David Ashley at CDC, and Sid Gordon at Battelle, still a very promising marker of exposure to tobacco.

And if you're a chemist in the lab preparing these standards, this stuff smells just like a musty old ashtray.

(Laughter.)

DR. BLOUNT: So, you know, you know that it -- your nose knows it. Also, some of the other VOCs and aldehydes look promising as fairly selective markers of smoke exposure.

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DR. BLOUNT: We focus specifically on VOCs, because there's quite a bit of harm from a hazard index approach. The classic Fowles Dybing paper in tobacco control of 2003 showing much of the -- a lot of the carcinogenic impact of tobacco smoke comes from VOCs as well as the respiratory irritation.

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DR. BLOUNT: And when we look at these from an

analytical standpoint just a shout out to the laboratorians in the room, you know this, trying to develop these multi-analyte methods is a big challenge, where, for example, for VOCs, very broad range in boiling points from negative 13 degree C to 210 for the VOCs that are listed in the Food and Drug Administration's harmful and potentially harmful constituents list, also broad polarities with the Henry's Law constants shown in the slide as well.

And then lastly, these things can be reactive, both when you're preparing your standards there can be reaction. And also just physiologically, many of the aldehydes and more reactive VOCs are -- cannot be detected in serum as parent compounds, and we have to target metabolites.

Finally, some of these compounds are, at least historically, common laboratory solvents. And so, in some ways, the laboratory is not a particularly good place to measure part per trillion levels, because there's a jug of it in the lab next door. So very careful techniques are required in this.

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DR. BLOUNT: When we apply these techniques here, just -- it's a fairly busy slide, but a scatter plot

matrix of NHANES data showing how closely correlated the monoaromatic VOCs are with themselves. The correlation with cotinine not quite as strong, perhaps, somewhat -- something of a toxicokinetic factor, as well as some of the people perhaps are getting cot -- are getting nicotine from other sources.

The panel, at the far right, is for 1,4-dichlorobenzene, which is not in tobacco, but is included as a negative control just to show what the scatter looks like. So a lot of correlation of these things. And just again, a reminder, as we've participated in a number of studies of fence-line refinery exposures, or fracking exposure, quite often what we find is the elevated benzene results that we do find are coming from the tobacco smoke, and not from the refinery.

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DR. BLOUNT: And this fits with what we see in tobacco smoke analysis. This is an analysis of 50 different U.S. brands that are machine smoke in a standardized way in actually two different protocols. But basically the take-home message from this busy slide is that the smoke constituents tend to run together. The more smoke, the more smoke toxicants with some variability caused by differing levels of nitrate, for example, for

the nitrated VOCs, and some of the ketones. There's some more complex formation chemistries involved.

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DR. BLOUNT: Lastly, just the pun intended, smoking gun here connecting the pattern of monoaromatic VOCs that we see in the U.S. population for smoker's blood. We see that same relative concentration of toluene, benzene, xylenes, styrene, and ethylbenzene as I see in tobacco smoke.

So certainly, from the U.S. population's non-occupational exposure, benzene exposure, for example, from tobacco smoke is a very important factor.

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DR. BLOUNT: Just to wrap things up, tobacco smoke exposure, as we see in the U.S. population.

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DR. BLOUNT: In this next series of slides, I'll be talking about data that underscore -- well, I guess I first want to underscore that especially in NHANES 2013-2014, a lot of new analytes were added. These classes of compounds are listed in this table. I don't have time to go through them, but just for your reference,

these are there. I'd be glad to, you know, if you want to know which VOC metabolites or which VOCs, I'd be glad to follow-up with you separately.

Also, to correct one typo on this, starting NHANES 2013-2014, we're actually starting at age three. And I think that information will be available in the public release data sets. Some of these will be continued after NHANES 2013-14, depending on financial availability.

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DR. BLOUNT: One of the reasons we're trying to measure more than just nicotine biomarkers is to understand this pattern in slide 30 -- these patterns of exposure are a simple color cartoon. Green is low background levels, yellow medium levels, red high levels, are in typical cigarette smoker. All of these classes of compounds shown in this slide are elevated non -- someone without environmental tobacco smoke, lower levels, and with secondhand smoke somewhat higher levels to these constituents.

And then understanding the different patterns of exposures we find with e-cigarette use, for example, or smokeless tobacco use, and then using that to better understand the population harm caused by the use of these tobacco products.

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DR. BLOUNT: So what does this data look like in NHANES. So here, I'll be showing some overlaid histograms of log 10-transformed data, blue being never tobacco users, red exclusive smokeless tobacco users, and green exclusive combusted tobacco users primarily, cigarette smokers.

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DR. BLOUNT: And so in this slide, you can see the overlaid histograms for these two -- these three categories. We see that on the right, offset very nicely, the tobacco product users, both smokeless and combusted tobacco, separated nicely from the non-users.

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DR. BLOUNT: A similar pattern is seen in the urinary NNAL, which is a biomarker of TSNA, tobacco specific nitrosamine exposure, and a note that, yes, that offset where smokeless tobacco users actually have higher levels of these biomarkers than cigarette smokers is something that has been characterized in the past, likely caused by swallowing of some of the -- some saliva and oral fluid from that tobacco product.

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DR. BLOUNT: So arsenic -- inorganic arsenic, of course, is being monitored as well. And there is some inorganic arsenic in tobacco products. But as you can see from this display, probably there are other sources in the population that are more important than tobacco product use, at least in this decade and a half sampling, where we don't see any difference in tobacco use versus non-use for this inorganic arsenic species.

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DR. BLOUNT: So with some of these selective combustion biomarkers, such as cyanide, you can see a very nice separation where most of the smokeless tobacco users have levels of CYMA similar to the non-users of tobacco. There are a few individuals with higher CYMA levels more similar to combusted tobacco users. And it will be nice to follow up on this in a controlled fashion. We do have a common practice where people, a lot of smokers, underreport, shall we say, their use of smoke products.

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DR. BLOUNT: Also two -- 2,5-dimethylfuran, a very promising -- sorry, the title of the slide is

incorrect. This is blood 2,5-dimethylfuran, where most non-users and smokeless tobacco users are non-detect for 2,5-dimethylfuran, and the smokers have elevated levels.

Next, please.

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DR. BLOUNT: A quick shout out to the CDC National Exposure Report. We're starting in 2011-12 actually, and the fourth NHANES, and the fourth report. We have a separate section specifically for smokers, where for assays that include biomarkers that are impacted by tobacco smoke, we have a break out for smokers versus non-smokers, and these are population-weighted. These weights specifically factor in cigarette smoking. So an additional section of potential use for reference.

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DR. BLOUNT: And lastly, you note that lots of times I talked about smoke instead of just tobacco smoke. And as there's increasing recreational use of marijuana, we are seeing an emerging pattern, both in the NHANES data where we can't measure cannabinoids in urine because of the federal government's stance on marijuana, but there is question about recent use. When we studied that and subtracted out exposure from tobacco, based on the cotinine levels, we were able to see significantly

elevated levels of many smoke constituents in these regular marijuana users.

And the graphic shown here - smoke carcinogens acrylamide, acrylonitrile, thiocyanate, acrolein, butadiene, and one of the PAHs or some of the PAHs - all showing significantly higher levels in marijuana users versus non-users. Sometimes the marijuana users had levels as high as the cigarette smokers, but typically they were somewhere between the non-users and the cigarette smokers.

And this, of course, fits what you would expect with smoke chemistry where marijuana smoke is likely to contain many of the same combustion products as tobacco smoke.

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DR. BLOUNT: So I just want to wrap-up by acknowledging many of the people who have contributed to this in the group, and a shout out to colleagues, some of who are in the room who have helped to do some of the studies presented today. Jianwen somehow I forgot your name on there.

So it's truly a pleasure to speak to the Panel and to reconnect with Biomonitoring California collaborators. So I'd love to address any questions you

have.

CHAIRPERSON BRADMAN: Thank you for that presentation. Very comprehensive and interesting. So we have time now again for some Panel clarifying questions, and public comment, and also some opportunities for discussion after that.

So why don't we start with Panel questions.

Dr. Cranor.

PANEL MEMBER CRANOR: Yes, I wanted to follow up just a little bit about your carcinogens that were -- wherever that slide was. I don't remember. Can you translate those concentrations into parts per million, parts per billion? I saw some numbers elsewhere, but they were harder to understand. I'm curious about the extent of exposure.

CHAIRPERSON BRADMAN: Which slide was that?

PANEL MEMBER CRANOR: The volatile organic -- benzene. I can't find the slide, but I marked it somewhere. Let me see, it's near the beginning, I think.

DR. BLOUNT: So I guess to -- just to broadly comment on that, I think there's certainly that challenge of understanding how does a measured biomarker level relate to a toxicological benchmark or, you know, related to the reference dose.

PANEL MEMBER CRANOR: Yes.

DR. BLOUNT: And there have been several approaches to that reverse dosimetry, forward dosimetry with both showing, for example, benzene. The levels of benzene in a typical cigarette smoker's blood exceed what would be expected from someone with an exposure at the reference dose.

And so it's above that threshold value. Also, from a biomonitoring equivalents approach, the -- that same conclusion was reached. Lastly, again, I guess a shout out to some work that was done here in the Bay Area a long time ago in Ken Turteltaub's group showing that, at least for benzene, it's a -- it looks like it's a linear acting carcinogen with no threshold.

And so it certainly can be argued that if you have a carcinogen that's acting and is linear down to zero, that's not a good thing without that threshold. So -- but certainly, that whole area of putting perspective around a measured biomarker level is an active area of work and an important area of work.

PANEL MEMBER CRANOR: Thank you.

CHAIRPERSON BRADMAN: Dr. Schwarzman.

PANEL MEMBER SCHWARZMAN: Thanks so much for this review. It's really helpful to hear about the variety of markers that can help distinguish environmental exposures from cigarette smoke. Could you expand a little bit on

your discussion of the difference between biomarkers of -- between smokers and secondhand smoke, environmental tobacco smoke exposure?

My understanding is there was -- I'm familiar with some of the early work by Kathy Hammond on environmental tobacco smoke in flight attendants, that -- and they measured the different components between mainstream smoke and sidestream smoke, and, you know, finding that cotinine wasn't a very good marker of environmental tobacco smoke exposure, and what -- you had one slide that showed a little bit, but it sort of -- sort of the coarse resolution, slide number 30, that looks at, you know, the relatively lower exposure to a lot of the biomarkers in ETS exposures compared to mainstream, but it doesn't distinguish among the biomarkers. Can you say any more about sort of those finer grain details?

DR. BLOUNT: Yes. I guess, first, a comment. I agree with the clarification that sidestream smoke chemically is somewhat different than mainstream smoke. And so there are some differences. There's more smoldering, for example, and that can lead to -- just modest differences, I would say. I would take exception to saying -- to the statement that cotinine is ineffective as a -- for measuring secondhand and thirdhand smoke exposure. I think it's quite effective and selective for

that measurement.

If one understands that there are also -- there's a modulation -- there are some different factors that play, and Dr. Quintana has a lot of expertise in that area. I -- one last comment. I don't have -- in my bonus slides, I didn't put in a slide that would comment on your thought around second- and thirdhand exposure, or people who are not directly using smoking cigarettes, what do their exposure levels look like for cyanide, for acrolein, for benzene?

I do have some plots of that. And for many -- so if you plot serum cotinine versus the acrolein biomarkers we're measuring in urine, you see, that serum cotinine below 10 are associated with elevated levels of acrolein exposure, compared with the individuals who have no secondhand smoke exposure.

So on slide 30, for example, I'm showing that in cartoon form with the different colors. I do have -- I can back that up with some graphics. Unfortunately, I didn't put them in my slide deck. So it, in part, also depends on how many other sources are common in that population.

So while secondhand smoke does contain, let's see, cyanide, we can also get cyanide exposure from cyanogenic foods from -- and the biomarker, thiocyanate

can be found in milk. And so there -- that signal for secondhand exposure is somewhat masked by these other sources.

But it definitely -- secondhand smoke exposure is a big deal both -- whether we're talking about tobacco smoke or marijuana smoke.

CHAIRPERSON BRADMAN: Dr. Luderer.

PANEL MEMBER LUDERER: Yeah, I have actually a question -- following up, a question about that same slide. I was really interested in the e-cigarette exposures. And one of the things that kind of jumped out at me is the tobacco specific nitrosamines are increased in the e-cigarette users. And isn't -- I mean, aren't those mostly synthetic nicotine and where would the tobacco-specific nitrosamines be coming?

DR. BLOUNT: And your -- so to comment on that, note that it's yellow not red. And so, first of all, e-cigarettes to date have been exclusively tobacco extracts in the liquids, because then they are a tobacco product that don't fall under FDA's regulation, otherwise it's a drug delivery device, right? And so -- because there's nicotine there.

And so it depends on that e-liquid. And because it's a tobacco extract, work that we've and others have done looking at e-liquids, some have found some NNN and

NNK, the levels are quite low compared to actually tobacco products. So, you know, probably it would just -- it would mainly be green with a little bit of yellow for TSNA. So correction appreciated.

Also for aldehydes, for VOCs, and probably for a lot of the trace metals. Well, let me hold that thought on trace metals, but for aldehydes and VOCs, the levels, except for some extreme conditions, are likely to be lower than the levels found in cigarette smoke. Metals, it depends. It depends on how the product is put together. A lot of these are disposable and have lead solder joints, and, you know, there's potential certainly for a lot of different kind of metal exposure, but again, the field is fairly young and it's a moving target.

CHAIRPERSON BRADMAN: All right. I had a couple comments, and then we have some opportunity for public comment and the discussion. But anyway, I just have one comment and one question. The comment really is just that, you know, your results for urinary perchlorate in different age groups, I think is really interesting and important, and just kind of underscores that often younger people have higher exposures, and often relative to body weight.

And this data actually almost perfectly reflects the CDC NHANES data for DAPs, the organophosphate

metabolites. It's almost identical. And I've just wondered, has CDC Biomonitoring considered sampling -- collect biological sample for kids younger than 6? And that's something that we've talked about here, but I wonder if that is a priority or perhaps something to comment on?

DR. BLOUNT: Yeah. Thank you for that shout out. And, in fact, in NHANES 13-14 that was piloted with three to five year olds, and was a success. I don't know if that data will be publicly released. But certainly in the future, those three to five year olds will included, I think, it's somewhere over 100, 150 maybe, 125, 150 kids age three to five. So there will be a new category there.

And all of -- our effort in the biomonitoring lab is to apply -- is to -- any place we have a subset to include those kids, because as you mentioned, quite often, the exposure, the concentrations, and certainly the dose, if we do some kind of extrapolation to try to compare to dose is quite a bit higher in children.

So I think that data -- that data is coming. I just don't know which two-year survey cycle it will first be available in, but we started measuring that in NHANES 13-14.

CHAIRPERSON BRADMAN: All right. Okay. How about one more question -- two more, then we'll have

public comment, then we have a little time for discussion.

Dr. Cranor.

PANEL MEMBER CRANOR: A quick question about perchlorate. I was reading an article recently that suggested that perchlorate levels in -- generically in the western states, and you mentioned the same thing, were extraordinarily high in water systems. And I think they mentioned Wyoming and places like that. Are you -- are you -- have you done -- is it true, and are you doing studies there? Because the suggestion was they were huge, and compared to say California's safety standard for perchlorate, it was like a million times greater. I mean, just shockingly so, and I don't know if it's true, and if you're sampling there.

DR. BLOUNT: So in the biomonitoring lab on occasion we'll do water testing, but our focus is really on human exposure through biomonitoring assays. We -- I know that EPA, as part of the UCMR project, collected nationally. California certainly has been tracking perchlorate for some time. Water utilities are tracking and there are -- there certainly is guidance around that, depending on the State.

I -- with the State of Wyoming, I don't know what -- if they have any perchlorate regulatory guidance for utility -- for public utilities.

PANEL MEMBER CRANOR: The suggestion was no on the -- no MCLs, no national MCLs.

DR. BLOUNT: And there's no national MCL. There are national health advisory levels. And I would think that a public utility at least would look at, you know, if they're putting out into the distribution something that's over the 10-day health advisory level, that they would take some kind of action.

There are ways to mitigate that, selective resins, that can be used that are somewhat expensive, but there are ways to clean that water up.

PANEL MEMBER CRANOR: The suggestion was that there are really millions of people exposed. Now, how much -- what's showing up in their bodies, I don't know.

DR. BLOUNT: As far as NHANES, we did do some tap water sampling, and put that together with biomonitoring levels, and the tap water perchlorate we found was just low part per billion. And when we put that as a regression model, and compared it with other foodborne perchlorate exposure pathways, the foodborne variables were much more significant in predicting your elevated urinary perchlorate.

So dairy products, green leafy vegetables were more of a significant source, in general. But they're certainly -- you know, this situation you're describing

would be a huge exposure.

PANEL MEMBER CRANOR: Hot spots of some sort.

CHAIRPERSON BRADMAN: Dr. Quintana.

PANEL MEMBER QUINTANA: Hi. Thank you for that presentation. Just following up on what Dr. Bradman said about sampling in younger age groups, that's especially significant talking about tobacco toxicants, because they're likely to get more exposure to the residue of smoke -- thirdhand smoke in dust. I know house dust is a major route of exposure to lead and flame retardants in some studies.

But also, it made me think when you looked at -- again, showing that perchlorate slide, if you're sampling younger children, you have additional pathways of exposure, but you also have potentially higher dose showing up or higher levels showing up in the urine, because of a higher intake per kilogram of body weight.

And it made me wonder, looking at your NHANES tables, would you have to start normalizing per kilogram of kid, or something in a way, to look at this -- this ages where they're growing and so rapidly. And those stratifications might be changing quite rapidly. And I'm just curious if you had any discussions about that?

DR. BLOUNT: We grapple with that a Little bit. I co-authored a paper with Sean Hays and Lesa Aylward

looking at biomarker excretion rates, and we went back and forth with do we divide by body weight as part of that presentation or not? And ended up presenting it both ways.

So, but it's definitely a factor and comes back to, you know, do we -- I guess, from a toxicological standpoint, there's certainly a compelling argument to be made that you really want to know how much toxicant per kilogram of target tissue. And so I don't know there might be something where you eventually move toward that. But for the time being, we're just presenting our excretion data both ways, and, of course, creatinine scales with, you know, that lean body mass, and body size, as well, so it adjusts somewhat as well, but ongoing research in that area.

CHAIRPERSON BRADMAN: Okay. Thank you for those questions. And again, we will have some more time for discussion related to this, but we have at least two requests for public comments. And the one by email, and one in person. And we'll start first with the in-person Nancy Buermeyer from the Breast Cancer Fund.

MS. BUERMEYER: Thank you, Dr. Bradman. Nancy Buermeyer of the Breast Cancer Fund. Good to see you again, Dr. Blount. And thank you for that really interesting presentation. And I ended up with three

questions about three completely different things. So I'll start with perchlorate. Really fascinating information.

I have to say I was really shocked to find out that perchlorate is intentionally added to food packaging, and is approved by the FDA to do so. The Breast Cancer Fund has signed on to a food additives petition to try to get the FDA to decertify the use of perchlorate in food packaging. It's used as an anti-static compound in plastic packaging for dry products like flour and the like.

So you said that food was one of the major sources. And I'm assuming that's not what you're thinking about. But I wanted to see if it's something that you had -- was aware of or had thought about at all?

So that's one question, and I'll let you finish that and I'll come back.

DR. BLOUNT: So just very briefly, I -- that's definitely worth following up, and getting an idea of what food products that's used on, and plugging that into our regression modeling of urinary perchlorate, and the 24-hour dietary recall to see if use of those products is associated with increased exposures. Our model so far, dry good, we've not seen an association with cereal products, for example, but that's really broad.

I guess one of the challenges, if there's staples like -- staple foods like flour, how do we assess that with that very specific dietary recall question, where it's more finished foods, but definitely something to look into. Thanks for the heads up.

MS. BUERMEYER: Yeah, I mean, we were hoping to get some migration studies out of the FDA as well to see what they think is migrating into the food.

So moving to the tobacco products, you had really clear bar graphs that showed the difference between combustion and smokeless or non-combustion products, does that drop out, the e-cigarettes, which sort of feels like it's neither or?

And so e-cigarettes have been a big issue here in California. We've just passed a law to try to regulate them more like the rest of tobacco products. Laws to try to prevent kids under 18 from buying them. So it's a big issue here, and it's not clear to me how developed the science is around some of this exposure stuff.

DR. BLOUNT: So our goal is to try to characterize the exposure patterns related to it, so that we can better study the potential harm caused by that, and connect exposure with health effects. E-cigarettes are a moving target right now. There are multiple generations, very different kinds of products, you know, ranging from

these disposable little cigalites to fourth generation, dual coil, adjustable voltage, you know, very -- you know, and the resulting chemistry varies quite dramatically.

So definitely a moving target. We're trying to cover the different classes of compounds that could be of relevance, and also trying to cover the differences in potential harm caused directly by uses of combustion -- combusted product versus non-combusted product, such as e-cigarettes, and to provide data to policymakers about that, both with -- from an individual standpoint and a population standpoint.

I think one of the potential concerns there, even if an e-cigarette is a less harmful way to deliver nicotine than a cigarette, what's the overall population harm, if a whole generation of young people becomes addicted to nicotine from using that product?

And so we're trying to understand the exposure and track what is happening, for example, as part of NHANES, where for NHANES 13-14 we asked about e-cigarette use for the first time in NHANES, and connect -- and can connect that with serum cotinine, urinary nicotine metabolites.

MS. BUERMEYER: Just when you thought you had tobacco figured out, the companies gave you something else to work on.

(Laughter.)

MS. BUERMEYER: And my last question is really simple. In looking at the three- to five-year old children, are you looking at both urine and blood or just urine?

DR. BLOUNT: The three- to five-year olds have always been part of the serum cotinine analysis. I think all down to very young children, we have serum cotinine. The comments I made are just for urine with the environmental subsamples, and that's where we've expanded into collecting urine from these kids for environmental exposure questions.

So it's -- there are serum samples available for young children. But as you can imagine, those are very valuable and very difficult to get approval to measure serum toxicants in those kids. Cotinine is one of the analytes that is approved for that though.

MS. BUERMEYER: Than you, and thanks for all the great work that you do. Appreciate it.

DR. BLOUNT: Thanks.

CHAIRPERSON BRADMAN: I think we have now a public comment by email and Amy is going to read that.

MS. DUNN: This comment comes from Jessica Frank of the EPA National Exposure Research Laboratory in Research Triangle Park.

She says, "You mentioned that poor diet contributes to health outcome for perchlorate exposure, but the foods you showed aren't typically associated with poor diet. Can you expand? Were you simply referring to a reduced iodide intake as poor diet?"

DR. BLOUNT: Point well taken. I was speaking about low iodide intake, and low iodine intake, certainly green leafy vegetables, many dairy products are part of a healthy diet. The -- it is important to understand the need to have adequate iodine intake, especially when the prevailing public health message for many people, and rightly so, is to reduce your salt intake, while the public health effort to make sure everybody gets enough iodine is to put iodine in salt.

And so yeah to clarify that comment, it's important for people to be purposeful about getting enough iodine in their diet. And for those who have lower iodine levels, we see this interaction with environmental exposure and tobacco smoke exposure to be associated with lower thyroid hormone levels.

CHAIRPERSON BRADMAN: Yeah. We actually have -- if there's no more public comments, we actually have about 10 minutes for so, or a little bit more, for Panel discussion around the presentation and related topics.

So, Dr. Schwarzman.

PANEL MEMBER SCHWARZMAN: Just taking on that point about the perchlorate. It reminded of a question that I had and forgot to ask about. Did you look specifically at pregnant women just because I understand the demand -- increased demand on the thyroid during pregnancy? In addition to exposure to perchlorate as a competitive inhibitor for iodide uptake tends to produce more low thyroid hormone levels, which, of course, is much more significant during pregnancy than for adults.

DR. BLOUNT: So in our study, with NHANES, as you know, NHANES is cross-sectional, and is great for looking at where the population is at this particular time. NHANES does include some pregnant women, typically in our one-third environmental subsample, around 100, 125 or so, and at different places in their pregnancy.

We and others have looked at pregnant women as part of these data sets. And, you know, pooling that across multiple years, we've not found an association in pregnant women. And I would -- it doesn't mean that it's not there. Certainly it's a time of great thyroid flux, and there's -- because of that change in -- as a normal part -- the change in thyroid hormone levels is a normal part of pregnancy, it's harder to see something that is causing a more modest change.

I think that the CATS study with John Lazarus and

Elizabeth Pearce has found some interesting things around perchlorate exposure and pregnancy. And then several studies have looked at thyroid function in pregnancy and neurocognitive development of subsequent children in decrements. So there certainly are some papers indicating that there are some things to pay attention to there.

I would also add the lactating -- or lactation in infants as a -- also a vulnerable life stage, where at least in utero, the baby is also protected somewhat by mom's thyroid. After birth, there's very little thyroid stores of T4. And so especially if breast milk or -- well, if the infant source of nutrition has perchlorate and low iodine levels, that it's a population to be careful about.

PANEL MEMBER SCHWARZMAN: Just to clarify, when you said you didn't see an association between pregnancy and level, did you mean perchlorate levels or --

DR. BLOUNT: Yeah, perchlorate levels.

PANEL MEMBER SCHWARZMAN: Yeah. Okay. So maybe no disparate exposure level, but a disparate impact of any exposure that there is?

DR. BLOUNT: Oh, and just clarify, yes, we did not see -- pregnant women had perchlorate exposures similar to other women of -- you know, age-matched women, and secondly, in perchlorate women -- or, sorry, in

pregnant women in particular, we did not see a relationship between perchlorate exposure and thyroid hormone levels.

CHAIRPERSON BRADMAN: So we have time now -- more time now for Panel discussion. I know I have a comment. It perhaps derives from your presentation, although it's not specifically about it, but I think it's relevant to California and the biomonitoring program. You mentioned in here that you made some comparisons between possible exposures related to marijuana use, and how some of those chemicals overlap with tobacco smoke.

And, you know, given that a few states have legalized recreational use of marijuana, and it's probably likely to happen in California in the next year or so, I understand that the federal government is not in a position to do biomonitoring related to that. But I have some concerns about exposures to those materials, especially for kids and young kids, and also the marketing have, you know, edible forms, which is going to be, I think, potentially a kind of new Joe Camel, in terms of attracting kids to candy and brownies and stuff like that, at a younger and younger age.

And I'm just wondering, if there's been any scientific thought about that at CDC, and it's also maybe something we should consider here, given that's

potentially emerging and increasing in the State.

DR. BLOUNT: Certainly, for us at CDC, we -- we see our -- part of our public health role as engaging with the states, and States Department -- State departments of health and being of service. We've had many queries, especially from Colorado, questions related to active use by lactating women, active use in the presence of children, where the law states you cannot smoke in public. If you live in an apartment, you know, where else do you have? You're smoking inside in front of your children.

And there are increased rates of bronchiolitis, and other respiratory conditions in the children, as a result. And there's very little guidance here for a lactating woman who has stopped smoking marijuana and how long does she pump and dump before many of these combustion products are cleared from the breast milk, and the psychoactive components as well.

So we're trying to respond proactively in those kinds of ways, as well as just trying to quantify the exposure. So looking at secondhand exposure questions, for example, where there's a perception this is a natural product. It's not bad for me. So in some ways, it's renormalizing smoking back in public spaces.

CHAIRPERSON BRADMAN: Exactly. And I know I've actually been approached individually by people in the

industry in Colorado about pesticide residues in marijuana. And right now, there's no standard for materials being used. And quite, you know, a mixture of materials are being used. Potentially, you know, right now, there likely, if there's any regulatory framework, they're going to adopt the tobacco framework for pesticides on tobacco. But right now, it's still kind of the wild west.

DR. BLOUNT: Yeah, definitely.

CHAIRPERSON BRADMAN: Dr. Schwarzman.

PANEL MEMBER SCHWARZMAN: I have a related question about -- tell me if this is a little too far out, but the potential use of biomarkers of exposure to marijuana in the application of like field sobriety testing, so where we have very accurate blood alcohol level testing, and we know that marijuana impairs driving, but I don't -- you know from a public health perspective, as we look at increasing legalization of marijuana, I'm afraid we're just going to see a lot impaired driving. And there's a problem in making that assessment in the field, because we don't have a breathalyzer, and in making any sort of conviction, because unless there's really sophisticated field sobriety testing, you can't establish the level of impairment very easily.

So do you have any thoughts, or tell me if this

is just outside, what you've looked at, but for the use of these biomarkers in that kind of application?

DR. BLOUNT: It is completely outside the scope of what I do. Having said that, by understanding the half-lives of the biomarkers, and also understanding -- you know, differentiating between direct inhibition or impairment and past exposure, I think, is very important here.

The National Transportation Safety Board and others in states are actively grappling with this, how to do this, how to establish this, you know, in a legally effective way.

And I think analytical measurements, and therefore biomarkers will be part of this. I'm not sure how that will be implemented, what it will look like, because it's really far afield from CDC's mandate around this, but I know people are looking at that very important question.

MS. DUNN: Asa.

CHAIRPERSON BRADMAN: Amy.

MS. DUNN: We have another comment from Jessica Frank. I don't know if it's too late?

CHAIRPERSON BRADMAN: Okay. I think we have time.

MS. HOOVER: I think we should end.

Okay.

CHAIRPERSON BRADMAN: We have about one minute. Are there any other questions from the Panel? I think we'll prioritize the Panel comments right now, and then we're going to have an announcement and a break for lunch.

Dr. Fiehn.

PANEL MEMBER FIEHN: Thank you again for your very wonderful presentation actually. I was enthused about the progress in analytical chemistry that has led to, you know, much lower prices, and much higher throughputs, and much better sensitivity. But even with very good triple quadrupoles or Q-Traps like that you have outlined here, you still need 200 microliters of plasma just to measure cotinine.

You also said it's nice, and I think might be in your bonus slides that we didn't show, that it's nice to have as many targets as possible. So that's also like the speed of mass spectrometers can do this.

You know, to the best of your estimate, how many of those panels can we combine? You know, and how could then untargeted exposome analysis help, in addition for higher concentrations? And that relates also a little bit to the question that we had lined up with the iodide exposure, because, you know, obviously nutritional exposure is a huge impact on overall health outcomes. And

it's a huge question in many epidemiological studies, where right now people ask food frequency questionnaires, and they're just miserable, based on huge evidence.

So it would be much nicer to say, well, we go for very low environmental pesticide, and so on, exposures with targeted methods. And then we have very abundant -- or relatively abundant compounds -- and I thought all this cotinine would belong to those -- you know, where we can also go for less sensitive but broader methods. So I'd like a little bit to gauge your kind of opinion here.

DR. BLOUNT: Yeah. So I think that it's an important question. And as there are more chemometric approaches, or untargeted approaches. It's an important topic to be aware of. I would say an effective analytical method depends on the intended purpose of the data.

If you need to have an unambiguous quantitative trace level measure of something of defined accuracy, specificity, and precision, then a targeted analysis is the only way to get there, because there are so many different components in a biological specimen. And, you know, for the analytical chemist and biomonitoring measurement people in the room, we can tell you, you know, this could work in 90 percent of the urines, but in 10 percent I get this strange ion suppression phenomenon, and unless I have a stable isotope-labeled internal standard,

I can't adjust for that in my quantitation.

So there are factors such as that, that if one takes a chemometric approach, and then tries to say I can use this data also in a regulatory manner and say I'm confident in the accuracy and precision of this quantitation, I think you're -- there are some questions there that one needs to be careful about with the untargeted analyses.

Having said that, as I said in my opening comments, untargeted analysis is a great discovery tool. It's a great tool from a broad perspective around the exposome and broad biological processes. But if you want to drill down and quantify secondhand smoke exposure by picking a peak out of a untargeted analysis chromatogram, one needs to be careful about interpreting that data at ultra trace levels.

CHAIRPERSON BRADMAN: I'm going to just interrupt here, because we're at our break point for lunch, and we need to make an announcement. We can continue some of the discussion during lunch within the confines of the Bagley-Keene announcement that we'll hear, and then we'll be able to reconvene this afternoon.

So we'll have the announcement and then adjourn for lunch.

STAFF COUNSEL KAMMERER: Hi. Fran Kammerer,

staff counsel for OEHHA, just reminding you to refrain from discussing Panel matters or this meeting matters when you're away from the public forum here.

Thank you.

MS. HOOVER: Very concisely done.

And go ahead, and I just want to --

CHAIRPERSON BRADMAN: Well, I was just going to reiterate the time frame for lunch.

MS. HOOVER: Go ahead.

CHAIRPERSON BRADMAN: Okay. So we have a break for lunch now. We have a tight schedule in the afternoon, so we'd like everyone to be back here by 1:25 p.m. So we have about an hour and 10. If you have a smartphone, if you want to be really smart, if everyone can set their timers to go off at 1: --20

(Laughter.)

CHAIRPERSON BRADMAN: -- so you'll know when to start walking here. Okay.

MS. HOOVER: And also, just so everyone knows, for the quickest dining option, you should use the cafeteria. That's going to be your best bet.

Thank you. See you soon.

MS. CHRISTENSEN: For our visitors, visitors who are not from this campus, you have a badge, the doors in the cafeteria will let you in and out only for the

lunchtime hour. Okay. So please be sure to be back here on time, otherwise you'll be trapped outside.

The other thing is our cafeteria closes at 2:00 p.m. So, please, if you want to, drinks or snacks, pick them up now.

(Off record: 12:18 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: 1:28 p.m.)

CHAIRPERSON BRADMAN: Okay. So I'm going to call the meeting back to order and welcome everybody. And we're on schedule, which is good.

So this afternoon, we'll be discussing topics related to biomonitoring pesticides in California. The afternoon session will include three presentations with time for questions for each -- after each presentation. We'll also have a brief minute break following the second presentation and question period.

After the break, the session will continue with the final presentation, public comment, and time for in-depth discussion on topics presented.

And the one thing I really want to emphasize too, that this is really an important topic for California. California is the biggest agricultural State in the country, dollar-wise. We produce a lot of fruits and vegetables. Fruits and vegetables are also really important for better public health in California and the nation as a whole.

And tools for growing that food include pesticides. And so I think this is a really important discussion both to consider how to look at exposures related to pesticides but also when we consider what the

health results are, we also have to consider what the benefits are of some of the foods that are being produced.

So we do have some specific goals for this afternoon's session. One, we want to discuss general considerations for biomonitoring pesticides. That will partly be informed by my presentation, and also we're going to hear from Dr. Paul English about his work looking at pesticide use near schools.

And then importantly, we want input on strategies for future program studies, both in terms of new sample collection, and also possible classes of pesticides to test for as target analytes. In particular, OEHHA is looking at three possible pesticide classes that should be considered as potentially designated chemicals. And down the road, we'll also consider whether we'll want to prioritize them.

But just importantly, this is a really important issue for the State of California. And I think there's a place here to really understand exposures. And as we understand them, perhaps move forward on ways to protect public health, but also protect agriculture.

So I want to introduce Dr. Paul English. He's a Senior Branch Advisor for the Environmental Health Investigations Branch at CDPH. His work is focused on the public health impacts of climate change, air pollution,

pesticides and other environmental health issues, including work at the U.S./Mexico border, and also reproductive outcomes.

Dr. English is the Principal Investigator for California Environmental Health Tracking Program, which takes a community-based approach to develop surveillance systems related to environmental health issues. He's dedicated to involving the community and responding to their needs and concerns through application of many disciplines, including environmental epidemiology, geographic information systems, and health communication. So, again, Dr. English will be talking on their report, Agricultural Pesticide Mapping and Proximity to Public Schools.

So thank you, Paul, for making the time to present this information. And I think we all look forward to hearing about it.

(Thereupon an overhead presentation was Presented as follows.)

DR. ENGLISH: Okay. Can you hear my okay?

I started to unbutton my shirt.

(Laughter.)

DR. ENGLISH: Okay. Can everybody hear me?

Yeah. Okay. Thank you very much, Asa, for that introduction, and thanks to the Panel for inviting me to

talk today. So -- let's see, so as Asa was saying, I'm going to talk a little bit about a report that my program, the California Environmental Health Tracking Program put together a couple of years ago.

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DR. ENGLISH: And so what I'm going to talk about is that report a bit. And then I want to show you a tool that we've developed in the program to visualize and display the data from the California Department of Pesticide Regulation from their pesticide use reports, which may be useful to this program or others interested in pesticide issues.

And then I'm just going to make one -- one slide, one suggestion on how to use some of these mapping tools to do some sampling for biomonitoring that maybe you'll have some ideas about.

So next slide, please.

MS. CHRISTENSEN: We're having a technical issue.

DR. ENGLISH: Okay. While they're dealing with that, I'll just keep going.

So next slide, please.

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DR. ENGLISH: So the -- first, I just want to tell you a little bit about the California Environmental Health Tracking Program. This is a program we've had here

in the Health Department, but it's a -- actually a partnership between the Department of Public Health and the Public Health Institute in Oakland.

And we've been funded. This is a program funded by the CDC. We have some other funding for our Program also. So the mission of the Program then is to provide really usable, understandable information on environmental health hazards, and health outcomes that are related to the environment to stakeholders. And the stakeholders can range from researchers all the way to the public.

Back to the previous slide. Yeah.

And so what we -- as part of our mission, I mentioned, you know, improving the availability and usability of this data. We also want to build stakeholder capacity, and promote community engagement with the use of these data, and inform public health actions in California, including research policies and practices.

Next slide.

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DR. ENGLISH: So let me talk about the pesticides and school study. So this was a descriptive study released in 2014. And the goal of the study was to assess the poundage and types of pesticides that are applied near schools in 2010. This was the year we had data.

And now for near schools, we chose a quarter of a

mile from the school boundary. And this distance was a little bit arbitrary, but it was chosen, first, as a reasonable distance that pesticide drift could occur. And secondly, this is a distance that's been used a lot in regulations on the books.

We chose 15 -- the top 15 counties in California by their total agricultural pesticide use, and we used four different sources of data for the project. I mentioned the pesticide use reports from DPR, Department of Pesticide Regulation. We also used some data from the Department of Education on schools.

And then this one is a key element. It was the very first time this data has ever been obtained, which made this study very special. It was actually the borders -- the electronic borders of the actual fields where pesticides are applied. And I'll mention in a minute why this was important. And we were able to get those from the individual agricultural commissioners.

And then there was also land survey use data that we also used from the Department of Water Resources. So this only -- this study only included agricultural pesticide use. It did not look at structural pesticide use, you know, for like termite sprayings, and also not data that is used when pesticides are applied on school properties. And I'll mention that again why not we didn't

use that.

Okay. Next.

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DR. ENGLISH: You guys -- probably everybody knows this issue, but I'll just reiterate it why we were interested in looking at children. They are mostly -- they're more susceptible to exposure than adults, because they eat and drink more relative to their body weight than adults. They -- of course, they play outdoors. They engage in hand-to-mouth behavior. And when you look at health outcomes such as neurological and physiological development, whether you're looking at it prenatally and postnatally, you know, this is a very precisely choreographed sequence of events.

And this is why we sometimes say there's very important windows of vulnerability that we want to look at exposures that might impact growth, development, neurodevelopment, reproductive outcomes. And then, of course, kids spend a substantial time of their life on school grounds.

Next slide.

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DR. ENGLISH: So here's the question that we got when this report came out, you know, well, this is really no good, because here's looking -- you didn't measure --

you didn't measure human issues in these kids. You don't know what's actually -- you didn't do any environmental sampling, so, you know, how -- you know, why should we even be concerned about the results of this.

Well, it's true that proximity doesn't necessarily totally equal exposure, but I would say it increases the risk of exposure. And we continue to have studies coming out showing that, first of all, things are drifting. Drift is acknowledged as a phenomenon that happens. For example, methyl bromide has been detected up to 70 meters away from an application site.

We know work that's done by NIOSH that a large percentage of pesticide illness, almost half, is associated with fumigant drift. And then there's been work that's come out from CHAMACOS. They had been looking at proximity to fields, and seeing associations with higher levels of metabolites in children.

And then just -- you may have seen just recently a couple days ago, they have a new report out. And I'm sure Asa would be glad to talk more about this, if you have questions that they're seeing, I believe, it was one kilometer away from residences of children in the Monterey Valley in the Salinas Valley area, that they were seeing deficits of IQ up to two points of IQ associated with applications of primarily OPs.

So again, that adds more weight of evidence to looking at this.

Next.

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DR. ENGLISH: Okay. So I'm going to go over briefly the basic methods for what we did. I'm going to go through each one of these in a little bit more detail. First, we had select counties, determined school boundaries, what pesticide categories were we going to look at, and then we had to link the school boundaries to pesticide data. And for each category then, we calculated the number of pounds used near schools, and then we did this other demographic analysis using the data from the Department of Education where we obtained data on race/ethnicity for the children attending there, and then also, we had income proxy. And this was whether they -- the children participated in federal free-lunch programs, so we used that data also.

Okay. Next.

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DR. ENGLISH: So the first step on selecting counties. I think Asa in his introductory comments was talking about how we use a lot of pesticides here. We grow a lot of the fruits and vegetables. There is a health benefit, of course, of eating fresh fruits and

vegetables. California is about -- supplying about a quarter of -- well, California uses about a quarter of pesti -- the country's pesticides.

And when we selected these counties, these 15 top counties, it was about 85 percent of all the pesticide use in California. And even these 15 counties account for almost 20 percent of the entire country's pesticide use. So as it was mentioned before, this is a significant amount of pesticides.

And you can see in 2010, the poundage -- the top 27 million pounds in Fresno -- probably Fresno is still the top county in terms of pesticide use.

Next slide.

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DR. ENGLISH: Now, this point is really important. This is the time we've most accurately found the locations of schools. So in past, a lot of times when people are doing these types of geographic analyses, they would get the address of a school, put it in to a -- you know, into software, and find the latitude and longitude or geocode that point in space.

Well, oftentimes if you just use this address, as we found when we started looking into the data visually, you know, there could be errors up to a mile away, because they have the office address or some administrative

address, and it wouldn't really relate to where the schools are.

So we put together a very highly accurate boundary file where we went in and, as you can see from the slide, visually look -- found the actual boundaries of the schools, and then digitally mapped these using aerial photography, Google Maps and to verify that we were actually getting the locations of the actual boundaries.

And just as an aside, there's now going to be available very soon a complete set for the entire State, if people are interested in that, because there's a group called GreenInfo that did some work for Stanford, I believe, and they're going to -- when you combine their work with our work, we're going to have a complete set of school boundaries. So that's pretty exciting.

Okay. Next.

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DR. ENGLISH: So these were the pesticide categories that we selected. There were six groups selected for public health relevancy and categorized by known health effects and regulatory status: carcinogens, development and reproductive toxins, cholinesterase inhibitors, toxic air contaminants, fumigants, and then prior pesticides that were selected -- these were on a list that -- and maybe you guys are talking about this

today. There's a list that DPR has. They're priority pesticides for monitoring and assessment. So we looked at those -- at those compounds also.

And you can look in the report if you want to get a little bit more detail on how those categories were selected, and how pesticides were put in these categories. But primarily, they're, you know, based on EPA classifications, the Prop 65 classifications, or other lists from DPR, hazardous air pollutant lists. So, you know -- or this list from CDPR on priority pesticides.

Next.

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DR. ENGLISH: Okay. So I'm going to go just a little bit in, but not a lot of detail on how we actually did the linkage. It's fairly complex how to link -- how to link the pesticide applications to this distance to the school boundaries.

And what I want to show you here is -- I don't know, is there a pointer available on the thing, or it's not working?

MS. CHRISTENSEN: That pointer, you push the green button.

DR. ENGLISH: The green button.

So if you look here, the data that's normally available from the pesticide use report is called a

section. It's based on this thing called a Public Land Survey, which probably, you know, when the wagon trains came out, they probably established this originally.

But the lowest level of geographic detail normally is one square mile. This is called a section right here. And just to show you the better data that we got, this is an example of field. We can call it field number 103.

And this is the boundary. So we actually got these boundaries from this 15 county agricultural commissioner offices. So we were able to link then the school boundary -- a quarter mile from the school boundary, which, let's say, we were buffering it with this buffer right here, and let's say this was the school. And so we wanted to capture all this pesticide use within this boundary. So we were able to use this linkage for 80 percent of the applications. This was the best linkage.

And this was basically used -- a distance -- not a distance, an area-weighted approach. And so, for example, if there was 100 pounds of a pesticide applied, you know, to walnuts in this field, let's say it was a walnut grove, and then we can calculate spatially that 55 percent of that field lies within a quarter mile of that school, then we would estimate, well, there was 55 pounds in that boundary area. And so we would just redo this

over and over again for all the compounds within the boundary.

Then for about 20 percent of the applications, we used another method that's been published by Beate Ritz from UCLA, she's used this method a lot, in a lot of her pesticide work. And it's using this land use data the Department of Water Resources collects. I won't go into detail, but they do these surveys every so years they go -- every six or so years they do each county. And they go out, and they're actually doing a survey of what crops are grown in a parcel. And then we can -- because we have crop data in PUR, we can go back and find out what pesticide was applied in that area.

And then the final -- the crudest data for this linkage, which was only for one -- less than one percent of the applications, we went back to just saying -- looking at the information on what's applied in this one square mile area. Although, we don't know for sure where in that one square mile area that was applied. So that's what has the most error is less than one percent of the applications.

And you can read all the details about that in the report, if you're interested.

Next.

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DR. ENGLISH: Okay. Let's already go to the findings. So we found that 36 percent of schools, so this was 899 schools, they had pesticide use -- these pesticides of public health concern applied nearby. A small percentage, about five percent, had large amounts ranging up to 28,000 pounds applied in this year. And we found Hispanic children were 91 percent more likely than white children to attend schools in the highest quartile of use.

And there was a lot of varying amounts of pesticides applied near school by county. And I could mention Monterey and Ventura as two of the counties that really came up a lot. And you can see all the county rankings in the report.

Next.

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DR. ENGLISH: So let's look at these compounds for a minute. So these were the top 10 pesticides of public health concern. The first thing to think about, when you look at this list, is most of these compounds, not all of them, but most of them are fumigants. So these are going to be likely to be prone to drift.

The next thing you might notice about this is on the chemical persistence, a lot of these have moderate to high persistence. This is a fact from this report that's

really not getting enough attention, because, you know, whenever we would go back to the agricultural commissioners they would say, well, you know what, you know, we just -- we don't apply it when the kids are there. You know, right before they come, we apply it, but they're not there. You know, or we'll do it on the weekends.

Well, you know, the school is used during the weekends. These are persistent these -- these are compounds of, you know, up to 1,000 days of persistence. So, you know, there's still the potential for exposure, even if they're not applied during school hours. So, of note, you know, chloropicrin is the top compound applied near public schools. So we're applying a compound that was investigated originally as a poison gas in World War I near schools where kids are. That's really cool.

(Laughter.)

DR. ENGLISH: Now, that's combined with methyl bromide usually and Telone, which is the second one on the least, 1,3-dichloropropene. A lot of these compounds have carcinogenic properties. Methyl bromide is being phased out. This was a compound that most of the world does not use. It was banned by the Montreal Protocol. This destroys the ozone layer, so -- but the United States had got a special exemption to be continuing to use this

compound, because of economic reasons. This is something that's primarily applied on strawberries.

It's, of note, also metam potassium, number 5, which generates MITC, which is a highly, a highly irritant gas. So that's one of the main concerns about that.

So I'm sure there's other people that have knowledge of pesticide toxicology and can talk more about some of these compounds than I can, but that was our list.

Next slide.

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DR. ENGLISH: And this gives you just a visual idea of some of these schools. This is actually the location of a family that had been involved in a lawsuit with U.S. EPA over civil rights violations, about pesticide exposures around schools. This is Rio Mesa High in Oxnard, one of the counties I talked to you about being high on the list. And you can see chloropicrin, methyl bromide. And that is methyl potassium -- No that is Telone being -- no, that's metam potassium, sorry. Metam potassium is three of the top compounds applied by the school. Sixty-five percent Hispanic. So kids are out here running around the tracks, exercising as these compounds are being applied right by the school.

Next slide.

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DR. ENGLISH: So these were the recommendations from the report. We wanted to have a routine and standardized collection, digitization, and reporting of agricultural field locations. And after a complete publicly accessible database of pesticides applied on school properties, there was a bill, SB 1405, that was actually focusing more on training of applicators on school grounds, but does not address the applications outside the school grounds.

I mentioned the school property boundaries issue. And then also, we recommended that there would be ongoing surveillance of the use of pesticides, not only near schools but other sensitive land-use sites, such as day care centers, or elderly rest homes, and the like.

Next.

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DR. ENGLISH: After the report came out, Brian Leahy, who is the Director of DPR, he published this editorial in the Sacramento Bee that school kids must be protected from pesticides. So there was a reaction from the regulatory agency right away, and he proposed that they're going to host, of which they did, a series of public workshops throughout the State.

And I do think it was kind of interesting though that he kind of criticizes that schools are sometimes

built on prime ag land, and, you know, what kind of logic is that?

Well, I mean, anyone who knows anything about how our schools get located, it's not like schools have an awful lot of cash to -- where they can locate schools. So that's kind of a contentious issue. And it's -- this -- I think this report also has some implications for land-use planning, and kind of, you know, what is this interface? How are we dealing as a society with this interface between ag uses and the expansion of communities out into the agricultural zone?

Next.

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DR. ENGLISH: So here's a couple slides from the -- that was the reaction of communities after the report came out. There were press conferences. These individuals here are people that showed up at these series of workshops. And so what was proposed is there will be some plan to create standardized buffers around schools, and/or are better notification to schools that these compounds are going to be applied.

And so I'm hearing that later this summer we should be seeing these proposed rules for comment.

Next.

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DR. ENGLISH: So these were the things that the stakeholders were advocating to the Department of Pesticide Regulation, that they notice these three compounds of concern, chlorpyrifos, chloropicrin, and Telone.

They're saying again Latino children are being disproportionately affected by pesticide use. We need consistent statewide buffer zones, better notifications. We need a modernized electronic database tracking pesticide applications in fields, and we need to do -- continue with monitoring.

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DR. ENGLISH: Okay. So that's what I wanted to talk about the report. I'll be glad to answer questions about that in minute, and I just have a couple more things to tell you.

I wanted to tell you that we have a relaunch of our agricultural pesticide mapping tool.

Next slide.

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DR. ENGLISH: So what you're seeing right here, this is all pesticides applied. Now, this is a map that currently viewing at the township level. You're going to be able to view this map at the county level, township, which is a conglomeration of sections, and then at the one

area by zooming in on this map.

But what you're seeing here basically is where agricultural use is in the State, you know, the San Joaquin Valley, the Salinas Valley area, and pockets around Ventura county, and then the Imperial Valley east of San Diego.

Next slide.

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DR. ENGLISH: So what you can do is we have multiple years of data in this program. You can select a geographic unit. You can see how you can summarize the data in different ways. And then you can just type in -- you know, into the search box a compound that you're interested in. It will pop up. Also, you can look at -- you know, I want to see chlorpyrifos applied at a certain crop. You can type that crop name in too.

Next.

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DR. ENGLISH: Is that it?

Okay. I guess my little interactive thing didn't work, or maybe your program isn't working. But, oh, well, you -- so you can go onto that cehtp.org and find that tool. Ask us any questions, but, you know, we also show -- we can show trends of pesticide use at a specific area. It's been a real valuable tool for research. And

we've published several studies, some working with Stanford University on the association between proximity to pesticides and some birth defect outcomes, congenital heart defects, and others.

My colleague Eric Roberts did a study looking at this, and the risk of autism spectrum disorder in women living near these fields during pregnancy. And, of course, CHAMACOS and other researchers have used these data, very valuable data.

And I just wanted to leave you with this final slide on an idea of, you know, using this tool, using this linkage ability to, if you wanted to take some type of random or stratified random sample of where people are exposed to pesticides in California. One thing that we do have, we don't have a map -- we don't have the data of everybody's address who lives in the State, but there is a proxy that you can be -- that you can use that we have individual level data on, on where populations are, and that is the birth addresses.

So we have the address in vital statistics, electronic address, of every woman that's given birth in California, and whether it might be interesting to look at that population, too.

So you could take a random sample or stratify it in some way. You could geocode those addresses, and then

if there was a compound you were interested in looking at, like say chlorpyrifos, you could say, well, I want a selection of these women that live within a quarter mile of where these applications are.

Another great thing about that data, it's temporally -- it's temporally resolute. Also, you have every day of application, so you can look at specific time periods. For example, if you were interested during gestation, you can see exactly what was applied during a women's gestation.

Of course, you would have their birth date, the birth date of the infant also. And then maybe you want to take a sample then as a control population of individuals that live more than some distance away. So this is just one approach that has come to mind in our team on a way maybe the Biomonitoring Program might want to think about doing some sampling, or there could be other methods too, other approaches.

So with that, I think I just have a slide -- one more slide that just shows -- just wanted to acknowledge --

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DR. ENGLISH: -- there's my email address if you want to ask questions, and then I just wanted to acknowledge my team at the Tracking Program that helped

put this together.

So thank you very much and be glad to answer any questions.

(Applause.)

CHAIRPERSON BRADMAN: So we have 10 minutes for clarifying questions from the Panel, and then we'll have another presentation, then there will be more opportunities for discussion.

Dr. Bartell.

PANEL MEMBER BARTELL: Yes. This is a fascinating presentation. I had a couple questions just about the public use data, the web tool. I was wondering how far back in time this goes, you know, what year you have records going back to that actually have the geographic resolution? And then also what the time lag is between the use of the pesticide and it showing up in the web tool?

DR. ENGLISH: Yeah. So your second question first. It's still about a two-year lag before we get the data. I think that's a real issue. I mean, I think with the technology that we have today, you know, we should really be having real-time reporting of this stuff. And we can talk about that issue more about how that might happen. You know, I think it's having the political will to do this is one of it.

And then on your second question, I think the tool only goes -- I'll have to double check, but I think it only goes back to the data that we have in there going back to 1999 right now.

But there is older data I've used. We've done some work on data. I think the data is actually in pretty good shape going back to 1980, and there's even previous data. But the older data, they only focused on restricted materials -- restricted use pesticide applications.

So I believe it was probably when we started looking at it that you started getting all the compounds in the database, so that's one definition.

CHAIRPERSON BRADMAN: I think it was 1990 when they went to --

DR. ENGLISH: 1990 when they went full reporting. Okay. Maybe the tool -- I should have checked that before I left. Maybe we have it back to '99 then.

CHAIRPERSON BRADMAN: Dr. Quintana.

PANEL MEMBER QUINTANA: I just had a question about your study of the schools. I know this was outside of the purview of your current study, but it would be interesting to know of the children who attend a specific school, how many of them also live within a certain radius of the fields that might be affecting their school. And for elementary schools it might be a higher percentage, so

they're kind of getting a double whammy - schools and home. And for high schools maybe a smaller percentage; they draw from a bigger area.

But I'm just curious if that would be something possible to estimate, based on the school's knowledge of where their kids live attend the schools.

DR. ENGLISH: Yeah. No, it would be possible. I mean, you have to realize we looked at tens of thousands of kids. And, you know, it took years to do this study and years to get it released from the State. So that would be a giant project.

(Laughter.)

DR. ENGLISH: But, sure, yeah, you could do that.

PANEL MEMBER LUDERER: That was really fascinating. You know, I was struck by the methyl bromide and that that was still number 3 in 2010.

DR. ENGLISH: Yeah.

PANEL MEMBER LUDERER: I thought it was already phased out, so that's --

DR. ENGLISH: Not then, but it -- I mean, you look at the data and it really is getting phased out.

CHAIRPERSON BRADMAN: I believe that 2017 --

DR. ENGLISH: Next year, I think it's supposed to be totally out, right?

CHAIRPERSON BRADMAN: Yeah.

DR. ENGLISH: Um-hmm.
CHAIRPERSON BRADMAN: I just --
DR. ENGLISH: What are they replacing that with, do we know?
CHAIRPERSON BRADMAN: Basically, there's been --
DR. ENGLISH: They just have some --
CHAIRPERSON BRADMAN: From what I can see, there's been increasing use of chloropicrin and Telone may also be increasing. And there's also a certain amount of work going on for fumigant alternatives.
DR. ENGLISH: Um-hmm.
CHAIRPERSON BRADMAN: I had a question about the linkage, because this is something we've had trouble with, especially going back to 2000, is it sounds like you were able to actually use the CAC data and link individual pesticide use reports to individual fields.
DR. ENGLISH: For one year only.
CHAIRPERSON BRADMAN: Okay.
DR. ENGLISH: 2010.
CHAIRPERSON BRADMAN: Okay. Yeah, and if I remember correctly, going back that's not possible.
DR. ENGLISH: Sure, it's possible. I mean, again, we're talking about political will issues. I mean, there -- certain advocates wrote to DPR about, well, you know, can't we get this data centralized, and they just

said - beyond our scope, we can't do it. I mean, we did it, you know, and it's not -- you know, I don't feel it's the Health Department's responsibility to do that. I think really the Ag Commissioners, DPR, they should be providing this data to the public and to researchers. And we spent a lot of resources doing that, you know, so they could do it if they wanted.

CHAIRPERSON BRADMAN: But in the PUR reports, I mean, at least right now even at the county level, is there a linkage between a field identification number and a pesticide application?

DR. ENGLISH: Oh. Yeah. That's -- you still would have to get those field -- the boundaries. But once you have -- once you have the boundaries, you can link it on ID number. That's what we did, yeah.

Yeah, Jenny.

PANEL MEMBER QUINTANA: I just had a clarification question. I think I took confusing notes for myself, but did you say you could -- one of your ideas was you could search for exposure within a quarter mile of the address and the birth records?

DR. ENGLISH: Um-hmm.

PANEL MEMBER QUINTANA: But I thought you said earlier that the database was only within a mile section block or am I misunderstanding?

DR. ENGLISH: No. You can put in any distance you want.

PANEL MEMBER QUINTANA: But if it's data -- is it true that a section block is the finest resolution --

DR. ENGLISH: Right.

PANEL MEMBER QUINTANA: -- that you have?

DR. ENGLISH: Right, a square mile.

PANEL MEMBER QUINTANA: Square mile. So a quarter from that square mile, is what you're thinking?

DR. ENGLISH: Yeah, from where the boundary gets set, yeah.

PANEL MEMBER QUINTANA: From the boundaries of that mile. Okay. Okay. All right.

DR. ENGLISH: Yeah, you just have to have -- you know, know the assumption that the actual application you're pulling out of the data could be anywhere in that one square mile area, which isn't all that great, you know.

PANEL MEMBER QUINTANA: Okay. Thank you.

DR. ENGLISH: But that's how most of the published studies -- most or all the published studies that I know of use that data, the one square mile data, because, yeah, it's just -- it's only available for one year. And usually you want to use multiple years.

PANEL MEMBER QUINTANA: So one more follow-up

question. So I guess with your doing it in such a careful good way, could you find out the error by just looking at it old the fashioned way so to speak?

DR. ENGLISH: Yeah, I mean --

PANEL MEMBER QUINTANA: Could you make estimates of the air that could be introduced, because you have both for your data.

DR. ENGLISH: Yeah, I could. We could, and then, you know, fortunately, we were -- it was only one -- less than one percent of the linkages we did was using the one square mile data. So we had more accurate ways of doing it for this study.

PANEL MEMBER QUINTANA: No, but I was thinking you could tell other people how --

DR. ENGLISH: Oh, yeah, exactly.

PANEL MEMBER QUINTANA: -- how off they were or how off they could, you know, because you could have them both -- you could compare them both.

DR. ENGLISH: Right.

CHAIRPERSON BRADMAN: So are there any more clarifying questions?

PANEL MEMBER KAVANAUGH-LYNCH: I have one. I noticed that you were using the quarter mile within it. And you explained the rationale for that, but you also mentioned the drift can be up to 70 kilometers.

DR. ENGLISH: Um-hmm.

PANEL MEMBER KAVANAUGH-LYNCH: So -- which is a whole lot more than a quarter mile.

I'm wondering if -- about the possibility of doing something that takes a wider range into --

DR. ENGLISH: Yeah.

PANEL MEMBER KAVANAUGH-LYNCH: -- or wider distance into consideration, and maybe, you know, a weighting for the amount of distance.

DR. ENGLISH: Yeah. I mean, we -- when we were doing the project, that issue came up and we thought about doing a sensitivity analysis with different size buffers and things like that, that because -- I think our computers are a lot faster now, then we did it, but because of all the -- you know, we're processing millions of records, and we were kind of like, going, wow, this is taking a year already to do a quarter mile. We -- kind of our IT people kind of nixed the idea, like, oh, yeah, we'll do that after the report, you know, was done.

Sadly, our main person passed away who kind of came up with all this ideas and stuff. So some of the momentum was lost. But also when we went through a very difficult process of getting this released, we kind of lost some enthusiasm also about going through this again.

But, yeah, that would be good to do some

sensitivity analyses for different things. And I think some -- I don't know, have you ever done that Asa? Have any of you done other -- or you proposed that, I think, at least.

CHAIRPERSON BRADMAN: We tried working with the Department of Water Resources data --

DR. ENGLISH: Yeah.

CHAIRPERSON BRADMAN: -- and then compared that to using proportions of one square mile, which I'll talk about in a bit. And the problem we had is that the farm -- the land ownership maps had IDs that were tied to ownership, not to individual parcels of land.

DR. ENGLISH: Oh.

CHAIRPERSON BRADMAN: And ownership of land, there could be a piece of land here, and a piece of land there, even in a different section, but they'll have the same field identification or ownership identification, because they're owned by the same entity.

So we weren't able to have a Pesticide Use Reporting application tied to a field ID, and therefore we couldn't really use that approach.

DR. ENGLISH: Oh.

CHAIRPERSON BRADMAN: We tried. I mean, this, of course, was looking back at 2000 data.

DR. ENGLISH: Um-hmm.

MS. CHRISTENSEN: We've had a suggestion from people on the phone to please speak more clearly into the mics. They're having trouble hearing it over the line.

MS. DUNN: Should I read the comment?

DR. ENGLISH: Is there more to the comment than --

MS. DUNN: "So it would be great to use biomonitoring to look at exposures to teachers and school staff. Many of these employees are at child-bearing age and they will have exposure for many years. Teachers and staff sometimes stay in the same school for decades."

DR. ENGLISH: That would be great.

(Laughter.)

CHAIRPERSON BRADMAN: I think, at this point, we'll stop with the clarifying questions, and then we have another presentation, and then we'll have more opportunity for discussion and public comment.

(Thereupon an overhead presentation was presented as follows.)

MS. CHRISTENSEN: Paul, did you take the mic?

DR. ENGLISH: What was the question?

(Laughter.)

DR. ENGLISH: Did I steal something?

(Laughter.)

CHAIRPERSON BRADMAN: All right. Thank you. Can

everyone hear me okay?

I'm hoping that the people on-line can also hear me well. I'll try to speak up a little bit.

So I'm supposed to introduce myself. I think almost everyone knows me. But I helped co-found the Center for Environmental Research and Children's Health, at UC Berkeley, and have been working for many years on a study -- cohort study looking at environmental exposures and children's health and development in the Salinas Valley. We'll talk a little bit about that today. We're looking at pesticides, but also lots of other exposures too, flame retardants, social factors, pollen and mold. It's not just a pesticide study.

And then I've also done a lot of work in other arenas, like environmental health and child care, and other topics as well.

So -- and again, I'm at the Center for Environmental Research and Children's Health, and I'm also in the Department of Environmental Health Sciences at UC Berkeley. So I wanted to talk a little bit just to kind of help frame some of the discussion later today and perhaps add a little bit of information to the presentation we just heard around considerations for biomonitoring pesticides.

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CHAIRPERSON BRADMAN: So just to give kind of a brief outline of today's talk, I'll give -- I have a brief refresher on exposure biomarkers. We've talked about this at various times, and I did a presentation a couple of years ago. And we'll just kind of remind ourselves on that. And then I'll present some new data on recent epidemiologic analyses. We actually had a paper that came out this week that used some of the data that Paul just talked about.

And I just want to highlight when we think about exposures - where do children spend time, and what pesticides are used there, and I hope we can discuss that, in terms of priorities for biomonitoring, and then considerations for biomonitoring pesticides.

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CHAIRPERSON BRADMAN: So just a brief refresher when dealing with biomarkers of exposure. Usually, we're measuring metabolites in urine. Not always, but often for these nonpersistent compounds, we're measuring metabolites in urine. If we're looking at the parent compound in blood, there's still a relatively short half-life in the body and we have some of the same issues we find with urine.

And importantly, one of those is high intra-individual variability, or high within-person

variability, which makes it difficult to take a given measurement and use that to predict exposure in a longer time frame.

Also, when you measure a metabolite, it may be class, but not pesticide-specific. That's true for the DAPs, for organophosphates, also some of the pyrethroid metabolites. So we don't really know when we measure something, whether we're looking at a really toxic OP or a less toxic OP when we look at the same metabolite.

And then we have this issue that metabolites in urine may reflect, in some cases, preformed metabolites in the environment. In other words, a material breaks down into its degradate, and then you're exposed to it and you excrete it unchanged, you're getting exposed to a less toxic material. And therefore, you may overestimate pesticide or other exposures for the metabolite.

However, given all those limitations, many studies show clear links between determinants of exposure and metabolite levels in urine. And we've -- there's a number of epi studies, ours and others, that have shown associations, for example, with pesticide exposure, and adverse health outcomes, at least for organophosphates.

And importantly, it's -- urine samples and measuring metabolites in urine is easy, because it's easy to collect urine samples. They're not invasive especially

for children.

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CHAIRPERSON BRADMAN: So I just want to highlight a few kind of recent results that we have from our CHAMACOS study. Just a reminder, this is the study we have in the Salinas Valley that's investigating environmental health in children. And we first got this going - in 1998 is when we founded the study, and we started enrolling people in 99/2000.

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CHAIRPERSON BRADMAN: Just a reminder, we're focusing on the Salinas Valley. It's an agricultural area in Monterey County. This gives you kind of a sense of organophosphate pesticide use compared to the State on the right, and then within the valley itself.

And you can see here we used the mapping tools that Paul just talked about to, in this case, look at organophosphate pesticide use during the enrollment period of our study 1999/2001 in the Salinas Valley. And it lights up as an area with relatively heavy use compared to other locations in the State.

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CHAIRPERSON BRADMAN: This is a cohort study. Just a reminder, this slide needs to be updated. We're actually -- our kids are just turning 16 right now, and

we're doing our 14- to 16-year visits right now. We've had contact during pregnancy and at multiple birth, and then multiple times as children age.

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CHAIRPERSON BRADMAN: So just a little example here of some biomonitoring data just to characterize some of the things we found.

One, if you look at the -- and I presented this before, so I'm going to be very brief. If you look at the blue columns here, that's CHAMACOS, and the green is NHANES. During pregnancy, to the left of this dotted line is the pregnant moms, and you'll see the levels are generally higher than they were in the NHANES, which is women of child-bearing age.

So there's some evidence here for higher exposures. And if you look at the kids on the right, at six months going up to five years, the levels increase, and by the time we get to five years, they're higher than the youngest age group looked at in NHANES. So there's some evidence too that there are higher exposures in our kids compared to NHANES. We haven't actually measured levels in our older kids yet.

But I also want to point out here, we were able to successfully collect urine samples from kids as young as six months. So we did this at 6, 12, 24 months. In

those age ranges, we used urine bags. And just to underscore that it is feasible, and this was a fairly large scale study, to collect urine and try to assess exposures in very young kids.

As a side anecdote, you know, we put a lot of effort into this. We estimated that the value of the urine from the six month olds in particular was probably worth more than its weight in gold.

(Laughter.)

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CHAIRPERSON BRADMAN: But even still, it was feasible. And we can look at exposures to very young children using some of these tools.

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CHAIRPERSON BRADMAN: Despite the limitations, I mentioned earlier about biomarkers, we have seen very consistent associations between higher urinary metabolite levels of the dialkyl phosphates, the organophosphate metabolites, in the pregnant women and poor outcomes in the children.

Just very briefly, we've seen shorter gestation, more abnormal reflexes in newborns, behaviors -- potentially related to behavior pervasive developmental disorder at two years, poorer neurodevelopment at several age points through age seven, attention deficits at age

five.

There's been consistency across age points, and we've continued these analyses now looking at older kids, and at 11 and 12 years, we're still seeing consistent associations between these early prenatal exposures, and poorer neurodevelopmental outcomes in the children. So at least one thing we look for there's some internal consistency in our study, and some consistency with other studies in other regions in the country.

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CHAIRPERSON BRADMAN: So just to kind of review now some of the more recent findings that we've had, one of which in a paper - actually it just came out this week. But just a reminder, I presented this a couple years ago, and this is kind of a simple summary of the relationship between poorer -- higher exposure prenatally, and poorer outcomes in the kids. So we had low, medium, and high exposure in the moms during pregnancy. And if we look at the IQ score, the low kids, as a group, were up around 107, and the high kids -- higher exposure as a group were around 100. So there's about a seven -- six or seven point difference in the high exposure point. And that was something we've talked about for some time.

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CHAIRPERSON BRADMAN: One thing we were

interested in was whether there are interactions between these exposures and other factors that influence child health and development. We know that, you know, if you -- if have read to children, if you have a stimulating environment, if you have less stress, people tend to be healthier. And there's some evidence with lead and other toxicants that where you have exposures to both adversity and toxicants, there's a potential for a synergistic or additive effect, or some sort of interaction between those exposures and poorer outcomes in the children.

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CHAIRPERSON BRADMAN: And this kind of provides a little theoretical framework here, where we know stress -- more stress is not good for neurodevelopment, and then this question of whether prenatal neurotoxic exposures. In this case, we're looking at the organophosphate pesticide metabolites interact with this stress and affect development in the kids. I want to ask, too, if somebody could keep me up on the time --

MS. HOOVER: Sure. Yeah, that's fine.

CHAIRPERSON BRADMAN: -- because I'm not timing myself.

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CHAIRPERSON BRADMAN: Okay. So just to kind of highlight some of the challenges in this agricultural

community, we have a lot of crowding in terms of, you know -- in terms of housing quality. I'll talk a little bit about it in a second, but there's a lot of crowding, a lot of pest infestations. Many participants in our population report some food insecurity, i.e., not having enough money to buy food in certain times of the year. Many households have few stacking toys, blocks, other kind of toys that kids can play with and have stimulation.

Just to kind of put in picture some of these -- you know, some of these stresses, these are some pictures of poor housing quality in the area. About 40 percent of the households we looked at had mold problems, poor structural elements and rot here. This is actually cockroach feces on a door here in a building that was shut down by the county, because there are problems with maintenance and crowding.

And this here is Chinese chalk, a miraculous chalk. It's form of deltamethrin. Most of it, I think, is off the market a this point, but this was commonly used for things like cockroaches and ants. A lot of cockroach infestation in the homes.

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CHAIRPERSON BRADMAN: So just to make the point when we talk about development, there's a lot of factors. And I think this kind of highlights a lot of the social

components of what our community faces. You know, these kids are living -- don't have a great place to play. They're in a parking lot across the street from a liquor store. We've actually had two kids in our studies killed by cars backing out of soft story garages like this, and the kids were playing in the parking lot. So there's potentially a lot of sources of stress --

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CHAIRPERSON BRADMAN: -- that could, you know, interact with these environmental exposures.

So when we look at the relationship between the prenatal exposures and outcomes in the kids, again this is at seven years, whether we look at kids with relatively low family adversity, so these are homes where, for example, the parents -- the father is not going away to work in the field in Arizona during the winter. There's higher income. There's less, you know, division in the family. There's a whole set of things that we looked at.

We have an association where for each kind of unit of prenatal -- exposure to prenatal OPs, we loose about two and a half points in IQ, and it's not statistically significant. But when we look at the kids where there was higher family adversity, and again, we're talking family here, not outside in the community. So we're actually -- going forward, we're going to be looking

at factors like neighborhood quality, crime, and things like that. But this is stress within the family. We see the slope is much steeper, and it's statistically significant. They're losing about eight points for every unit of exposure to OPs during pregnancy.

So there's evidence really of an interaction here. And I want to kind of highlight our graduate students that have worked on this, and that was also recently published.

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CHAIRPERSON BRADMAN: And now to present this kind of visually in a way, I think it's a little easier to have that background before walking through, you can see here -- this red line here is for the group with higher family adversity. And this is now the verbal comprehension score of the WISC child development tool. And again, you can see that these slopes are different. It's steeper for the kids that have higher adversity, you know, greater than the mean versus kids that have less, and it's statistically significant.

So there's here an interaction between these factors in development in the children, and it also underscores, I think, some of the validity of also our biomonitoring measurements to characterize exposure, that we see these kinds of associations. You know, this is how

we would hypothesize the direction to go in. And if the exposure measurements were noise, we wouldn't see -- we would see noise in the outcome.

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CHAIRPERSON BRADMAN: We've also looked at asthma and respiratory disease and symptoms, partly because there's been evidence occupationally that organophosphate pesticides are associated with breathing problems.

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CHAIRPERSON BRADMAN: And we do find in the kids, particularly both for respiratory symptoms and for lung function associations between higher exposure, in this case though during childhood and poorer lung function in the kids. And it kind of made sense that concurrent exposures with the kids would result in breathing problems, if there's an association.

And you'll see here, these slopes here are negative. Here, we have kind of the slopes plotted, and these are statistically significant. So kind of what this is showing, that for higher exposure to the kids during childhood, they have slightly lower forced expiratory velocity in one second. So this is how much air they can breath out in one second. They do a big huff.

And that's an indicator of lung function. I should mention here that what we did is we had multiple

measurements up to age seven of metabolites in urine. So we looked at the area under the curve as kind of an integrated measure of exposure.

So and again, the prenatal DAPs were not associated with lung function.

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CHAIRPERSON BRADMAN: So now to kind of move ahead a little bit to some of the work that perhaps resonates with the work that Paul did, we've tried to also look at the PUR data. Given the problems with urinary metabolites that I mentioned before, in terms of variability, preformed DAPs, et cetera, are there other metrics of exposure we can use?

So we use the Pesticide Use Reporting data. We've already kind of a summary of what information is available.

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CHAIRPERSON BRADMAN: And we used kind of what I think Paul would call the old-fashioned method to estimate exposure, partly because, as I mentioned earlier, we weren't able to link the individual fields to individual Pesticide Use Reporting reports. So just to kind of give you a visual, so we have a residence here. We draw a circle around it of a given buffer, and then we calculate the area within that buffer. And this one, it's about 85

percent, so 85 times 200 is about 170 kilograms. So we would assume that there was even distribution of pesticide use in that unit, and then that we can kind of add up all these little percentages.

So just to quickly go through this, you can see the buffer kind of had different levels of overlap with different sections. And then we weighted that -- used that weighting to estimate pesticide uses within the buffer. That's certainly cruder than what we heard earlier that Paul did. And this is an approach that many have taken. We've also done some work trying to weight this by wind direction.

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CHAIRPERSON BRADMAN: So interesting, I mentioned earlier that we had a -- we have an association here between higher exposure and lower scores, and IQ at seven years. Now, this is a model, however, where we have both urinary DAPs and nearby agricultural use in this same model.

And what we found was that agricultural use near the home was significant -- statistically significant, and inversely associated with poorer neurodevelopment outcome, again this is at seven years, in the children. And that was independent of the urinary metabolite levels.

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CHAIRPERSON BRADMAN: So we've -- just to summarize, with increasing use of OPs near homes, we had about a two point decrease in IQ that's similar, a little bit lower, but similar to some of the magnitude of slopes we've seen for OP metabolites, and they were independently associated. And this has kind of raised for us, you know, a lot of questions about how to think about what does the biomonitoring measurement mean, and then what does the environmental characterization mean in terms of pesticide use as indicators of exposure.

We know that the metabolites are relatively short-lived, and maybe they're reflecting a shorter term of exposure. We did take the average of our pregnancy samples when we used that, so that's perhaps evening it out a little bit.

Does it perhaps reflect different pathways?

One issue with the PUR data is that we can sum all of the pesticide use in your homes. We can even weight it for toxicity using EPA relative potency factors. The metabolites in urine, there's some OPs that don't devolve to those metabolites, so we're missing them.

And perhaps also, there's better resolution, because we're able to, in the PUR data, look at individual pesticides. And interestingly, I gave you the overall slope for organophosphates used nearby as some, but we

found the strongest slope for this one particular pesticide oxydemeton-methyl, and oxydemeton-methyl is by far the most toxic of the OPs that were used in the Salinas Valley during the time of this -- beginning of this study.

So there's kind of some interesting issues here and challenges when we think about how to use the biomarker and how to use these other metrics of exposure.

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CHAIRPERSON BRADMAN: So also when we think about biomonitoring, it's not just the epidemiologic context, we want to think about what we want to measure and where are kids getting exposed.

We've heard already about agricultural communities, and perhaps some of the work that Paul did gives us some ideas to prioritize, compounds for biomonitoring. I just kind of want to remind us though that pesticides are used in many different environments, and where kids spend a lot of time.

And I want to just highlight homes and child care, but certainly not actually exclude schools, because certainly there's also materials used there by school staff.

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CHAIRPERSON BRADMAN: This is a graph here of

overall insecticide use in California. We only go to 2011, but if we continue out to 2014, this trend is still significant where there's an overall decline over time of pesticides. And the red here is organophosphates that pretty much in all categories there's declining use of insecticides in California, probably because of more efficient applications, and, you know, better use of technology to control pests.

And just to highlight though, this little band here has gotten a little bit thicker. It's small relative to the total, but that represents the neonicotinoids, which have actually increased over the past year, although the overall use of insecticides is going down.

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CHAIRPERSON BRADMAN: And just to give a little more detail for the neonicotinoids, you can see it's mainly dominated by imidacloprid, but there's other ones that are showing up. And I'm sure if we extend this data out to 2014, we'd see that trend continue.

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CHAIRPERSON BRADMAN: But this graph here now, I think, is really interesting and just kind of reminds us of some of the challenges of when we think about pesticide use reporting data, and also biomonitoring. So this shows changes in organophosphate pesticide use between 1992 and

2014. And like the overall State, there's been kind of a trend of decreasing use of OPs.

But within that, there's also been changes in the mixture, which, for example, we don't really reflect in our biomonitoring. But if we look at when we started our study in 2000, there was a lot of use of diazinon. There was a lot of use of chlorpyrifos and a lot of use of oxydemeton-methyl.

But when we go out to the most recent data set 2014, these compounds decline to almost zero. So just a reminder that when we do biomonitoring, we may be reflecting different mixtures, and that has different implications, potentially for epidemiologic studies, and also if you're using the data for risk assessment especially, when you have class-specific, but not pesticide- or compound-specific metabolites.

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CHAIRPERSON BRADMAN: Just a reminder, in home pesticide use, that environment, in our study in Salinas, about 65 percent of homes had, you know, cockroaches or 60 percent, about half were using pesticides to control pest infestations.

And home pesticide use has really dominated still in California by pyrethroids, but there are other compounds that are increasing, including neonicotinoids,

especially imidacloprid. And just a reminder that a lot of people are using pesticides on their pets to control fleas. Imidacloprid is a big one, but also there's a bunch of new products on the market that we may want to consider.

And I've been into child care facilities, for example, family child care facilities, where they would never use a pesticide in the home, but they are losing on their pet. And just a reminder that that's a really common use. And that when we think about pesticide exposure, we can't think just agriculture.

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CHAIRPERSON BRADMAN: Another environment that I've been doing a lot of work in is child care. And we should remind ourselves that this is a place where many or most children in California, very young children, at vulnerable age points, spend a lot of time.

There's 45 -- about 45,000 licensed child care facilities in California. There's about a million kids in child care. And some kids spend up to 50 hours a week, 10 hours a day. They have both their parents working full-time. So definitely an important place where kids spend time.

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CHAIRPERSON BRADMAN: We did a survey, funded by

DPR, published in 2010, so this is a little bit old, but in that survey about 90 percent of child care facilities reported at least one pest problem, about half were using sprays to control pesticides, and about 20 percent reported monthly or more frequent applications, which is pretty frequent.

Now, this is already -- you know, we collected the data, what, 2009, so this is already seven or eight, nine years old. DPR has been really implementing extensive training on integrated pest management. And through the Healthy Schools Act and revisions, there's been a big effort to really encourage IPM. So I suspect that some of the things we found here back, you know, before 2010, have changed. But just to underscore, a lot of these materials are used. And I've also done some sampling in Alameda and Monterey county and we still found, this is now a little more recent, we still found relatively common pesticide use, and we detected a number of pesticides in dust, indicating exposure to the kids, including pyrethroids, which were basically in almost every dust sample we collected.

We did both Alameda and Monterey county, so we found both diazinon and chlorpyrifos both ag use, and there was prior use indoors. Interestingly dacthal, which is an agricultural herbicide, we only found in regions

that were agricultural. So some evidence that, you know, nearby pesticide use does ingress into indoor environments, where kids spend time. And we should think about that in terms of exposure.

And then if we, -- DPR actually has the Pesticide Use Reporting data for schools and child care, it's really just the beginning. And with new revisions to the Healthy Schools Act starting in 2016, that database will probably get a lot better.

I'm sure some of the people listening could provide more details on that, but of pesticides that come up in terms of current information, pyrethroids definitely are probably the most common, but we also see, for example, some neonicotinoids and other compounds as well.

And I kind of just want to underscore it's important to think about where kids spend time, and what material you use there when we think about biomonitoring.

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CHAIRPERSON BRADMAN: So just a reminder when we consider for biomonitoring for pesticides, you know, we have -- in this some cases, we're kind of stuck with urinary metabolites. We really, I think, should get more information on the validity of urinary metabolites as exposure biomarkers in terms of how good a spot sample is say versus a 24-hour sample is, and then the issues around

variability over time, how good does one sample characterize exposure for a week, more or less.

Of course, the issue of preformed metabolites. And also, you know, one issue that, you know, we often hear about, pesticide use does not necessarily equal exposure. So the biomonitoring can help answer questions about that.

So kind of out this discussion, and we'll hear some more today, as a Panel, as a Program, we need to prioritize, you know, what pesticides to monitor for, and what to test for. And I think really thinking about where they're used, and where kids spend time, where people spend time can help guide that.

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CHAIRPERSON BRADMAN: So thanks to our funders for a lot of the work around CHAMACOS, NIEHS, and EPA, and some support from NIOSH.

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CHAIRPERSON BRADMAN: And there's some time. I think if I go back to my other role, we have 10 minutes for --

(Laughter.)

CHAIRPERSON BRADMAN: -- clarifying questions, and then we'll have time for public comment and discussion.

(Applause.)

CHAIRPERSON BRADMAN: Dr. Schwarzman.

PANEL MEMBER SCHWARZMAN: I think I remember from either a presentation or reading some of the CHAMACOS papers, that you looked at take-home exposures from agricultural workers, as well as proximity to fields as sources of exposure to children or pregnant women in the household. But I seem to remember that proximity to fields turned out to be more important than take-home exposures. Am I right, can you expand on that a little bit?

CHAIRPERSON BRADMAN: Well, we did do a study with strawberry harvesters, and we looked at kind of the potential for take-home, in terms of residues on hands, and clothing. We've done some analyses in the kids looking at factors that predict exposure. And it's been a little bit messy when we look at the urinary metabolites.

There's -- for the youngest kids, around six months, we saw associations, for example, to be nearby pesticide use, and higher metabolite levels in the young kids. That wasn't consistent across all age points.

But when you think about it, kids at six months are kind of sitting there. You know, they're just really getting ready to crawl, or maybe they're crawling, but they're not quite getting out in the world. By the time

they're 12 and 24 months, they're toddlers, and 24 months they're really cruising around. They're also eating a lot different foods, so they're getting more dietary exposures. And I think kind of the signal gets messier.

We did also look at pesticides in dust. And for some of the more persistent pesticides, like chlorpyrifos, we did see some associations between nearby use, and also things potentially related to take-home exposure, like wearing shoes in the house and things like that.

So -- but in terms of health outcomes that really the only consistent associations have been with the biomarkers and with nearby pesticide use.

Dr. Bartell.

PANEL MEMBER BARTELL: You know, and I want to start with kind of a question for you about the issue raised regarding the variability over time, and the urinary metabolites. It's something that I worry a lot in thinking about how to actually, you know, design sampling strategies or studies that would rely on these as measures.

And I think it's really interesting in that in your work you still manage to find a signal in epidemiologic associations despite, you know, what might be some noisy exposure measurements due to the short-term kind of half-life, and maybe temporal variability in

exposures.

But I think for the California Biomonitoring program, I think it raises some important questions about the extent to which, if California Biomonitoring moves forward with incorporating maybe some urinary pesticide measures and -- or expanding those measures, the extent to which they should consider routinely collecting multiple biomarkers per participant, for example, you know, several urine measurements over a space of a week or several weeks. And I know you have a nice paper in EHP about the sort of high variability within those sort of time series.

And I wonder if you have thoughts about that, in terms of how, you know, CDPH and the other actors here in California Biomonitoring might use that information in thinking about sampling designs.

CHAIRPERSON BRADMAN: Yeah, I think that's really important for all urinary metabolites we use. And since those are such an important tool to look at exposure. You know, I think in many cases, urinary metabolites provide kind of a population distribution as a snap shot, and we probably can characterize the likely highs, you know, and the shape. But for an individual, you know, over time, we don't know what it looks like.

Although, in some studies from CDC with phthalates, over at least a week or something like that,

there was relatively low within-subject variability, and relatively high between-subject. That was for adults though.

There haven't really been that many studies done for adults overall, but there's a growing literature and there's been very few studies done on children. And I think that's -- you know, I think we really need to do that. And I think perhaps with any biomonitoring study, it would be good if we -- if we're using cross-sectional samples that for a subset we consider taking some samples each day, or a few a week or just to get some information to that.

And I think that's really important. I mean, we had that presentation, by, I think it was, Jon Sobus from EPA. That might have been before you were on the Panel a few years ago, but they're doing some interesting statistical work to try to take, you know, spot samples and deal with variability and come up with some way to think about chronic exposures and risk.

But I think there's a lot of challenges there. And the more data we actually have, the more we can inform those kinds of analyses.

PANEL MEMBER BARTELL: Thanks.

PANEL MEMBER QUINTANA: I had a question related to that about the association between your PUR data and

your individual metabolites. You, I think, briefly touched on it, but you said both were independently DAP metabolites. The PUR was independently associated with decrements in IQ. But could you comment on, if you looked at those subset of pesticides that would show up in the urine using your measures, how correlated were those two measures with each other.

CHAIRPERSON BRADMAN: In the moms, not very correlated. And given that, you know, it's important for the moms, because it's that prenatal data that seems to be associated with the poorer health outcomes as the kids get older, poorer neurodevelopment, but we don't see real strong correlations. We haven't published that yet. We have published some data on the moms, but we tend not to see very strong correlations between, you know, the mothers and nearby pesticide use. So that's kind one of the puzzles we have in our data.

PANEL MEMBER QUINTANA: One of the reasons I ask is that you brought up earlier the need to know how -- what radius should we draw that circle. And it seems like biological monitoring data would have the ability to perhaps tell us how far the circle should go, if it were perfect data, of course.

CHAIRPERSON BRADMAN: Right.

(Laughter.)

PANEL MEMBER QUINTANA: But, you know, it has the ability to kind of help us see how far away are people affected.

CHAIRPERSON BRADMAN: Right. And if you look at the data I first presented by, you know, the overall distribution of the moms, you know, say compared to NHANES, women of childbearing age across the country, you know, our levels in our moms are about 40 percent higher.

So if we drew the boundary -- in that case, it was really the whole Salinas Valley. You know, the population distribution was shifted up. But characterizing it on an individual basis relative to local use didn't, you know -- was not very successful.

PANEL MEMBER LUDERER: Thanks. That was a really interesting talk. One of the things that I was interested in is -- so for some of these pesticides that are used agriculturally, you know, like the organophosphates that you were talking about, the -- you know, we can do these kinds of comparisons between using pesticide use data versus biomonitoring. We can look at that.

But then, and I think we're going to hear more about this later in the afternoon, there are a lot of pesticide uses, and you mentioned some of these, you know, home use, the pet uses, where those kind of data on use are not available, and really biomonitoring is all -- is

probably one of the few ways that we have of actually getting any kind of a handle on those exposures.

CHAIRPERSON BRADMAN: Yeah, I think that's true. Yeah. So maybe we're done with clarifying questions, and I'll -- okay. Dr. Fiehn.

PANEL MEMBER FIEHN: One more. I always wonder a little bit about just the kilograms of application, whereas you also showed the types of pesticides used were very different. And, of course, we know that the efficacy of these pesticides per gram is very different, right, in the home?

CHAIRPERSON BRADMAN: Right, very different.

PANEL MEMBER FIEHN: So shouldn't that be rather be represented as a weighted score --

CHAIRPERSON BRADMAN: Right.

PANEL MEMBER FIEHN: -- or so, rather than just the pounds or kilograms applied?

CHAIRPERSON BRADMAN: Right. Well, for the OPs, and when we looked at PUR in relation to health outcomes, and we talked about this in the paper, we have done analyses where we use the EPA relative potency factors to weight the nearby pesticide use before we sum it together. And you can do that for organophosphates. You can also do that for carbamates, which have the same mechanism of effect.

But, I mean, one issue we've been dealing with is how to deal with it statistically what about when we start looking at other pesticides that are potentially neurotoxic, and some even have no biomarker. There's really not a good biomarker for fumigant exposure, for example, but some of those are probably neurotoxic. You know, then you start trying to look at groupings -- somehow grouping exposures across classes. And that's challenging, and we've done -- we've talked a little bit about that in the paper, and we've also -- we're trying to do analyses of that to get at that issue.

But once -- once you go across different classes with different mechanisms of toxicity, at least in our case, the reviewers have basically said you can't do it.

So maybe I'll sit down now.

MS. HOOVER: Hi, this is Sara Hoover. I just want to let you guys know we're going to take a brief break now for the transcriber. So we're going to start back up at 3:00. With Shoba's talk, and then we'll have the full one hour discussion to talk about the first two talks and Shoba's talk, and the three possible pesticide classes. But we'll start promptly at 3:00

(Off record: 2:45 p.m.)

(Thereupon a recess was taken.)

(On record: 3:01 p.m.)

CHAIRPERSON BRADMAN: Okay. I think we're going to get started now, if everyone could sit down.

Yeah, it's working now. So if everyone could sit down. And I would like to introduce Dr. Shoba Iyer.

Dr. Iyer is a staff toxicologist in the Safer Alternatives Assessment and Biomonitoring Section.

Her focus since joining OEHHA in 2012 has been researching high-throughput toxicity testing assays, and investigating ways to incorporate these data into chemical-specific health assessments.

She is a co-author of two related publications, one that compares ToxCast results for the pesticides endosulfan and methidathion, with results from in vitro and in vivo studies on a range of endpoints, and a second case study that explores chemical activities and hazard traits of ortho-phthalates, based on ToxCast data. She also conducts research to support biomonitoring metals.

So Dr. Iyer will present a brief summary of information relevant to possible pesticide classes for future consideration as designated chemicals.

So thank you.

DR. IYER: Thanks. Is this on? You can hear me okay?

Great.

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(Thereupon an overhead presentation was presented as follows.)

DR. IYER: All right. So the purpose of this agenda item is to follow up on four previously screened pesticides. OEHHA presented a preliminary screen of the pesticides glufosinate-ammonium, glyphosate, imidacloprid, and propanil at the August 2013 meeting of the Scientific Guidance Panel.

The SGP recommended that we continue research on all four as potential designated chemicals. Rather than evaluating these four pesticides individually, we have been reviewing three possible classes that encompass them. These classes are organophosphorus pesticides, neonicotinoid pesticides, and anilide pesticides.

Later in this afternoon's session, we'll be inviting Panel and public input on next steps, such as possible future consideration of these classes as potential designated chemicals.

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DR. IYER: So why classes?

Well, evaluating chemical classes, rather than individual chemicals, is resource efficient. It allows the Program to quickly respond to shifts in chemical use. It facilitates development of broad lab panels, and it allows for non-targeted screening.

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DR. IYER: In our preparation for this meeting, we researched several topic areas based on input we've received from the SGP and the public, including agricultural pesticides applied near schools using information from the 2014 report that Dr. English described this afternoon, pesticides that are in pet products, such as spot-on treatments and flea collars, and cholinesterase-inhibiting pesticides.

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DR. IYER: Based on our recent research and practical considerations in defining classes, we ultimately chose to focus on pesticides classes that encompassed the four previously screened pesticides. I will make note in my presentation of information relevant to these above three topics here, and I'd be happy to answer more questions about the research I did on those above three topics afterwards.

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DR. IYER: Just as background for our discussion today, these are the criteria for recommending designated chemicals, which framed our preliminary research on the three pesticide classes. The criteria covered the areas shown, which are; exposure or potential exposure, known or suspected health effects, the need to assess the efficacy

of public health actions, availability of a biomonitoring analytical method, availability of adequate biospecimen samples, and incremental analytical costs. And just as a reminder, that these criteria are not joined by the term "and".

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DR. IYER: In our preliminary research, we reviewed several broad class considerations. The first is function, which in this case is use as pesticides. When I use the term pesticide, I'm using it in a broad sense that includes, for example, herbicides, insecticides, fungicides, and plant growth regulators.

To define classes, we also considered the chemical structures of the pesticides of interest, and common mechanisms of action. We also reviewed toxicity concerns associated with selected pesticides in each class, agricultural use trends in California, and availability of biomonitoring methods. Also, in the document you received, we also included information on pounds of pesticides sold in California in 2014.

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DR. IYER: The first class I'll cover is organophosphorus pesticides, which we are defining broadly based on structure as phosphorus-containing organic compounds used as pesticides. Note that organophosphate

pesticides are a subclass of organophosphorus pesticides, and many organophosphates are already on our list of designated chemicals.

Organophosphorus pesticides is a broader class and encompasses additional pesticides including glyphosate and glufosinate-ammonium.

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On the next slide, I'll be showing you some example pesticide structures, but first I'll briefly outline some toxicity concerns associated with pesticides in this broad group.

Exposure to organophosphate pesticides has been linked with neurotoxicity outcomes, such as decreased cognitive function and peripheral neuropathies. With regard to carcinogenicity, dichlorvos, tetrachlorvinphos, and tribufos are listed as known to the State to cause cancer under California's Proposition 65.

And in 2015, the International Agency for Research on Cancer classified glyphosate as probably carcinogenic to humans, and a Notice of Intent to list glyphosate under Proposition 65 has been issued.

In terms of development, we heard Dr. Bradman recently present a number of effects associated with prenatal urinary levels of dialkyl phosphate metabolites. As another example, glufosinate-ammonium has been shown to

affect development in exposed mice.

Some endocrine effects of organophosphorus pesticides have been reported based on animal and cell culture studies. For example, chlorpyrifos has been shown to affect the estrogen pathway in rodent and zebrafish models. And as a second example, rats exposed to glyphosate had reduced testosterone levels and altered testicular morphology. Glyphosate has also been shown to affect estrogen and androgen pathways in cell culture.

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DR. IYER: Here are the chemical structures of some example organophosphorus pesticides. The examples shown here are not currently on the list of designated chemicals. And as I just mentioned, many organophosphates are already on the list of designated chemicals.

These examples shown here are all used agriculturally in California. The isopropylamine and potassium salts of glyphosate, as well as bensulide, ethephon, and fosetyl-aluminum all ranked in the top 100 pesticides, in terms of pounds used, statewide in 2014. Glufosinate-ammonium, bensulide, and ethephon were in the top 10 pesticides applied within a quarter mile of schools, in one or more of the counties assessed in the Tracking Program report that Dr. English described. And bensulide and ethephon are cholinesterase inhibitors.

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DR. IYER: Okay. Here's a graph showing annual agricultural use of glyphosate in California from 1990 to 2014. I'll make a note here -- agricultural use is broadly defined to include use on crops, as well as, for example, landscape maintenance.

So in this graph, the black triangles here represent the sums of all forms of glyphosate used in a given year. The other data points show some of the specific forms of glyphosate.

As shown, the isopropylamine salt and potassium salt are the major forms of glyphosate used in recent years. There are approximately 200 products containing glyphosate that are registered for use in California. This includes herbicides containing glyphosate that are widely used for consumer home and garden use and are available in retail stores and on-line.

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DR. IYER: Here I'm showing you a graph of annual agricultural use of glufosinate-ammonium, ethephon, bensulide and fosetyl-aluminum. Interestingly, the agricultural use of glufosinate-ammonium was reported to drop substantially after reaching a peak in 2011. And this type of pattern illustrates the benefits of a class-based approach.

As some individual pesticides in a class decrease others will increase, and the class listing will capture all of these. I'll all also note that we're aware of the development of crops that have co-resistance to glyphosate and glufosinate-ammonium, which would suggest possible expanded use of glufosinate-ammonium again in the future.

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DR. IYER: There are many biomonitoring studies of organophosphate pesticides, a subclass of organophosphorus pesticides. Here in this slide, I list selected references on glufosinate-ammonium, and/or glyphosate measured in serum and/or urine. These two pesticides are not currently on our list of designated chemicals.

The references shown here, and in later slides in my talk, include both methods papers and biomonitoring studies. So as you can see in this table, glufosinate-ammonium has been measured in both serum and urine. Glyphosate and its major breakdown product, aminomethylphosphonic acid, or AMPA, have both been biomonitored in urine.

I'll give you a little more information on one of our selected references, Adams et al., 2016. Dr. Axel Adams and colleagues in Dr. Roy Gerona's lab at UCSF recently developed a method to measure glyphosate in

urine, and are currently working on a method for AMPA. As reported in their recent poster, glyphosate was detected in 93 percent of 131 urine samples tested. We have been in touch with Dr. Adams, and he could be a resource for our laboratory in the future.

The current Biomonitoring California lab capability for organophosphorus pesticides is for organophosphates only, that is, nonspecific dialkyl phosphates and specific metabolites for chlorpyrifos and diazinon.

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DR. IYER: The second class I'll go over is neonicotinoid pesticides. These pesticides share a mechanism of action as they bind to and activate the nicotinic acetylcholine receptor. Potential toxicity concerns associated with pesticides in this class include immunotoxicity and developmental neurotoxicity. And I'll go over some examples.

Studies in rodents exposed to imidacloprid have found immune effects such as suppression of delayed type hypersensitivity, decreased stimulation index of T lymphocytes and compromised immune system.

And as another example, rats exposed to acetamiprid had decreased lymphocyte proliferation, and macrophage function. With regard to developmental

neurotoxicity, the European Food Safety Authority has concluded that both imidacloprid and acetamiprid show some indications of developmental neurotoxicity potential, based on available data.

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DR. IYER: Here are the chemical structures of some example neonicotinoid pesticides. Currently, there are no neonicotinoids on the list of designated chemicals. These example neonicotinoids are all used agriculturally in California. Imidacloprid ranked in the top 100 pesticides in terms of pounds used statewide in 2014.

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DR. IYER: Here, I'm showing you a graph of annual agricultural use of imidacloprid. There are over 200 products containing imidacloprid that are registered for use in California. This includes insecticides containing imidacloprid that are used for consumer home and garden use, and in pet products, as Dr. Bradman mentioned earlier, that are available for purchase in retail stores and on-line.

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DR. IYER: This will also look familiar. It's essentially the same graph that Dr. Bradman showed earlier on the other -- some other neonicotinoids, but expanded out to 2014. So this shows the annual agricultural use of

acetamiprid, thiamethoxam, clothianidin, and dinotefuran and you can see that, in general, since 2011, the trend has been increasing, as Dr. Bradman alluded to.

I'll make one note on home use here, dinotefuran is in some insecticide products for consumer home and garden use, as well as in some spot-on pet products for flea and tick treatment.

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DR. IYER: I located a number of recent biomonitoring studies of neonicotinoids, as shown on this slide, all of which were conducted in Japan. As an example of some recent findings, Harada et al. reported detection frequencies of over 90 percent for n-desmethyl-acetamiprid, which is a specific metabolite of acetamiprid, as well as clothianidin, dinotefuran, and thiamethoxam in urine samples collected from Japanese adults.

This same research group found an increasing trend in measured urinary neonicotinoid levels between 1994 and 2011.

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DR. IYER: And there is no current lab capability for neonicotinoid pesticides.

The third class I'll go over is anilide pesticides. Anilide pesticides contain an amide group, in

which one hydrogen is replaced by a phenol group. This is a structure-based definition, and I'll show you some example anilide pesticides when I get to my next slide.

Anilide pesticides is a broad category, so if the Panel were interested in considering this group further, we would review possible subclasses.

There are some potential toxicity concerns associated with pesticides in this broad group. Again, I'll go over some examples.

Urinary levels of 3,4-dichloroaniline, the major metabolite of the anilide pesticide propanil were associated with altered cytokine production in agricultural workers, and various immune effects following propanil exposure have been described in in vivo and in vitro models.

In terms of carcinogenicity, diuron and sedaxane both have the anilide substructure and are listed as known to the State to cause cancer under California's Proposition 65. Note that sedaxane is not currently registered for use in California. Sedaxane is a relatively new pesticide that was registered by U.S. EPA in 2012.

With regard to developmental effects, linuron, a pesticide, containing the anilide substructure, is listed as known to the State to cause developmental toxicity

under Proposition 65. And 3,4-dichloroaniline affected development in a study of minnow embryos and larva.

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DR. IYER: Here are the chemical structures of some example anilide pesticides. And none of the pesticides shown here are currently on the list of designated chemicals.

This blue outline shows you the anilide moiety in propanil, which is an amide group, in which one hydrogen is replaced by a phenyl group. These example anilide pesticides are all used agriculturally in California. Propanil and boscalid both ranked in the top 100 pesticides in terms of pounds used statewide in 2014.

--o0o--

DR. IYER: Here is a graph showing annual agricultural use of propanil from 1990 to 2014 in the State.

--o0o--

DR. IYER: And this graph shows annual agricultural use of boscalid, fenhexamid, flutolanil, and fluxapyroxad from 1990 to 2014. You can see a dramatic increase in the use of boscalid starting in 2004.

--o0o--

DR. IYER: With regard to biomonitoring anilide pesticides, the studies I note on this slide measured

3,4-dichloroaniline, or 3,4-DCA, in urine. 3,4-DCA is a shared metabolite of propanil, diuron, and linuron. Dr. Gail Krowech had discussed biomonitoring 3,4-DCA in her talk at the SGP meeting in August 2013. I didn't find any new studies on biomonitoring 3,4-DCA, and I didn't find any biomonitoring studies on other example anilide pesticides.

There is no current lab capability for the anilide pesticides I've just been discussing. However, a separate method for the anti-microbial chemical triclocarban, which also has an aniline substructure, has been developed by EHL.

--o0o--

DR. IYER: Okay. That brings me to a close on my overview of these three possible pesticide classes we've researched. I have some options for the Panel listed on this slide. The SGP could request that OEHHA prepare a potential designated chemical document on one of these pesticide classes. Additional classes could be considered later. The Panel could propose further screening or continued tracking of one or more of these pesticide classes, advise no further action, suggest other pesticide classes for possible consideration.

Thanks. And I'd be happy to take any clarifying questions.

(Applause.)

CHAIRPERSON BRADMAN: Dr. Bartell.

PANEL MEMBER BARTELL: Yeah. Is it possible that we request that OEHHA prepare more than one as a designated chemical for next year? Is that an option? I'm just curious why it's only listed as choose one --

(Laughter.)

PANEL MEMBER BARTELL: -- of the above.

MS. HOOVER: This is Sara Hoover. You can probably guess why we're asking you to choose one. The last time when we screened four, the answer was do all four. And now since we're deciding to look at classes, we want to, you know, thoroughly, basically, whenever we do a potential designated document, it's a very extensive undertaking.

PANEL MEMBER BARTELL: Sure.

MS. HOOVER: And so we want to start with your highest priority. We're not excluding doing the others certainly, but we want you to say which would be your highest priority for 2017.

PANEL MEMBER BARTELL: Gotcha. Thanks.

CHAIRPERSON BRADMAN: Also, I just want to kind of outline, we have an hour now between --

MS. HOOVER: Finish clarifying questions.

CHAIRPERSON BRADMAN: Yeah. But just to mention,

there will be lots of time for discussion after this.

PANEL MEMBER CRANOR: I'm going to have to leave in a few minutes, but it seemed to me as you went through those that the organophosphorus pesticides satisfied multiple considerations for considering them as a class, is that correct? They're fairly toxic. You have tests for them. You have -- you can find them in human bodies. You have -- you can run them through your machines and identify them and so forth. It seemed to me it was fairly clear that they satisfied more than one of your criteria.

DR. IYER: I think each of the classes satisfied a couple of the considerations, but I think part of today's discussion will be, you know, hearing more information from the Panel and the public on, you know, which of the classes would be most interesting to folks.

CHAIRPERSON BRADMAN: Dr. Fiehn.

PANEL MEMBER FIEHN: Yeah. You said one of the those criteria also that adding any of those metabolites or the classes of pesticides into the current panels of compounds, or compound classes that can be followed, should have, if possible, incremental costs to it. And so, for example, dichloroaniline seems to be like a good candidate, because it would -- it will be a common metabolite of several chemicals, so that it could, you know, balance out the different uses of different

chemicals in that pesticide class.

The question is, do we have any other examples of compounds, metabolites, or other types of features that could be relatively inexpensively added, so that we can get a good idea about use of these chemical classes, rather than very specific individual compounds.

DR. IYER: Yeah. I think this might be a good question for the labs. I personally don't know about the costs.

MS. HOOVER: I want to -- yeah, you don't have to answer quite yet, Jianwen. I don't want to put you on the spot. Basically, yes, that will be a consideration. I want to mention that we showed the criteria for designated chemicals kind of to frame like what we would consider and what we would really delve into. We have been in touch with the labs. We've been sharing the papers we have, but they haven't actually examined like of those classes which would be the easiest. We've talked about it, and certainly Jianwen has thought about it, but -- and obviously, we have a panel as Jianwen mentioned. We have a panel for OPs already, DAPs and some specific metabolites.

We have a new method for triclocarban, which has an anilide substructure. So this is something we would pursue further. So that's just a little intro, but you

want to add to that Jianwen?

DR. SHE: Yeah. I'll be honest, I don't think I have to go through all of the method. But I look at this method, it look like generally to be sensitive enough. Most of the chemicals we needed to look at the population levels. I think majority of them are at a 0.1 ppb. So the method needs to be sensitive enough.

And then some of the chemicals are very polar, so the method they use, because the current analytical technology have some trouble with this polar compound, especially like ES, ESI, LC-MS measure its effect. So the technology people use is standard addition isotope dilution, which have a benefit. You don't have the matrix effect, because each calibration is by sample itself. But it's own limitation you cannot do larger level study.

So I think a good -- the question from Professor Fiehn is can we find a class biomarker? That's like Dr. Asa Bradman talked about. You'll find the class biomarker for like DAPs. That's a class biomarker to look for all of them, or if there's something we need to think, because I have no knowledge.

But right now, I think another approach that I mentioned briefly before, can we have a comprehensive method that looks through all of this phosphorous-containing compound, which include OPFR, DAPs,

and specific metabolite, and then newer ones. This is all in the exploratory stage. I think after the Panel give us clean direction, we will do more research.

PANEL MEMBER FIEHN: Okay.

PANEL MEMBER LUDERER: You know, thanks for that presentation. You know, one of the things that seems to me to really jump out of the tables that you gave us, you know, which was presented was for a number of these pesticides, and particularly for some of the ones that seem to be -- that have very high usages like glyphosate, the pounds applied in California in 2014 is much, much less than the pounds sold that same year. And so one immediately wonders, well, does this have to do with non-agricultural uses?

Do you -- and that's true for some of the other ones too. So like the glufosinate-ammonium, and the propanil, I think, is another one. Do you have a sense of that? Is that what you think is going on? Do you know?

DR. IYER: Yeah. Well, I remarked on that one in my talk in particular with the, you know, products that are available for purchase, because you can check to see what are the products that are registered for use in California. I -- so where I noted that like for glyphosate, dinotefuran, for example, I pointed it out. Some of the others were less clear.

MS. HOOVER: Just to follow up, I think what you're asking is, is that an indicator --

PANEL MEMBER LUDERER: Yes.

MS. HOOVER: -- that there's high -- yes, that's how we're interpreting it. And we actually had some really great consultations with DPR ahead of this, and DPR is here actually representing us and listening. But the -- you know, the use data, the PUR, is really solid data. The sales data is a voluntary reporting system, so it's -- you know, they can't really say for sure, you know, how good that is. But I don't know, did you want to say anything more or if that covers it?

DR. DuTEAUX: Shelley DuTeaux, Human Health Assessment Branch, Department of Pesticide Regulation.

The sales data are voluntary and people are allowed to report when they want to. And essentially, we don't have a good tracking mechanism for on-line sales as well. We're working with two major on-line retailers to capture their sales. But you can't even correlate the use data with the sales data. And the sales data might be a good point in time indicator, but lots of folks buy in bulk when the market is good. They'll store it. They'll use it the following year, because it's still good. So it's really hard to use those data as exposure or any other kind of data.

MS. HOOVER: Yeah. I'll just -- thank you for pointing that out, because we did notice that actually. So when we -- when Shoba was mentioning that there seems to be more consumer use, that was because we verified there were products like that available. There were a couple spots where there was discrepancies like that, and there wasn't -- there aren't home products. So I think, you know, that explains it. The data you can't just -- you track the data that way.

PANEL MEMBER LUDERER: But, I mean, just to follow-up. I think some of the ones where the differences are the most striking are ones where there is home use.

MS. HOOVER: I think so.

PANEL MEMBER LUDERER: That's what it looked like to me.

MS. HOOVER: Yeah.

PANEL MEMBER BARTELL: One more clarification question. On Slide 5, which was very helpful where you showed the criteria for recommending the designated chemicals, these are general criteria for specific chemicals. There's no different criteria for thinking about a designated class of chemicals, is that correct?

DR. IYER: That is correct.

PANEL MEMBER BARTELL: Okay. Thank you.

CHAIRPERSON BRADMAN: Are there any more

clarifying questions?

Well, right now we have budgeted a fairly good chunk of time to discuss issues related to the first -- really all of these talks, and coming up with some suggestions from the Panel to OEHHA in terms of evaluating some of the pesticides we've talked about.

I thought now would actually be a good time for some public input. And there are a number of requests right now. I don't know if we have any -- Amy, do we have an email requests?

MS. DUNN: There is one that came in early on, so maybe you could --

CHAIRPERSON BRADMAN: Okay. Why don't we -- how about if we start with the in-person, and then we will make sure we get the email comment read into the record.

But right now, we have a comment from Rachel Kubiak from the Western Plant Health Association.

MS. KUBIAK: Hi. This Rachel Kubiak, Western Plant Health Association. Thank you for having me. It's been a while since I've been here. I forgot that was 2013 when we first started talking about this group.

I guess my comments, just sort of general comments. I don't want to go into -- this is a -- this is a scientific discussion, and I don't want to get into the back and forth with the 2014 report. I think some of the

statements that were made during that presentation were misstatements or misguided.

In particular, I mean, I recognize -- let me just first say, I completely recognize the passion, and the emotion, and the feeling behind this. As someone who is a mom and has children, small children, who lives in an agricultural area, whose children go to school in an agricultural area, I completely understand the concern in that area. Especially for people who don't live in my world who have worked in this field for 15 years, and previously, and have worked in all sides of the spectrum in the environmental world, as a regulator for Department of Pesticide for many, many years, and now on the industry side, I think that it's evident that we don't do a good enough job of getting out information to people who don't live in our world, and it's a scary subject. And I completely understand that.

But having said that, I think there were some things, just for clarification, that I think need to be made. Number one, again, recognizing if we had unlimited resources or the Department of Pesticide did things such as -- you know, that the Pesticide Use Reporting that DPR has is probably the most complex and best in the entire world. So I appreciate the information that we have here in California, especially as someone who works, not only

in this State but two other states. What we have in this State is amazing.

Can it be better? It always can be better. But I recognize that there's limitations and there's reasons behind why that system is as good as it is.

I guess I'll pretty much leave it at that for that particular presentation. Although, I might suggest in the future that having some folks here. Appreciate that Shelley is here now. I know Jay Schreider used to be involved back in the day, and many of you know him, who since retired. But having some folks here from Department of Pesticide, because this issue is complicated, and we're talking about use, and we're talking about toxicity, and we're talking about other things, I think it would be beneficial to have maybe folks -- different folks from within that Department to be able to speak to those different things, because within the Department people work on different areas. So just as a suggestion going forward, that might be something to be of use to this Panel to get a different perspective of that.

And then I guess the only other point that I would make just out of fairness or clarity with respect to glyphosate, that, yes, it has been listed by IARC, but I think that in terms of it being a probable carcinogen is debated in the scientific community, it's been found by

pretty much all other world organizations to not be a carcinogen. So I just wanted to make note of that, and I think I'll leave it at that.

Thank you.

CHAIRPERSON BRADMAN: Yeah.

DR. ENGLISH: Yeah. Hi. This is Paul English, Department of Public Health. I would just -- from the last commenter, I would just like her to please point out what comments she felt were either misguided or inaccurate. This was just part of a pattern from the response from this report. There were accusations in the media that the report was flawed, scientifically inaccurate. And nothing has ever been shown to be true that these commenters have said.

So if the previous speaker wants to accuse my talk of being inaccurate or misguided, I wish she would please say specifically what points she's referring to.

MS. KUBIAK: Certainly, we can talk about this afterward, but in essence of time, I don't think we necessarily need to get into specifics on that.

DR. ENGLISH: Okay. Well, then I would recommend in a public forum not to say things are inaccurate unless you can back them up.

MS. KUBIAK: Well, I don't think we have appropriate time.

CHAIRPERSON BRADMAN: Okay. Well --

MS. HOOVER: Hi. This is Sara Hoover. I just wanted to respond to your suggestion about having more people from DPR. So we actually had a really robust consultation process. Jay was our go-to guy before. But very fortunately, I've been in touch with Shelley now and Marylou. And there's actually I believe a whole room full of DPR people listening to the webcast.

DR. DuTEAUX: Hi, everyone.

MS. HOOVER: So it's been actually a really great opportunity for us to reconnect with DPR at a different level, and it's been a really positive process. So they were definitely all invited and I think there's a lot of people listening on the webinar.

CHAIRPERSON BRADMAN: So we'll move on to the next public comment, but I think this kind of discussion really reflects kind of the complex issues around pesticides, both as important tools for producing food and fiber and other resources. They're also important for public health protection, and we use them for mosquito control, mosquito abatement, and other settings.

And, you know, I think this is one of the challenging issues with this. But for the Biomonitoring Program, you know, really our goal is to understand what exposures are. And we're not making judgments about

regulation. And so I just want to kind of put that out there. And I think it's really important that we get input from, you know, all perspectives on these issues.

Our next public commenter is Emily Marquez from the Pesticide Action Network.

MS. MARQUEZ: Thank you for the presentations today. They were really interesting.

Hello. Okay. Hi. So I think for the biomonitoring work, the groups that we -- PAN was most interested in finding more about ex- -- or finding out more about exposure. Dr. Quintana mentioned one, which was children either living near schools or living in the neighborhoods where the -- around the schools or doing the biomonitoring based on where they attend school.

Another group that would be of interest is farmworkers working with some of the priority pesticides named in the DPH report, or named by DPH. And then the other thing I was curious about was whether or not there was interest in doing biomonitoring in the areas where the air monitors are located. So Rio Mesa High School is one of those sites that Dr. English, I think, showed in his presentation, and could be a really -- possibly a really good place to do biomonitoring of the high school students attending.

And then the other thing I was curious about was

whether or not there was a possibility of using those silicone exposure bracelets in conjunction with doing, you know, urinary biomonitoring -- or urine biomonitoring to see if there is correlations between the silicon bracelets. I don't know that much about those bracelets, but I know that they're definitely of interest, because they're relative -- or much more non-invasive and, in some ways, make some of the work easier possibly.

So, thanks.

CHAIRPERSON BRADMAN: Thank you for that comment. Just to respond to one thing about the bracelets, we actually have a study in the field right now, probably as we speak using those bracelets, and we're also collecting urine samples. These are in Latina teenagers. We don't have money for urinary metabolite analyses at this point, but we do have -- we are going to -- this is really our first chance to use those bracelets for pesticides. They've been used for other chemicals. I'll be curious to see how that turns out.

Next public speaker is Veena Singla from the Natural Resources Defense Council.

DR. SINGLA: Good afternoon. Veena Singla with the Natural Resources Defense Council. Thanks so much for a very interesting day of presentations. And so I had a couple comments. One of my comments is in relation to the

morning's discussion about the funding augmentation to focus on environmental justice projects. And my organization, the Natural Resources Defense Council, along with the Breast Cancer Fund was one of the groups to help advocate for that funding augmentation.

And I wanted to highlight the diverse range of organizations that were in support of that funding augmentation, representing kind of a cross section of advocacy, health, labor, and environmental justice groups. So I have here a copy of the letter that we submitted in support of the funding augmentation. And I'll just read off some of the groups that were in support, and we do have copies of the letter to share with the Panel as well.

So - Black Women for Wellness, Breast Cancer Fund, California Environmental Justice Alliance, California Healthy Nail Salon Collaborative, California League of Conservation Voters, Californians for a Healthy and Green Economy, Californians for Pesticide Reform, Clean Water Action, Coalition for Clean Air, Communication Workers of America District 9, Natural Resources Defense Council, Physicians for Social Responsibility L.A. and San Francisco, USW Local 675, Worksafe, American Cancer Society Action Network, Comite Civico Del Valle, Environment California, Commonweal Biomonitoring Resource Center, Friends of the Earth, Pesticide Action Network,

and the United Fire Service Women.

So there really was broad support from the community for the funding augmentation. And we're very enthusiastic about the program moving forward looking at projects -- these environmental justice new projects. And I did want to echo one of the statements made earlier by Dr. Schwarzman in terms of interest in looking at pesticide biomonitoring, and, in particular, for the organophosphate pesticides, which the Program has -- currently has capacity to monitor for.

So, you know, organophosphates, or OPs, are often commented on as declining in use overall. However, they do still represent the large majority of insecticide use in California, as shown in Dr. Bradman's presentation. And particular OPs can change in use, volume quite significantly. So, for example, chlorpyrifos had a 32 percent increase in use in 2013 in California. And it's applied annually at over a million pounds. It was one of the top pesticides used near public schools as well.

And as Dr. Bradman highlighted, OPs are linked to serious health concerns, both in relation to prenatal and postnatal exposures. And it's low-income minority communities that are disproportionately impacted by these agricultural pesticides, agricultural communities, farmworkers, and their families.

So I did want to highlight what I think is an opportunity for studies looking more at children's OP pesticide exposure. And also, I wanted to comment on the organophosphorus pesticide class as potential designated chemicals, and do agree that they meet many of the criteria for listing and would strongly support that class for listing as designated chemicals.

Thank you.

CHAIRPERSON BRADMAN: Thank you for that comment. And then we have our last comment from Nancy Buermeyer from the Breast Cancer Fund. And then I want to bring the conversation back to the Panel for discussion related to the Program goals. Oh, excuse me, and after the email.

So, Nancy, thank you.

MS. BUERMEYER: Sure. Just really briefly, I just wanted to echo a lot of what my colleague Veena said around the OP as a class. It's one of particular concern to us, because of its link to breast cancer. And as the Panel has discovered, as the presentation said, it does check off a lot of the boxes around the criteria for listing as a class for designated chemicals. And we've always been in favor of class listings, so that it provides that flexibility for the Program to keep up with the industry as they move the shells around, and move from one chemical to another.

And so we would strongly urge the Panel to consider further investigation of listing those OPs as a class.

Thank you.

CHAIRPERSON BRADMAN: So I think we have the email comment.

MS. DUNN: This is a comment from James Nakashima of the Pesticide Epidemiology Section of the Office of Environmental Health Hazard Assessment.

He writes, "In the early comments that followed Robin Christensen's talk, others have addressed the potential for coordinating environmental justice studies with either existing studies or future studies. I'd just like to add that the ongoing combined DPR and ARB ambient air monitoring program is being expanded in 2017 to cover eight sites. Environmental justice considerations were part of the revised sample site selection process. Sample analytes include both fumigants as well as more than 30 semi-volatile conventional pesticides. Biomonitoring efforts that include the people nearby these ambient monitoring sites might provide a unique opportunity to gather additional exposure data from populations in high pesticide use regions."

CHAIRPERSON BRADMAN: Okay. Thank you. Well, at this point, I think we've had some excellent public input,

and now we have some time for some Panel discussion. And there will be more opportunity for public comment. And I think part of the -- really the format here can include discussion that includes input from, you know, not just the Panel but other people here.

So I want to bring it back. It might be helpful if we put up the slide -- Shoba's slide on the options for the Panel for discussion. I don't know if we can --

MS. HOOVER: I was thinking maybe we could actually start with your slide where you talked about considerations in biomonitoring pesticides, because we still have some more time.

CHAIRPERSON BRADMAN: Sure.

MS. HOOVER: And we thought we could get some general input on, you know, strategies --

CHAIRPERSON BRADMAN: Sure. Okay.

MS. HOOVER: -- before we get into the specifics of just those options.

CHAIRPERSON BRADMAN: Sure.

MS. HOOVER: And while we're putting that one up -- that's Asa's talk. It's like -- I think it's his last -- your last slide before the end.

CHAIRPERSON BRADMAN: Yeah, near the end.

MS. HOOVER: Yeah. So that would be a good framing for this. I also wanted to mention, for those

listening and for those in the audience, that when Veena mentioned she'll be giving copies of the letter to the Panel, that means we'll also be posting it on our website. So that will be available for anybody who wants to take a look.

CHAIRPERSON BRADMAN: Are there any general discussion comments or thoughts from the Panel right now?

PANEL MEMBER LUDERER: I'll say something. So we've already -- I think, several people have commented that all three of these potential designated classes meet multiple of the criteria that we have for designating chemicals or classes. And so, you know, I've just been trying to think of what -- you know, what are some of the things that we might try to use to sort of rank these.

And the one -- and one that I think was already mentioned by several people is the looking at the -- you know in terms of pounds applied and pounds sold, the organophosphorus group certainly is the highest. It seems to be. You know, and in looking at the -- and another thing we might consider is trends in use over time. And as was just mentioned, there's -- it's been said that organophosphates, at least, that the use has been declining. But certainly the graphs that were presented in the presentation for the organophosphorus group as a whole, some of those really have been increasing in recent

years as well. So there's not a decline in all of the potential -- the members of that potential class.

And on the other hand, if we are interested in emerging chemicals, and things that may be increasing on the horizon over time, if we look at the neonicotinoids, we know that those -- those, there were almost -- there was almost no use until maybe around 2000 looking at some of those graphs. So although the absolute amounts are lower, the -- there's definitely a trend of increasing use over time. Although, we know that there's been regulatory action on those compounds in other parts of the world as well.

So those are just some thoughts in trying to think about how we -- you know, might want to go about, you know, trying to rank these, since we're asked to choose one.

CHAIRPERSON BRADMAN: Any other comments or discussion from the Panel?

Dr. Quintana.

PANEL MEMBER QUINTANA: So to get back to my colleague's point, are there methodological considerations or costs which kind of jump out at the people who have to actually do this? Do they have any comments on that piece of it?

MS. HOOVER: I think I'll just say a couple

things here. This is Sara Hoover again. One, just to make sure everybody is clear, we're not -- you know, as Dr. Luderer said, we're just deciding which we would look into in more detail as potential designated chemicals. So some of those questions will be answered once we delve into the class itself.

I think that Jianwen earlier mentioned that, you know, obviously with organophosphorus, we have a lot of experience with that set of -- that class of compounds. So that's just a fact to consider, you know, in terms of analytical capability.

But as I mentioned, you know, they just developed a method for triclocarban, which is an analyte. I did want to circle back too to a comment by Dr. Fiehn earlier, which was about 3,4-DCA. So that was something that actually came up years ago from the Panel looking at pesticides or chemicals metabolized to 3,4-DCA. And so we -- you know, Dr. Krowech had looked at that earlier in 2013. Shoba looked at it again. Basically, so far, and correct me if I'm wrong, Shoba, but what we were finding is the most prominent chemicals like that were propanil, diuron, and linuron. I wasn't able to locate -- I did some research again, preliminary research, trying to find, well, maybe this would be an interesting class.

But what we found -- am I on the right track

here?

DR. IYER: Yes.

MS. HOOVER: What we found is that, well, diuron and linuron are already on our list. Propanil is not, but we can't find other similar chemicals. So that was sort of an interesting feature that came out of delving more into trying to define a class. And we had looked at the broader group of anilides, but they're related in terms of that anilide substructure. But there's quite a bit of differences you know -- and Dr. Fiehn is shaking his head and nodding his head at the same time. So do you want to follow up on that?

PANEL MEMBER FIEHN: Well, there's obviously, and we have discussed it before, for some chlorinate -- some clear chlorinated, and they're relatively easy to find, based on their patterns. You know, similar to your DCA where, you know, it has a certain pattern so to say. And others have not these types of patterns.

So therefore, I think some of them might be a little easier to find as a pattern so to say and others might be more difficult, just, you know, saying that.

And I think we can conclude by your answers right now that there is no judgment that, you know, from the analytical side or the literature survey side would give us indication of one or the other classes to prioritize.

But I find it interesting that we were asked to do this prioritization today. And we usually are reluctant because we find them all important.

(Laughter.)

CHAIRPERSON BRADMAN: I think that's true. And --

(Laughter.)

CHAIRPERSON BRADMAN: -- one of the challenges with pesticides, I mean, they're designed -- they're poisons. I mean, they're designed to be poisonous. So we're going to have issues with toxicity as a matter of course.

I mean, the question is at the exposures we might see, you know, are they really a hazard? And certainly, you know, they're tools in our economy, but we don't really know, and they've gone through a risk assessment process to get registered, but we have found with a lot of pesticides that despite that risk assessment process and registration process, post hoc, we've done studies that have raised concerns, and therefore changed the registration status of pesticides.

And I think in a way what we're doing here is we're kind of doing a post hoc evaluation. And the important thing is that to really understand what the risks are, we need to understand what the exposures are.

And to understand the exposures, we need to do some biomonitoring.

I know I have personal opinions about this, and you know, I would tend to prioritize -- you know, I think it's important to look at glyphosate and the groups that that comes with. I'm really interested in the neonicotinoids and other insecticides that are used heavily indoors, and as we see, also have increasing agricultural use, and partly because we know so little about exposures to those compounds in California.

But I think that's just a challenge here, and that we need to come up with either some criteria that's either judgment based or data based to try to, you know, make suggestions on how much work we want the Program to do evaluating these, because everything we suggest or recommend creates work for people. And we need to be conscious of that when we -- resources are in limited supply.

MS. DUNN: We have another comment that's come in.

CHAIRPERSON BRADMAN: Okay.

MS. DUNN: Okay. This is from a DPR staff member Puttappa Dodmane.

"It is important, it seems to be, that the OPs that are increasing in use are not cholinesterase

inhibitors. The criterion of increasing use over time seems to deserve a lot of weight, but let's not lump apples and oranges."

CHAIRPERSON BRADMAN: Dr. Schwarzman.

PANEL MEMBER SCHWARZMAN: I wanted to pick up kind of on where you were just now, and Dr. Luderer's earlier point about the gap on some of the organophosphorus compounds like glyphosate between the applied numbers and the sales numbers, which at least, in the case of glyphosate, seems may be because of consumer use, as opposed to agricultural application. And, to me, that's a very interesting point, especially because it's happening at such high volumes.

And it -- sort of getting to Dr. Bradman's point about how can we best apply the biomonitoring resources, that is, what questions really need biomonitoring to be answered? That's one indicator to me of a place where biomonitoring information could be very illustrative, because we don't understand the use information very well.

And potentially, there are -- because of that consumer use segment, or what we're guessing consumer use, there may be exposures that are much larger than what we would estimate based on the better data that we have for agricultural application.

I'm going a little bit beyond my own personal

understanding. So certainly speak up if I'm -- if that's not accurate. But based on the information that's been presented here and other stuff that I've read, I would favor -- to me, that tips the scale a little bit in otherwise very merited classes here in getting some understanding of what's happening about exposure to organophosphorus compounds where there's such high volumes, but also such potentially poorly understood use.

CHAIRPERSON BRADMAN: I thought that was a very helpful comment.

(Laughter.)

CHAIRPERSON BRADMAN: Yeah. Any other comments from the Panel or discussion?

PANEL MEMBER BARTELL: Sure.

CHAIRPERSON BRADMAN: Dr. Bartell.

PANEL MEMBER BARTELL: It strikes me, you know, we've circled around this a couple times, the idea of what -- by what criteria we might actually make this recommendation or which class? And, you know, the use of production figures --

MS. HOOVER: Can you turn?

PANEL MEMBER BARTELL: Oh, sorry, yeah. And the use and production figures are probably one important criteria we might use. I think another thing we might think about is relative toxicity, which I know is a

difficult thing to think about when you're thinking about entire classes of chemicals.

And I'm just wondering if, you know, maybe the toxicologists on the Panel have any advice, or in the audience any advice, on -- and I don't know if it's even possible to generalize in a way to say, you know, one class is probably more potent than another class in terms of toxicity. But I guess that's an open question, if anybody has anything to contribute to that.

CALEPA DEPUTY DIRECTOR SOLOMON: If I may?

CHAIRPERSON BRADMAN: Yes, absolutely.

CALEPA DEPUTY DIRECTOR SOLOMON: Gina Solomon, CalEPA. I actually -- it is a little tricky to address that question, because of the widely varying toxicity within each of these classes. And the fact that some of the more toxic among the organophosphorus are already on the list. So that sort of means that the remainder are maybe sort of similar, I would say, overall.

But one of the things that I was sort of hoping to mention since Tom McKone was unable to make this meeting, I was sort of hoping to channel him, because he's published a fair amount on this question of how much of any given chemical that's out there in the environment actually gets into people. And he has stated at previous Panel meetings, made this point, you know, that things

that are used indoors are far more likely to get into people's bodies, molecule for molecule, than something that's used, you know, in outdoor uses.

And so, you know, not to say that that should be the determining factor, but I think, you know, I've heard several of you speak about this -- you know, the indoor uses and the consumer uses being kind of important. But that actually is related to several different classes here, because there are consumer uses of several of these. But, you know, some of the pet uses are of particular interest perhaps from a pediatric perspective.

But I think you can make a good argument either way. But I think that that exposure issue might be important in terms of the likelihood of detecting something.

DR. DiBARTOLOMEIS: Hi. As one of the toxicologists in the audience - Michael - I want to muddy the waters a little bit more on that question about the toxicity of chemical.

PANEL MEMBER BARTELL: Sure.

DR. DiBARTOLOMEIS: We cannot forget that we are not exposed to these chemicals one at a time, which is really how they're evaluated in a toxicology study, and even in the risk assessment. So you can't -- I don't think you can actually start playing that game of which is

more potent from the others, because it's more than likely you're getting exposed to chemicals in all these classes at the same time. We don't know that, but, you know, that's why biomonitoring would be really helpful.

And so I -- I guess I would try to steer away from that being one of the criteria you use. Exposure is still probably the best for you to think about, but I wouldn't rule out a pesticide that has much lower amounts of usage right now if it's starting to increase.

I'm not trying to sway you. But, you know, again, individual chemical toxicity versus mixtures and how people are really exposed, you'll get into a real mess if you start trying to do that kind of incremental comparison.

MS. HOOVER: Asa.

MS. DUNN: There's another public comment.

CHAIRPERSON BRADMAN: Thank you.

MS. DUNN: Again from the DPR staff person we heard from earlier, who says "Good point about the gap between use and sales, but isn't that also true for neonics, not just glyphosate? And we still feel that glyphosate is not really an OP in regards to hazard, even if basic chemical structure is comparable."

MS. HOOVER: I just want to make a clarification to that. This is actually an interesting point that we've

encountered in a number of discussions. And I think -- and actually, some of the things that Michael was just talking about is another important consideration. And we are not calling glyphosate an OP. An OP is typically the abbreviation for organophosphate, and organophosphate has a specific structure and specific characteristics, many are cholinesterase inhibitors.

No, glyphosate is not an OP classically defined as an organophosphate. We intentionally did a broader structure-based definition is not organophosphate. It's an organophosphorus, which just means it's a phosphorus-containing or organic compound used as a pesticide. We did that intentionally. Why did we do it that way? Because what we're dealing with here is a lab-based program. And so, as again Jianwen has pointed to, this commonality of structure can be very helpful.

Now, you know, maybe glyphosate would have to be a completely different method. We're not claiming that we could do like one lab method, but the idea is to try to grab as many similar compounds in one class as possible. And that was the reason why we designed organophosphorus. So just clarification on that last comment.

CHAIRPERSON BRADMAN: I should know. From my understanding, the lab issues with glyphosate, it often requires its own analysis. It's kind of complicated.

MS. HOOVER: Yeah, I mean, we -- as Shoba mentioned in her talk, we actually had a phone meeting with Axel Adams --

CHAIRPERSON BRADMAN: Oh, great.

MS. HOOVER: -- and he -- so he's in Roy Gerona's lab at UCSF, and they -- he's a great resource. He's done a lot of looking into all the difficulties with the method. They developed a method for glyphosate. It was, what, 93 percent detect. So they did, you know, voluntary population, found 93 percent detect in the population. They're developing the AMPA.

So, yeah, I think, as he said, it's a difficult compound to measure, so not necessarily going to be in a panel, but we're just looking at the broad class of phosphorus-containing compounds.

CHAIRPERSON BRADMAN: Right. That's great. Yeah. We're also giving -- Axel and Roy are taking 10 of our samples just to do a pilot with to see what we find. So maybe that will be a little bit informative.

Dr. Bartell.

PANEL MEMBER BARTELL: Yeah, I'll go again. So was it the neonics that are then more used indoors? I'm starting to be persuaded by this idea of paying more attention to the indoor versus outdoor. Am I remembering that correctly?

CHAIRPERSON BRADMAN: Yeah. The neonics have a variety of uses. There's --

PANEL MEMBER BARTELL: Indoors and outdoors.

CHAIRPERSON BRADMAN: There's been increasing use in agriculture as an insecticide. It's still small relative to the total insecticide use, but it also has use for structural pest control, termites and things like that, foundation, treatments, crack -- foundation crack treatment, and things like that. It's really replaced chlorpyrifos for that.

And then it's also been used -- it's used in a lot of pet products. I think Advantage or Frontline, one -- some of the common spot-on treatments use imidacloprid. So it's part of the, you know, general group of neonicotinoids. It also shows up in some of the -- for example, the structural pest control, PUR, reporting databases. It came up for child care. That data is pretty sparse right now in terms of its quality, but there's going to be a big increase in that quality, but it seems to show up in a lot of places. And it's -- imidacloprid, in particular, has been controversial, because of issue around pollinators.

MS. HOOVER: Can I just pipe in here, too?

So I think you're struggling a little too hard with the idea of I -- you know, the criteria and how do we

pick one. I'm not asking you to pick one permanently, just pick one for 2017.

(Laughter.)

MS. HOOVER: So it's not like this is the end, and we -- and, you know, this is a really helpful discussion, and we can go back and start -- we're not going to drop these classes. We're not going to shelve them if you say choose this one.

So we'll look into it. You know, like anilides, very interesting. There's a lot more we could learn about anilides. I think one thing I want to just -- this idea of neonics inside versus organophosphorus, you know, glyphosate, for example, is super widely used. And I think by, you know, Roundup. It's used at home. It's very widely used.

So I think that one thing that Tom was saying is does it get indoors? You know, and once it gets indoors, it stays indoors. So if you're using it a lot and tracking in it. I don't know anything about glyphosate personally, but it was striking to me that in this voluntary sample it was 93 percent detect. So that kind of says, you know, something about exposure to me.

So I -- you know, again, I don't think you have to be real strict with yourselves about how you give this input.

CHAIRPERSON BRADMAN: Dr. Quintana.

PANEL MEMBER QUINTANA: I feel like I'm hearing more support for the first two choices as presented than the third one. Did we get that far that we want to --

(Laughter.)

PANEL MEMBER QUINTANA: But I do want bring it back to also some of the public comment that we had. I believe favoring the organophosphorus, which I find swaying me to that direction.

PANEL MEMBER FIEHN: Yeah, I would second that. You know, I would like to go that we would have a vote on that, so that we -- I think we --

MS. HOOVER: Could you talk into the mic?

PANEL MEMBER FIEHN: I think we are ready to make a vote. And I would like to see that we have in our priorities like the OPs first, and then -- that doesn't mean that the other classes are not important, right?

But I think both, in terms of public comments as well as in users -- in total use, including indoor use, including -- let's put it this way, public debate, a disagreement in the scientific area, you know, there was a lot of noise, as we have all known, but not only on OPs, but also neonics, of course. But as I would like to tend to say that we vote in favor of the OPs as being the highest priority --

PANEL MEMBER QUINTANA: Phosphorus.
PANEL MEMBER FIEHN: Yeah --
(Laughter.)
PANEL MEMBER FIEHN: Okay, organophosphorus compounds.
CHAIRPERSON BRADMAN: Should we make that as a motion?
PANEL MEMBER FIEHN: Yeah, that's a motion.
MS. HOOVER: No need to vote. This is just informal input --
CHAIRPERSON BRADMAN: Okay.
MS. HOOVER: -- so you can get a sense of the Panel, and you can each have your own priorities, if you want, and we'll take that into consideration.
PANEL MEMBER BARTELL: Could we have a little more discussion of the indoor uses of organophosphorus pesticides, like are there specific ones that are actually applied indoors intentionally, that we know of?
PANEL MEMBER QUINTANA: I just want to answer your comment by saying that it doesn't have to be applied inside to end up inside.
PANEL MEMBER BARTELL: Sure.
PANEL MEMBER QUINTANA: In house dust, we can find all these agricultural pesticides in house dust. Just as a reminder that use inside shouldn't be the only

indicator, I think.

PANEL MEMBER BARTELL: Yeah, but if it's not directly used inside, it's certainly less likely to show up in the same quantities, right? I mean, there's migration from dust, but you're not going to get probably as large amounts indoors, if it's not actually like directly sprayed inside or used inside, I would think, you know, for most of these chemicals.

MS. HOOVER: Speak into the mic.

PANEL MEMBER BARTELL: Sorry. Yeah. No, I was just commenting that I would think that, you know, whether it's intentionally applied indoors or outdoors would still affect the magnitude of exposure, I mean, from first principles you would -- certainly, there is always going to be migration of dust in the air inside, but you would expect that, you know, things being sprayed directly in the house, for example, and used and applied in the house, you would have larger quantities than something sprayed outside that migrates in through dust, depending on the quantities.

PANEL MEMBER QUINTANA: Well, if you sprayed it in equal amounts that would be true. Because if you use a lot outside and only a little bit indoors, then I'm not sure that's true.

PANEL MEMBER BARTELL: That's true. Yeah, it

could be.

PANEL MEMBER QUINTANA: And if it's a pet application instead of spraying, it's another thing.

PANEL MEMBER BARTELL: Right. Okay.

PANEL MEMBER LUDERER: Yeah, that was going to be my comment too. I think the pet applications are probably in terms of the quantity used maybe quite a bit less than say something that's used as an herbicide kind of broadly around the garden. But again, it's just --

PANEL MEMBER BARTELL: Depending on how much you're touching the pet that is touching the things in the garden too.

PANEL MEMBER LUDERER: Well, in terms of it being tracked in, I guess, as well. But, yeah, I think it's very hard to know. It would be really nice to be able to -- I mean, I agree that my vote would be for organophosphorus, but neonicotinoids would be very close behind, you know, for the reason that you said. And I think we don't really know what the exposures are.

CHAIRPERSON BRADMAN: That's kind of how I feel. I mean, since most of the organophosphate pesticides are on our list within the organophosphorus compounds, I think there's a lot of interest in glyphosate, both, you know, just nationally and information on exposure. I think it would contribute to the science and the understanding.

But I think the neonics are really important.

I know you're asking for one compound -- you know, class to work on.

MS. HOOVER: That's okay.

(Laughter.)

MS. HOOVER: You can make it two.

CHAIRPERSON BRADMAN: We'll, I would prefer to name two.

(Laughter.)

MS. HOOVER: That's fine.

CHAIRPERSON BRADMAN: Or I would name glyphosate and the neonics.

PANEL MEMBER BARTELL: And that is actually an option to seriously consider.

MS. HOOVER: Can you speak into your mic?

PANEL MEMBER BARTELL: Yeah. Sorry. I think that is an option to seriously consider. You know, I think we've all expressed interest in glyphosate. But, you know, if there are already the other sort of high use, high toxicity organophosphorus compounds, they're already on the list, other than glyphosate, you know, it may be advantageous to kind of consider both just specifically picking that chemical, glyphosate, and then pursuing another class.

I'm not necessarily opposed to, you know,

pursuing organophosphorus as a class of chemicals for the next listing. It's just -- I think it's worth thinking a little bit, are there -- you know, are there other organophosphoruses on the rise in use, or is it really just glyphosate that's kind of driving that use and that interest in listing that as a new class right now.

MS. HOOVER: Can I say something?

CHAIRPERSON BRADMAN: Absolutely.

MS. HOOVER: We're looking at our charts right. I will say that, yes and no. I mean, I think that, for example, there was a really big increase in glufosinate that -- and that's why it came onto our radar, then it dropped. However, Axel Adams actually told Shoba and I with all this research that they're developing now co-resistant crops, you know, so it's glufosinate and glyphosate.

And so I'm -- we're speculating that maybe in the -- you know, it started to go up again, a little bit glufosinate. So I guess -- and I'm going to make a -- you know, I'll make a pro-classes kind of argument. This is some -- this is work that Gail Krowech and I started developing in 2008, and with colleagues, other colleagues, Laurel and Martha Sandy -- Laurel Plummer, Martha Sandy, Lauren Zeise, and Gina Solomon. And we just heard today that our paper describing the class approach has been

accepted by EHP, so it should be published soon.

And I think we've seen so many times that if you target one, you know, and we do all the work -- this is a lab-based program. We're not talking about Prop 65 listing. We're talking about -- it's not a regulatory situation. It's allowing us to be able to look for these chemicals.

So if we target one, and then -- we were very surprised when Shoba updated the research on glufosinate. It was about, you know, what a year or two after Gail did her talk, and it just plummeted. You know, so we could have -- we all would have thought, wow, this is a really good important one. Let's do this one.

And now, you know, it's down again, but now it's increasing again. So I think we've seen this so many times that there's real value in trying to say, okay, you know, is this group of interest, let's do the group. And we don't have to -- you know, I think -- I actually -- I came from Proposition 65. I was very used to the very high standards to putting something on a list. And again, this is a -- it's kind of a list of analytes. That's what we're creating, a list of analytes that we can look for, and having the flexibility to be able to look for, you know, and shift what's important, what's important now, can we do a broad screen and see what's important, you

know, and actually look into exposure?

So that's really our preference now. That being said, I am -- you know, maybe something like propanil is so unique, you know, maybe we'd want to just grab propanil. Not now, that's not the priority now clearly. But we might think about doing kind of one pagers, you know, on, okay, here's a chemical. We don't see really a great logical class of interest, but this chemical is still of interest. Maybe we can do an expedited form of the designated document and bring that forward.

So it really is resource driven, trying to be efficient, trying to look forward for the Program.

PANEL MEMBER BARTELL: Yeah. And I think this is a very challenging exercise, given everything you've pointed out about the rapid changes in uses in all of these pesticides.

But I think that's important as you sort of consider where you're prioritizing your immediate efforts for next year, because really you're not just sort of deciding what may go on the list of designated chemicals next, but you're planning ahead for several years of lab activity.

And so I would be trying to think of, you know, which of these classes is going to be what I, you know, would like to be measuring five years from now, because

that's probably more three- to five-year kind of time scale you're talking about for actually putting in the -- you know, developing the lab methods and implementing, you know, some kind of sampling design.

And I know that's a -- that's a very challenging kind of activity to try to predict, you know, which of these -- which of these pesticide classes you're going to be most interested in, you know three, five years down the road. But I think that's probably what you want to be trying to think about.

And that might argue -- just to be the contrarian here today, that might argue for more like the neonics, because, you know, certainly there's sort of an increasing trend with, I think, a variety of the different neonics in terms of use.

DR. BOLSTAD: Hi. I just want to make a couple comments. Heather Bolstad, the Pesticide and Environmental Toxicology Branch of OEHHA.

First, I think the relative toxicity is really important. And I've studied extensively imidacloprid as well as methomyl and currently chlorpyrifos. And in terms of relative toxicity, I believe that the organophosphate -- I don't know much about organophosphorus pesticides, but organophosphate pesticides are much more potent than the neonicotinoids.

And there are studies of veterinarians that are constantly exposed to pets with imidacloprid on them, and they don't show clinical signs of toxicity, like your farmworker shows when they're exposed to organophosphate pesticides.

And then the last thing it sounds like you're not so keen on the third class. And I have something to support, which is propanil, even though it's used in great quantities and was increasing substantially, its only registered use in California, I believe, is cotton.

MS. HOOVER: Rice.

DR. BOLSTAD: Is it rice? Is it rice?

Okay. Sorry.

So it's a single commodity, so -- but it does have a common metabolite, you know, with the others. So you'd be looking for DCA. You wouldn't necessarily know it was from propanil or not, but -- so anyway.

CHAIRPERSON BRADMAN: Dr. Schwarzman.

PANEL MEMBER SCHWARZMAN: I just wanted to say briefly I appreciate your sort of sense of flexibility of would it be interesting to develop a shorter one-page summary investigating, if we were particularly concerned about some compound. But I just wanted to speak sort of from the Panel's side, or my own perspective, in support of the class approach. I think we've seen so many

examples of places where there's such fluid shifting from season to season, or year to year, or month to month with what chemicals are used for a variety of applications, that it's just -- the smart way to go is to keep them -- keep the focus broad, so that you can pick out what's rising to the top within that broad class. So you already articulated it. I don't need to repeat the why, but I just wanted to sort of speak out in support of that class approach.

CHAIRPERSON BRADMAN: I was just going to say, I mean, I think I there's still a lot of us here who are -- maybe I'm in the camp with the people at DPR far away that I have a hard time thinking of organophosphorus versus organophosphate. And I feel like glyphosate and the herbicides are kind of in their own -- you know, because their mechanism of toxicity is different. They're in a different class, but I know that that's -- may not be helpful.

But, you know, again, I know I'm very interested in the glyphosate and neonicotinoids. I know -- I was also, a few years ago, involved with some priority setting with U.S. EPA. And in that context, the neonicotinoids also came up as something we need, you know, more information on exposure.

And you know we saw on the list that these

materials are used indoors. And I think there's potential high -- a high potential for exposure, but there's really not much data on either environmental contamination or residential contamination for these or glyphosate, despite the relatively high use outdoors for the glyphosate and then in mixed settings for the neonicotinoids.

So I'm -- if I were to prioritize one, you know, part of my -- I think I would prioritize the neonicotinoids, partly because there's relatively little information on them, as we've said, and also -- I mean, and this is kind of another issue if there's another laboratory in California like, you know, Dr. Gerona's lab at UCSF, developing methods for glyphosate, is there any issue where maybe we want to, in terms of the investment there, there would be potential for duplication. And if we want to -- you know, maybe there's other alternatives that would not create burdens on the State lab, and would then leave room for other, you know, biomonitoring activities. I guess that's a question that we haven't really considered.

MS. HOOVER: Sara Hoover again.

Remember, this is not about which lab methods we're going to develop. So, for example, suppose we wanted to collaborate with Dr. Axel Adams and Dr. Gerona on glyphosate, we need glyphosate to be on our list.

So right now, all we're talking about is having a menu of options of things that we can measure. That's it.

So, you know, I wouldn't overthink this one. This isn't a vote, you know, at that level. I think that, you know, we've now put this options for the panel slide back up, and I think you could just each go through and say of these three classes, I'd want to see work on this one first, or I'd want to see you continue to screen all three. I'm not interested in -- you know, just each say what your opinion is. That's fine.

CHAIRPERSON BRADMAN: I think that's perfect. So why don't we go -- have everyone comment.

Should we start on the wings?

(Laughter.)

PANEL MEMBER QUINTANA: Start on that wing.

(Laughter.)

CHAIRPERSON BRADMAN: The bookends.

So Dr. Luderer.

PANEL MEMBER LUDERER: I mean, I think I'm with everybody else that it's difficult for me to decide between the organophosphorus group and the neonicotinoids, but I think I would probably lean towards the organophosphorus.

PANEL MEMBER SCHWARZMAN: If I were picking one for designation, just looking at this list of options, I

would choose the organophosphorus class for further consideration in 2017. But I like option number 2, which is propose further screening or continued tracking of one or more of these pesticide classes. And I would love to be able to stick neonic -- the neonics into that list.

CHAIRPERSON BRADMAN: I think I'll echo Dr. Schwarzman, although I think if I had my druthers, I would say both --

(Laughter.)

CHAIRPERSON SCHWARZMAN: -- or at least prioritize glyphosate and the neonicotinoids as a class.

PANEL MEMBER BARTELL: Yeah, I would agree with Asa. I mean, I think the glyphosate and neonicotinoids class, as a combination, would make a lot of sense. You know, pick the one that really is driving the -- what seems to be driving the use on the OPs. I know it's changing, but -- yeah, that's my two cents.

PANEL MEMBER KAVANAUGH-LYNCH: Well, certainly from a breast cancer standpoint, I'm quite interested in the glyphosate and I would like to see us pursue that further. So I'll go with the organophosphorus.

PANEL MEMBER FIEHN: Yeah. In terms of the high usage and the toxicity of organophosphorus chemicals, I also think that these would be my priorities. Although, I am interested in neonics, which would be then my second

priority.

(Laughter.)

PANEL MEMBER QUINTANA: I have the same thing to say basically.

MS. HOOVER: Thank you very much. This has been really, really helpful, and we're perfectly timed, so move on.

CHAIRPERSON BRADMAN: Okay. So, at this point, we have an opportunity for open public comment on any of the topics related to Biomonitoring California. And then after that, we will be -- I'm sorry. Are there two additional?

Okay. So just to throw it out there, anyone who wants to make any additional comments, please fill out the form or raise your hand. And if there's anyone on the web who would like to send in some final comments for the open public comment period.

So we'll start with Nancy Buermeyer. Thank you.

MS. BUERMEYER: Thanks very much. Nancy Buermeyer with the Breast Cancer Fund.

I want to thank the Biomonitoring staff for another great Panel discussion and day of panels, and all really interesting information for -- even for us non-scientists. It's really been a really good learning experience.

I wanted to just follow up on some of the things my colleague, Dr. Singla, had mentioned around the funding for the environmental justice work. You know, I've been hanging out with you all for a long time and working on funding for this Program for a long time. And this is the first time we were able to get any traction to actually get funding -- additional funding, supplemental, augmentive funding for this Program.

And it was something that I worked very closely with Veena and Avi from NRDC on, and we worked really as a team. But as with anything like this, it happens because a lot of folks do a lot of work. And I wanted to just thank, not only the stellar work of the Program, without which we couldn't have made the case to the California legislature and to the Governor's office, I wanted to call out Dr. Kavanaugh-Lynch. The California Breast Cancer Research Program sent a letter extolling the virtues of the program -- it wasn't related to the funding -- for potentially obvious reasons, but just talking about the importance of the Program relative to the CBCRP Program.

I know that Panel members have weighed in in the past on the importance of the Program, and asking the California budget committees and Governors to take a little bit of money, and it will go a long way in this program, which has been so effective in getting really

much better information about exposure, and the way we've been able to use that information.

I will call out particularly the HERMOSA Study was incredibly effective in talking to legislators about the importance of showing what happens when you change people's consumer products, and looking at actual drops in chemical levels. So sort of a long rambling way to say thank you to everybody who pitched in and helped out, not just in the specific efforts around talking to legislators, but in doing the work you do every day, because if we didn't have a product to sell, we wouldn't be very good sales people.

So we have an absolute commitment to try to make this more than a one-time event. And so, you know, we look forward to working with the Program to try to get the EJ stuff up and running as quickly as possible, so that when we go back in January and February, we can show the progress, even though we know progress does not move at the rate that politicians would like it to, based on the fact that it's science.

But we'll be working closely with you all to try to help get the word out to the EJ community and bring -- continue to bring advocates back to the legislature. I did want to make one more note which is that the partner that worked on the ACE -- that is continuing to work on

the ACE program, the Asian family services group, actually went with us to a legislative meeting to talk to Phil Ting in San Francisco. And they were very effective, obviously, in talking about the partnership that they have with the Program, and the importance of the study that they were in the midst of.

So trying to get more of those community partners who have had actual interface with the Program in to talk to the people who make the decisions about the purse strings is going to be an important ongoing effort. And I just want to, again, thank everybody for their efforts, and we'll be back.

So thanks.

CHAIRPERSON BRADMAN: And then another request from Veena Singla. Were you going to --

DR. SINGLA: No.

CHAIRPERSON BRADMAN: You checked open public comment period.

DR. SINGLA: No.

CHAIRPERSON BRADMAN: Okay.

(Laughter.)

DR. SINGLA: Emily Marquez, were you going to make an additional comment during the open public comment period?

MS. MARQUEZ: I checked it. I already made my

comment.

CHAIRPERSON BRADMAN: Okay. Are there any other public comments or anything from email?

I think, at this point then, we can wrap-up the meeting. A transcript from this meeting will be posted on the Biomonitoring California website when it's available.

And also everyone should keep in mind that the next Scientific Guidance Panel meeting will be on November 3rd this year also here in Richmond.

So I think, at this point, we can adjourn the meeting. So thank you.

(Applause.)

ACTING DIRECTOR ZEISE: My thanks to the Panel and the Chair for another excellent meeting, and for the staff who prepared so very hard, and for the audience for all the participation. This was just a great meeting.

Thank you.

(Thereupon the California Environmental Contaminant Biomonitoring Program, Scientific Guidance Panel meeting adjourned at 4:35 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 11th day of August, 2016.

JAMES F. PETERS, CSR
Certified Shorthand Reporter
License No. 10063