CALIFORNIA ENVIRONMENTAL CONTAMINANT BIOMONITORING PROGRAM (BIOMONITORING CALIFORNIA) SCIENTIFIC GUIDANCE PANEL MEETING

CONVENED VIA HYBRID FORMAT BY:

OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

STATE OF CALIFORNIA

CALIFORNIA ENDOWMENT

CENTER FOR HEALTHY COMMUNITIES OAKLAND

2000 FRANKLIN STREET

OAKLAND, CALIFORNIA

MONDAY, AUGUST 3, 2026

10:00 A.M.

JAMES F. PETERS, CSR
CERTIFIED SHORTHAND REPORTER
LICENSE NUMBER 10063

J&K COURT REPORTING, LLC

A P P E A R A N C E S

PANEL MEMBERS:

Thomas McKone, PhD, Chair

Carl F. Cranor, PhD, MSL(Remote)

Lara Cushing, PhD, MPH

Timur S. Durrani, MD, MPH, MBA

Oliver Fiehn, PhD

Penelope (Jenny) Quintana, PhD, MPH

José Suárez, MD, PhD, MPH(Remote)

OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT:

Dave Edwards, PhD, Chief Deputy Director

Stephanie Jarmul, MPH, Research Scientist Supervisor, Section Chief, Safer Alternatives Assessment and Biomonitoring Section, Reproductive and Cancer Hazard Assessment Branch

Rebecca Belloso, MPH, Health Program Specialist, Safer Alternatives Assessment and Biomonitoring Section, Reproductive and Cancer Hazard Assessment Branch

Aalekhya Reddam, PhD, Research Scientist, Safer Alternatives Assessment and Biomonitoring Section, Reproductive and Cancer Hazard Assessment Branch

Alex Shing, MPH, Graduate Student Assistant, Safer Alternatives Assessment and Biomonitoring Section, Reproductive and Cancer Hazard Assessment Branch

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

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH:

Kathleen Attfield, ScD, Supervisor, Exposure Surveillance and Epidemiology Unit, Environmental Health Investigations Branch

Kiera Melton, MPH, Research Scientist, Biomonitoring Outreach and Communications Unit, Environmental Health Investigations Branch

Alex Okrut, Research Scientist, Inorganic Lead Testing Unit, Biochemistry Section, Environmental Health Laboratory Branch

Jianwen She, PhD, Section Chief, Biochemistry Section, Environmental Health Laboratory Branch

Jeff Wagner, PhD, Chief, Environmental Health Laboratory Branch

Nerissa Wu, PhD, MPH, Supervisor, Exposure Assessment Section, Environmental Health Investigations Branch

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL:

Ranjit Gill, Research Scientist, Environmental Chemistry Laboratory

GUEST SPEAKER:

Nancy Burke, PhD, Professor of Public Health, Department Chair, University of California, Merced

Tyler Pollock, PhD, Senior Scientist, Environmental Health Science and Research Bureau, Healthy Environments and Consumer Safety Branch, Health Canada

Marinelle Villanueva, PhD Candidate, Environmental Health Sciences, University of California, Los Angeles

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

ALSO PRESENT:

Katie Boronow, MA, Silent Spring Institute

Ahimsa Porter Sumchai, MD, Hunters Point Biomonitoring Foundation

I N D E X

	PAGE
Welcome	
Dave Edwards, PhD, Chief Deputy Director, OEHHA	1
Overview of the Meeting	
Tom McKone, PhD, Chair, Scientific Guidance Panel (SGP)	4
Program Update	
Presentation: Nerissa Wu, PhD, California Department of Public Health (CDPH)	7
Panel and Audience Questions	19
Panel Discussion and Input	24
The Use of Biomonitoring Data in Chemical Risk Assessments and Management in Canada	
Opening Remarks: Kathleen Attfield, ScD, CDPH	33
Presentation: Tyler Pollock, PhD, Senior Scientist, Environmental Health Science and Research Bureau, Healthy Environments and Consumer Safety Branch, Health Canada	42
Panel and Audience Questions	66
Panel Discussion	73
Afternoon Session	94
Evaluating Participant Feedback on Biomonitoring California Results Return Materials	
Presentation: Kiera Melton, MPH, CDPH	94
Panel and Audience Questions	106
Presentation: Nancy Burke, PhD, Professor of Public Health, Department Chair, University of California (UC) Merced	109
Panel and Audience Questions	127
Discussion and Input	138
CHAIRS-LA: Community Health and Air Quality Implications of Refinery Retirements in Los Angeles	
Presentation: Marinelle Villanueva, PhD Candidate, Environmental Health Sciences, UC Los Angeles	162
Panel and Audience Questions	176
Panel Discussion and Input	183
Open Public Comment	195
Wrap-up and Adjournment	200
Reporter's Certificate	202

P R O C E E D I N G S

CHIEF DEPUTY DIRECTOR EDWARDS: Good morning. I would like to welcome Panel members and the audience to the August meeting of the Scientific Guidance Panel for Biomonitoring California, more formally known as California Environmental Contaminant Biomonitoring Program. Thank you all for joining us today.

The Panel last met on March 4th, 2026. And the March meeting included updates on Biomonitoring California Program activities and presentations from two guest speakers on measuring microplastics in consumer products and biological samples.

Key discussion topics included: the feasibility of using microsampling devices to collect blood and serum sampling in Biomonitoring California studies; the Program's recent use of individual carbon-13 standards when measuring PAHs in urine; presentation and formatting of data on the Biomonitoring California website; the listing of products that contain or can generate microplastics as priority products by the Safer Consumer Products Program at the Department of Toxic Substances control; the European Union's REACH regulation, which restricts intentionally added microplastics in products;

And then considerations regarding current biomonitoring methods for microplastics, including: the

importance of identifying target organs and associated health effects of microplastics; methods used for measuring microplastics and accounting for potential contamination; potential biomatrices to measure microplastics; and measuring other plastic-related chemicals at the same time as microplastics to provide a more complete picture of exposure.

There were also a number of public comments, which included information from the Hunters Point Biomonitoring Foundation on chemical exposures and breast cancer clusters at Hunters Point, California; and comments from the Green Science Policy Institute and Breast Cancer Prevention Partners recommending chloroxy -- sorry, chloroxylenol to be added to the Program's list of designated chemicals.

The summary and transcript of the meeting is posted on the March meeting page of the Program's website at biomonitoring.ca.gov. I will now invite the Panel members to introduce themselves by name and affiliation. Let's start with José Suárez, from UC San Diego and Carl Cranor from UC Riverside who are attending remotely.

PANEL MEMBER SUÁREZ: Good morning. This is José Suárez. I'm Professor at the Herbert Wertheim School of Public Health at the University of California, San Diego and also faculty in the Department of Pediatrics.

CHIEF DEPUTY DIRECTOR EDWARDS: Thanks, José.

Carl.

PANEL MEMBER CRANOR: It's Carl Cranor, Distinguished Professor Emeritus and faculty member, Environmental Toxicology Emeritus at the University of California, Riverside.

CHIEF DEPUTY DIRECTOR EDWARDS: Great. Hi, Carl.

And now, I'll start at this end. So I guess we'll go down here, start with Lara.

PANEL MEMBER CUSHING: Good morning. Lara Cushing, Associate Professor of Environmental Health Sciences at the University of California, Los Angeles.

PANEL MEMBER FIEHN: And Oliver Fiehn, University of California at Davis, Professor at the Genome Center.

PANEL MEMBER QUINTANA: Hi. I'm Penelope, or nicknamed Jenny, Quintana and Professor of Environmental Health at the School of Public Health at San Diego State University.

PANEL MEMBER DURRANI: Hi, everyone. I'm Timur Durrani. I'm a Professor of Medicine at University of California, San Francisco.

CHIEF DEPUTY DIRECTOR EDWARDS: Great.

CHAIR MCKONE: Me.

CHIEF DEPUTY DIRECTOR EDWARDS: Oh.

CHAIR MCKONE: Turn the meeting over to me?

CHIEF DEPUTY DIRECTOR EDWARDS: Yep. And now I'll hand this off to our Chair, Tom McKone.

CHAIR McKONE: Okay. And I'll start by introducing myself. I'm Tom McKone, Professor Emeritus of Environmental Health Sciences at the University of California, Berkeley.

So now, we'll begin with a little overview of the meeting. First, as a reminder for Panel members, please comply, as usual, with the Bagley-Keene open meeting requirements that all discussions and deliberations of the Panel about subject matter at issue today need to be conducted during the meeting, not on breaks or with individual members of the Panel or -- on- or off-line, including via phone, email, chats, or text messages.

Panel members who are attending remotely must visibly appear on camera during the open portion of the meeting, unless they have been granted a reasonable accommodation. If you are unable to keep your camera on during the meeting because it is technologically impractical, please make an announcement when you turn your camera off.

Additionally, if someone older than 18 is in the room with the Panelists who are attending remotely, you must disclose the presence of that person and their general relationship to you now. If anyone has -- Carl or

José.

Nothing to report.

Okay. So the goals for today's meeting. We will first hear an update on the Program activities followed by a presentation from Health Canada on the use of biomonitoring data in chemical risk assessment and risk management. The afternoon -- then we'll take a break. And the afternoon session will include presentations from Program staff and a guest speaker from UC Merced on evaluating participant feedback on Biomonitoring California results return materials, followed by a presentation from UCLA collaborator on the Community Health and Air Quality Implications of Refinery Retirements in Los Angeles. That's the CHAIRS-LA Study.

There will be time for questions from the Panel first and audience after each presentation. If an SGP member wishes to speak or ask a question, please raise your hand. I will call on you at the appropriate time and then you can ask your question or provide your comments.

If online webinar attendees have a question or comment during the question periods after each talk, you can submit them via the "Q&A" feature on Zoom webinar or by email to biomonitoring@oehha - O-E-H-H-A - .ca.gov. We will not be using the "Chat" function during the meeting. Please keep your comments brief and focused on the items

under discussion. Relevant comments will be read aloud and paraphrased when necessary.

If online attendees wish to speak during the public comment periods and discussion sessions, please use the "Raise Hand" feature in Zoom webinar and Rebecca Belloso will call on you at the appropriate time. Please make sure that you join the webinar under the name you would like to be identified as when commenting or have questions, including if you would like to remain anonymous. If you are attending in person and wish to comment during the public comment periods and discussion sessions, please come to the front or raise your hand and I will call on you at the appropriate moment. For the benefit of the transcriber, we encourage you to clearly identify yourself before providing comment and write your name and affiliation on the sign-in sheet at the back of the room. However, there is no obligation to identify yourself and you are free to comment anonymously, if you wish.

At the end of the meeting, there will be time for an open public comment period.

So now, we're going to move to our -- the beginning of our Program and I'm going to begin by introducing Nerissa Wu who will give an overview of the Program. Nerissa Wu leads the Exposure Assessment Section

in the Environmental Health Investigations Branch, known as EHIB, at the California Department of Public Health, CDPH, and is Program Lead for Biomonitoring California. She will provide an update on current Program activities.

Nerissa, I'll turn it over to you.

(Slide presentation).

DR. NERISSA WU: Thank you so much and welcome, everyone. Good to see you all here in person. I just wanted to --

[SLIDE CHANGE]

DR. NERISSA WU: So I'll be giving the Program update this morning focusing first on our population-focused surveillance, our community-focused studies, laboratory activities, and then our Outreach and Communications Unit.

CHIEF DEPUTY DIRECTOR EDWARDS: Oh, Nerissa?

[SLIDE CHANGE]

DR. NERISSA WU: Yes? Oh, yes. So for just a reminder of some of our different surveillance activities that are going on: The CARE Study; MAMAS, Measuring Analytes in Maternal Archived Samples; STEPS, Studying Trends in Exposure in Prenatal Samples; and then, of course, we are working on developing a future surveillance program.

So CARE and MAMAS are in the data analyses phase.

For CARE, we're continuing to analyze collected data, which will then be added to the CARE report supplement, which is online. And for MAMAS, you've heard about our work on temporal and demographic trends for PFAS exposures, and also temporal trends for hexachlorobenzene, HCB, and other persistent organic pollutants. And we are continuing to work on those analyses and getting those findings published hopefully later this year.

STEPS is in the lab analyses phase. And as I mentioned, we are working hard now to plan for our future surveillance efforts.

So I'm just going to adjust this.

[SLIDE CHANGE]

DR. NERISSA WU: So for the CARE study, we were able to go back to Region 2 samples and speciate arsenic for all participants. Just a reminder, the California Regional Exposure Study was in the field in 2019 for Region 2. And that includes -- -- this includes San Bernardino, Riverside -- oh. Okay.

It's just a little hard to see the screen while I talk into the microphone, so -- Region 2 is San Bernardino, Riverside, Inyo, Mono, and Imperial counties. We had 359 participants in total, 357 of whom gave us urine samples. And at the time, all urine samples were analyzed for total arsenic, which then following our

Levels of Concern protocol, we speciated arsenic for anyone who had a 19.5 microgram per liter total arsenic level. Participants with an inorganic arsenic level, meeting our Level of Concern was then contacted as soon as possible for follow-up. And all CARE-2 participants received their total arsenic results in the year following field work.

So more recently we were able to go back to the CARE-2 samples and speciate arsenic for everybody, for all remaining samples. And we did that, so that we would have a full data set and better understand the distribution of arsenic across the whole population.

So for the second round, we did have eight people who didn't consent to further testing, and the results for five samples were not reportable, which gave us 294 additional participants for a total of 344 participants in our data set. And results for the second round of arsenic speciation have been returned to CARE-2 participants.

Sorry. I'm not sure why it's not forwarding.

[SLIDE CHANGE]

DR. NERISSA WU: So this table shows data weighted to represent the underlying population of Region 2. And we measure -- I'm sorry. I'm just having trouble with the laptop. I can't actually move the cursor down here.

So we measure six species as part of our speciated arsenic panel. And I just want to point out that although DMA and MMA are organic species, we do categorize them with -- sorry. I'm just having web issues here -- or slide issues here.

Can you move this line up so that I can actually see this.

Yes, that's better. Thank you. Sorry about that.

So DMA and MMA are organic species, but we classify them with the inorganic related species, because they can be indicators of exposure to inorganic arsenic. So both DMA and MMA were detected in essentially all participants. And detection of Arsenic(III) is also quite high in about 75 percent of participants.

Arsenobetaine, which is considered less toxic, and often comes from consumption of seafood, is also around 75 percent detection.

[SLIDE CHANGE]

DR. NERISSA WU: So we compared the detection frequencies across CARE-LA, CARE-2 and NHANES. Just note that the limit of detection for NHANES is higher than for the CARE Study. So all data here has been re-censored with a higher detection limit. CARE-LA generally had the highest detection frequencies for inorganic arsenic

species, but detection frequencies for Arsenic(III) and MMA were also higher in Region 2 compared to the national levels. And then the organic arsenic species were similar between the three groups.

Comparing geometric means, CARE-LA, CARE-2 and NHANES again, this is re-censored weighted data. We only calculate geometric means when detection frequency is above 65 percent. So as this table shows, we can only compare Arsenic(III), DMA, MMA and then the sum of the measured inorganic species. And as shown, CARE-LA generally had the highest geometric means, followed by CARE-2. And both were higher than the geometric means in NHANES.

[SLIDE CHANGE]

DR. NERISSA WU: So now that these results have been returned to participants, we're focusing on evaluating and reporting demographic trends to be included in the CARE Report Supplement, which will be posted on our website. There will be a preliminary analyses of exposure questionnaire data, including dietary habits, and linking CARE urinary arsenic data to public water system data from the California Water Boards.

The results will be presented at ISES in the fall and we'll plan to do a -- to present findings at a future SGP meeting as well.

[SLIDE CHANGE]

DR. NERISSA WU: So pivoting to community-focused studies, I do have updates on BiomSPHERE and CHAIRS-LA -- and I think I have missed a slide. Hold on a second.

Yeah, let me just talk a little bit about our new population-based work. We're doing some work designing the -- our new surveillance efforts, starting with identifying primary questions we want to be able to answer with the data we collect. So consistent with our mandate, we'll be focusing on generating population estimates for chemical exposures, looking at differences between demographic groups, and detecting temporal trends. So we've been running a lot of power calculations to determine the minimum study size and working on other aspects of study design, like study location, and sampling strategy.

We've been meeting with survey methodologists, with CHIS, the California Health Information Survey, and NHANES. We had an opportunity to tour the mobile examination centers and talk to NHANES staff. And we're also evaluating tools like REDCap and DERBI, as we design the study.

[SLIDE CHANGE]

DR. NERISSA WU: So now, I will pivot to the community-focused studies and I have updates on BiomSPHERE

and CHAIRS-LA. I do also want to mention the publication, which was released in April, which focused on findings from SAPEP, the Stockton Air Pollution Exposure Project. This is led by Susan Hurley with co-authors from OEHHA, CDPH, UCSF, UC Berkeley, All Saints Academy of Stockton, Little Manila Rising, and UC Merced.

And the article highlights the high levels of urinary naphthalene metabolites that were measured in school kids as part of SAPEP, the work of which has been presented here.

[SLIDE CHANGE]

DR. NERISSA WU: For BiomSPHERE, we held a community meeting in Fresno in April. And Aalekhya from Biomonitoring California and Asa Bradman from UC Merced presented on findings from biomonitoring, air, and noise data. We had a good crowd. There was live interpretation for Spanish speakers. Community members were engaged and asked really good questions, and then we were able to hold one-on-ones with participants after the meetings.

So results return has been completed. The evaluation has been completed, and UC Merced is actually going to present results from this results return evaluation this afternoon.

We have two publications in progress and we're hoping to have those in print this fall.

[SLIDE CHANGE]

DR. NERISSA WU: For CHAIRS-LA, we received urinary metals results for all 86 participants and have followed up with 12 of those participants with results over a Level of Concern, three for mercury and nine for for arsenic. Staff are planning to return full metals results to all participants later this summer and we'll actually be hearing much more about the CHAIRS-LA Study this afternoon.

[SLIDE CHANGE]

DR. NERISSA WU: Now, turning to our laboratory activities.

[SLIDE CHANGE]

DR. NERISSA WU: This summer we were able to participate in the APHL Peer to Peer Learning Program. So a big thanks to the Association of Public Health Laboratories and to Jianwen She from CDPH for making this all happen. This is a great opportunity for state public health laboratories. California was matched with Minnesota. Carin Huset from the Minnesota Biomonitoring Program pictured here was able to spend a week with our Biomonitoring staff. And then Jianwen was able to visit with the Minnesota Biomonitoring Program.

So lots of information exchanged, discussion about our standard operating protocols, our method

validation, comparison of methods, especially for PAHs and phenols. And again this is a great opportunity. We got a lot out of having this exchange and I encourage other biomonitoring programs to do the same.

[SLIDE CHANGE]

DR. NERISSA WU: Other lab activities, EHL and ECL, are busy analyzing samples related to different studies. For CHAIRS-LA, EHL has completed analyses for total metals, creatinine and arsenic speciation for our year one samples. And analyses for urinary VOCs will start in the fall. And the metals team has now turned to working on samples that were collected for the Intra-Program Pilot, or IPP, study using those microsamplers that we talked about in our last meeting.

As part of our evaluation of devices for sample collection, we'll be looking at those results, and we should have those results in the coming months. And then for STEPS, as we mentioned earlier, analyses of the Orange County samples are coming along.

[SLIDE CHANGE]

DR. NERISSA WU: In method development and improvement, the PAH metabolite method at EHL has successfully been transferred from an older machine to a GC-QQQ. And this is activity that's really important as part of lab maintenance as our equipment ages. The

transfer will then allow the method to be more reliable. Sample cleanup is improved and we now have better absolute recovery. The ECL method to measure PAH parent compounds in serum is in the validation steps and we will -- we are working on that final analyte list.

And then EHL staff is continuing to work on the automation in the class-based semi-targeted analyses, both for more timely identification of emerging chemicals of concern, but also so that they can look for chemicals that are structurally similar to things that we already measure, like benzophenone-3.

[SLIDE CHANGE]

DR. NERISSA WU: And finally, I want to talk about the Outreach and Communication Unit. It's been working to get study findings and environmental exposure information out to different audiences.

[SLIDE CHANGE]

DR. NERISSA WU: Starting with our own study participants. Since we last met, the Program has distributed speciated arsenic results to those 344 CARE-2 participants. We've gotten PAH results out to 35 IPP participants using the DERBI online platform, which you'll hear more about soon.

[SLIDE CHANGE]

DR. NERISSA WU: And then in addition to the

peer-reviewed papers, which our Program has released, our findings are sometimes cited in more popular press. So, for example, BuzzFeed included findings from Toki Fillman's paper on PFASs in drinking water.

And Mongabay, which is an online platform that covers environmental stories from around the world, recently included findings from Kathleen Attfield's paper on the Foam Replacement Environmental Exposure Study, or FREES, that came out earlier this year.

So these platforms obviously reach a really different audience than our peer-reviewed papers. It's great. It's a very broad audience. And it just demonstrates the importance of getting our materials out into the peer-reviewed literature in a timely manner.

[SLIDE CHANGE]

DR. NERISSA WU: So Kathleen is going to be speaking next about where and how data from our studies is been used, but I do want to highlight one recent situation, which is that this past summer, we had the opportunity to use the findings of the FREES Study, the Foam Replacement Environmental Exposure Study, to comment on proposed flame retardant regulations in the UK.

So the UK still requires the use of chemical flame retardants in furniture, but regulations to reform that are currently under review. So the Program was able

to provide commentary citing our recently published article from FREES, which demonstrated that changes to California's flammability standards enabled the reduction in flame retardant exposures. So great example of how the work we do here in California can have impacts far beyond our state.

[SLIDE CHANGE]

DR. NERISSA WU: The outreach group has also continued the campaign to increase the general public's awareness of chemical exposures and exposure reduction strategies. Since we last met in March, our campaign has gotten over 21,000 more impressions. And the Outreach Unit has also been promoting our publications. And they're working on translating Kelly Chen's findings on fish consumption and PFAS exposures into nine languages, again with the effort of getting our findings out to impacted communities.

[SLIDE CHANGE]

DR. NERISSA WU: We've also been continuing to work on increasing Program visibility across various audiences. The social media post and websites have been featured in CDPH's newsletter, which reached an audience of over 3,000 subscribers, many of which are local health jurisdictions. And this is a really important audience for us, not only because they amplify our message to their

followers, but also because local health jurisdictions will be a critical partner to us in our future surveillance efforts.

[SLIDE CHANGE]

DR. NERISSA WU: And then finally our web group is busy making sure our data is posted quickly and that Program updates are reflected on the web. The June 2026 updates to the Designated and Priority Chemical lists, which included formatting edits and some chemical nomenclature corrections. That has now been posted on the web. And the website group has been actively working to increase language accessibility on the website, getting some more content translated and posted in Spanish and other languages.

[SLIDE CHANGE]

DR. NERISSA WU: So big thanks, of course, to the team that gets this done. I just want to note Eimi Percival, who is -- she's not noted as somebody who's leaving the Program. She's leaving in a week or so for grad school. She's been a great part of DTSC's protocol method development. And I just wanted to say thanks to her for all her work and good luck. And with that I'll close it up and open up to questions.

CHAIR MCKONE: Thank you, Nerissa.

So we be -- we'll begin with -- first with just

questions of clarification starting with the Panel and then opening it up to the broader audience.

Panel members?

Oliver.

PANEL MEMBER FIEHN: Oliver Fiehn.

The differences between NHANES and the LA-CARE in terms of arsenic detection frequency, was that anyway related to the technologies, like the limit of detections, or just because apparently overall that was the higher, as indicated by the arithmetic mean?

DR. NERISSA WU: Well, the data is censored by limit of detection, so we do standardize across the three studies. There were differences between -- I believe in CARE-2, one of the LODs did change midway and NHANES is -- their LOD is typically higher than our own lab, so we do censor the data. So that was not the issue.

I think we -- in our other studies, we have -- it's consistently seen that California has higher arsenic levels than NHANES, so it is not surprising or unusual.

PANEL MEMBER FIEHN: Okay. And similarly, there were five not reportable. Why were these not reportable?

DR. NERISSA WU: That is a question for the lab. I don't know if Josie or Jianwen, you have a response for that.

DR. JIANWEN SHE: Hi, Professor, Oliver Fiehn.

This is Jianwen. And Josie can correct me. These five samples, I believe this study was done a few years ago. These five samples after all this long storage and then we concluded they may not meet our current data reporting criteria, is detailing -- is that our previous -- current report criteria have something room to improve or this sample needed to be completely excluded, but the laboratory do not have confidence to report them, but we can talk in details, if you have more interest. Yeah.

PANEL MEMBER FIEHN: Okay. Thank you.

DR. JIANWEN SHE: But we did have an investigation, yeah. Thank you for very good question.

PANEL MEMBER FIEHN: Thank you.

CHAIR MCKONE: While we're on this, I had -- on the same topic, you did mention the issue of diet. Are you exploring how much the NHANES -- you know, the U.S. diet differs from the LA diet?

DR. NERISSA WU: This is still in its early stages, but we do have our dietary questionnaire, so Toki Fillman will be looking at that. I'm not exactly sure what her approach will be, but it's a good thought.

CHAIR MCKONE: Other Panel members?

Timur

PANEL MEMBER DURRANI: This is Timur Durrani. One question similar on the dietary questionnaire, this is

probably even further out in terms of questioning. But besides diet, has there been any thought of looking at some genetics methylation differences, metabolism differences of the group? I know it would be hard to do, but has that been discussed at all?

DR. NERISSA WU: Kathleen, do you have a response for that?

All I'm doing today is deflecting questions to other people.

DR. KATHLEEN ATTFIELD: That intriguing question has certainly come up. I'm not sure we have the data characteristics of our participants to be able to look into that, but some of the ratios between the different metabolites can give us some insight into that. So welcome input and further analysis, so...

CHAIR MCKONE: Okay. Further questions?

Yes, Jenny.

PANEL MEMBER QUINTANA: Hi. This might be a naive question, but I was wondering, first, you're looking at total arsenic and then you went to looking at the more toxic species, and like you mentioned, the ratios eventually. So did the proportion of kind of inorganic arsenic indicators differ by sample in a certain pattern or are they pretty much all the same percent coming from inorganic arsenic, if that's a question. I didn't really

see a way to look at that from the State. I was trying to do it, but it was in micrograms per milligram of creatinine. Another one was in micrograms per liter, so I couldn't do it.

DR. KATHLEEN ATTFIELD: Sorry. Kathleen Attfield from California Department of Public Health.

Is your question more about the comparison of total arsenic to the inorganic sum?

PANEL MEMBER QUINTANA: Yes. And how much that varied.

DR. KATHLEEN ATTFIELD: Yeah. It's true we didn't present it in that format here. So far, the demographic distributions between who is high in total and who is high in inorganic species don't look wildly different. But yeah, we can certainly segment it out in future analyses, so that it can be compared. I mean, that's one of the reasons we wanted to do further speciation was to be able to understand these more toxic ones, you know, what are the patterns we see there in order to help intervention planning.

PANEL MEMBER QUINTANA: Thank you.

DR. NERISSA WU: Our first priority of course is to look at the people who hit that Level of Concern. And so that's why we do that first, but that population is not representative of the larger population. So that's why it

took a little longer for us to go back and do speciation for the full CARE-2 cohort.

CHAIR MCKONE: Other Panel questions?

I cannot see very well, the -- on the screen, José and Carl, I can't see if you're raising your hand. Do you have any questions?

PANEL MEMBER CRANOR: No, not at this point.

CHAIR MCKONE: Okay.

PANEL MEMBER CRANOR: Thanks.

PANEL MEMBER SUÁREZ: Same here.

PANEL MEMBER CRANOR: The screen is a little strange today, but okay.

CHAIR MCKONE: Questions of clari -- this is short questions of clarification from the audience, either those here or anyone online, Rebecca?

REBECCA BELLOSO: We have not received any comments online.

CHAIR MCKONE: Okay. All right. Well, we're one minute ahead, but given where we are, I think we can move on to the next phase of this, which is a more open discussion, a deeper dive into some of this. And again, we'll begin with the Panel members, and then open it up to those in the room and those online.

Actually, I'd like to start by just going back to the NHANES versus Los Angeles arsenic levels. And I am

just wondering if you -- and again you're still in the early phases. Is this an opportunity maybe to begin to sort out some of the sources? The trouble with arsenic is there's so much -- there isn't a lot in the diet and it does depend upon what you eat. I mean, I seem to recall rice can be very high and there are many foods -- some seafood are quite high. And so I think it's eventually going to be important to use NHANES and the California study to start saying, well, what are the rel -- you, what do we know now about relative contributions of environment, because again we're really focusing on is this environmentally related or lifestyle related.

DR. NERISSA WU: Right. Right. That is some of the first questions that Toki and Kathleen will be looking at, looking at the drinking water. You know, we do have some of the work that we presented on PFAS in drinking water and the association between drinking water levels and biomonitored levels will be -- will be replicated for arsenic, and then to look at diet.

We do have food frequency for some of the larger food groups. And, of course, dietary questionnaires are always a little fraught. And arsenic is quick to exit the body, and so you don't have -- we do have questions for like typical diet and then we have a smaller set of questions for the 24 to 72 hours preceding sample

collection.

So we'll be using both of those sources of information. And then, of course, we have information on other sources like occupation and other environmental factors we to look at.

CHAIR MCKONE: Okay. Thank you.

Other -- yeah, Lara.

PANEL MEMBER CUSHING: This is Lara Cushing. I had a related question, which is I don't know if in the past you have ever or if, in the future, you have plans to try to get the geographically identifiable NHANES, like get access to that, because for this question of like drinking water contributions to arsenic, there's increasingly better data on drinking water arsenic concentrations in other parts of the country. And I know NHANES is representative, but it's also, you know, geographically targeted. And so that might be a fruitful way to try to understand more broadly the contribution of drinking water to body burden of arsenic as -- if you could get your hands on the -- you know, where the NHANES participants live, and even possibly the combined analysis between the California data and NHANES.

DR. KATHLEEN ATTFIELD: Yeah. Thank you for that suggestion, Lara. Again, Kathleen Attfield from CDPH.

One thing we have -- we've been sort of shopping

around some of our early work to some researchers looking at arsenic, so we've been talking with Annie Nigra's group at Columbia, who has done an analysis like that in the past. And so we might be able to complement some of their current work, I think with this, but she's also -- her group is giving us good advice on thinking about -- like to Tom's question, how to sort of disentangle the dietary component from drinking water. So we hope to fold these all into how we progress.

CHAIR MCKONE: Yeah.

PANEL MEMBER QUINTANA: I guess I just had a minor comment to our Chair maybe that I don't think diet is necessarily not environmental, I mean, for a lifestyle choice, I mean, because I think rice grown in arsenic contaminated soils has much higher arsenic levels. And my understanding that California rice is generally lower, but I don't -- I'm not an expert on that. I think if anyone has any comments. I've seen some comparisons geographically, imported rice and rice grown in the South. So I think that, you know, as the diet is contaminated, environmentally that's an important issue too, to know about. Thank you.

CHAIR MCKONE: Yes. I agree. More.

PANEL MEMBER DURRANI: We've done a little bit of work on rice, not geographic, but -- oh, it's Timur

Durrani from UCSF -- and not on the geography, but brown rice versus non-brown. And so, it tends to be in the food stuffs that we see, brown rice or brown rice that has been -- or pack -- processed food based on brown rice. And so we'll see that in baby foods and things like that. And then the same with other things like apples, grapes, a variety of things that have shells that have arsenic incorporated.

So what I don't know for you all is if that's helpful. I don't know about geography, but if brown rice versus non-con -- processed foods versus not, things like that.

CHAIR MCKONE: All right. I'd like to follow up on this point that Lara brought up. I mean, we talked a little bit about this, but it's a very interesting point about getting into NHANES and comparing it. And I want to relay an ex -- I worked in the Health Tracking Program. And a couple of things we learned is that NHANES is supposed to be a statistic -- it is a statistically representative sample of the U.S. population and regions, but not states. And they oversample California, because Californians seem to be much more willing to volunteer.

So they like to come. They set up in Northern California and Southern California. They don't violate the randomness of the region, but they oversample within

the, what they call, I guess the western region. They way oversample California, because they get all the things they're looking for, urban versus rural, all of the different ethnic groups. So that's one.

The other thing was it was really difficult to get the raw data from them on location. I think we succeeded, but it took a lot of -- I mean, it has -- you have to go to a special isolated place. You can't take the data with you. So it's tricky, but it might be worth seeing, you know, how much we could pull out that's California related. But that's -- again, that's your choice, because it's a lot of work.

CHAIR MCKONE: Other comments.

PANEL MEMBER SUÁREZ: Hi. I have a question. This is José Suárez. So circling back on where we're discussing here with arsenic differences. If I recall in one of the previous reports or presentations, it was found that Asians had a little over twice the arsenic concentrations than non-Hispanic whites, and please correct me on the exact figures if you have them there. Have you considered standardizing these -- the values here for CARE-LA by ethnicity to be able to compare the differences in the concentrations with the rest of CARE-2 in this case and NHANES as a way to see if there are differences beyond consumption practices and other

behaviors associated with certain ethnic groups for instance?

DR. NERISSA WU: Well, comparison by race for total arsenic at least is already in the CARE report. We have the demographic breakdowns, and that's available online. The arsenic speciation supplement to the CARE report will be completed sometime this year. So we will be looking at it by race. And, of course, when we build these models to look at different predictors of arsenic, participant demographics are included in that.

PANEL MEMBER SUÁREZ: Yeah, I guess my question is mainly trying to understand the differences between NHANES, I guess, and LA. And I think a good method to do that would be to standardize it by ethnicity, so that way you can compare both populations and see if there -- what else is there beyond ethnicity this particular case, if anything.

DR. NERISSA WU: Sure. And that brings up a good point. As we're talking about diet as a source of arsenic, I mean, one of our purposes as a Program is to put out information on how to reduce your exposure. So identifying populations that might be impacted or identifying actions that people can take to reduce their exposure is one of the -- one of our primary functions.

DR. AHIMSA PORTER SUMCHAI: Dr. Ahimsa Porter

Sumchai, Hunters Point Biomonitoring Program. I just wanted to point out how much value geospatial mapping could add to your data, knowing we're in the relationships that these findings represent.

From our own database, we have two unique clusters that map and track arsenic in relationship to other chemicals in aggregate. And these chemicals are detected in concentrations that exceed reference range. You know, our first cluster, the South Basin cluster, was arsenic with gadolinium, vanadium and manganese. And then the cluster I'm going to be presenting to you later on is arsenic with cesium, nickel, rubidium, and thallium.

So, you know, you can kind of get a sense as to whether or not you're dealing with inorganic and organic acid, depending upon, you know, the gang of chemicals it's hanging out with. And again, this is in an area that's highly industrialized. So the mapping adds a great deal of information.

I also want to caution you about, you know, racially-based assumptions. I know that the data exists, you know, that links organic arsenic with the Asian population, but we personally referred an Asian woman who was gardening next to a federal Superfund site, a landfill. She and her husband had symptoms of arsenic toxicity and our screening detected high arsenic levels.

And she was dismissed as to, you know, reduce her seafood level and come back in two weeks for the testing for speciation.

So, you know, again, you know, that's kind of a really sensitive issue in the setting of someone who has potential symptoms of arsenic toxicity.

CHAIR MCKONE: Thank you. And again at this point, we're open to questions from the Panel and also to the broader audience, both here and online.

STEPHANIE JARMUL: This is Stephanie Jarmul. Jianwen has his hand up.

DR. JIANWEN SHE: Thank you, Stephanie. Thank you, Nerissa and Panel. The discussion from the Panel triggered me to make a comment. Identify the source of the arsenic, critical pathway, develop a strategy to reduce the exposure is the goal of this Program. Laboratory is part of the element to help to achieve that objective.

When I visited Minnesota laboratory, discuss with them all the laboratory stuff, the biomonitoring included that -- the visitor, Carin -- Dr. Carin Huset and Stephanie, the lab management. I noticed they conduct one study try to go to this direction for the -- find out if this arsenic exposure from -- let's say from rice. So they collect this over 50 different species of rice from

different produce site, and then try to see if rice is a major source of seafood, or drinking water, or where water is the source.

I didn't ask where this fund come from. Minnesota still have CDC fund. But anyway, find out the rice and a similar approach beyond the questionnaire for data might we allow we use laboratory evidence on the questionnaire data together to source -- solve this comprehensive a -- complex source identification, and then objective. Thank you.

CHAIR MCKONE: Thank you.

Okay. If there's no additional comments, I think we can move forward. We're just about two minutes ahead. I don't think there's a punishment for that.

Okay. So our next part of the Program is on the use of biomonitoring data and chemical risk assessment management, with the main focus on what's going on in Canada. But to introduce this, we will first hear opening remarks from Kathleen Attfield, who is with the California Department of Public Health.

Kathleen.

(Slide presentation).

DR. KATHLEEN ATTFIELD: All right. Can you hear me effectively?

Okay. Good.

All right. Well, good morning. My talk this morning is to provide context for Dr. Pollock who will be coming after me to introduce how Biomonitoring California data has been used in a risk assessment context. So this is a topic that hasn't been brought to the Scientific Guidance Panel for a while.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: So, of course, we all know and we've just heard from Nerissa that our data, our lab methods, our participant results return materials and other educational materials -- I need to be closer. Okay. Let me know if I need to pick it up -- had been used in many contexts, and we've shared many of those with the Panel before. So today's focus on risk assessment and risk management uses and other legal and regulatory uses has really been borne out of observing some of the actions of our international program colleagues and also in our increased efforts in the last few years of trying to really catalogue how our data is being used.

Tracking the uses in risk assessment has not been a focus previously, so we're still finding and learning about these uses.

So what I'll share with you today is not meant to be comprehensive, but to provide some examples to provide some insight that we can build upon.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: Is that better?

I can hear.

Okay. In collecting our uses and reading up on other programs, it seemed the risk assessment and management possible uses really fell into these general categories. The deceptively simple beginning one is simply demonstrating that exposure is occurring. And, in fact, this is where we found the bulk of the usage of our data in this context. And I'll return to this in a moment with some examples for you.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: Additionally, there is use for our data to understand time trends. So demonstrating continued exposure over time and in different populations was used by our attorney general for a lawsuit against PFAS manufacturers. And you just heard from Nerissa about our use in comments that we submitted to the UK for helping them understand the benefits of changing their flammability standards, akin to what -- to how California changed ours.

One aspect we do less of is to compare our data to population guidance levels. And in the early years of our Program, we discussed this with the Panel of looking at biomonitoring equivalent concepts, but we haven't

revisited that concept for several years. And while we don't use guidance values routinely, we have been more recently contextualizing some of our studies with PFAS, with the levels identified by the National Academies of Science, Engineering, and Medicine with their levels for PFAS for clinical follow-up and care for PFAS exposure.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: For uses in estimating dosages, for risk assessment calculation, these we haven't actually come across uses of our data for these purposes, but we have seen examples of these being done with data from the National Health and Nutrition Examination Survey, NHANES, and those by the Canadian Health Measures Survey. And so I will defer to Dr. Pollock for talking us through that in the next presentation.

And just as an aside, I have several acronyms floating around in my slides. There are definitional slides at the end, if you need that assistance, but I will try to spell them out, of course, as I go.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: So to return to the main usage of our data, the demonstrating that exposure is occurring, different risk assessment processes have different evidence needs, such as a simple yes/no that exposure is happening and -- to humans or a more demanding

information need that exposure is common, often evidenced by high detection frequencies.

These are the main evidence needs we've seen with California entities so far, but other entities using biomonitoring data also look for change over time, difference in exposure in different vulnerable groups or specialty groups, such as occupational, or differences between different regions.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: So there are two uses of Biomonitoring California data and risk assessment that I wanted to spend a little bit more time on. These are in the usage for drinking water advisory levels and in listings with Proposition 65. For those less familiar with that proposition, it requires California to publish a list of chemicals known to cause cancer, birth defects or other reproductive harm.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: So there are two processes our data are used for in drinking water advisories. So the first is in the establishment of Public Health Goals. Public Health Goals are defined as the level of a chemical contaminant in drinking water that does not pose a significant risk to health over a lifetime. And these are used as the scientific basis for

the State Water Resources Control Board, which I'll refer to as the Water Boards, for their establishment of Maximum Contaminant Levels. For chemicals that don't have an MCL, there are also possible to establish notification levels, which are health-based advisory levels.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: So our data is used in prioritization processes. And unfortunately, we all have to worry about many potential water contaminants. And our data is specifically used for prioritization when it is shown to be consistently found in biomonitoring studies and at a -- and with a high detection frequency. And it's also useful if it is similar to other national or other data and some examples here are some PFAS.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: But then it is also used to demonstrate the exposure context in the official PHG and notification level recommendation documents to the Water Board. So examples here PFOA, PFOS and PFHxS.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: For Proposition 65, data is also used for prioritization efforts. And here, the evidence needs are more about whether there is or is not potential for exposure in California and less that the detection frequency must be high. Examples include

benzophenone-3, BPA, diethyl phthalate. And then this data is then supplied as part of the exposure context in the hazard identification documents provided to the State's qualified experts who make the decisions on whether to list a chemical under Proposition 65. So examples on the right-hand side are for bisphenol S in 2025 and PFOS.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: So there are other uses of our data, which may not fit strictly within a risk assessment context but influence and support other government and regulatory actions. And one of these includes the use of our Biomonitoring California list of Designated and Priority chemicals. So thank you to the Panel for being part of that process. And these could help bolster other groups' abilities to list analytes for assessment or action, so such as with the Safer Consumer Products Program and the Air Resources Board.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: Another example of exposure being common being a useful assist is for again Safe Consumer Products group with their prioritization processes and some recent examples where our submissions on findings that we had from quaternary ammonium compounds and parabens.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: So in our searches, we saw -- also saw the data has been used for governmental groups who need to evaluate exposures among vulnerable groups and subpopulations. And our data out of an early biomonitoring project on firefighters has seen a lot of use. And as you see, it's been used for in firefighters -- this firefighters study used for an ATSDR tox profile and two IARC monographs, and risk evaluation by EPA for phthalates and also in a Health Canada report for PFAS.

And interestingly, the IARC Monograph and ATSDR tox profiles on PFAS didn't actually make use of our CARE and BEST studies, our population best -- based studies. And this might be related to -- in our early days, we didn't have those out in peer-reviewed literature, whereas those for the FOX Study have been available for quite a while.

So to return to other vulnerable populations, our ACE Study in Asian Pacific Islanders in the Bay Area was cited as part of the Supreme Court interested party filing, as evidence on high fish-eating populations and levels of mercury that were detected there. And then also, findings from an early study of pregnant women of the Biomonitoring California Program for the State of

Washington's PFAS Chemical Action Plan.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: So I just want to highlight that, of course, we have a lot of data from different time points, populations and analytes available on our website. So we'll be examining where the opportunities for this work might be to get further usage in risk assessment contexts.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: For next steps, as I mentioned, this is a newer effort to be cataloging this type -- these types of uses. So we will continue to document these data uses and provide more information on our website about it. We may also plug this information into our programmatic strategic planning, since it could influence the types of studies we do, our chemical selection or the breadth versus depth of various lab methods. We're also learning about how we serve our data and if mode or format influences the data being picked up, as I previously mentioned. And we'll seek to have some deeper discussions with potential users for risk assessment to learn what influences the data use, or lack of. And we will continue to learn from our sister biomonitoring programs, such as with our next presenter from the Canadian Health Measures Survey.

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: So that is my introduction and --

[SLIDE CHANGE]

DR. KATHLEEN ATTFIELD: -- I think we go directly to Tyler, yes. Okay.

(Slide presentation).

DR. TYLER POLLOCK: Okay. Great. Thanks everyone for having me here today. My name is Tyler Pollock. I'm with the Environmental Health Science and Research Bureau at Health Canada working on the Canadian National Human Biomonitoring Program through the Canadian Health Measures Survey. It's somewhat analogous to NHANES.

And today I'll be speaking about the Canadian Human Biomonitoring Program, including the data and the use of the data in chemicals management.

[SLIDE CHANGE]

DR. TYLER POLLOCK: So right at the very beginning, I have no conflicts of interest to declare or disclose.

[SLIDE CHANGE]

DR. TYLER POLLOCK: And then a bit of an outline for the points that I'll be speaking about today. So just a brief overview of the chemicals management legislation

in Canada followed by the Canadian National Human Biomonitoring Program through the CHMS and the use in -- of the human biomonitoring data and risk assessment and risk management. And then some current/future directions that -- under those legislative mandates.

And I will try and sprinkle in some considerations for program planning, because that's really my background on the Canadian Health Measures Survey on the National Human Biomonitoring program. I'm, of course, today speaking on behalf of a lot of colleagues in risk assessment and risk management.

[SLIDE CHANGE]

DR. TYLER POLLOCK: So the Chemicals Management Plan in Canada was a federal initiative launched in 2006 to reduce risks posed by chemicals to people living in Canada, as well as to the environment. It's jointly managed by Health Canada and ECCC, or Environment and Climate Change Canada. And it uses the Canadian Environmental Protection Act, 1999, as we refer to it CEPA, as the core legislative framework to monitor, assess and regulate existing and new substances.

And although CEPA is the sort of legislative underpinning of the Chemicals Management Plan, the data that we collect, the human biomonitoring data specifically, are used to inform programs and regulatory

decision-making under other acts in legislation, such as the Food and Drugs Act, the Pest Control Products Act, Canada's Consumer Products Safety Act, for examples.

There are six different pillars under the Chemicals Management Plan. Of course, human biomonitoring falls under the research and monitoring pillar. Informs activities under the risk assessment pillar. And then you sort of come all the way back around to performance measurement and effectiveness evaluation, which is how the human biomonitoring data informed the risk management activities predominantly.

[SLIDE CHANGE]

DR. TYLER POLLOCK: And CEPA was recently modernized under an initiative that's referred to as The Right to a Healthy Environment. And so CEPA was amended in June 2023 to include changes that recognized that every individual in Canada has a right to a healthy environment. So there's a bit more rigor or like bolstering of the human biomonitoring activities, in that the Act now specifies that the ministers of Environment and Climate Change Canada and Health Canada conduct research studies and monitoring to inform the right to a healthy environment.

And then there's a detailed implementation framework that was published just last year. It outlines

how the right to a healthy environment is to be considered in the various activities under CEPA including the human biomonitoring activities. And just to give you a couple ideas, one of the pillars is environmental justice. And so we address that through the way that we consult, public participation, indigenous engagement, as well as more effort and focus on disaggregated data to inform exposures in disproportionately impacted or vulnerable populations.

There's also non-regression, which we attempt to address through things like monitoring for substitutes, not just the chemicals that are declining over time, for which regulations are in place. And, you know, that would be taken into consideration by the risk assessment and risk management teams through things like cumulative assessments.

Okay. So that's the legislative background.

[SLIDE CHANGE]

DR. TYLER POLLOCK: Now, I'll turn my attention to the Canadian Health Measures Survey itself, which is conducted or led by Statistics Canada in partnership with ourselves at Health Canada and the Public Agency of Canada. It's a cross-sectional survey conducted in two-year cycles, which we sometimes refer to as collection periods. And then each collection period samples around 6,000 people living in the southern ten provinces to

produce those national estimates that are representative of 96 to 97 percent of the population.

Now, of course, you can see from the shading on the figure there that not all of Canada is covered through the CHMS. We do have other human biomonitoring activities that are funded or conducted by Health Canada that address the other components of the Canadian population. So there's the Northern Contaminants Program, which would monitor in individuals living in the three northern territories, as well First Nations people living on reserve are excluded from the Canadian Health Measures Survey and they are monitored through other biomonitoring initiatives, as an example, the First Nations Biomonitoring Initiative. You'll see some of those data in future slides.

[SLIDE CHANGE]

DR. TYLER POLLOCK: But back to the national Canadian Health Measures Survey. There have been seven cycles completed over 17 years understandably with a three-year break for the pandemic. Around 40,000 people have been sampled since 2007 and over 350 chemical biomarkers measured in blood or urine. We also sometimes measure things in pooled serum, in hair, and in drinking water from participants' homes. So if you add in all those other matrices and approaches, it's up to over 500

chemical biomarkers measured through the CHMS.

[SLIDE CHANGE]

DR. TYLER POLLOCK: And, of course, we won't go through all 350 or 500 today, buy just to give you a very high level overview of the chemical groups that have been measured over the different collection periods or cycles. This is what you would see in some cases for some of the higher priority chemical groups. They've been measured consistently. Although, the actual biomarkers or chemicals themselves may have changed over time, whereas other chemical groups have been cycled in and out to -- as a cost-saving mechanism and to be able to generate trends over time in longer periods.

[SLIDE CHANGE]

DR. TYLER POLLOCK: We now release all of our human biomonitoring results for the Canadian population through the Canadian Biomonitoring Dashboard and no longer in long form PDF reports. So it's more of an interactive platform that features visualizations of the environmental chemical levels in the Canadian population, as well as for various subgroups in the population, predominantly the ones that are reflected in the CHMS survey design, like the standard age groups, which parallel NHANES, as well as by sex. There is also a relatively new content summary tab, included on the dashboard, which allows you to

interactively go through and navigate all 350 to 500 plus chemical biomarkers by the age group matrix, and time that they were collected, and links directly back to the results. So we're quite happy with the development of the dashboard.

And to supplement the information on the dashboard, we also have a series of biomonitoring fact sheets, which are more like stand-alone webpages or chemical information pages about the environmental chemical, including levels from the CHMS as well as some of those other human biomonitoring activities that I referred to.

[SLIDE CHANGE]

DR. TYLER POLLOCK: And so fact sheets are available for 19 chemicals or chemical groups and we track things like the webpage views of the fact sheets. And, you know, you can see that PFASs are quite high of interest, as is glyphosate, and then some of the other chemicals. Not as much, but you can also track the web views over time. And if you see, for example, a really high profile media article comes out, it drives traffic to the webpages. And quite interesting in a Canadian context is we have these fact sheets available in English and French, and sometimes we'll see, you know, a prominent media article come out from the France Public Health

Department, which will drive traffic to the biomonitoring fact sheets available in French.

[SLIDE CHANGE]

DR. TYLER POLLOCK: The various uses of the human biomonitoring data mirror what Dr. Attfield presented. So establishing those baseline chem -- concentrations of chemicals in the Canadian population and tracking the trends in levels over time, comparing those levels with various population groups, including subpopulations within Canada and populations of other countries, for example, using data from NHANES, which is included in some of the biomonitoring fact sheets that we've reported or published.

Of importance for today's talk is to inform chemical risk assessments and assess the effectiveness of risk management tools that have been implemented. And then, of course, there's supporting research and active research programs on the links between chemicals and health outcomes or indicators of health.

[SLIDE CHANGE]

DR. TYLER POLLOCK: So we'll focus on numbers three and four today. And how are human biomonitoring data used in risk assessment. So there's a few different high-level topics or ways that they're used.

So the first is to support risk assessment by

identifying priorities for future assessment based on detection and levels and people living in Canada. And so this -- you know, when we see things like increasing levels over time, we could flag that as a priority for future, both monitoring and follow-up assessment. If there -- if we detect and measure new and emerging chemicals, we can flag those.

And then, we also do our own screening of the population levels, which uses biomonitoring guidance values, but I'll save that for a little bit later in the talk, once I introduce these concepts, but we'll come back around to it and I'll point that out. And all of these priorities are wrapped up under the plan of priorities under the CEPA Act, which was -- the most recent version was published last year.

[SLIDE CHANGE]

DR. TYLER POLLOCK: The second method is a little bit more simply to confirm exposure levels in the Canadian population, as well as identifying population groups with higher exposure levels. So I've given a couple examples on the slide here. For example, the guidelines for Canadian drinking water quality for cadmium, simply mentioned that exposure to Cadmium exists in the population and identified sort of which population groups might have higher cadmium levels, for example, smokers in

the Canadian population.

Another example is deltamethrin, a pesticide, which again confirmed exposure levels and actually did incorporate the comparison with the human biomonitoring guidance value, which is a health-based value to -- but not as the basis of the assessment, simply to confirm the outcomes of the approach that was used in the assessment, you know, things like modeling exposure for soil ingestion among toddlers after residential application of the pesticide, you know, intake of food with residues of the pesticide.

So this is different than --

[SLIDE CHANGE]

DR. TYLER POLLOCK: -- a human biomonitoring based risk assessment, where human biomonitoring data underpin the conclusions of the assessment. And there is an article published by my risk assessment colleagues, this one from 2017, outlining a review of the use of human biomonitoring data in risk assessment under CMP.

[SLIDE CHANGE]

DR. TYLER POLLOCK: And there's a few different approaches for using human biomonitoring data in risk assessment. So this is what I gather is of interest for today's talk. I won't go into the technical details. It gets into the weeds pretty quickly. I've tried to keep

the slides more plain, non-technical language, but I also want to highlight the second paper that was published more recently in 2024, which really documents well the different approaches. So you can see four of them on the slide. The first most basic form is a qualitative approach and then there's a few different kinds of quantitative approaches. And over 350 substances have been assessed using these various methods in -- under the Chemicals Management Plan in Canada.

[SLIDE CHANGE]

DR. TYLER POLLOCK: So the first approach here, the qualitative approach, this is a low exposure scenario. So where we have low detection rates in the population and there is an existing low concern with respect to human health, it -- by definition for the qualitative approach, they would be considered CEPA non-toxic, so non-toxic to human health would be the conclusion. There's a list of substances assessed through the approach -- this approach on the slide. These are predominantly rare earth minerals, rare earth metals, that -- for which there's very lower exposures. So the general sort of idea behind this approach is that we have human biomonitoring data available. There's very low detection, often less than 10 percent of the population with a detectable level. And importantly, the major uses manufactured in imports of

those substances confirm low exposures.

They would be nominated or identified as candidates for a qualitative low exposure approach. And as I mentioned, they would receive a CEPA non-toxic conclusion under the screening assessment report.

On the program planning side, of course, important here is to have a sufficiently sensitive analytical method. If you had very high limits of detection, you would inadvertently conclude that there's low exposures in the population. And so that's, of course, an important emphasis for the human biomonitoring program planning.

[SLIDE CHANGE]

DR. TYLER POLLOCK: The second approach, now we're moving into the quantitative approaches, so this is direct comparison. So human biomonitoring data are compared directly with the corresponding blood, urine or tissue levels measured in people or animals, where a biological affect was observed. And so this requires extensive data and information to underpin the link between the biomarker levels with that measured health outcome or adverse effect. There's only been a few substances assessed through the -- this approach, which you can see two of the PFAS and lead. And so that's where there's a lot of knowledge and consensus in the literature

that the effect is directly associated with the biomarker levels.

So one of the examples that I can give that I didn't put on the slides is, for example, PFOA. It was a study that dosed rodents with PFOA and identified increased liver weight as the outcome. And they actually measured PFOA in the rodent serum. And so that measurement of PFOA in rodent serum is what allows that direct comparison with the human biomonitoring levels in serum or plasma. And so, yeah, you need a really high confidence in the link between the biomarker level and the health effect that's being observed in order to do this direct comparison approach.

[SLIDE CHANGE]

DR. TYLER POLLOCK: Much more common are the other two quantitative approaches. The next one here, dose reconstruction, which is also known as reverse dosimetry for those who have a more technical background. And this is where you have an exposure guidance value or a dose associated with a critical health effect. And those exposure guidance values or those doses would be expressed in terms of the amount of the chemical, micrograms per kilogram of body weight per day. And so understandably, you cannot compare intake levels or dose levels with the human biomonitoring data directly, which are expressed in

terms of the amount of chemical, micrograms per liter of serum, blood, urine.

[SLIDE CHANGE]

DR. TYLER POLLOCK: And so you need to do some fancy modeling to convert. In the case of dose reduction, you're converting the human biomonitoring data back into those external exposures. So what intake amount, what dose, what exposure level would be consistent with the level that you're measuring in blood, urine, or tissue? You can tell that it's reverse dosimetry, because the squiggly line goes backwards on the slide.

[SLIDE CHANGE]

DR. TYLER POLLOCK: Okay. In order to do that sort of modeling, it requires information about the population, so things like daily urine output, body weights, as well as information about how the chemical moves through the body, so metabolism, excretion, in the form of urinary excretion fractions. There predominantly have been organic substances that have been assessed through this approach under the Chemicals Management Plan in Canada. And it's -- okay. Leave it there.

But I don't have any examples for this approach, because it's becoming less common and less preferred and I'll speak to that --

[SLIDE CHANGE]

DR. TYLER POLLOCK: -- in the context of the now more common and seems to be the way that the field is moving is to use the comparison with human biomonitoring guidance values, the forward dosimetry approach. And so this case, you're starting with the same inputs, the exposure guidance value, as well as the human biomonitoring data. But rather than converting the human biomonitoring data, you convert that exposure guidance value into a human biomonitoring health-based guidance value. It is the same inputs or like very similar inputs to be able to do the modeling. It's just the -- yeah, the preferred approach for making conclusions about the health risk in the context of risk assessment.

So in this case, you derived those health -- human biomonitoring health-based guidance values, which we sometimes refer to as HB2GVs from the exposure guidance values, which can be compared directly with the human biomonitoring data.

[SLIDE CHANGE]

DR. TYLER POLLOCK: In the context of the Chemicals Management Plan so far, these -- this approach has predominantly been used for inorganics. But again, this is not a -- like there's no advantage disadvantage between inorganics versus organics. This approach can definitely be used for organics in the -- you know, the

context of the Chemicals Management Plan work and the various work by the -- my risk assessment colleagues. It's tended to be more of like what the evaluator is more comfortable with, rather than any sort of advantage or disadvantage. So again, the use of human biomonitoring guidance value seems to be where the field is moving.

The actual advantage there is that you have to do less modeling overall to be able to make the comparisons and to be able to interpret the human biomonitoring data and health risk context.

Now, what do I mean by that?

You know, there's lots of biomonitoring initiatives, biomonitoring studies, surveys that are collecting data. Under the dose reconstruction approach, you have to apply that modeling to every single data set, data point. So you would have to back-calculate under dose reconstruction the -- for example, the geometric mean levels from one of the California Biomonitoring studies or the 95th percentile levels.

When you use human biomonitoring guidance values, you don't have to do that for every single biomonitoring study or survey results. You do it for the more limited pool of exposure guidance values that exist. And then those guidance values, the human biomonitoring health-based guidance values are available for any

biomonitoring study to use. Hopefully that makes sense.

[SLIDE CHANGE]

DR. TYLER POLLOCK: I'll give a couple examples. Inorganics are not my background or expertise, but I tried to brush up to talk about them today.

So, the draft screening assessment for zinc and its compounds was published in 2019. This comparison supported a CEPA non-toxic conclusion. And the derivation of those human biomonitoring health-based guidance values, which, in this case, were biomonitoring equivalent values for zinc were undertaken by Health Canada. And so, you can see those blue bars at the bottom of the slide. You know, I don't expect you to be able to read the text or anything. But those blue bars all represent results from the Canadian Health Measures Survey.

So for the total population by age group and -- between the two sexes, for urinary zinc levels, the red bar there is from the First Nations Biomonitoring. Initiatives, so reflecting First Nations people living on reserve.

You can see the dashed line is the biomonitoring equivalent value, that human biomonitoring health-based guidance value, for the NOAEL, the no observed adverse effect level, NOAEL. And then the solid line much higher up is the biomonitoring equivalent value for the LOAEL, so

the lowest observed adverse effect level. These levels were derived from the -- I should have put this in the notes. These levels were derived from a study where human volunteers were dosed with zinc and then monitored over a course of 12 weeks for adverse affects.

And so that BE for the NOAEL, the dashed line, is the level of zinc in urine that's consistent with no effects in those human volunteers. And then the BE for the LOAEL, the solid line, is the level that's consistent with effects. In this case, I think it's headaches, dizziness, so zinc toxicity. And the -- you can see UF 1 is on the slide. So there's always -- there's a whole bunch of uncertainty around this modeling of human biomonitoring health-based guidance values.

In this case, there was not much uncertainty. The uncertainty factor is one. And the reason for that is that the study was done in what was considered to be a vulnerable subgroup in women. So, yeah, it's quite an interesting approach, but -- because the levels in the Canadian population are far below the LOAEL, the solid line, that would indicate, you know, effects from zinc toxicity. And they're even below the level where no effects were observed in the study, then the conclusion was that zinc exposures are not happening in the Canadian population at a level that would be consistent with

adverse health effects. So CEPA non-toxic conclusion.

[SLIDE CHANGE]

DR. TYLER POLLOCK: The second example where we have a CEPA toxic conclusion is the screening assessment for selenium and its compounds, which was published in 2017. Again, those biomonitoring equivalent values were derived by Health Canada in collaboration with Sean Hays from Summit Toxicology, who is very -- been very active in the biomonitor equivalent field. On the slide, you see a variety of results in the bars, including from the Canadian Health Measures Survey, that First Nations Biomonitoring Initiative. And then importantly on the -- towards the right there is results from various studies under the Northern Contaminants Program, so reflecting individuals living in the three northern territories, including from the Inuit Health Survey Q 2017 survey, and then children living in Nunavik in the territories.

And so you can see that green line towards the bottom of the figure is just the estimated average requirement. That's a dietary nutritional guideline level. It's expect that the population would exceed selenium exposures for that. They -- then there's the biomonitoring equivalent for the institute, which was derived around the Institute of Medicine's upper intake level for, I think in this case, the upper intake level

was derived based on selenosis, so like hair loss and brittle cracked nails in a population in China with a lot of selenium in their environment, a very seleniferous environment, which is -- yeah, so you can see how like the research underpinning these health effects feeds into agency decisions and feeds into the derivation of biomonitoring guidance values.

And in this case, because -- perfect. In this case, because the levels exceeded the biomonitoring equivalent, there was a CEPA toxic conclusion. So selenium exposures in certain parts of the Canadian population are occurring at levels that could be consistent with adverse health effects.

[SLIDE CHANGE]

DR. TYLER POLLOCK: If you're interested in understanding like all the different inputs that are needed to do this kind of modeling and to make these kind of comparisons based on human biomonitoring data, there's a biomonitoring equivalents is a screening tool for population level biomonitoring data, a Health Canada perspective that was published almost 10 years ago, but its principles are very much still relevant, and it speaks about the need for high quality, analytical methods in the context of human biomonitoring, high quality studies often by regulatory agencies, and governments that demonstrate

these adverse effects as a result of exposures. And then how to put that all together with the various inputs like the daily urine flow rates and the average body weights of populations. And that -- yeah, that document contains a lot of information that I'm alluding to today.

[SLIDE CHANGE]

DR. TYLER POLLOCK: We're still very active in deriving biomonitoring equivalents from a Health Canada perspective, including some for pesticides, like glyphosate back in 2023, and then just earlier this year for select neonics, which will be used again to support the risk assessment or pesticide reevaluation decision-making in Canada.

[SLIDE CHANGE]

DR. TYLER POLLOCK: I previously alluded to the HB2GV acronym. That was developed under the Human Biomonitoring -- International Human Biomonitoring Working Group, which is affiliated with the International Society of Exposure Science, or ISES. And we have a Human Biomonitoring Health-Based Guidance Value Dashboard, which is a compilation of all these HB2GVs that are available. We've spoken a lot about the biomonitoring equivalents, or the BEs, but there's also HBM-I and HBM-II values from the German HBM Commission and then human biomonitoring HBM-GVs for the general population under -- formerly HBM for you,

now the European Union PARC Initiative.

There will be -- just because it's relevant to the earlier presentation, there will be a session at the ISES conference this fall on the health-based interpretation of inorganic arsenic, which is very much an active field. And there's a lot of discussion around whether it's, for example, appropriate to include DMA and MMA in the -- yeah, in the derivation of the Human Biomonitoring Guidance Values or whether it's appropriate to consider only the other -- the As(III) and As(V) inorganic arsenic metabolites, so cases of interest.

[SLIDE CHANGE]

DR. TYLER POLLOCK: Coming back around to what I alluded to previously under the CEPA Plan of Priorities and how human biomonitoring data can inform priorities for risk assessment. This is one way that we do that, so we use those biomonitoring guidance values from the Human Biomonitoring Program perspective to screen the population levels.

And so these -- you know, in these cases, we would compare the Canadian Health Measures Survey results at the geometric mean in the 95th percentile and calculate what we call hazard quotients, so it's just dividing the result by the guidance value level. And if you have a hazard quotient greater than one, means that there's

indication of exceedance of the Human Biomonitoring Guidance Value.

[SLIDE CHANGE]

DR. TYLER POLLOCK: And here's a few examples, I think. Yeah, you can see there. So a hazard quotient of one is identified in the red line and there's exceedances for a handful of chemicals shown on the slide, including acrylamide, cadmium in certain populations, arsenic. Yeah, so this is just a snapshot of the latest -- yeah, the latest findings that will hopefully be published soon.

[SLIDE CHANGE]

DR. TYLER POLLOCK: And then human biomonitoring data used in risk management. I don't have as many examples for this. It's more of a recent initiative under the chemicals management plan, now that's been on for 20 years -- 20 years ongoing. But human biomonitoring data can support risk management effectiveness evaluation as a key performance indicator. There's a lot of requirements to successfully do this. It requires Human biomonitoring over time, ideally before and after the implementation of risk management tools and regulations, as well as in the relevant population groups for which the regulations were implemented.

And so you can imagine that Canada back in I believe 2008 was one of the first countries to regulate

BPA, but it was regulated in baby bottles, and we don't have human biomonitoring data for babies, so we wouldn't be able to use human biomonitoring data directly to assess the effectiveness of the regulations for BPA.

[SLIDE CHANGE]

DR. TYLER POLLOCK: But we do have it for a phthalate, so DEHP. In this case, the phthalate regulations came in 2009 in Canada. And we overlaid the CHMS data with NHANES, which we thought told a nice story. So you can see the decline over time of phthalates, at least for DEHP metabolites, which encompass the phthalate regulations being put into place.

[SLIDE CHANGE]

DR. TYLER POLLOCK: And the last slide here, current and future directions. So under the right to a healthy environment, we will be increasingly considering or we already are disproportionately impacted our vulnerable populations, including people who may have higher exposures to substances or be at greater risk of -- greater health risk or greater susceptibility as a result of those exposures.

There's will be measurement of pertinent biomarkers of effect, which are becoming increasingly important to interpret the human biomonitoring data in a health risk context and to underpin some of the guidance

value derivation alongside those biomarkers of exposure.

So I'm happy to talk about, you know, how BDNF might be of interest, how thyroid and sex steroid hormones might be of interest to measure alongside certain chemicals, as well as some oxidative stress markers. There will be continued characterization of concurrent exposures to chemical mixtures, which will help inform the cumulative assessments that may be undertake as examples. PFAS is likely to be assessed as a class, as are BPA, bisphenol A, structural analogs and functional alternatives.

[SLIDE CHANGE]

DR. TYLER POLLOCK: That's it.

(Applause).

CHAIR MCKONE: Thank you very much, Dr. Pollock. Very interesting. I'm sure -- it's stimulating a lot of ideas for me and interest.

As -- before, we will start with just about five minutes for some clarifying questions from the Panel first and then also from the audience. And then we will have time for a broader discussion to probably get into some of these topics, that you alluded to that we might want to explore further.

So are there some questions that would be more of a clarifying nature?

Yes.

PANEL MEMBER FIEHN: Thank you. Oliver Fiehn.

So, in your slides, you said you were also monitoring or interested in consumer products and self-care products. And I saw triclosan. But, you know, are there broad lists or, you know, very short ones? So we are, you know, here in California also con -- very concerned about those, for example, quaternary ammonium compounds and other types of compounds. Is there also an active kind of like investigation of consumer products that might be harmful over chronic conditions.

DR. TYLER POLLOCK: Yeah. That's a great question. So we do -- we have measured and we will continue to measure various classes or groups within the self-care and consumer product chemicals, bisphenols, triclosan, parabens, phthalates, UV filters in some cases like the benzos.

In terms of I think maybe a good way to address the question is planning forward. There's no requirement to continue monitoring. There's no -- yeah, to continue monitoring certain compounds versus others. It's all -- so we have a chemical consultation that we recently conducted at the end of last year and then into January of this year. And then it undergoes a chemical prioritization. So through that mechanism, which is, of

course, open to our colleagues in risk assessment and risk management, we hear a lot from them. It's also open to the public, in case there's concerns from the public or if there's a lot of media attention for certain compounds.

That's what would dictate the next chemicals that will be measured. In this case, for example, we're working on right now for the Cycle 9 of the Canadian Health Measures Survey, so 2028-2030 collection.

So, yeah, I think -- I'm not sure if that fully answers the question, but we expect that we'll continue monitoring for self-care and consumer product chemicals. We hear that they're of continued interest through the Canadian human biomonitoring chemical consultation.

CHAIR MCKONE: Then we can go back. I think we don't want to get into the -- Carl Cranor, you have your hand up.

PANEL MEMBER CRANOR: Yes. Thanks, Tom. I have a ton of questions, but I'll control myself for the moment. It seems to me it's a great idea to incorporate or utilize the biomonitoring information for risk assessment. And I've raised that issue from time to time here in California, but there's often -- one response is that the quantities of blood measurement that are used for biomonitoring are so small that they can't be spread around and used for other purposes. Have you -- so that's

one question. Have you solved that problem? And I'd also ask a quick question about beryllium. But can you address this sort of procedural issue first?

DR. TYLER POLLOCK: For -- just for clarification. When you say quantities for human biomonitoring, do could mean the actual levels in the --

PANEL MEMBER CRANOR: I think the amount of -- the amount -- I'm getting at the edge of my knowledge here, but the amount of -- the amount of blood that is taken for biomonitoring purposes is very limited. And not -- there's not going to be a lot left over for more extensive risk assessment. Have you dealt with that?

DR. TYLER POLLOCK: Yes. I mean, in the context of the Canadian Health Measures Survey, it is something that comes up for each cycle. There is sort of a vying of the sample availability predominantly for the blood samples. Of course for urine samples, it's a lot easier to collect more volume and be able to use that for more purposes, but it typically depends on what is being planned on the like clinical nutritional side. But we've -- and how that affects human biomonitoring is that we would sometimes need to prioritize the chemicals or the biomarkers that we know are best measured in blood, you know, the most specific and sensitive biomarker is measured in blood. We would need to do a prioritization

of those substances.

And then, in some cases, we might not be able to measure the full list of prioritized substances depending on the blood that's available. And often the challenge is more so for the younger participants. And so we -- you'll -- in the context of the Canadian Health Measures Survey and the National Human Biomonitoring Program in Canada, you'd find that the -- like we often work with the analytical laboratories to develop different collection protocol for the younger participants that relies on a smaller sample, which, you know, that really gets into the considerations for the lab folks that you may have more missing data in you data set, if you need to run a duplicate analysis and it's not available.

But generally, I think to walk it back, to answer your question directly, the blood that's available, you know, the blood that's collected from the CHMS participants, a portion of that would be available for human biomonitoring, and would address risk assessment priorities, because we -- part of our consultation and prioritization exercise is to measure chemicals that are priorities for risk assessment.

PANEL MEMBER CRANOR: So you address this by collecting more blood, if needed, and that's probably authorized that you're going to have dual purposes for the

collection biomonitoring and then maybe further risk assessment. Is that the legal authorization as it were?

DR. TYLER POLLOCK: Yeah. The -- I think a concise way to put it is that the blood that's collected for biomonitoring is for risk assessment, just by nature of the fact that the chemicals are prioritized. The chemicals that we measure in blood and urine are prioritized, largely based on risk assessment needs in Canada.

CHAIR MCKONE: Just if I can -- I think we're kind of getting into our broader discussion. But if there are any like shorter clarifying -- I think Lara had a question of clarification, and then we'll go back. And I think, Carl, you probably have a couple of more questions.

PANEL MEMBER CUSHING: Hi. Lara Cushing. Thank you for a great presentation, as I learned a lot. I had a quick question about the direct comparison quantitative approach that you mentioned. And you emphasized the need for like having strong evidence on biological effects. But I was unclear if you were referring to like outside sources of evidence or you also mentioned measuring biomarkers of effect in some of your participants. So are you attempting to collect that strong evidence of biological effect through your activities to support risk assessment or it's more relying on, you know, other --

like these healthy volunteers that you mentioned, like outside studies, separate studies for that evidence.

DR. TYLER POLLOCK: Yeah. So far -- it's a good question. So far it's -- it has largely relied on outside -- activities outside studies and literature. There are -- you know, there's under some of the OECD working parties, there are initiatives to better characterize the health effects through biomarkers of effect in the individuals that you're conducting human biomonitoring for biomonitor -- biomarkers of exposure chemical levels in.

It's a challenge though, because, of course, as you could imagine, if you measure a reproductive toxicant, you know, one of the self care and consumer product chemicals that is known to have reproductive effects just because there are altered reproductive hormones in a participant, in, you know, the Canadian Health Measures Survey does not mean that that's caused by the chemical level. So that's the challenge is that you, in order to -- you know, the -- currently, the biomarkers of effect would certainly be considered by the risk assessors. There are certain risk assessment groups that are interested in having those data. They would also be, of course, used for some of the epi -- epidemiological research, but it's challenging to say whether the field is

there quite yet.

And we're only, I think, first starting to see indications of the joint measurement of biomarkers of exposure and effect used directly in risk assessment. And, you know, there have been examples with kisspeptin and the bisphenols. And I think it -- right now, that's why it's sort of like current/future direction is we need to start collecting them to see what can be done and how they could be more formalized in assessment. And I think probably it will start out much like the biomonitoring based assessments did, where like they start to be used to support a conclusion that's made using other methods, and then eventually, ideally, used to -- as the like underpinning of the assessment.

CHAIR MCKONE: Okay. Did you have a follow-up question?

Never mind.

CHIEF DEPUTY DIRECTOR EDWARDS: Stephanie is raising her hand.

CHAIR MCKONE: Oh, yes.

STEPHANIE JARMUL: This is Stephanie Jarmul. Just a really quick clarifying question on that. Are you saying then that biomarkers of effect are not yet going to be included in your next round of collection, but you're working towards sort of gathering the evidence you need to

support that, is that correct?

DR. TYLER POLLOCK: (Nods head.)

STEPHANIE JARMUL: Okay.

DR. TYLER POLLOCK: No. In the -- sorry. In the context of the Canadian Health Measures Survey, there's already been -- like they already collect clinical nutritional biomarkers. It just hasn't been part of the national human biomonitoring consultation. So I guess the way to think about that is more -- like more informed decisions around which biomarkers of effect will be measured, based on which biomarkers of exposure.

So, for example, in two of the cycles of the Canadian Health Measures Survey, Cycles 3 and 4, the sex steroid hormones were measured, but it wasn't a decision that was made around the environmental chemicals that were being measured in those cycles. And so that's where the -- at least for the future of the human biomonitoring program will be to more intentionally more intently measure biomarkers of effect that we know are related to certain biomarkers of exposure. And that all sort of -- like that comes back to the -- yeah, like the weeds of the exposure guidance value derivation. Is it a neurotoxic substance? Is that the critical effect? Is the critical effect in the reproductive system or development?

And so that's sort of where -- what guides the

like what could be a pertinent biomarker of exposure -- or, I'm sorry, biomarker of effect in people related to those exposures.

CHAIR MCKONE: Are there -- so, I'm trying to get this to a broader. There was one issue I'd like to bring up, which is you talked early on about pooled samples. And the reason I think -- I mean, they may not be useful for a lot of things, even in risk assessment, but in risk assessment, the first phase, the hazard identification, has been dominated, as an exposure scientist I say, has been dominated unfairly by toxicologists, who say the possibility of harm is only driven by whether it's toxicologically feasible this chemical causes a problem.

But I think in the exposure community, we argue, well, we should monitor exposure and say, hey, if it's out there and in people, even if we don't fully understand the toxicology, that's an indicator of harm or that's the possibility of harm, and that should be more included. And I think you've kind of opened the door to that. And, I mean, that's -- especially with pooled sampling, which is rather easier to get. And in a hazard identification, you don't need to know the distribution. You only want to know whether it's there or not.

DR. TYLER POLLOCK: Yeah. That's a really good comment for the part that I may have like skimmed over a

little bit. But on the program planning side, again coming back to the ISES meeting in Vancouver in the fall, there's going to be a session on lessons learned from human biomonitoring programs over the pandemic. And so to relate that back to your comment, Tom, the -- it's a challenge right now. Like the budgets are going up, as you can imagine, everything is, over the pandemic.

Right now, in the context of the Canadian Health Measures Survey, for the last two cycles, Cycle 7 and 8, which were the two post-pandemic cycles we're at about $11 million Canadian per cycle, which translates to -- you know, these are typically four or five year funding agreements. Translates to about $5 million Canadian per year.

And we want to be doing more. We want to be measuring biomarkers of effect. We want to be covering more high priority substance groups through the biomonitoring to get exposure levels. There's a lot of thinking about how to do that under budgets that are being constrained and costs that are growing. And one of the ways is to focus more on just establishing exposures and exposure levels through pooled sample approaches, at least when the new compounds are introduced into the survey.

So, yeah, it's still like very much a fine balance between exposure science, exposure assessment, and

toxicology. I think in the context of the human biomonitoring guidance values, they're still very much driven by toxicology, being based on exposure guidance value in critical health endpoints.

But, yes, there is room for exposure science to -- and the use of biomarkers of effect to indicate more where there could be a health risk as a result of chemicals.

CHAIR MCKONE: Thank you.

Others?

PANEL MEMBER QUINTANA: Are we on the general?

CHAIR MCKONE: Yes, we're in the general now, I think, unless there's like -- I think we got beyond -- That last point was not general -- I mean not a specific. We're on the general.

PANEL MEMBER QUINTANA: Thank you for that interesting presentation. And I think it's especially relevant to us, because I believe the populations of Canada and California are very similar, if I recall. So it's very much relevant to our approach. I guess when you were talking, I was think about that forward going from a standard to biological measurement. And I was thinking back to the occupational world where the American Conference of Governmental Industrial Hygienists, I know had these air standards, the threshold limit values, and

they were predicting biological levels, you know, back when. And they would try to have a little recognition of other routes of exposure, for example, that you have a notation for dermal potential and things like that.

But I'm just thinking it sounds like you might take a standard, like a water standard of how much micrograms per liter. And then you might turn that into a certain amount of say arsenic in the urine going forward from the standard. But how would you incorporate other routes of exposure and do you consider background levels? And the reason I'm asking partly is because if you have say a strong background level from diet that's affected by rice consumption and say -- and arsenic, one way to look at it is that oh, the water level is a small contributor compared to rice, when you could say that for a certain person, or you can say the person already has a high burden, we should bring the water level down to protect people that are already starting out with a high burden.

So there's kind of two ways to look at that in risk assessment. I'm just kind of curious of your thoughts.

DR. TYLER POLLOCK: Yeah. So it's definitely a good point about occupational monitoring. We have a -- like guided a lot by the occupational monitoring and the PEI values, the biological exposure indices, I believe,

which are specific to occupational levels. And, of course, the -- our European colleagues have their HBMGVs for workers as opposed to the general population.

But it's a good point. Yeah, so currently still, the -- a lot the biomonitoring guidance values are derived from an exposure guidance value that would focus on a -- like an acceptable daily intake or an oral REL for example. So I guess the way that that's accounted for maybe through a couple different ways in the context of human biomonitoring and then risk assessment.

So for human biomonitoring, of course, you're capturing everything from all sources and exposure routes, which, you know, adds a layer of, I think, confidence around the exposure level data. Then from a risk assessment perspective, you're still looking for those margins of exposure. And so, you know, a target margin of exposure might be 300, or in some cases, 1,000, depending on the level of certainty.

So you're still looking for some comfort level between, you know, what is the level that's associated with the adverse outcome or a health-related effect and the exposure levels that you're observing in the population. And so I think, you know, that's probably one of the limitations of the human biomonitoring guidance values as well. I'm a little bit biased pointing out the

advantage, but not maybe one of the disadvantages.

And one of the disadvantages is it's just very easy to make those comparisons. You know, the fact that the -- like the modeling is taken care of. You can go on the HB2GV Dashboard that's available online. You can find biomonitoring guidance values that exist for many compounds, and you have your biomonitoring data. And you could just -- in some ways, it could be a naive comparison where you are making a conclusion just based on simple division. But really there's still a lot of technical consideration and important consideration behind the scenes, like you still need to select the most appropriate health effect that underlies the biomonitoring guidance value that may be more or less relevant to certain populations than others.

And so that's -- you know, that's, in some ways, reflected by the different approaches for deriving human biomonitoring guidance values, whereas biomonitoring equivalents are often derived for all available exposure guidance values. And then it's up to the assessor, the evaluator to make the determination of which one is important. That's a much different approach than our European colleagues who they do that determination for which exposure guidance value, which critical health effect is most appropriate, and only derive a

biomonitoring guidance value for that health effect.

So I think there's a lot to consider, but yeah, it's really important that you're taking into account those various exposure scenarios when you pick the biomonitoring guidance value, which is based on an exposure guidance value, or a health effect, or a point of departure, which might be specific to an exposure route.

So it's not as simple as just, you know, as I presented maybe on the slides the micrograms per liter, micrograms per liter. You can compare them. Like, no, there is a lot of -- yeah, there's a lot of important consideration. And typically for a lot of the chemicals that -- you know, for which biomonitoring guidance values exist, you know, there are predominant exposure routes. So you're capturing -- you know, you may have some uncertainty, but typically what we see is like if it's largely in food, then it's an intake. If it's, you know, largely inhaled then it would be like based on a reference concentration as opposed to an ADI. So hopefully that leads to --

PANEL MEMBER QUINTANA: Yeah. Thank you. I do think that there are some situations where there are multiple, not only routes of exposure from the same source, but also exposure -- different exposures, so that's where it gets tricky from a who do we protect point

of view. I remember, because I'm fairly old, I think way back when OSHA was trying to develop a cadmium level in urine, but first -- biomonitoring standard for cadmium which we did. And -- at first they proposed having two standards, one for smoking workers and one for non-smoking workers, because smokers already had so much cadmium, they were letting them have more from the occupational, which doesn't make sense from if you're thinking about children that already have lower levels or higher levels maybe from secondhand smoke. You don't want them to say oh, well, they have secondhand smoke, so we're going to let them have a higher level.

So it's kind of a tricky question about who we protect and how we protect them, I guess. And since I think we're so much -- so agency specific, the water people, the air people, it's hard to get together about protecting people from all routes kind of thing I think.

Thank you very much for your answer.

CHAIR MCKONE: Yeah, you were --

PANEL MEMBER FIEHN: I would like to follow up on your good comment, and that it's not just true for smokers, non-smokers, or old and young people or men and women, but also on occupational levels. So when you talk about priorities, here in California we talk a lot or take advantage of ongoing studies that focus on specific risk

groups, like firefighters, or people working in hair salons, or people working in the fields, or people being indoors, or -- you know, so I wonder if that is also considered in Canada?

DR. TYLER POLLOCK: Yeah, it's a really good question. We do have like different groups working on different substance types, like existing substances versus new. We have a drinking water group. We have a pesticide group. So there is that sort of split. And we do see -- I mean, for one of the examples that I gave, the deltamethrin, and that's applicable to a lot of the pesticides. They do consider all of the different exposure routes. You know, that would be like agriculture workers. In fields, that would be residents living, you know, near farms and fields where the pesticides are applied, all the way through to, I think one of the examples I gave, residential applications, and hand-to-mouth behaviors of infants, soil ingestion from infants.

So I think, you know, maybe that's one example where the -- because there's so many diverse exposure routes, that might be why the human biomonitoring data and the guidance value comparison are used to support the conclusions of the assessment versus, you know, if it was a simpler situation with exposures, then it would support

the human biomonitoring based assessment.

But it will be interesting to see, you know, the -- what's happening with the cumulative assessments, which I -- from what I understand the BPA SAFA, the bisphenol A, structural analogues and functional alternatives will be a human biomonitoring based approach as a class. So that's something that, yeah, might help shed some light on how to address these complex issues.

CHAIR MCKONE: Lara

PANEL MEMBER CUSHING: Yeah. This is Lara Cushing. I'm curious whether you've thought about or are already using the biomonitoring equivalents in reporting back to participants, because one of the challenges is, of course, how to give people useful information about how to interpret their results. And a lot of the time, we're just comparing them to other people, so they get a sense of how do I rank versus NHANES, you know, general population or others in the study. But it would be really nice to be able to tell them, you know, something that's more connected to health.

DR. TYLER POLLOCK: So that is a great and very timely question. There's differing opinions on whether or not it's appropriate to compare individual level data with human biomonitoring guidance values. So BEs, biomonitoring equivalents, is a concept in the original

position papers. They were only meant to be compared with population results, descriptive statistics of the population, like geometric means, 50th percentiles, 95th percentiles. Part of that was recognizing that the -- a population level biomonitoring program or even just a biomonitoring study with sufficient sample size would capture the distribution of exposure levels that are likely to happen.

And so that's especially important for the rapidly metabolized chemicals that are excreted quite quickly. For comparing with individual level data, often the recommendation is that you should have repeated measures to try and capture that variability before you compare to a biomonitoring guidance value.

That said, there are some folks who support that type of communication. So I think ultimately that's something we're hoping to address through the International Human Biomonitoring Working Group putting out a position paper like helping to guide when it might be appropriate to use the biomonitoring guidance values in things like report back.

For me personally, I think that they have information and that information is of value to participants. And it would just need to be, one, likely very careful communication in language around explaining

what is a very complex topic to a participant, who likely doesn't have a substantial background in biomonitoring, and two, the availability of like a physician or a clinician or an exposure scientist to help interpret and answer questions, because they are likely to come, if you include the biomonitoring guidance values. But right now, it's -- there are very few that are used in the context of the Canadian Health Measures Survey, and they are only like Health Canada guideline levels for blood lead, and blood mercury. And even those are not, you know, super up to date. It's more used as a like legal reporting threshold under the survey. Yeah.

So not something we're currently doing, very interested in the afternoon talk on report back, because as the Canadian Health Measures Survey is rethinking the design for the next cycle, we're also thinking about, you know, advertisement, communication, to increase recruitment rates and how we give respondents more --

CHAIR MCKONE: We're running a bit short. I do want to make sure we have some time to see if there are comments or -- questions, comments from the public in the room or those online, if Rebecca has some.

DR. AHIMSA PORTER SUMCHAI: Thank you so much for your excellent presentation. I will definitely rely on your exposure data. I do need to point out, however, and

I did forward an email from the National Library of Medicine National Center for Biotechnology Information, it's the ATSDR toxicological profile for vanadium. And I know that your research identified vanadium to be nontoxic for disproportionately populations that are related to the -- you know, or next to the 65 ores in which vanadium is detected in fossil fuels. You know, the exposure risk is significantly higher and the health effects are also significant, headaches, respiratory -- usually inhaled respiratory. And vanadium pentoxide is the form that is most likely associated with toxicity.

DR. TYLER POLLOCK: Okay. Appreciate your comment.

CHAIR MCKONE: Okay. Stephanie.

STEPHANIE JARMUL: Tom, there's a couple online that I'm going to read aloud.

CHAIR MCKONE: Okay.

STEPHANIE JARMUL: Well, Asa, I'll let you do yours after I read a couple of questions from Heather Bolstad.

Thank you for your presentation. Two questions. Have you identified highly exposed subpopulations to the non-toxic compounds that have low detection frequency. For example, people living near oil and gas production may have increased vanadium exposure. So do that one first.

DR. TYLER POLLOCK: Very relevant --

STEPHANIE JARMUL: Yeah.

DR. TYLER POLLOCK: -- comment.

STEPHANIE JARMUL: Timely.

DR. TYLER POLLOCK: So the -- many of the substances that were assessed through that qualitative approach, the low dose or low exposure scenario, they were specifically included in one cycle of the Canadian Health Measures Survey for that purpose. So we don't actually have ongoing monitoring data for a lot of those rare earth metals and other things like critical minerals.

They may be prioritized for the next cycle. We're aware of analytical methods that exist. We're aware of the need for more updated data around some of those compounds. And so, yeah, it's not something that we have undertaken yet to do sort of disaggregated data analysis of all those substances, which were measured I think back using samples from 2009 to 2011. So quite older at this point.

CHAIR MCKONE: There's another question?

STEPHANIE JARMUL: Yes. It's a comment. The zinc and selenium examples compared to systemic health guidance values. Inhalation of metal-containing particles can have local effects in the respiratory tract, which would not be reflected in comparing biomonitoring values

to systemic health standards. That's a comment.

DR. TYLER POLLOCK: Yeah, it's a good -- a good comment. You know, I'm not sure that I have anything too informative to offer other than that we are taking a look at nanoparticles for future measurement, which I think would likely -- you know, a lot of the nanoparticles that are of interest are metals and would be more likely to be inhaled, so yeah. I'm not sure that I have anything specific to respond to that comment, but it's an important comment.

STEPHANIE JARMUL: Thank you. And then I guess I'll read Asa's out loud.

Just a reminder that the Summit Toxicology, who also worked closely with Canada, published a comparison of California biomonitoring data with biomonitoring equivalents in 2015.

CHAIR MCKONE: That's just a comment. Okay.

I think as --

CHIEF DEPUTY DIRECTOR EDWARDS: Asa has his hand up. Asa wants to make a comment.

CHAIR MCKONE: Oh,

DR. ASA BRADMAN: I just wanted to ask a question if that's okay? Can you hear me okay?

CHAIR MCKONE: Yes.

DR. ASA BRADMAN: Okay. Well, one, just

referencing that report. And I'm really interested in your -- you commented about looking at kind of cumulative exposure, or risk assessment, or, you know, multiple exposures, and just to kind of point out that OEHHA has guidelines on grouping hazard quotients. Based on the toxicological basis for the endpoints for the risk assessment. So I believe that was in the air toxics documents that came out maybe 10 or 15 years ago.

You know, I think that approach could be used as a guideline for combining hazard quotients and looking at multiple exposures, and at least for our substances where there is a -- you know, there is an endpoint, a reference level, or reference dose. For those without reference doses, which is often the situation we deal within environmental health studies, including Biomonitoring California, you know, we have to think about how to treat those and whether there should be an obligation to do a toxicological assessment, at least come up with perhaps even preliminary or some guidelines for what would be an appropriate reference dose or reference exposure level.

But again, I'm really interested in the multiple exposure risk assessment.

DR. TYLER POLLOCK: Yeah. Maybe just a quick comment. So in the context of the Canadian Health Measures Survey data, we've undertaken what we refer to as

exposure load. It's just a simple way to quantify the concurrent exposure to multiple substances above a certain threshold. And that threshold can be defined however you sort of like -- we've produced multiple indices of exposure load using the limit of -- the analytical limit of detection, all the way up to like the 75th or 90th percentile in the population. So you could imagine that somebody with a higher exposure load of like 12, for example, where the threshold is the 95th percentile, that means those individuals are very highly exposed to multiple chemicals in the context of general population exposures.

That work has advanced now to a recent publication called the "Cumulative Health Risk of Exposure Load" -- or "from Exposure Load", where we grouped different substances based on the critical health effects, like a neurotoxic effect or a liver effect, and looked at the number of substances that individuals in the Canadian population are concurrently exposed to for those substances with the same sort of underlying critical health effect.

The issue there, of course, is that the biomonitoring guidance values, which were used to inform that work, are still derived based on exposures to that one substance at a time. So the challenge is, you know,

some of these cumulative assessments have already looked at developing guidance values for multiple compounds, multiple metabolites or biomarkers from within a class. But how do you do that across classes seems to be the challenge, you know, looking at, you know -- yeah, if you had half a dozen compounds that all affected the liver, how do you derive that hazard quotient, that biomonitoring guidance value, that you could do a sum of all the biomonitoring data and compared to one value does not seem to be much progress made on that.

But I will certainly take a look at the work that California has done. And I think as well, you know, if there's an interest in deriving more biomonitoring guidance values from the many exposure guidance values that California has derived, like the RELs, there would certainly be interest on our end to include them in the dashboard.

CHAIR MCKONE: Okay.

DR. ASA BRADMAN: Yeah, I think the --

CHAIR MCKONE: Asa.

DR. ASA BRADMAN: -- OEHHA guidelines. And it's just a -- it takes a simple sum essentially of the hazard quotient to develop an index. If the basis for the hazard -- the reference dose was, for example, hepat -- you know, liver or respiratory, so if there's a common --

if there's a common outcome, then it's just kind of a simple sum of the hazard quotients. And, you know, correct me if I'm wrong, those in OEHHA, but there is an approach there I think that could be applied.

CHAIR MCKONE: Okay. Well, we're running over quite a bit. So I think this is a really interesting discussion. Hopefully some of us can come to Vancouver and maybe engage there more.

But at this point, we're going to break for lunch for an hour. I don't know should we come back at 1 or give people a little more time. 1:08. Okay. We're going to start 1:08. Thank you, everyone.

(Off record: 12:08 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: 1:08 p.m.)

CHAIR MCKONE: Welcome. Now, we're going to move on to the afternoon program. In the next session, we'll be hearing from two speakers. First is Kiera Melton. Kiera is a Research Scientist in the Biomonitoring Outreach Communication Unit of EHIB, Environmental Health Investigations Branch. That's California Department of Public Health.

Today, she'll be presenting on the Program's consideration of digital results return.

(Slide presentation).

KIERA MELTON: Thank you. As mentioned, I'll be --

(Microphone not on.)

[SLIDE CHANGE]

KIERA MELTON: Okay. So I'm going to go over our current results return materials and process, compare our current results return process to the process we used for our digital report back, briefly discuss some of the results from the evaluation, which you'll hear in the next presentation, and then some takeaways and next steps.

[SLIDE CHANGE]

KIERA MELTON: So I'll start with an overview.

[SLIDE CHANGE]

KIERA MELTON: So our founding legislation requires that results be made available to participants. Additionally, the legislation specifically calls out the need for information to be linguistically and culturally appropriate. The Program has found that over 90 percent of participants in our studies ask to receive their results. Our goal is to commun -- is the communication of complicated scientific information to an audience with a wide range of literacy and scientific literacy.

Providing results to participants can be an opportunity to build scientific literacy and understanding of the environmental -- of environmental exposures. Biomonitoring California has ongoing discussions on best practices for results return materials, resources, and platforms with other state biomonitoring programs, as part of the National Biomonitoring Network.

In 2024, Biomonitoring California staff helped lead a discussion on our result -- on results communication at the National Biomonitoring conference.

[SLIDE CHANGE]

KIERA MELTON: Our results return materials usually include a cover letter and a packet that includes background information about the study, instructions on how to read their results, their -- a results table or tables with comparison values, and chemical fact sheets

and other resources. We provide materials in the participant's preferred languages. And all materials are reviewed by the Institutional Review Board.

The Program has done multiple rounds of results return evaluations and testing of materials, asking for participant -- asking for feedback on how we can improve them. The feedback we have received in the past has informed how we currently return results to participants.

[SLIDE CHANGE]

KIERA MELTON: This slide goes into a lot of detail, but I'm going to just include some of the main highlights. So prior to receiving data, we began work on updating materials, including the cover letter, results packet, and translated materials for IRB review. Once the data is reported to us, we review the data and create standardized data sets, as well as calculate or identify comparison values. These data sets are exported and then added into the participant's result packets.

Finalized packets in the participant's preferred language are printed and delivered to participants. We do mostly over mail, but we do some email results. And then quality checks are built into every step of the process. We have really worked to create protocols that -- for this process, so that we don't miss any steps, and so that our materials are fairly uniform study to study. We have also

tried to steam -- streamline this process as much as possible, but it does take a lot of staff time.

[SLIDE CHANGE]

KIERA MELTON: So to date, we have generally provided printed reports, which come with some challenges. Most of the focus will be on our process, but our priority is always the impacts on participant experience. So for staff, the layout and design of materials. So staff spend a lot of time creating and formatting materials, processing data, and prepping, printing, and packing materials. If issues arise throughout the process during quality checks, staff time is spent on recreating and formatting the packet materials and performing additional quality checks. Once the packets are merged and PDFs are generated, it can take a lot of staff time to make corrections and for final checks to be completed before printing.

For management and logistic of the confidential results return, for each round of results return, staff spend a lot of time managing participant information. Staff work to confirm and update addresses before mailing out packets. This is particularly an issue when we have results that are sent out over many years and when we have a large number of participants. As we are planning for our next surveillance project, we are thinking about ways

we can make this more efficient.

On the participant end, the length of the packet can be challenging. Depending on the study, the results materials may range from a few pages to 50. We have received feedback that our packets can be long and have too many words. Additionally, when the packets get long, it adds extra review time and quality checks on the staff end. Our results are presented mostly as tables. We are limited in our ability to add graphs and other graphics to our packets. Our current packets do not include any graphs, which is something that has been requested from participants in past evaluations.

Additionally, we have limited space to add images to make our packets more engaging, since they're already really long. As we think about our future surveillance project, we are working to find ways to improve our efficiency when distributing results to hundreds of participants. Over the last year, we've been piloting a digital results return platform with the hopes of moving to a digital platform for our future studies to address some of the challenges we have with our current process.

[SLIDE CHANGE]

KIERA MELTON: So we have been testing a digital platform created by Silent Spring Institute called Digital Exposure Report Back Interface, or DERBI for short. DERBI

is an interactive web-based platform that takes complex chemical exposure data and presents it in a way that the average person can understand. Each report is personalized to the participants and includes information that is present in our current materials.

DERBI allows participants to have a more interactive experience, when reviewing the results. It presents results graphically in addition to tables to make the results more engaging and includes features that help participants interpret what they're seeing in their graphs. And it can be viewed on a computer, tablet, or smartphone.

Silent Spring Institute has done extensive testing and evaluation of DERBI to support the user experience in understanding the results. They continue to make improvements to the DERBI platform to improve user experience and help participants understand their results. Recently, they've added a graph reading tutorial that walks participants through how to read the graphs in DERBI.

Additionally, they provide tools for researchers to understand how participants interact with the platform, so we can see what pages they access, when they've logged in, if they've downloaded their PDF reports. Silent Spring also provides technical support and assistance to

study staff working on the platform, and have been very helpful in addressing any questions or issues we have. To date, more than 25 studies across the country have used or are in the process of using DERBI to create personalized report-backs.

[SLIDE CHANGE]

KIERA MELTON: Now, I'm going to discuss how our current process compares to the process we used for DERBI.

[SLIDE CHANGE]

KIERA MELTON: So first, I'm going to talk about our data processing. Overall, the initial steps of our data processing and updating of materials are the same between our current process and the process we use for DERBI.

Additionally, some of the steps in our data processing would be removed, which will decrease staff time for data analysts, such as updating of some of the SAS code that's specifically for printed packets, updating of the summary statistics, and other comparison values in the results templates, and merging of data to results templates and creation of final PDFs for printing.

But for DERBI, we do have to create an additional data set file that will be uploaded with the specific formatting required for DERBI.

[SLIDE CHANGE]

KIERA MELTON: Now, I'm going to talk through our material development. So our develop -- the process for developing materials, such as our FAQ documents, study description, how to read your table results, is similar to our current process and takes about the same amount of time.

DERBI does have a learning curve, but it can take some time for initial -- and can take some time for initial setup. But once staff are familiar with the system, it's pretty easy to navigate and use. DERBI has template pages and fields, where we can upload the content that we use in our current paper packets.

One of the main differences or improvements is that DERBI allows for quicker editing and addition of materials. Once the data and content are uploaded in English, Silent Spring can easily duplicate the system for translation into other languages.

[SLIDE CHANGE]

KIERA MELTON: Now, I'm going to talk about how results are delivered in the platform and how we send result -- send the participants the access codes. So in DERBI, results are presented graphically and in a table to make the information easier to interpret. The system has pop-up messages that appear when participants hover over different parts of the graph, which can help them

interpret what they're seeing. DERBI allows participants to click on different parts of the report and dive deeper into their results.

We are also able to make information easier to find by linking to different pages, which is impossible in our printed packets. With our current packets, participants have to leaf through the pages to find what they're looking for.

As mentioned in the last slide, DERBI allows for quick addition of materials, and that includes updated results. This means that we may be able to deliver results in rounds, which can be quicker for participants to access them. Quicker delivery is something that is especially important, as we think about our results return for surveillance when we will be returning results to hundreds of participants. And then elimination of some of the steps in the process can reduce staff time. Staff send access codes via email or text, eliminating address checks, and the digital system reduces staff labor for preparing printed materials for mailing.

DERBI can create PDF packets for long-term storage, mailing to participants who are unable to access digital materials, and for participants to download for their own personal records. This allows us to still have packets available for mailing that are consistent with the

information on the platform.

[SLIDE CHANGE]

KIERA MELTON: As I mentioned earlier, Silent Spring Institute has done extensive testing and evaluation of DERBI. Now, I'm going to discuss a small portion of our evaluation feedback we've received from the focus groups conducted by University of California, Merced, comparing our paper packets to the DERBI platform.

The next presentation will provide more details on the results return evaluation of the paper packets from a Biomonitoring California study and comparing -- comparison to DERBI.

[SLIDE CHANGE]

KIERA MELTON: Overall, the participants reported that DERBI was more user-friendly, and they were enthusiastic about the visual design and interactive elements in the DERBI platform. Some participants did report challenges accessing and navigating the platform, and using smartphones to view DERBI.

Additionally, some participants struggled using the interactive hover option on the graph, which trigger pop-up messages that help participants with additional context. And then one suggestion from participants was to include additional navigation aids throughout the platform. Again, you'll hear more about this in the next

presentation.

[SLIDE CHANGE]

KIERA MELTON: Now, I'm going to move on to our takeaways and next steps.

[SLIDE CHANGE]

KIERA MELTON: We have a few takeaways from our experience using DERBI. The platform does take some experience and there is a learning curve. For the staff end, once staff are comfortable with the system, uploading, editing, and adding information is quick and edits are instantly applied. DERBI can reduce staff time for parts of the results return process. The extra staff time can be used to work on additional programmatic work.

On the participant end, from the evaluation, we learned that participants have enthusiasm for the visual design and the interactive potentials. This is similar to feedback we have received from previous evaluations of our materials. Additional visuals and interactive elements are consistently something that participants want to see in our results return materials.

DERBI also has the potential to allow participants to access their results quicker than our current paper packets. Instead of one packet with all the results, we can add results in rounds, allowing participants to have access to some results quicker. This

could be helpful when we're thinking about distributing results to participants in our future surveillance project.

We can also create and download PDFs that can be downloaded by their program for record keeping and for mailing to participants, if needed. Additionally, participants can download PDFs for their own records or to bring to their partic -- or to their physicians.

[SLIDE CHANGE]

KIERA MELTON: For our next steps. Our next steps include continuing to assess the feasibility of long-term use of DERBI, gain more experience while using the DERBI platform, work with Silent Spring Institute to customize the DERBI platform for Biomonitoring California results. And then no matter the method of or platform we use for results return, we will use information from the evaluation to consider how to best communicate what the results mean to participants, and use participant suggestions to improve results return materials and delivery methods.

[SLIDE CHANGE]

KIERA MELTON: I would like to thank the Biomonitoring California staff for all of their work on results return, the Silent Spring Institute staff for their support while we've piloted DERBI, UC Merced

research team, and the Central California Asthma Collaborative staff for conducting the results return evaluation, BiomSPHERE focus group participants for their feedback, and Mario from Sequoia Foundation for helping us think about long-term use of a digital results return platform.

[SLIDE CHANGE]

KIERA MELTON: Questions?

(Applause).

CHAIR MCKONE: Thank you very much. We're going to just take five minutes at this point for just some clarifying questions as needed. And then there will be time later after the second talk to go into depth on both presentations.

We'll begin with the Panel members.

PANEL MEMBER FIEHN: Thank you. I -- we all appreciate and understand the challenges you are facing with all the printed materials, and the desire to go online, and interact better, and have more abilities.

Now, when I look at that, I thought about people who didn't have a high school degree or -- at least not a university degree. And I looked at it and I zoomed in with my eyes. And I can understand it, but I wonder is it really accessible for people with lower education?

KIERA MELTON: That's something as a Program that

we're still working on figuring out ways to communicate our results to participants in a way that is easy for them to understand. We're also thinking about different ways we can work with groups to answer questions and help them understand what the results mean. So that's something we like are really focused on as we work on future projects.

CHAIR MCKONE: And Jenny.

STEPHANIE JARMUL: Really quick. Stephanie Jarmul. Just to follow up on that. In the next presentation, Nancy will also be talking about different experiences by different groups with different education levels, et cetera, because that is an important thing to consider. Thank you.

PANEL MEMBER QUINTANA: Thank you for that. Can you just clarify a little bit about the security of the participants and the data, because it is confidential human subjects data. Is it -- it's a web platform. They don't download the app, right? It's on the web?

KIERA MELTON: Yeah, it's --

PANEL MEMBER QUINTANA: And then do they have like a link? And then how do we know the platform is keeping their data safe, I guess, or how do -- could you -- could you elaborate on that? Thank you.

KIERA MELTON: Yes. On the participants -- so there's no participant information in DERBI. It's only

their ID number and their results. We store the link for the ID number to the participant's information on our internal surveys, so -- or servers. So DERBI has no access to any participant identification information. So that breaks the link there. And then when we send emails, we send them through secure email where they have to log in to a portal and get the information that way. So that's how we send their access codes currently.

PANEL MEMBER QUINT: So DERBI doesn't keep -- or has -- presumably they can see the IP address, or things like that, or -- I'm just curious. I'm thinking of if we tried to use this for a study what our IRB would ask us. And so --

KIERA MELTON: Yes. I don't know about the IP tracking. I don't know if Katie from Silent Spring is online.

KATIE BORONOW: Hi. Thank you for your presentation. DERBI does not store IP addresses.

STEPHANIE JARMUL: And that was Katie Boronow from Silent Spring.

CHAIR MCKONE: Okay. Other clarifying questions from beyond the Panel, audience, online audience.

STEPHANIE JARMUL: José has his hand raised.

PANEL MEMBER SUÁREZ: Yeah, hi.

CHAIR MCKONE: Oh, sorry.

PANEL MEMBER SUÁREZ: Is DERBI HIPAA compliant is one of them? And the other one, what are the costs associated typically? How does that work?

KIERA MELTON: As far as -- the cost will have to come from the Silent Spring end. And as far as I'm aware, yes, DERBI is HIPAA compliant and we have submitted the DERBI information through IRB and got it approved to use in the study we're piloting it with.

CHAIR MCKONE: Further questions?

Well, then let's -- so we'll wrap up just the first talk. Again, there will be more time for in-depth discussion.

But next, we're going to move on to our second speaker. We'll be hearing from Nancy Burke. Nancy is a Professor of Public Health and Chair of the Public Health Department at UC Merced. She is a medical anthropologist and community-engaged researcher focusing on rural health and health disparities. She will present findings from the evaluation of exposure results, report back to participants in the BiomSPHERE study.

(Slide presentation).

DR. NANCY BURKE: Great. Thank you so much.

First, I want to acknowledge our partners, California -- the Central California Asthma Collaborative and my amazing team with a special shout-out to John

Christman, the graduate student who worked on this study, and we have no disclosures to report.

[SLIDE CHANGE]

DR. NANCY BURKE: So, I'm going to be covering a short introduction, background, the methods that we followed, talk a little bit about results, and then I'll go into some specific results related to DERBI, because -- did not, and then our conclusions and recommendations.

[SLIDE CHANGE]

DR. NANCY BURKE: So we were given a task of evaluating the biomonitoring results from -- the biomonitoring results materials and processes from the perspective of BiomSPHERE participants. So we were really focused on understanding what this meant to them, what -- getting this information what kind of impact it had in their lives. And we were also asked to provide some recommendations to improve future report back processes. And the last time the results return process was evaluated was in 2017.

[SLIDE CHANGE]

DR. NANCY BURKE: So we just had a wonderful description of how these results are developed and the kind of behind-the-scenes processes that happen in this -- for this particular study, the BiomSPHERE study, the results were returned through standard paper mail or

email, depending on the request of the participant. And if people requested email, they received two emails, one was a password-protected PDF and the second was the password. And each report that they received included exposure results for themselves and their child.

[SLIDE CHANGE]

DR. NANCY BURKE: So this is just a little bit of a timeline to give you a sense of what we were working with. So importantly, the results were returned to participants as they became available. So this meant that participants received three reports. So in the spring -- from the spring to fall of 2023, the BiomSPHERE study engaged in data collection. In the fall through the summer of 2025, they returned the study results. So the first report that participants received in fall 2024 was the report on biomarkers of response. In the spring of 2025, they received the PAHs and nicotine levels.

Our evaluation focused on these two reports, because the third report came out as available, which was after we had already engaged in a number of our evaluation processes. And then in the spring of 2026, as Nerissa described, there was a community meeting to discuss study results.

[SLIDE CHANGE]

DR. NANCY BURKE: So the BiomSPHERE study that we

were engaged with included 64 parent/child pairs from Fresno and Stockton, California. And this is just some description of the overall sample that received the results. So about 50 -- just over 50 percent spoke English and just under 50 percent Spanish. The sample was predominantly Latino. Ninety-five percent were parents and five percent were grandparents. The majority -- the major majority were female. The mean age was 42 and 37 percent had not graduated from high school. And a combined majority had either some college or an associate's degree or were college graduates. And the majority of families, this becomes important, rented their homes.

[SLIDE CHANGE]

[SLIDE CHANGE]

DR. NANCY BURKE: Okay. So we worked with CCAC and OEHHA to ensure that we did -- conducted a really comprehensive evaluation. So we engaged a mixed methods approach. We conducted surveys over the phone. We conducted in-depth conversational interviews in people's homes. And the goal there was to get people to kind of refer to things in their homes or their surroundings during the interview. And then we conducted focus groups.

The focus groups were kind of a two-part. The first half was an in-depth discussion of issues that

people wanted to talk about related to receiving their results and any challenges. And the second half was a -- an evaluation of the DERBI process.

So in the following, I'm going to be drawing on surveys, in-depth interviews, and the first half of the focus group. And then I'll turn to the DERBI-specific findings.

So all BiomSPHERE participants were invited to take part in their preferred language. We had members of our research team at UC Merced, as well as CCAC included bilingual staff. We had 46 surveys completed, 17 interviews, and three focus groups.

[SLIDE CHANGE]

[SLIDE CHANGE]

DR. NANCY BURKE: So for results of the 64 BiomSHPERE adults, 46 agreed to participate in our survey, 25 of those survey respondents participated in in-depth interviews, and 17 respondents participated in focus groups. This is important, because we learned that each of these touchpoints was, in a sense, a little bit of an intervention with the participants. And I'll talk a little bit more about that as I continue.

[SLIDE CHANGE]

DR. NANCY BURKE: The good news is that a hundred percent of people answering our survey appreciated

receiving their results, and 98 percent felt respected by the team and the results return process. I think that's what we all want. Sixty-seven percent, at that time, disclosed that they preferred paper mail and over 80 percent told us that they didn't really fully read either report.

And when asked about that, they talked about color-coded visualizations that could help them understand a little bit better to interpret some of the complex data. So I have a quote here with one participant saying, "I wish you could have had maybe like a scale, like green, yellow, red. I just don't know what four thousand naphthalene means. So give me green if it's okay, give me red if it's really bad."

[SLIDE CHANGE]

DR. NANCY BURKE: In terms of comprehension, this is probably not surprising, 52 percent did not understand Report 1 and 50 percent reported that they didn't understand Report 2. And this became more challenging when working with our Spanish-speaking participants. Sixty-six percent didn't understand the report versus 32 percent of English speakers. And that's for Report 2. It was a little bit lower for Report 1. It was 55 percent of Spanish speakers didn't understand the report.

We also discussed this with folks in the

interviews and in focus groups. And in our focus groups, some of the participants realized when they were sort of talking with other people, because the idea of the focus group is to have a collective experience, that they hadn't actually understood what they thought they had understood. So it wasn't until they had that kind of interface with others.

And they also shared that they weren't aware that scientists also had a limited understanding of the health implications of some of the reported levels, even though this is stated in the report. And there's a quote here that says, "I want to see the numbers but I want to see them in a way that someone who is not a scientist can understand it. Like what is 4,000 based out of what, 100,000? What does that mean? So I still don't know if that's good or bad."

[SLIDE CHANGE]

DR. NANCY BURKE: There were health literacy barriers that we identified. Technical complexity and dense presentation were challenging for folks to understand. Some describe the reports as inaccessible, that they weren't written for the general public. They reported confusion regarding measurement units. And as I mentioned, very few people actually read the whole report. And when asked what they actually did, they talked about

skimming and looking for what they thought was really the most important information.

And so, as these quotes illustrate, one of our participants said, "It felt like a foreign language... written for scientists." And another used the skimming strategy to focus on graphs. He said, "I just read graphs... I figured, oh, if I just read the table, it's going to summarize whatever this whole thing is."

[SLIDE CHANGE]

DR. NANCY BURKE: So we also asked people about how they understood the comparisons. As was mentioned earlier, we provide often comparative data for participants. So in this report, their own, as the parent and their child's results were compared to the other participants in the BiomSPHERE study, and then if appropriate, to national level data through NHANES.

And when asked how useful the comparisons were, over 90 percent said that they were helpful. And when asked if their levels were higher or lower than the reference, about 30 percent didn't know. So a large proportion did understand that, but we still have work to do. About 30 percent didn't understand it.

And as this quote illustrates, "...the only thing I really looked at was if something was higher than someone else's. That's where I was concerned... I just

wanted to know if it could hurt us or like what?"

[SLIDE CHANGE]

DR. NANCY BURKE: And as I mentioned, we were really interested in how receiving these results were impacting people's daily lives. So we asked about levels of worry, concern, things like that. And so we had 56 percent reported that they felt worried after they received their results, 78 percent reported an increased concern for their child's health, and 76 percent reported concern that their own health was affected.

[SLIDE CHANGE]

DR. NANCY BURKE: Participants also expressed concern with results that were difficult to understand or sources that couldn't be identified. And this became very clear in the discussion of findings around nicotine. Several people were upset that they -- there was a finding of nicotine in their child's results, but they lived in a nonsmoking home. So they felt like there was no -- they had no control over how to protect their child.

And as this quote illustrates, "And you wouldn't even think how do you protect your kid when you're like, well, we're not smoking. Like, how do you protect your kid?"

[SLIDE CHANGE]

DR. NANCY BURKE: We also found that there was a

bit of a gap in help-seeking. So we weren't surprised by some of the health literacy challenges, but what was a little bit surprising was that people were reluctant to reach out for help. So of the 24 participants who reported that they didn't understand Report 1, 67 percent didn't seek additional information. And of the 23 participants who reported that they didn't understand Report 2, 78 percent didn't seek additional information.

And our discussions with participants in interviews and focus groups revealed that there was an expectation of consultation. So as I mentioned, each of these touchpoints was in a sense, a little bit of an intervention. So, for example, one participant in the context of responding to the survey asked the surveyor some questions about chemical cleaners that she had in her home. In the interview, subsequently, she discussed how after that conversation, she reduced the use of those cleaners in her home, but she wasn't willing to do it until she had checked or had this conversation with the interviewer.

I include Rebecca's picture here, because it's a lovely picture and she's a lovely person. And we really urged our CCAC colleagues, who were conducting the surveys and the interviews, to suggest to people to call and to ask Rebecca for information if they had questions. And

they talked about how personable she was, and how she's bilingual, and all of these things to try to get that connection, but people were just reluctant to call. They still perceived calling the institution as kind of calling a scientist. And they wanted someone more like the people who were interviewing them to be the person they would speak with.

[SLIDE CHANGE]

DR. NANCY BURKE: So we also assessed self-efficacy and motivation using a five point self-efficacy scale. And here you can see the scores are pretty high. There was a high confidence in talking to friends or relatives about their results, pretty high motivation to use the report to make healthier life choices. Pretty high confidence in taking steps to reduce exposure within the household, and confidence in understanding personal results. And some pretty high motivation, over 3.3, to work with others to reduce community-wide exposure.

[SLIDE CHANGE]

DR. NANCY BURKE: In terms of readiness for action, 33 percent reported immediate home changes, such as adding or removing items since receiving their results. And several others in interviews talked about reducing candle burning, use of incense, things like that, even

prior to receiving their results, just because they were part of the study.

Eighty percent expressed an intention to look for more information. But as we saw, there was a low uptake on that. And 57 percent expressed a desire to join an environmental organization. And the primary barrier to action that we found across our forms of data collection was a delay in decision-making related to this expectation of consultation. People felt like they were waiting for someone to reach out to explain to them the results before committing to a specific action.

[SLIDE CHANGE]

DR. NANCY BURKE: An overarching challenge that the participants in our study faced was the environmental justice context of the San Joaquin Valley. People reported feeling somewhat powerless and limited in the changes that they could make, especially when living in multi-family settings. So, for example, the nicotine finding, people living in multi-unit housing felt that they didn't have much control over the quality of the air that their children were breathing. And then also feeling discouraged by the threat of wildfires, poor air quality, and nicotine exposure again.

A hundred percent agreed when asked that companies should limit pollutants, but 65 percent

disagreed that their government protects them. So there was a generalized kind of desire for systemic protection, but recognition that it's not happening.

[SLIDE CHANGE]

DR. NANCY BURKE: Okay. So now, I'm going to turn specifically to the DERBI focus groups. So our -- we had from these form -- these -- the qualitative interviews and the surveys, a general idea of how people felt about the receipt of their results, and some of the challenges that they had experienced. And so in our focus groups, we wanted to present them with DERBI as an option to see how they felt about that.

And one of the -- one of our goals was to get a sense if there was a strong preference, either for the written, you know, sort of paper report that they could hold in their hand or this digital interface.

[SLIDE CHANGE]

DR. NANCY BURKE: So we recruited participants to these focus groups, two of them were conducted in Spanish, one in English. The first half of the focus group, as I mentioned, was a discussion. And then we shifted to the DERBI portion. The DERBI portion was presented using demonstration data, so no one was accessing their own personal results. And participants were provided with a QR code to log in using their personal devices. So if

they brought a smartphone, they could use that if they had a tablet or a computer. And if they didn't have one, then the study provided tablets that they could use.

And the facilitators distributed a short worksheet. It had 10 questions that assess the ability of the participants to locate and understand information and then their perceptions of ease or difficulty in comprehension. And the participants were given about 15 minutes to explore and answer the worksheet questions.

And facilitators then led a semi-structured discussion exploring reactions to the design, layout, ease of navigation, and effectiveness of the built-in tools, like glossaries and summaries.

[SLIDE CHANGE]

DR. NANCY BURKE: So as was mentioned in the prior presentation, participants appreciated the colors and the graphics as improvements over the paper results. And at the same time, the digital interface introduced new barriers. They -- several participants were stalled on the landing page. They missed the additional tabs or didn't understand that you could scroll. And this was really exacerbated on the smartphones. Several people were kind of like couldn't see the smartphone it was so small.

And participants failed to realize that for

example with the dot plot graphics that they were hyperlinks. That if you have hovered, there was an interactive component. And Spanish -- we did not set this up to do any kind of comparison across language groups, but we did notice and the facilitators commented on the fact that Spanish-speaking participants experienced greater challenges navigating the interface and accessing information.

[SLIDE CHANGE]

DR. NANCY BURKE: So the built-in educational tools, which are a really great component of DERBI actually in this -- in our evaluation did not bridge the health literacy gap, because they ended up replacing scientific language with more scientific language. So as this quote says, "3-HPMA is a metabolite of acrolein. Okay. So what's acrolein?"

And that's something just, you know, that I think we can all think about. And learning a new interactive interface, introduced a technological hurdle that compounded existing health literacy barriers. So you're already struggling with this feels like scientific language and now you've got to figure out how to navigate this website. So only one participant reported feeling confident on navigating this site independently.

[SLIDE CHANGE]

DR. NANCY BURKE: We also found in the focus group that it was a supportive environment. So people were talking and sharing about their challenges and they did note that at -- if they were doing this at home, they would just stop. That, you know, the focus group kind of kept them going to keep exploring, but if they were trying to do it at home, it would just be challenging. So as one person said, "For me, on paper, yes, but I'm not as motivated as I am here. At home, I just got lazy... I said, well, since I don't understand anything, I'll just stop," which I think we can all identify with.

[SLIDE CHANGE]

DR. NANCY BURKE: So some of the positives are that there is better overall user-friendliness in some ways. There was a positive reaction. They like the color and graphics. There's some positives about the glossary and the FAQ tools, if people could find them.

[SLIDE CHANGE]

DR. NANCY BURKE: And there were also challenges with navigating the pages, accessing all the information, realizing that there was more information to access. The smartphone interface was a definite challenge, but that's clearly fixable. The recognition of interactive elements was not there and some of the challenges with the literacy level of the glossary. So people who aren't used to using

computers that much found it really challenging. And the access code delivery was a challenge.

And I forgot to mention this earlier, that was something also related to the paper delivery as well. Because people received three reports and at first they received the PDF and then the password, that meant they received three different passwords. And so people lost their passwords and got confused. And there was also some confusion about the difference between the reports.

[SLIDE CHANGE]

DR. NANCY BURKE: So in terms of whether people had a -- expressed a strong preference for DERBI versus paper, in general, people said they really liked having the paper, but they really wanted a hybrid approach. They wanted both. They wanted the best of both worlds. So they wanted the paper to hold on to and to know where it was, but then they wanted a QR code to be able to quickly access specific information from the DERBI report as necessary. So there was -- it was mixed in that regard.

[SLIDE CHANGE]

DR. NANCY BURKE: So, in general, participants said they felt respected receiving their BiomSPHERE results and they were interested in exploring them. They were challenged by the complexity of the information that there were challenges related to comprehension as well as

action. And participants expected some form of additional follow-up to explain the results they received. And they were reluctant to proactively seek answers. And so they, in a sense, received that follow-up through the course of this evaluation. But in a normal results return, they wouldn't have this form of follow-up.

So they wanted to learn about their exposures and the ways they can reduce those exposures, even when the were faced with some limited structural conditions, such as living in a region this is beset by wildfire smoke and poor air quality.

[SLIDE CHANGE]

DR. NANCY BURKE: So some of our recommendations are to think about a scheduled opt-out consultation model, rather than a passive opt-in or call us system, because people were unwilling to make that call, think about how we're defining units of measurement to avoid confusion, prioritize visual simplicity with color coded graphics instead of dense tables. We did have people describe tables as sort of sticks and letters. So there was -- there was some confusion around the tables. And to continue to provide individual level action recommendations that are within participant's control to change. So that's really a reference to the motivation that people had to make these changes. They were making

changes prior to returning -- receiving their results. And they actually asked for more information -- more specific information, if possible, about brands that were recommended of air purifiers or things like that. So that was definitely appreciated.

Participants also requested the possibility of a voice or audio summary option and provide -- and the -- we suggest providing facilitated support through webinars, tutorial videos, or guidance for motivational scaffolding of understanding and accessing their results. And then using a single intuitive password for all participant files, because that was just a practical challenge that people experienced.

[SLIDE CHANGE]

DR. NANCY BURKE: And that's it. Thank you.

(Applause)

CHAIR MCKONE: Well, thank you, Nancy. We have now five minutes for some questions of clarification, first from the Panel and then from the broader audience. After that, then we'll have time for a much deeper dive into some questions that the staff wants us to consider specifically, but are there -- yeah.

PANEL MEMBER FIEHN: Well, there's obviously a field of consumer perception and consumer interaction, and the industries are good at that. You know, are there

lessons that we should have learned already how to do it right?

(Laughter).

PANEL MEMBER FIEHN: It's a broad question.

DR. NANCY BURKE: I'm not sure I understand.

PANEL MEMBER FIEHN: The -- when I get my health reports from my health provider, it is not as complicated as that.

DR. NANCY BURKE: Right.

PANEL MEMBER FIEHN: So these people know how to report my cholesterol to me --

DR. NANCY BURKE: Um-hmm.

PANEL MEMBER FIEHN: -- and my HDL and you name it, right, my blood pressure and stuff?

So there are people who know how to talk to people.

DR. NANCY BURKE: Um-hmm.

PANEL MEMBER FIEHN: Why does DERBI not know, let's put it this way, or we not know? I mean, why are we giving them little asterisks, bubbles here and there, the triangles, and you name it.

DR. NANCY BURKE: Um-hmm. Yeah. I mean, I think it's -- I think engaging experts in health communication is a really great idea in thinking creatively about how to communicate complex information through -- I mean, you

know, during COVID, we did graphic novels for people. You know, we were using sort of out-of-the-box ideas, and I think maybe engaging that a little bit could be helpful.

Oh, sorry. Sorry.

PANEL MEMBER QUINTANA: Hi. Jenny Quintana, SDSU.

I don't think that's a fair question to be fair, because your health provider has a clinical meaning for those data. And the big problem with this data is there isn't a clinical meaning. If you have a blood lead over a certain thing, you should go do this, you know. So it's -- I think it is a much more difficult problem. I'm part of the Thirdhand Smoke Consortium. The thirdhand smoke is the cigarette smoke that gets into house dust, and has nicotine and nasty carcinogens and metals in there, and maybe some of the source of their nicotine. We had a health communication person trying to work with us to communicate our thirdhand smoke results to the families, but it's -- it is more challenging than when you have a specific clinical action, but what I was kind of wondering is there's some things that we all know will help children's health. So reducing house dust, you know, is one, cleaning the air is another.

So, I mean, just wondering if even before you get the results back, here's your local advocacy group that

loves volunteers, here's your -- here's your link to the CARB report on air filtration or something like that, you know. But one thing I did wonder about is if you'd thought about talking to primary care physicians, because they might be the ones getting, you know, having them evaluate these results, because they might -- somebody might bring it in and say what do I do? I'm just kind of curious if you -- if you brought them in.

DR. NANCY BURKE: We did not in this study, but I think that's an excellent idea, yeah. And we did ask people if -- who they shared the results with, because we were wondering if they did that -- if they did bring them in and, we didn't really hear anyone talk about bringing it into their primary care.

PANEL MEMBER DURRANI: I would second that. Timur Durrani from UCSF. I sit on both sides of this, because I have people that will bring these into me. Particularly, I have primary care folks who will refer them, because they don't know what these are and so they will bring them to UCSF where we have this overlap with understanding these kind of things. And so I think that would be great and there are some resources that we refer people to and try and explain the difference between what does a blood lead level mean, and what do you have to do clinically and what does somebody who's under surveillance

mean or let's say a work or otherwise maybe a public health thing?

So that would be great and we can show you some of the resources we use to provide to some of our -- the education stuff that we use we put out on the web and it's tracked. And we find that the people who are most receptive in the health care world are not the doctors, but the nurses. And so we have a much bigger nurse education uptake than we do from providers. So we'll make sure of that.

DR. NANCY BURKE: Great.

STEPHANIE JARMUL: This is Stephanie Jarmul. I just wanted to follow up a little bit too on what Jenny was saying is how we don't actually have the same level of information that we would want for all these chemicals unfortunately when we return them to participants. We do have them for select chemicals. We have our Levels of Concern, so when a participant is elevated, we have much more thorough conversations with them and additional surveys, if they have high levels of arsenic, mercury, lead for example. But unfortunately, those levels don't exist for all chemicals. It kind of goes back to Tyler's presentation too about the biomonitoring equivalents and the health guidance-based values.

But yeah, that is unfortunately a limitation of

biomonitoring data in general that we are trying to work with and constantly trying to improve our materials, which is why we did this study with Nancy. And we're learning a lot from it and we will continue to do so.

CHAIR MCKONE: Other brief questions of clarification, Carl or José?

From the audience here?

ALEX OKRUT: Hi. My name is Alex Okrut. I'm a Research Scientist at CDPH. You mentioned The word confusion quite a lot. People are confused about the results and about navigating the results. How much of that was maybe stress or anxiety, something is wrong with me. There's a chemical that I didn't know about. Have you monitoring that and were you able to address it, if they were stressed out or anxious about the results?

DR. NANCY BURKE: No. These were -- these were surveys, conversational interviews, and focus groups. So we weren't assessing people's anxiety or stress, but we did get a sense of the level of comfort and discomfort, and that came through in their narratives. So there was -- you know, there was definitely frustration communicated in terms of people's ability to really understand, because they felt like they should be able to understand and weren't able to, so -- and when asked what would be helpful, the -- that's why I kept mentioning this

expectation of consultation, because what we heard over and over again was that they wanted someone to come and explain it.

And when we -- you know, when our CCAC colleagues, who were conducting the interviews, talked to them about reaching out to OEHHA, for -- to Biomonitoring California for information, the response was very clear, like I don't need a scientist. I want somebody who -- maybe somebody who has just a little bit -- just enough education, kind of like you, to explain it to me. And so that was -- you know, it was very interesting. It was kind of the description of wanting almost like a lay health worker or promotore to be that kind of bridge between the information and understanding.

And I think that's not inconsistent with what we know about in public health around relational culture and the importance of this kind of, you know, the connections that we have with people.

CHAIR MCKONE: I think -- yeah.

DR. KATHLEEN ATTFIELD: Thank you for this presentation. Some really interesting takeaways to bring back to our work. Kathleen Attfield at the California Department of Public Health.

Your comment early on about how the participants didn't realize that there was some limited understanding

on the scientist's part as well, I thought was really interesting to hear, because it sort of really highlights the tension in what we're having to do, because our mandate -- our legislative mandate makes us have to return results back to participants in a situation where the science isn't clear yet exactly.

And, you know, we had -- it's clear for some than others and sort of how nuanced can you make, you know, you're delivery of the information. It is quite a tension that we have to go through. But, yeah, I wonder how we can enhance our reporting to sort of help people understand that, you know, you are on the edge of the scientific understanding, and it's not the same as a clinical report, where we do have a lot more understanding about what those values are being measured and what they might mean.

DR. NANCY BURKE: Great. I mean I think that's very much a part of the ethical conversation around results return, right, it's whether, you know, should you take a clinical frame where you only return results that have a clinical, you know, implication? Well, no, we have a mandate to return all results, because people have a right to know. But then how does that affect them and that's what, you know, we were hearing, it did cause worry and concern about their families, you know, and some

people did discuss that while I feel like I don't live in a good place now. So, you know, that's a hard part of it.

CHAIR MCKONE: We have a question right here.

ALEX SHING: Alex Shing from OEHHA. I wanted to sort of follow up on your comment about like sort of these emphasis on community members wanting someone a little closer to the community or like maybe a community health worker. And I wonder if that has been explored at all, whether working with like to whether CCAC already has the institutional capacity or other community organizations? And if not, what would be your like suggestions? Would that be like integrating like specific funding into like grants or even in the research design to have like a section for like health workers to communicate the results?

DR. NANCY BURKE: Yes. I think it would be wonderful if grants included in their budget funds for a lay health worker to be -- have this capacity of being the communication link. Yeah, I think there's a lot of value in that and there's a lot of research that suggests that in other parts of public health. So, I don't -- I imagine it would be very strong here as well.

STEPHANIE JARMUL: Stephanie Jarmul. I just wanted to follow up on that too. That's definitely a challenge that we often face is we are only allowed to

have a very small percentage of our contracts go to our community partner, which is a big shame. We would love to contract even directly with a community partner, but we don't always have that flexibility. However, with a lot of our studies if we were collaborators, we can often pool our funding sources together and have more of an engaged community partner who can actually go out and do a lot of the work for us.

And for FRESSCA, our -- one of our other studies we were able to do that. So when resources allow, that is always an excellent option that we will go for.

CHAIR MCKONE: Can we move -- I think we should move to -- unless -- is there one more hand up.

STEPHANIE JARMUL: Jose has his hand up. José.

PANEL MEMBER SUÁREZ: Oh, José. Okay.

PANEL MEMBER SUÁREZ: Yeah. Hi. First, I'm very happy that Biomonitoring California is spending or doing extra efforts to really improve the dissemination of findings to the participants. I really congratulate you for the work that you've been doing, for the survey and the results that I think are very enlightening as well.

The only parts that I am missing here is where can I actually look at some sample reports that you're giving out to participants. I know that you're using the DERBI platform and it looks like every study can have

reports done a little bit differently. So if you're able to share that with us, that would be phenomenal.

STEPHANIE JARMUL: We can send you an example of our report that we used for BiomSPHERE, José.

DR. NERISSA WU: This is Nerissa Wu --

PANEL MEMBER SUÁREZ: Okay. Thank you.

DR. NERISSA WU: -- also from Biomonitoring California. There are examples of our results return on our web for those of you listening in who also want to take a look at our template. Both for the CARE Study and for ACE Project, we do have templates available online.

STEPHANIE JARMUL: And I guess, sorry -- Stephanie -- one more thing. I will say again we've been meeting with Nancy pretty frequently since the beginning of this project that we've been working on. And luckily, we were able to hear sort of early on some of the initial feedback we were getting from participants and we've already started to incorporate that into our materials. We've been using Canva to put together a lot more beautiful color forward materials, which are not on our web right now, but we could send examples of some of the new materials that we've put together thus far.

CHAIR MCKONE: Right. Well, I'm not going to cut off the discussion, I just want to evolve it toward -- to make sure we have time to do the broader discussion.

So now, we're going to have an open discussion. We'll include questions and comments directed both at Kiera and Nancy's presentations.

We have roughly 30 minutes now to discuss the topics and questions raised in these two talks, which we've already been talking about. But the purpose of this further discussion is to provide input to the Program to help inform planning for future return of participant results.

And we're going to start off this -- now this deeper discussion with some slides, right, some questions that the Program would like us to consider. And there's two slides, right?

So I can probably read through these -- the first of these. "Participants expressed desire for more one-on-one consultations with study staff after receiving their results. Due to resource constraints, this may not always be possible. The Program is considering holding webinars after each batch of results are returned to the participants to walk through the packets and allow participants to attend anonymously and ask questions. What does the Panel think of this option?"

Should we just do one question at time or should I read them and then we can jump around?

STEPHANIE JARMUL: Why don't we read them all and

then they can respond to all of them.

CHAIR MCKONE: I'll read -- I'll read through -- I'll read through all the ones on this slide.

STEPHANIE JARMUL: Okay.

CHAIR MCKONE: Okay. "Participants have asked for more graphical representations of their results rather than only presenting the results in a table. Does the Panel have recommendations on what types of graphs work well for results communication?

Finally, we are considering providing a summary page at the beginning of the packets to highlight key takeaways for each participant. However, we would need to determine which information to include with careful messaging about what participant's levels mean. Does the Panel have recommendations on what information to highlight on a summary page?"

And then there's additional questions. So I'm going to cut us of probably -- unless you want to -- I think it's easier to --

STEPHANIE JARMUL: Read and then --

CHAIR MCKONE: -- do the first set --

STEPHANIE JARMUL: Yeah, that sounds good.

CHAIR McKONE: -- keep them up or do you want me to read the other one?

STEPHANIE JARMUL: That's okay. We can start

with these. Thank you.

CHAIR MCKONE: Hmm?

STEPHANIE JARMUL: We can start with these.

CHAIR MCKONE: All right Let's start with these three and then see what we get. Okay. I've got -- Oliver, you're up.

PANEL MEMBER FIEHN: Yeah. Well, I'm -- if I'm the first. So great questions. It's all about science communication. And as scientists we now must face that the people are afraid of us. And so in a Zoom or webinar, we still talk to scientists, so it's still a scary situation. Also, a situation where you have to have the time, the means, and, you know, overcome the barriers to actually do it.

I -- well, I understand all that. And in addition, we said, well, you know, we have to lower the language barrier or we use simpler words. We need to get -- you know, have people talking to them that are less scary, more people who are like them, and I totally get that. So the question to me would be could there be an AI system for that?

(Laughter).

PANEL MEMBER FIEHN: No, seriously. No, that's not even -- I don't -- the AI systems have been so good these days. They can -- actually can tell them you use

this kind of language. You don't use these complicated words. And for us, it's actually hard to not use the complicated words, which are our everyday language. Just saying.

DR. NERISSA WU: That's a great suggestion to use AI as a tool for us to learn language. For example, if you're writing an email, you can use AI to help you sound a little more friendly or ironically a little more human. But ultimately, we want the human to review it and for us to be able to respond to people and to adapt our responses. And particularly because AI sometimes glosses over some of the subtlety, a lot of the language we're using, one of the difficulties in getting the language just right for biomonitoring is there is a lot of nuance. There's a lot of subtlety which we don't want to lose and it would be a risk with using AI to have that information go straight out to participants without us being able to vet it and make sure it's captured. So, again, great as a tool, but maybe not as our first level of communication.

PANEL MEMBER CUSHING: Some of -- thanks for a really interesting presentations both of you. This is Lara Cushing. One of the -- I guess some of the takeaways that I took from Dr. Burke's presentation, which please correct me if you disagree with me, but one -- like I like -- I can't remember if it was a participant or if

it's a research team that suggested like a tutorial how to read your report video that could accompany the report back. I like that idea. I'm curious how many people would be able to access it, especially the older demographic that's maybe not familiar with QR codes and things like that, but that seems like worth trying. I don't know.

And then the graphs, in my experience, like a bar graph is somewhat comprehensible, but these -- like a box plot, anything try -- attempting to show distributions, like a box plot or even the DERBI -- you know, I love the DERBI graphic, but I'm not the target population. So those little dots I think people struggle with. So I feel like if you have -- and the table that's in your template, those numbers, you know, could just be two bars on a graph. And maybe that's sort of the level of figure it out. I don't know. It could be comprehensible.

And then the other thing I took was like the color coding and that people value knowing whether -- where they are in the distribution, although they would never use the word "distribution", right? Am I higher or lower than everybody else in the study?

So I wonder if -- you know, I probably wouldn't recommend using the color red, because that's going to raise alarm bells no matter what you're trying to

communicate. But if it was, you know, your level is above the median in the study, then you get -- it's bolded in purple. And if it's below, it's bolded in green. And if it's pretty close to it, it's blue, or something, you know, just slight modifications that aren't probably that hard to implement. So I don't know, I'm curious from those who've, you know, been thinking so much more about this and talking with people that are receiving those results, if any of that resonates.

But those are some of the things that came to mind as I was listening. And the opt-out consultation I totally get that, but yeah, it seems like it would be a lot more resources to implement when you're talking about hundreds of people -- trying to call hundreds of people on the phone.

KIERA MELTON: And then -- this is Kiera Melton to follow up. So DERBI, after the evaluation - so this wasn't part of the evaluation - has added a graph reading tutorial that when the participant first logs into DERBI it's the first thing that pops up. They can skip it, but it walks them through their levels. It will show them like if they're higher or lower, and it has options where, if they select an answer -- so it has questions and then they answer the questions. And if they're wrong, it will let them try again. It will give them a hint on what

they're looking for. And then if they continue -- so as they move through, it will show all the different pieces of the graphs, and then at the end, shows them how the hover options work. So that has been added and that wasn't part of the evaluation.

STEPHANIE JARMUL: And Stephanie Jarmul. I'll also follow up a little bit on that. I like your idea of using the bar charts or box plots. We already use them actually in our LOC materials. So perhaps it's something we can carry over to all of our results return materials.

And then just to your comment about potentially a video that we'll walk them through. I think the problem with that though is that's still more of an opt-in. They would have to watch the video themselves. And I think our colleagues in Minnesota, was it, actually developed something like that. And they were finding that nobody is watching it.

So that's why we're thinking, if we invite them to something, perhaps that's more like interactive. Maybe that's a step better, when we can't have these one-on-one consultations with every participant. If that's not possible, this would at least hopefully help improve their understanding.

DR. AALEKHYA REDDAM: Question. This is Aalekhya Reddam from OEHHA. I'm wondering when we compare their

levels to other comparison groups and color code them, we're trying to tell them that they don't need to worry if their levels are below a comparison group or need to worry if they're above a comparison group, which again we just don't have the information about at what level you worry. So I don't know if that's something that your team has thought about, because I understand how helpful comparison groups are, but what is that telling the participant again about their value?

DR. NERISSA WU: I think that's a really good point. This is Nerissa again. One of the things some of our other biomonitoring states are doing is providing a reference range, which is -- and I agree we're all trying to simplify the message, make it as clear as possible. But because it is nuanced difficult information, we really don't want to be misinforming people of the confidence we have in what this means. So, for example, providing a reference range it's often interpreted as this is what's safe or this is what's normal. Whereas that is not really the case. I mean, some of these chemicals there is no normal or no safe level that we're -- that we're confident in. So oh I think there's a little bit of danger in oversimplifying the message as well.

STEPHANIE JARMUL: Sorry one more thing. Stephanie. I can think of a perfect example of that for

our 2-naphthol levels, for example. If we were to say, oh, you're below the average for this study, they might think that that's safe, but their average is really high for a lot of these studies and so that would be, yeah, miscommunicating to the participant. Okay. We've got a couple of comments here.

DR. AHIMSA PORTER SUMCHAI: The protocol for our community biomonitoring program mandates a follow-up, a one-on-one follow-up. And I believe that all of the suggestions that you have made are probably more complex and more expensive than simply scheduling a follow-up appointment for interpretation of results that are not going to be normal, that often involve multiple analytes, analytes that have, you know, additive cumulative impacts. So I really strongly urge you, especially for a cohort as small as 64 people, there's no reason why, with a cohort that small, that you can't schedule a follow-up and talk with people about, you know, the information that you've derived from their data. In fact, I feel that it's morally compelled that you follow up with people directly.

STEPHANIE JARMUL: Thank you.

PANEL MEMBER SUÁREZ: Hi. I have a question. This is José Suárez. Again coming back to the reports. We can't really answer question number two without you sharing us -- with us what the reports look like. I

looked on your website and I cannot find what it is that you said is present there, only some 2012 letters from the FOX Study and 2018 from ACE's 2. So happy to provide feedback, just give us the information that we need so we can take a look at what to respond to.

KIERA MELTON: This is Kiera Melton just to follow-up. DERBI also has examples from other studies on their website. So if you go to the Silent Spring DERBI website, they have examples of different -- the different reports that they have. It's not our exact graphs or information, but the graphs are very similar across the different DERBI reports.

PANEL MEMBER SUÁREZ: Yeah. I'm requesting for this one specifically.

KIERA MELTON: Okay.

KATIE BORONOW: May I speak. This is Katie Boronow at Silent Spring Institute. I also just wanted to comment on our graphs. The strip plots have been extensively usability tested. And what we have found is that most people do understand on their own. And a lot of what they're lacking is confidence in their understanding. Like the strip plots rely on sort of basic visual communication of being higher or lower comparisons. And so the graph reading tutorial, a lot of that is really designed to build people's confidence in their

understanding.

We recently published a paper on that earlier this year. And some of our findings are that 70 percent of those participants were able to read their graphs on their own without tutorial assistance, getting all of the questions right. But the tutorial assistance was most beneficial for people who did not have a bachelor's degree. And it was really successful at closing that gap in the graph reading.

Yeah. Other people have mentioned how these chemicals aren't necessarily amenable to sort of these traffic light style categorization, and I would second that. That said, DERBI can incorporate different styles of graphs. And we have already developed a color block graph that we've used when there are VERY Specific guideline levels. And so we've used that with radon or with the NASEM medical monitoring guidelines for the some of seven PFAS, and that does put your result into this scheme of a specific recommendation, not relative to the study distribution.

DERBI has -- in some instances, people have embedded videos in there to link out to, you know, video instructions about the report. I don't know in those studies how many people watched those videos. And -- but in terms of holding webinars, one thing that other studies

have done that I think has been very successful is actually in-person community meetings, where results have been returned. And that we would definitely -- I think that's a great idea. Thank you.

STEPHANIE JARMUL: Really quick. Stephanie Jarmul. I did want to say that we do hold community meetings after all of these studies and Nancy's work took place before the community meeting was held. And during those community meetings, we make ourselves available. We sort of sit in the back at a table and we invite participants to come and have one-on-ones with us to discuss their results. And during our BiomSPHERE community meeting, we did -- in fact, we were able to talk to a number of participants about their results.

However, a lot of times, those meetings don't take place until much later after they receive their results, which is why we're trying to think of more frequent interaction with participants instead of waiting until the end and to have that opportunity at a community meeting.

CHAIR MCKONE: Okay. One more question, then --

DR. TYLER POLLOCK: I don't know if it's work. Yeah. Okay. There we go. Tyler Pollock, Health Canada.

Yeah, so just quickly mention, one of the things that we're trying to do under the International Human

Biomonitoring Working Group is to recommend specific health-based guidance values for purposes like these, so that agencies and HBM study planners don't have to try and identify ones themselves.

But I think there's -- I've become increasingly convinced that there's a very small window of results that respondents are actually interested in. And it's ones where they have something within their control to change their exposures. So, you know, you could be like well below the reference population, but still at risk of exposure to those chemicals, and we know that, you know, for like cancer risk, from arsenic, benzene, lead exposures.

Conversely, you can be orders of magnitude higher than the reference population and still well below any health based guidance value. But I'm not convinced that Respondent's participants are actually interested in that aspect. I think they're interested when they can do something. So just maybe for the third point, you know, on a summary page, like what can the participant actually do. I don't think people are so much concerned if, you know, they're very high and they're at risk of health impacts from a chemical, if there's nothing they can do if it's just in the water. If it's just in, you know, being sprayed on the forests nearby versus things like, you

know, you should probably throw away your cracked non-stick cookware, or, you know, try and microwave things in glass or ceramic containers as opposed to plastics.

I think that's where people are really interested. So probably a discussion for some behavioral scientists as well, but -- and maybe, Nancy, if you had heard anything to that effect, like in the community discussions would be really interesting to know. Yeah.

CHAIR MCKONE: All right. One more comment, question on this and then we're going to have to make sure we cover the other two questions.

DR. JEFF WAGNER: Jeff Wagner From CDPH.

Another comment about exposure reductions that participants might be interested in. Going back to that question of is my exposure the same as my neighbors, higher than my neighbors, or lower than my neighbors? I kind of feel like that's the one of the best metrics to get at this point, because unless my logic is flawed, if you're higher than your neighbor's in your exposure, that might be -- you -- there might be a way to communicate. Therefore you may have additional sources that you may have a chance to reduce.

And, you know, like at the community, I'll have the same exposure, Then that implies there's not as many choices. But I guess the exception I can think of is if

that means your metabolism is different than your neighbor's. So that's a little bit of a tricky thing, but otherwise, I think it points to choices you can make. So I kind of like that metric.

CHAIR MCKONE: Okay. I think, you know, there's more discussion to carry out. But I do want to make sure we post up the other two questions and don't short change them on getting a response.

Okay. So the next two questions, "The DERBI interface provides some challenges and opportunities for results return process. What does the Panel think of using DERBI or another digital report-back system to return results to participants? Does the Panel have any concerns about the Program using a digital results return system?

Second question, "Results return is one way that we communicate results to participants. We also hold a meeting at the end of the study to present overall study findings to participants and the larger community. What other strategies does the Panel recommend for communicating study results?"

Open to the Panel, first to them.

Jenny.

PANEL MEMBER QUINTANA: Hi. Jenny Quintana from San Diego State University. I think it's great to have a

digital option. I think that some of the challenge is accessing it, and people my age will go away as, you know, participants get younger. And, you know, my students read a study on their phones, which makes me nuts.

(Laughter).

PANEL MEMBER QUINTANA: So I do think it's great to have a digital interface. And perhaps since you can customize the DERBI with some of the things that we presented that we learned from your valuation would be the way to go. And I do think, just because I didn't get to talk during the last three questions, I just want to echo what Lara said about I don't think we should use green, yellow, red, because I do think that it's, you know, a clinical meeting almost to people that we're doing low cost air sensing and the Air Resources Board is saying don't use green, yellow, red, because that's the AQI. And then that confuses that your low cost results are the same as that, you know, so we have to use different colors. And so I just want to echo that in terms of when you do, you know, present the results as graphically to maybe avoid those colors or the orange and, I don't know, something else. So I support it.

PANEL MEMBER DURRANI: I was just going to add to I think the second question. I think we've touched on it, but it sounds like after the results were read back, there

were some community meetings. There was also some meetings before. I'm wondering if having the promotores health people there at the beginning to set the stage and having some handouts for them that can go to providers, if -- because I think there's some thought of consultation, which a promotore can do. But my suspicion is there's also just other things that come up of, oh, by the way, my cholesterol, or some other thing.

And so would having the promotores up front with some, not necessarily results, because they wouldn't have that, but what this study means for health care providers and a resource for them, if they could close that gap, might be helpful.

STEPHANIE JARMUL: Thank you. We do have a comment online, Tom. Kannan, do you want to unmute?

We can come back to him. We can go to Lara first.

DR. NANCY BURKE: Okay. Yeah, I can --

STEPHANIE JARMUL: Oh, Nancy. Sorry. Okay. Go.

DR. NANCY BURKE: Nancy Burke, UC Merced.

I just want to follow up on that last comment, because that was something that we discussed extensively in our group was not waiting to start the sort of scaffolding of education until the results were returned, but thinking about other time points in the research

project, where there could be touchpoints with participants to start getting them -- sort of priming them for what they were going to be receiving and in sort of using those as opportunities for enhancing their ability to understand the results that they would return -- that they were going to be receiving. So I think I really appreciate that comment.

DR. NERISSA WU: Can I answer that?

We have talked about that a lot. In the Program, we have a whole Outreach and Communication group, which is made up of health educators who really put a lot of thought into what is the language that's appropriate for this health communication. But also as I talked about this morning, there is this ongoing campaign through social media and through other means to start building capacity for talking about environmental exposures. That's something we'd like to do, particularly for studies where it might take a year or two years for people's results to come back. They might not even remember they're a part of the study or what the consent form said or what are some of the things we said at the very beginning. And so maybe having some points of engagement where we talk about you are going to get these results. Here's what they might say, even before your results are available.

So it's not only building capacity, but also building that relationship. I think as part of any kind of community-based work, that familiarity is really necessary to develop at the beginning of a study rather than just expecting us to be able to walk in at the end and have that relationship to talk about these very personal health issues.

CHAIR MCKONE: I think Lara was next and then Timur.

PANEL MEMBER CUSHING: Thanks, Tom. Lara Cushing. I don't have much too add. I just wanted to echo what others are saying that I think moving to a digital platform makes a lot of sense. I think DERBI is fantastic. And I -- you know, especially if it frees up staff time to do all of these other great things that we want to be doing, right, more in-person consultations.

I also like that when results would -- sounds like it would enable the Program to give participants their results more quickly, which would be a real benefit, and also visit like their report. You know, when you have things coming out at different time points, people don't keep their old paper reports. And so if they're online, then they can see everything in one place, which is nice. I do think in my own experience, there are going to be people that just want it on paper. So, you know,

maintaining that ability to either download it through DERBI or receive it in the mail in hard copy, you know, I don't think we want to get rid of that.

So there might be a need for both, but hopefully, you know, more and more it can be online. I think that would be great. And I also think more touchpoints sooner and in conjunction with each report-back would probably help with a lot of this -- these issues, yeah.

CHAIR MCKONE: Response to that or go to --

PANEL MEMBER DURRANI: No, I think that's great. The other thing I think would be helpful, in addition to having these printouts is in sort of two audience. One is for the participants. But I think for their health care providers, I think we see this a lot in different health care settings. For example, CDC or even CDPH has what does lead mean for me as a patient, and what does lead mean for me as a provider? And I think there's probably a space for what is surveillance, what is -- because I think a lot of folks, health care included, are really focused on trying to do clinical things, and you're essentially participating in something, you know, a research study.

And so having that -- giving that grounding, so they can have that explanation of -- we don't -- we're not thrilled that you have X number of whatever it is in your urine, but this is a biosurveillance. Let's tell you what

that means and what it doesn't mean, so that they would have that. So I think having those two perspectives may be useful, because where -- when the -- my experience is when some of these close down or they go way, they're still going to find health care. So they're still having somebody to talk to. It's just not the folks who are doing this. And so giving some of those resources.

CHAIR MCKONE: Okay. Thank you.

Responses.

We still have a couple of minutes. If there are any additional comments from the public or from online?

And I think people have provided a lot of input, hopefully some useful input.

PANEL MEMBER FIEHN: Well, I don't know if the input is useful --

(Laughter)

PANEL MEMBER FIEHN: -- but I am concerned that, you know, the people who responded and participated were 97 percent females. So we are missing out on the perspectives of male participant -- male fathers and so on. So that is -- I don't know how to reach them, you know. Don't ask me. You know, but it is a concern.

Also, again how to communicate, how to engage. If I had an answer, I would tell you guys, right, but it's not good.

CHAIR MCKONE: That's a good point. Yes.

PANEL MEMBER QUINTANA: I just have a last thought, which is you're returning results sometimes under different circumstances, some are surveillance, like CARE-2. Some are an intervention. Was BiomSPHERE the intervention with the air filters? I'm getting mixed up.

No, just --

STEPHANIE JARMUL: That was FRESSCA, not BiomSPHERE.

PANEL MEMBER QUINTANA: FRESSCA, sorry. I'm mixed up. But -- so I think maybe we live in a chemical world. You know, we can measure DDT. And all of our scientists have DDT and old ones a lot more in metabolites. You know, and so we're trying to figure out how those chemicals get in. It doesn't mean -- it's a health risk, but it's important for us to clean up our environment or something. I don't know, maybe you -- have you tried to any kind of zooming out stuff, or you do that at the beginning of the study or maybe bring it back to the results? I'm not sure.

STEPHANIE JARMUL: We do it during the community meetings and even in some of our more recent graphics and infographics that we share with communities, more like holistically what is being done, even by the government? Like, even if it's a regulation, or if there's incentives

available for participants or cities. We always make sure that they have those resources available to them.

PANEL MEMBER QUINTANA: I mean, I think -- I think one of the comments that now I'm worried about where I live from the participant. That's a hard one, because a lot of times they are being studied because of where they live. And so I'm not really -- but it is something to pay attention to how to ameliorate that feeling, I guess.

Thank you.

CHAIR MCKONE: Oliver.

PANEL MEMBER FIEHN: Okay. I'll give it one more try, if I may. One more try. So looking at this question about like, you know, do we have concerns about using a digital results return system? So we all agree that this is a good addition and -- but we also saw that many people liked the paper form. And we also heard that people were confused about the multiple passwords. So I would really encourage everybody to think about not using -- well, slight using of passwords - I don't how to phrase it - so as simple as possible, but not simpler, yeah, so that it's still safe.

And the other thing that is kind of, you know, should be -- should be easy to think about, right? But the other day I had to log in and I got three passwords to get something done and I'm like really.

The other thing is think about verbal interaction, right? Some people they said they liked verbal interaction. These days, most computers at least, and the cell phones anyway, they have a verbal interaction interface. We can talk to them. So why do we always have to type, right? So just think about it. Is it possible to have a verbal interaction rather than typing, typing, scrolling, and whatnot. Think about it.

CHAIR MCKONE: Okay. Something to think about. I think at this point, we're due for our break. And so we're going to take a 10-minute break. So I guess we come back at, what, 2:50, right? And so everybody be back in your seats ready to go and we will move on to another topic then, CHAIRS-LA. Thank you again for all your thoughts and input.

(Off record: 2:40 p.m.)

(Thereupon a recess was taken.)

(On record: 2:55 p.m.)

CHAIR MCKONE: All right. Now we're ready. We're going to being our afternoon final -- our final session in the afternoon. Next, we will be hearing from Marinelle Villanueva. Sorry. I think I mispronounced your name. Marinelle is a doctoral candidate in Environmental Health Sciences at UCLA. Her research addresses health disparities and inequality, inequitable

exposures to harmful pollutants in communities affected by oil refinery.

She serves as the study coordinator for the Community Health and Air Quality Implications of Refinery Retirements in Los Angeles, the CHAIRS-LA Study. She will be providing an overview of the CHAIRS-LA Study today.

(Slide presentation).

MARINELLE VILLANUEVA: Hi, everyone. I'm Marinelle and I'm -- thank you very much for having me here today. I'm excited to share the goals and our progress so far for the CHAIRS-LA Study.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: First, I have no conflicts of interest.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: And starting with some background going back to over a hundred years ago. Oil refineries were built near oil wells and transport hubs. And this meant that industrial development and growing population centers overlapped. And to this day, many households live near oil refineries, many of which live just a hundred -- few hundred feet from the smokestacks. And this is the case here in California, where this is home to the nation's third largest in-state refining capacity. And over 1.5 million people live within three

miles of a refinery.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: And housing tends to be more affordable near oil refineries. And so this is why many refineries are concentrated around communities of color. And we know that this can amplify adverse health effects.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: And so we recently published a scoping review in *Current Environmental Health Reports of* 54 epidemiological studies of communities living near oil refineries worldwide, which spanned over the last four decades. And what we found is that there's strong evidence of cancer with living near refineries, such as leukemia and pancreatic cancer, as well as a number of non-cancer health effects. And I don't expect you to be able to read the text here, but what we found is that there's strong evidence of adverse respiratory effects including asthma, lower lung function, bronchial inflammation.

Although most of the evidence here is cross-sectional. And so, since refineries tend to also be near ports, highways, other major industries, it's typically challenging to attribute health effects specifically to refineries.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: And the South Bay and Harbor regions of Los Angeles, in particular, are at the front line of these health effects. Following the Los Angeles oil boom in the 1920s, the six refinery sites here have been in operation for the last hundred years. And the communities of Wilmington, Carson, and Torrance are surrounded by hundreds of oil wells at the Wilmington Oil Field, as well as trucks and cars passing daily on these freeways, as well as shipping from the ports of Los Angeles and Long Beach.

And taken together, these communities rank as having some of the highest cumulative or pollution burdens statewide, according to CalEnviroScreen. And these communities were also formally red-lined and therefore were structurally disinvested in. In Wilmington and California -- or Wilmington and Carson, these communities are now home to a population of over 80 percent people of color. Specifically, in Wilmington, they have a large share of Latino residents and the poverty rate is much higher than the LA County average. Carson is home to one of the largest Filipino populations in the United States and Torrance is slightly less racially diverse and socioeconomically disadvantaged, but they are home to a large Asian-American population.

The communities here have had a long-standing concern related to the environmental and health effects coming -- or originating from the oil refineries here. And so there's been a long history over the last couple decades of community-led environmental justice organizing, specifically focused on air pollution and health impacts related to the oil refineries, and have hosted many toxic tours to highlight their adverse effects. And so this is where community-based research can come in and respond to their concerns by documenting these environmental hazards.

And the positive news though is that this refinery riskscape has been changing in this region. And this is thanks to --

[SLIDE CHANGE]

MARINELLE VILLANUEVA: -- the decarbonization efforts and the rise of electric vehicle adoption, and that's petroleum production. And our petroleum demand has been steadily declining in California and many countries. In California, what we've seen is in the last two decades multiple oil refineries have already retired, including the Los -- Phillips 66 Los Angeles Refinery, which recently retired in December 2025, last year, which includes two refinery sites located just five miles apart in Wilmington and Carson.

And so we inspect that local air pollution is

likely to improve after these refineries stop producing petroleum. Although, the extent to which public health can also improve after these closures is still unclear. The community organizers here have raised concerns of remediating the contaminated soil and water that's accumulated over the last century. But the dismantling of the equipment and remediation procedures may release emissions. And this can pose risks to the nearby residents.

And so this is why documenting longitudinal data after refineries retired and while they retire, it's important to understand refinery related impacts specifically to refineries.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: And so this brings me to the goals and our objectives in the CHAIRS-LA Study, which is a longitudinal community-based study, where we're measuring exposures to air pollution and cardiopulmonary health with the residents living near the recently retired and active oil refineries in the South Bay and Harbor regions in Los Angeles.

And we're specifically looking at the refinery retirements as a natural experiment to understand how things change before and after the refinery closures, and to understand and quantify the potential public health

benefits of transitioning from petroleum fuels.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: And so this study brings together a wonderful collaboration with academic institutions, the State agency, Biomonitoring California, and our community partners, the Asian Pacific Environmental Network, Communities for a Better Environment, and the Torrance Refinery Action Alliance.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: In terms of residents who were eligible to participate in our study, this includes adults who do not smoke any tobacco products and speak English lang -- Spanish or Tagalog. And they had to live within the circles on this map for at least one year. And these circles here represent about a two kilometer radius from the refineries of interest. The bottom two circles on the right represent a two kilometer radius of the refinery that recently retired in Wilmington and Carson.

And the circle on the top left represents a two kilometer radius from the Torrance refinery that is still active. And we consider them to be our control population, because they are not near any refinery retirements. We specifically selected residents who were spatially distributed around these refineries as in they were upwind or downwind, or closer and further, and only

included one person per household to minimize clustering and to capture a broader picture in this community.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: In terms of our timeline, we recruited residents and collected baseline air pollution and urinary samples and cardiopulmonary measures in year one between September 15 and December 15, last year. And then the Los Angeles Refinery then retired in December 31st, 2025. And this refinery reported a flaring, reported -- related to the shutdown procedures up to March 2026.

And then our plan is to follow up with the same participants one year, later this fall between September and December 2026 for the -- for these same measurements.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: So we conducted recruitments with the tremendous support of our community partners who opened our -- their doors to welcome us to speak at their community meetings. APEN distributed fliers about our study door to door in the neighborhoods. We also posted physical fliers at public institutions identified by our community partners, and also ran social media ads within the study area. And so with the success of our recruitment activities our list of residents who were interested in participating in this study quickly

grew to over 500 residents in just the span of three months.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: And so residents that were eligible to participate in the study were invited to what we call an initial visit, where we collected data with them. And we helped hosted these initial visits at publicly accessible venues, such as local libraries and event centers. And at this visit, we provided them with materials and instructions in their preferred language, English or Spanish, where they proceeded to sign consent forms and answer a questionnaire about their demographic information, characteristics about their home, any health symptoms that they had in the last two weeks or diagnosed health conditions.

Our trained staff also collected cardiopulmonary health measurements with our participants. And then we gave each participant a fresh air wristband to passively measure their personal exposure to air pollution, which they wore for one week. And they also completed an accompanying daily journal, while they wore their wristband. And we selected about 33 participants to hang a fresh air outdoor clip outside their home with the goal of understanding how air pollution is spatially distributed in our study area. And this included about 10

participants, each within the areas in Carson, Wilmington, and Torrance.

And midway into our recruitment and baseline data collection period, we added a biomonitoring component, where our participants collected two first morning void urine samples and also completed an accompanying biomonitoring questionnaire. And I'll go into more detail about each of these components as we move along.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: Starting with our cardiopulmonary health measures, we measured blood pressure, airway inflammation and lung function, sequentially in that order to minimize any distortions that can happen with performing four speedy maneuvers, which can be strenuous for some. And we measured three readings for blood pressure on the upper left arm for each participants. We then measured airway inflammation using a biomarker for fractional exhaled nitric oxide, FeNO for short. This is commonly used to screen for asthma.

And this is a biomarker of nitric oxide in one's breath, which is a gas. And our lungs produce more of this gas when they're inflamed. And so this represents our body's immune response to inhaled irritants.

We also performed maximal effort spirometry tests with our participants. And this is a measure for lung

function. It represents one's overall respiratory health. And this includes measures of FVC, which is the volume that one is able to exhale, and FEV1, which is how strong one's lungs are. And we returned these cardiopulmonary health measures to our participants on the day of their initial visit.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: For personal and outdoor air concentrations, we measured them using the fresh air passive samplers, which were developed by Dr. Krystal Pollitt at Yale School of Public Health. And these are different from silicone wristbands, because silicone wristbands come into contact with skin, lotions, and sweats, and so they capture both dermal and air exposures.

Whereas, in using the fresh air sampler, by design, it contains a protective case. And this protective case houses a sorbent bar. And this sorbent bar exclusively captures gas phase or airborne contaminants. And something to note about the sorbent bar is it's made of PDMS, which is a silicone polymer. And it's highly effective at capturing and retaining semivolatile compounds. So our participants wore these wristbands continuously for one week, and participants who were selected to hang up an outdoor clip outside their home hung this -- hung that outdoor clip during the same

period that they wore their wristband.

And these fresh air samplers that we deployed are currently being analyzed in Dr. Pollitt's lab for non-targeted and targeted panel of over a hundred semivolatile compounds by GC-MS. And our plan with our air analytes is to focus on PAHs because of their association with adverse health risks and also links to petroleum, because PAHs naturally occur in crude oil.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: And so for a little bit of background on PAHs. These are semivolatile chemicals that are highly toxic to humans. They're known to cause cancer and damage DNA in vital organs. And most of the PAHs in the atmosphere arise from mobile and industrial sources. And so we expect that our study area is exposed to higher levels of PAHs in the air. And it's important to note that regulatory community monitors only monitor naphthalene among dozens of PAHs that are commonly identified in the air.

And so, because the predominant exposure routes are inhalation and ingestion, we expect that our participants are more exposed, and so we plan to conduct source apportionment analyses to understand the major sources contributing to PAH levels in the air, particularly petrogenic sources, such as petroleum

refining and extraction.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: We collected a total of 178 wristbands from our participants in fall 2025. And since fall 2025, we've been conducting additional outdoor air sample deployments each season about six months apart, at six of our participant's households closest to the refinery or fence lines, as well as to background sites to -- and the goal here with the seasonal deployments is to understand how levels of air pollution change over time through the seasons and also after the refineries have retired. And so between fall 2025 and summer 2026, we've collected a total of 57 outdoor clip samples.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: For our urine sample analysis and collection, which is in collaboration with Biomonitoring California. Eighty-six of our participants collected two first morning void urine samples on two consecutive mornings on the last two days that they wore their wristband. And so this gave us a total of 178 samples in total.

The Environmental Health Lab has completed analyses of nine urinary metals. And Biomonitoring California has notified the participants whose metals of mercury and arsenic exceeded Levels of Concern and are

planning to return the urinary metals results to all of the participants who joined in on the biomonitoring component this fall. And the Environmental Health Lab will proceed to analyze the urine samples for VOC metabolites.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: So as I mentioned earlier, we instructed our participants to complete questionnaires during the sample collection periods. And so the daily journal accompanied while they wore their wristband to log activities for each day such as being exposed to environmental tobacco or vape smoke, cooking with a gas stove or barbecuing, or using candles or incense. And then the biomonitoring questionnaire accompanied -- or they pertain to the day before they took their urine sample for questions such as self-skin care products, or cooking habits, or dietary intake on the day before they collected their urine sample, and also their primary drinking water sources, or if they were involved in recent metal work in the last two weeks.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: So this is a summary of our participants who joined in on year one. We successfully recruited our -- a total of 180 residents, which is our target in this study. And this includes 150

residents in the Wilmington and Carson areas, and 30 residents near the still active Torrance refinery. And we have a broad age range from 18 to 85 years old, and a larger share of women and Hispanic individuals. About half of our participants are primarily Spanish speaking, and many of our participants also come from socioeconomically disadvantaged backgrounds, many of them were born outside of the U.S., have earned less than a high school education, and are of low income.

About a fifth of our participants have previously smoked tobacco products. Although just a small percentage currently smoke non-tobacco products. And the prevalence of asthma or that is self-reported is 17 percent, which is higher than the LA County average of six percent.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: So looking at the next steps for our plans with CHAIRS-LA, we're currently waiting for the lab analyses of our fresh air samples and urine samples to be complete. And we're currently exploring potentially adding PAH metabolites and biomarkers of affect into our panel of urinary analytes. And once lab analyses are complete, we intend to share individual results by returning those results to our study participants and holding a community meeting to present those results to the broader community.

And we also look forward to launching a study website to keep our engagement up with our participants and to share those results. And then we'll proceed with repeating the same measurements with our participants in fall 2026. And we plan to secure additional funding for data collection beyond fall 2026 and years subsequent.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: I'd like to acknowledge the support of our funders and our wonderful team that continues to expand as we prepare for this upcoming fall. It's been a ride and I'm very grateful for everyone who's been a part of this journey with us.

[SLIDE CHANGE]

MARINELLE VILLANUEVA: So thank you all so much for your time and I'm happy to take any questions.

(Applause).

CHAIR MCKONE: Thank you. As is standard, we now have five minutes that we're going to devote to just questions of clarification, both from the Panel and audience, but I'll invite the Panel members to begin the clarifying questions before we open it up to the audience. Please hold off on any substantive items or in-depth questions for the next step when we have a broader discussion.

So, clarifying questions?

Yes. Oliver.

PANEL MEMBER FIEHN: Okay. Great. So thank you. Great presentation and great study too. I see that, you know, you looked at Torrance, Wilmington and Carson. And the demographics of these regions are quite different with Latinx mostly in Wilmington and Blacks mostly in Carson. You know, but the participants are mostly, you know, Latinx women. So the question is similar to what we had before earlier today, can we -- what can we do to better embrace more participation from populations that don't respond directly, I guess? I don't know. So that is a little -- you know, it's definitely weighted. So do you -- maybe phrase it differently. Do you have equal representation from the different -- three different areas, Carson, Wilmington and Torrance?

MARINELLE VILLANUEVA: Yeah, that's a -- that's a great question. We have a higher proportion of participants within the Wilmington and less so from the Carson area, mainly because much of the land in Carson is actually made of petroleum refinery boundaries, and so we have a lower proportion of residents living within the Carson neighborhood specifically. And our target for the Torrance area was set at 30, since we consider them to be our control population.

CHAIR MCKONE: Other Panel questions?

I had -- I had one real clarification -- simple clarification, I think. But on slide nine, where you showed the open and closed refineries -- yeah -- there are underlying colors, you know, the violet, and the blue, and the orange. What does that indicate, the color of the land?

MARINELLE VILLANUEVA: Yeah. The differences in the colors of the refineries represented here are just to show that each refinery boundary is unique to a different refinery. Some of these colors are hosted by a single ownership, such as like the Phillips 66 Refinery, which recently retired. And then there's also two refinery sites that are owned by Marathon, but they're represented in different colors here to show that they're different properties.

CHAIR MCKONE: The ownership.

MARINELLE VILLANUEVA: Different ownership, exactly.

CHAIR MCKONE: Yeah. So I thought that's what it was. Curious. Okay.

Other clarifying questions, anybody?

Okay.

PANEL MEMBER QUINTANA: It's a question as much as advice, but I was making sure you are going back and collecting samples again this fall, right?

MARINELLE VILLANUEVA: Yeah, that's the plan. This fall we'll invite back our participants that joined us previously last fall to come back this fall for a second round of data collection for the same measurements that we collect with the -- collected with them last year.

PANEL MEMBER QUINTANA: I guess my advice would be to try and sweet talk these guys into doing more samples. I mean, who's doing the outdoor air samples? Are they also doing outdoor air? Are you guys doing outdoor air or is that Yale?

MARINELLE VILLANUEVA: So we're deploying the outdoor air samples and that's in collaboration with Yale, because that's --

PANEL MEMBER QUINTANA: So they're just doing all the analysis, so --

MARINELLE VILLANUEVA: Yeah, they're doing the lab analysis.

PANEL MEMBER QUINTANA: So the California Biomonitoring is doing the urine.

MARINELLE VILLANUEVA: Exactly.

PANEL MEMBER QUINTANA: Okay. Got it. Sweet talk Yale in to doing more air samples then, because I do think that the outdoor air samples would be very, very valuable, because even though they're outdoors, they might influenced by local school buses or whatever. So I think

having more would be helpful, just because they aren't as influenced by indoor behaviors, like the participants. And so I think you might see really a great signal there. And if you could get a few more, I just think, just as advice, maybe to help increase your power to find differences. That's all.

MARINELLE VILLANUEVA: Yeah. Thank you very much for that recommendation. We'll certainly look into if we can deploy more outdoor air samples this coming fall with our participants.

CHAIR MCKONE: Okay.

STEPHANIE JARMUL: Carl has his hand raised.

Carl.

CHAIR MCKONE: Oh, Carl.

PANEL MEMBER CRANOR: Yes. Question. I have evidence or seen evidence that this kind of the 2. -- PM2.5 also contributes to diabetes. I don't want to make your life more difficult, but that widens the scope of adverse effects.

MARINELLE VILLANUEVA: Thank you. Yeah, that's an important point to raise. Unfortunately, we're not measuring PM2.5, because our -- the wristbands through the fresh air samples exclusively capture gas phase contaminants. And so fine particulate matter is not part of the targeted panel.

PANEL MEMBER CRANOR: Oh, so we --

MARINELLE VILLANUEVA: We didn't take blood samples from our participants and so I'm unsure if diabetes is something that is a signal from urinary analytes, but I don't believe so. I think we'd have to add blood spots in order to be able to assess that. So unfortunately, that's a health out -- a health effect that we won't be able to analyze at this moment.

PANEL MEMBER CRANOR: Just a suggestion to consider in your future work.

MARINELLE VILLANUEVA: Thank you. Noted.

CHAIR MCKONE: Okay. I think we can move -- do we have questions online?

ALEX OKURT: I have one.

CHAIR MCKONE: Oh, sorry.

ALEX OKRUT: This is Alex Okrut from CDPH again. Thank you so much for this great presentation. It was -- and I saw on slide 19, if you don't mind going back to that. Nineteen. See these 30 people near Torrance an active refinery, they seem to like a positive control group. Their environment doesn't change over the next few years. What about people who live -- who do not live near a refinery, do we know the baseline of your chemical markers in these people, so that you know what the best possible outcome would be for the people who live near

refinery retirements?

MARINELLE VILLANUEVA: Are you referencing biomonitoring analyses in populations not the living near refineries?

ALEX OKRUT: Exactly. Like a negative control group, somebody who's not been living next to a refinery, just to see what they're -- the marker concentration would look like.

MARINELLE VILLANUEVA: Yeah. That's a great suggestion. We, in our study, did not collect any urine samples from populations not living near refineries. But I do believe, and I think Biomonitoring California can speak to this, there are urine samples that they've collected with other populations that I think we can reference to to understand how their urinary metals or VOC metabolites might differ between populations living near refineries and not. Thank you.

DR. AHIMSA PORTER SUMCHAI: I just want to point out the *UC Berkeley News* study May 22, 2018, "Closing Coal Oil Power Plants Leads to Healthier Babies." It was a 20, 25 percent drop in preterm births. You're probably aware of that. And there also is some evidence of improved crop fertility for both preterm births and overall fertility for humans. And for crops the retirement of coal and oil power plants, there is some research.

MARINELLE VILLANUEVA: Yeah. Thank you for raising that to my attention. I have seen some of that work that shows that health effects in communities do improve after coal refineries -- or coal plants have retired. There's only been one other study that I'm aware of in Oakville, Canada that suggests that health care utilization has decreased after an oil refinery retired. Although, this study population was only within one city living near the refinery. And they also showed that sulfur dioxide, for example, significantly decreased after this oil refinery retired. So that's like kind of the motivation for where this study came about is showing that things did improve after one refinery retired and we're hoping we can see that here with this community here in South Bay LA.

CHAIR MCKONE: So we are now in the open discussion part, other -- so you're all welcome to go deeper into other issues.

STEPHANIE JARMUL: This is Stephanie. We have a comment from Noel Duran online and a question. It says, "Hi. This work looks really impactful and I'm excited to see results/how it continues for the second year. For my question. I'm assuming that in working with these communities, you have been interacting with their members closely. How would you describe are the general feelings,

reactions of the community members, specifically in terms of living close to refineries, the refineries closing or working with you in this study?

MARINELLE VILLANUEVA: Yeah. Thank you so much for that comment. I -- you know, it was interesting collecting this data with the community members who have participated in our study, because, you know, as we schedule them to come for the initial visit, and when they're at their initial visit, they often shared what their experiences were when it came to living near the refineries with, you know, seeing flaring happen day to day, and noticing that they have a -- there's a rotten egg odor in their neighborhoods, noticing that when they run in their neighborhood, they have chest pain and that's not what they experience in other cities in California.

And so that's, you know, really opened my eyes as a researcher to see that. What we're collecting here is more than data. It's documenting what their experiences are. And so that's what inspires me to want to carry this out and see how the things might change is my hope.

And so subsequently to that is in our questionnaire for year two, in response to the stories that I've heard from the community members, I've additionally incorporated some questions about their perceptions of air pollution in their neighborhood to kind

of gather some statistics about, you know, I observed myself that residents here were concerned with what they were living in. And I think those stories are worth turning into statistics, and so that's what we've incorporated to their questionnaire for next year.

CHAIR MCKONE: All right. I actually had a question that came up for me that's broader in terms of -- so -- in terms of how you think about the study. Early on, you said what's causing the refineries to close in part is that there are more electric vehicles in Southern California and the demand for gasoline is dropping.

So at the same time the refineries are closing, there are fuel -- fewer fossil-burning automobiles. And so these two things are going to, you know, play together in terms of what we see showing up in the blood and urine of people. Are you thinking about a strategy for how to think about how that would impact your results or how to interpret that? When you see things going down, are they going down -- is it also going down because not only are you making less gasoline you're using less gasoline or do those -- or those will be hard to tease out?

MARINELLE VILLANUEVA: Yeah. I think you raise a very important point to keep in mind. I think as we're planning the analyses for the cardiopulmonary health measures for example, what we expect is that as our

participants age in prior studies, lung function, for example, declines and airway inflammation increases as one gets older. And so we would expect, I think, that with less gasoline-powered cars going through the neighborhoods, that this would be fairly similar across our study area, and so we wouldn't expect that there would be like a difference -- a major difference, I think in their exposures to traffic-related emissions. Whereas, the residents living near the refineries specifically, we would expect that, because there's less exposures to petroleum emissions that their lung function would decline at a lesser rate than residents who still live near active refining processes.

CHAIR MCKONE: Okay. That's --

STEPHANIE JARMUL: And this is Stephanie. I can elaborate a little bit more. For our plans at least for the PAHs, if you recall, Yan Lin presented a year or two ago on the method which involves the carboxylic acid metabolites as well as the hydroxylated metabolites of PAHs. And so our plan for the PAH analysis is to include both. And so hopefully looking at that ratio can give us a sense of where the exposures are coming from.

CHAIR MCKONE: And just to add to this, right, so their use of gasoline is going down. At the same time, the Los Angeles region is one of the largest oil producers

in the world, in terms of crude oil production. But that's going down, not so much because demand is going down, but because the wells are being depleted. And so, on top of all of this, you have these distributed oil fields all over in these -- in these communities, in other communities. And they're going down and they're being capped, and the infrastructure associated with them is changing too.

So again, it's like all these -- I mean, it's interesting to focus on refineries. I think they're very important, but then these things are happening in a very dynamic world where we're making this transition away from producing and consuming as many fossil fuels and making as much gasoline. It's a -- it will be an interesting story I think

MARINELLE VILLANUEVA: Yeah. And I think you raise an important point and I think that's where the inspiration comes from to do source apportionment analyses with the PAH analytes from our wristbands, because petrogenic sources and emissions from petrogenic sources, such as oil refining and oil wells are likely to be similar. And so any declines that we see with -- contributions to ambient levels of PAHs from petrogenic sources may not entirely be due to their refineries, but also because there is less and less oil well drilling over

time. And so that might be challenging to tease apart, but that is certainly something that we will hope to consider as we refine that analysis.

Thank you.

CHAIR MCKONE: Yeah, thanks.

STEPHANIE JARMUL: Jianwen online really quick.

Go ahead, Jianwen.

DR. JIANWEN SHE: Hi. Jianwen She, Environmental Health Laboratory. Thank you, Marinelle.

And then two things. Online, I ask if you can share your reference. You mentioned about 20 reference. We work with you to analyze the metals, creatinine, and also the VOCs. We are the laboratory working on them. I'm the laboratory leader. So beyond ask of a reference list you shared on slide, I think that might help us to check the details and making sure our analytical work match your need.

My question on slide 17, I have a question here. You list the emphasized BTEX as examples of the VOC metabolites. So I try to make sure currently that we have a method to analyze more than that, but we do have a few analytes we cannot report. So I think if you have a mandatory list, a wish list of whatever we called, we make sure -- we match to try to make sure whatever hypothesis ask us to do, we can support them from beginning.

And my last question is you conducted wristband analysis, and urinary analysis, is any strategic -- strategically try to conduct the one kind of analysis earlier than the other one to provide a learning experience or randomly arranged so that we'll learn from the wrist analysis result, which are considered environmental analysis nor the occurrence of compound, then conduct biological urinary analysis, or what's your strategy on this part of the work?

STEPHANIE JARMUL: I can try and take at least the last part. Jianwen, this is Stephanie. I believe the wristbands were for the whole week and the urine samples were taken at the end of the week, so we are hoping to be able to be able to compare the data collected from the fresh air wristbands, which as a reminder these are different than the silicone wristbands. These are just kind of passive air monitoring devices. We are hoping to compare that with the urinary biomarkers to see if we can see any relationships. And then regarding the VOC panel, we can continue to have conversations later about refining that list.

Thank you.

DR. JIANWEN SHE: Thank you.

CHAIR MCKONE: I think Oliver.

PANEL MEMBER FIEHN: Yeah. I also have a

question. I wonder how you will report the data from those air samplers, because it's not an absolute volume of air that's collected. It's passive sampling. It might be different. And also the reproducibility and absorption capacity. Although, of course, intended to be equal will not be equal. And that's always -- so how do we -- how do we report this?

MARINELLE VILLANUEVA: That's a great question. Thank you. So what we would receive from Dr. Pollitt's lab is like the total mass, the total concentration of each analyte that is measured by GC-MS. And what we would do and then report to the participants is what's called a time-weighted average concentration, where we would adjust for the duration that they wore the wristband, but also the uptake rate specifically for that analyte, because this differs across different analytes, even within the PAHs, and also because each of our participants didn't wear the participant -- the wristband for the exact amount of time.

And so that's why we adjust for the total concentration by calculating the time-weighted average. And that time-weighted average concentration would represent the average air concentration of that analyte over the Sampling period. And that's in micrograms per cubic meter, the units. So that's what are -- typically

is reported of ambient PAH levels.

PANEL MEMBER FIEHN: You just said per cubic meter. How do we know the cubic meters? I mean, it's a wristband and I wear it. How do I know the cubic meters? I don't think that is the way we can report it.

STEPHANIE JARMUL: One second. Here's --

DR. JEFF WAGNER: Jeff Wagner, CDPH, Environmental Health Lab. We're not doing the air analyses, but we do work with pesticide samplers, so I can only surmise, maybe you can confirm, that it uses assumed diffusion coefficients. And when the units of diffusion coefficient, if you normalize by that, you do get -- in fact, get cubic meters there, as your denominator. So it's like an assumed -- or it's an empirical absorption factor.

PANEL MEMBER FIEHN: Okay. So we have empirical absorption factor that we be believe to be true. Then we have -- we hope that our wristbands don't, you know, come over capacity. We assume that -- you know, there's a lot of -- a lot of assumptions. So it's like so many assumptions that I think, well, we had before, you know, the uncertainty discussion. And to me, that should be two asterisks, you know, with the uncertainties.

CHAIR MCKONE: Just -- I mean, if they calibrate it correctly, they can do an air liquid partition

coefficient equivalent, if it's reached equilibrium. I mean, I take your point, but I mean it is done. There's a fugac -- you know, the so-called fugacity --

PANEL MEMBER FIEHN: All right. There was targeted and there was also semi-targeted or something that was also talked about, right? So I don't think we have these parameters for everything or is it not done on the wristbands only on the urine analysis? And maybe I'm lost on that one.

MARINELLE VILLANUEVA: I am aware with the fresh air wristbands Dr. Pollitt's lab has published the uptake or absorption rates for the PAH analytes, and I've also derived equations for when the sampling period reaches equilibrium how to calculate what the time-weighted average concentration is from -- during that period of the sampling.

PANEL MEMBER FIEHN: For targets like the deuterated that we see here? I mean, there is a deuterated molecule on the screen. And that's obviously not a natural compound. Just saying. No matter. So I'm saying that we should not just trust analytical chemists.

(Laughter).

CHAIR MCKONE: Okay. Yeah.

DR. JEFF WAGNER: Jeff Wager again. I actually had a question about the benzo(a)pyrene, which I think

that's awesome that you're including this very toxic compound. Do you consider that sort of a special compound in this list, because from -- I mean, I do a lot of work on the air side and we definitely think of it separately from the other PAHs, because it tends to be predominantly in the particle phase, as opposed to predominantly in the gas phase, like some of the lighter ones like naphthalene. And I -- for that reason, I would assume it would have a lower diffusion coefficient and perhaps a higher limit of detection. But I was wondering if you could comment on like if you're trying to approach that particular molecule differently than the others?

MARINELLE VILLANUEVA: That's a great point. I can't recall specifically how the detection limits differ between the lighter and higher molecular weight PAHs. But from what we've seen from their prior published work using the fresh air samplers that they have detected benzo(a)pyrene in the wristbands previously.

DR. JEFF WAGNER: Okay. Yeah, that's very cool. Thank you.

MARINELLE VILLANUEVA: Thank you.

CHAIR MCKONE: Okay. Additional discussion points either online or offline.

Oh, here we go.

RANJIT GILL: Hello. Ranjit Gill from DTSC.

I had a general question. If you considered California goes into like a cleaner blend of gasoline during the summer, if that would -- if you would take your measurements during the summer, if some of your concentrations of these PAHs, whether their compounds would go down, as compared to wintertime or springtime? Thank you.

MARINELLE VILLANUEVA: Yeah. That's a great question. I have not thought about how PAH levels might differ, given the differences in gasoline blends. But from what I understand with seasonal variation in ambient levels of PAHs, that lighter PAHs like naphthalene, for example, that are most associated with petroleum activities tend to be lower in the summertime, because of their volatility. And so we would expect that lighter PAHs are probably going to be already lower and may even be too -- they may not be detected as frequently during the summer time, because of higher temperatures making them more volatile to be absorbed.

So we have yet to see the data to see what -- how those levels differ within seasons, but I do hope to present the results at a subsequent Scientific Guidance Panel meeting when we do have them.

(Inaudible Panel Talking.)

MARINELLE VILLANUEVA: Exactly

CHAIR MCKONE: Well, more comment, more discussion?

Okay. Well, we'll wrap up our discussion on this topic and CHAIRS-LA.

And now we've reached sort of the final part of the meeting, which is the open public comment period, where we allow roughly 15 minutes for the open -- for members of the public can make comments on any topic related to the Biomonitoring California Program, not just what we talked about today. Webinar attendees can submit written comments now and questions via the Q&A function of Zoom webinar or by email to Biomonitoring@OEHHA -- O-E-H-H-A -- .ca.gov, and we will read them out loud.

If you wish to speak, please alert us using the "Raise Hand" feature on Zoom webinar and Rebecca will call on you at the appropriate time. If you are attending in person and wish to comment, I will call on you at the -- no -- and wish to attend, you can come to the front of the room and raise your hand and I will call on you at the appropriate moment.

For the benefit of the transcriber, we encourage people to clearly identify yourself before providing comment and write your name and affiliation on the sign-in sheet at the back of the room. However, there is no obligation to identify yourself and you are free to

comment anonymously, if you wish. So we are open to public comment

DR. AHIMSA PORTER SUMCHAI: Dr. Ahimsa Porter Sumchai. I'm speaking to you as a Principal Investigator of the Hunters Point Community Biomonitoring Program and Hunters Point Community Toxic Registry.

And I wanted to talk to you about one of the most profound experiences in human biomonitoring I have ever had. It occurred in May of this year when I was approached by the mother of a two-year old boy who plays in a park that is literally across the street from a federal Superfund Site that is undergoing deep soil excavations and building demolitions.

The mom has as a PhD in biomedical engineering. And the little boy wears GPS protective trackers in his sneakers, so we know where he is. The boy underwent a biomonitoring urinary test in May and a repeat test in June. And the two tests documented exceedances in arsenic, cesium, nickel, rubidium, and thallium. The second test in June showed worsening cesium, nickel and thallium.

The little boy had developed refractory ear infections. He required two courses of antibiotics for an ear infection. He had recurrent upper respiratory infections. And prior to that, he was very healthy.

So myself and our medical consultant, Dr. Ramona Tascoe took the necessary steps to protect the little boy and remove him from the source of exposure that is literally within 500 feet of his dad's house. And after we did that, I went through the archives of the Hunters Point Community Toxic Registry Phase 3 cohort, which is a cohort of 125 people who have evidence of -- or proof of exposure to ionizing radiation, because three of the elements cesium, nickel, rubidium, and thallium have radioisotopes. I presume that that would be the best cohort to look at.

And in reviewing that cohort, we identified all of the people who had the five chemicals that were detected in Dylan. We'll call him Dylan. We have a consent and a release. We'll call it Dylan's profile. And from that search, we identified 37 people who had at least two of the analytes detected in concentrations that were above reference range. The reference range is the range of Genova Diagnostics. We also compare it with the CARE-Los Angeles study. And we looked at comparisons with Labcorp and Quest. In general, Quest has fewer analytes and allows higher concentrations of these toxicants. Labcorp only tests for four. It costs $269. Neither Quest or Labcorp gives you the exact concentration in milligram to gram of creatinine.

So I wanted to just give you the geospatial mapping. It's very, very crude. I essentially just took a one-mile perimeter around the federal Superfund Site, and assigned a different pin code to each of the analytes, and put the pin at the closest intersection where the person lives. And this is essentially what we get in terms of the pattern of distribution.

The farthest east point here is Dylan. What you'll notice is that he has a neighbor who has five of the analytes. And one of the things that is immediately evident is how many people have four or five of these analytes detected in the urine. The other thing that you see is how many people have red pins. A red pin corresponds to rubidium. Rubidium is a geologic biomarker for the Hunters Point hilltop. It is contained in the serpentinite bedrock of the Hunters Point hilltop. So it's serving as a biomarker.

For us, the arsenic is in yellow. The Thallium is in black. And one of the other disturbing findings is how many people have both arsenic and thallium arm in arm in their detections.

So this is the digital mapping. Maegan Leslie Torres at Greeninfo created this digital mapping. This is easier to understand because each of the people we tested has a ring and then it determines, you know, which of the

chemicals are present. So it cleans it up. We had a region where the concentrations are so dense that you can't even see the individual, you know, analytes, but this cleans it up.

And then she also produced for us this heatmap, which identifies where in the clusters are the most people, you know, and where they're most dense. And again, as you can see, it's in the northern regions on the hilltop and there's also an area here at 3rd and Palou, which is the major transit center.

So the question you're probably asking is where are these chemicals coming from? And we can go to the parcel A finding of suitability for transfer for the EPA document that shows that these chemicals are in Parcel A soils. He's being exposed to particulates -- chemical lading particulates. The research shows that particulates cause ear infections and upper respiratory tract infections in children.

But again, the, you know, take-home message is how easily human biomonitoring can be used for population epidemiological study. And this is something that unfolded over three months.

Thank you.

CHAIR MCKONE: Thank you.

(Applause).

CHAIR MCKONE: Additional public comments online?

In the room?

Can you make a public comment?

I don't know. Are the Panel members supposed to be quiet or can we -- we can -- okay.

PANEL MEMBER QUINTANA: I just wanted to quickly follow up on your comment, our speaker, Dr. Pollock, about how people want to know what they can do. And I'm just thinking how powerful biological monitoring is for intervention studies, you know, like the HERMOSA Study, where they didn't use certain consumer products, or the other study where you don't use plastics. So I'm just thinking -- I think it's a very good use of California Biomonitoring efforts is to show what you can do, you know, with certain changes, whether that's, you know, under your control, like what you eat maybe, but maybe not under your control, maybe just showing if you go somewhere else that your levels go down, or some kind of intervention study I think would be a powerful use of California Biomonitoring resources.

CHAIR MCKONE: Okay. Thank you.

Okay. So I think we've reached the wrap-up point. So the transcript of this -- we're wrapping up now. The transcript of this meeting will be posted on the Biomonitoring California website when it is available.

The next Scientific Guidance Panel meeting will take place on November 16th, 2026 from 1 p.m. to 4 pm. in Sacramento. Information regarding options for attending the meeting will be made available closer to the November meeting date.

I want to thank the -- all the Panel members and the audience for participating, for being engaged with us, and hope to see you in November.

Thank you.

(Thereupon the California Environmental Contaminant Biomonitoring Program, Scientific Guidance Panel meeting adjourned at 3:52 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 Contaminant 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 16th day of August, 2026.



JAMES F. PETERS, CSR
Certified Shorthand Reporter
License No. 10063