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

ELIHU M. HARRIS STATE OFFICE BUILDING

GEORGE ALEXEEFF ENVIRONMENTAL HEALTH LIBRARY

16TH FLOOR

1515 CLAY STREET

OAKLAND, CALIFORNIA

WEDNESDAY, MARCH 4, 2026

1:00 P.M.

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

J&K COURT REPORTING, LLC

APPEARANCES

PANEL MEMBERS:

Thomas McKone, PhD, Chair

Carl F. Cranor, PhD, MSL

Lara Cushing, PhD, MPH

Timur S. Durrani, MD, MPH, MBA

Oliver Fiehn, PhD

Amy Padula, PhD, MSc

Penelope (Jenny) Quintana, PhD, MPH(Remote)

OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT:

Kris Thayer, PhD, Director

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

Martha Sandy, PhD, MPH, Supervising Toxicologist (Managerial), Branch Chief, Reproductive and Cancer Hazard Assessment Branch

McKenna Thompson, MPH, MPH, Research Scientist, Safer Alternatives Assessment and Biomonitoring Section, Reproductive and Cancer Hazard Assessment Branch

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH:

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

Josephine DeGuzman, Research Scientist Supervisor I, Lab Systems Unit, Biochemistry Section, Environmental Health Laboratory Branch

APPEARANCES CONTINUED

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH:

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:

Dicle Yardimci, PhD, MS, Senior Hazardous Substances Engineer, Safer Consumer Products Program

Anne Cooper Doherty, PhD, Senior Environmental Scientist, Supervisor, Chemical Product and Evaluation Unit, Safer Consumer Products Program

GUEST SPEAKER:

Matt Campen, PhD, MSPH, Distinguished Professor, University of New Mexico

ALSO PRESENT:

Arlene Blum, PhD, Green Science Policy Institute

Nancy Buermeyer, Breast Cancer Prevention Partners

Rebecca Fuoco, , MPH, Green Science Policy Institute

Ahimsa Porter Sumchai, MD, Hunters Point Biomonitoring Foundation

INDEX

PROCEEDINGS

DIRECTOR THAYER: All right. Good afternoon, Panel members and the audience to this March Meeting of the Scientific Guidance Panel for Biomonitoring California, more formally known as California Environmental Contaminant Biomonitoring Program. Thanks for joining us.

So the Panel last met on March 14th, 2025. At that November meeting, we had updates on Biomonitoring California Program activities, including a presentation on hexachlorobenzene levels in California and results from the FRESSCA Study. FRESSCA is the Farmworker Women and Respiratory Exposure to Smoke from Swamp Cooler Air study.

Key discussion topics included: -- thank you -- Biomonitoring California analysis of persistent organic pollutant levels in California, which suggests that levels hexachlorobenzene are not decreasing over time; the Program's intra-program pilot studies; inclusion criteria and monitoring methods utilized in the Community Health and Air Quality Implications of Refinery Retirements in LA, or the CHAIRS study; results from the FRESSCA Project including: higher levels of urinary 2-naphthol in FRESSCA participants compared to levels reported in the general U.S. population as part of the NHANES study; possible reasons for PAH metabolites, other than 2-naphthol were

the same or lower in FRESSCA participants compared to NHANES; participant perceptions and use of the air filtration solutions utilized in the study; selection of metabolites measured in FRESSCA-Mujeres and other program studies.

The Panel and audience also provided input on possible topics for 2026 Scientific Guidance Panel meetings.

So the summary and transcript of that meeting is posted at the November meeting page on the Program's website at biomonitoring.ca.gov.

And next, I would like to introduce you to our new Scientific Guidance Panel Chair, Thomas McKone. Tom has been a Panel member since the Program's beginning in 2007. And we are grateful that you agreed to take on this additional responsibility. For those of you who don't already know him, Tom is a Professor Emeritus at the School of Public Health at the University of California, Berkeley, and a retired affiliate of the Lawrence-Berkeley National Laboratory. He earned a PhD in engineering from UCLA. His research career has focused on development, use, and evaluation of models and data for assessing the health and environmental impacts of energy, industrial and agricultural systems. He has authored 165 research papers, served on the U.S. EPA Science Advisory Board, and

has been a member of 15 committees of the U.S. National Academies of Science, Engineering, and Medicine. He has won numerous awards, including the Lawrence-Berkeley National Laboratory Lifetime Achievement Award in 2019.

Please join me in welcoming Tom McKone to his new role.

(Applause).

DIRECTOR THAYER: I'd like to invite the other Panel members to introduce themselves by name and affiliation. We're going to start with Jenny Quintana who is attending remotely. Jenny has been granted a reasonable accommodation to attend this meeting and to maintain her camera off.

But now, we'll go ahead and start in the room. Maybe we can start with Oliver.

STEPHANIE JARMUL: Let Jenny introduce herself first.

DIRECTOR THAYER: Okay.

PANEL MEMBER QUINTANA: Hi, everybody. My name is Penelope, or nicknamed Jenny, Quintana. And I'm a Professor in the School of Public Health at San Diego State University.

DIRECTOR THAYER: Thank you.

PANEL MEMBER FIEHN: Oliver Fiehn, Professor at UC Davis in the Genome Center.

PANEL MEMBER PADULA: Amy Padula, Associate Professor in the Department of Obstetrics, Gynecology, and Reproductive Sciences at the University of California, San Francisco.

PANEL MEMBER CRANOR: Carl Cranor, Professor Emeritus at the University of California, Riverside, and Emeritus in Environmental Toxicology, where I've got a partial appointment as well.

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

PANEL MEMBER DURRANI: Hi. Timur Durrani, Professor of Medicine at the University of California, San Francisco.

DIRECTOR THAYER: All right. Thank you. And then I'm now going to pass the meeting on to Tom.

CHAIR McKONE: Pass the torch and the microphone. Thank you. I have to say I'm honored to be serving as Chair. This is a very wonderful Committee to serve on our Panel.

So I want to begin with our reminder to the Panel members to please comply with the Bagley-Keene Open Meetings requirements, and that requires that all discussions and deliberations of the Panel about the subject matter at issue today need to be conducted during

the meeting, not on breaks 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's technologically impractical, please make an announcement when you turn your camera off. Additionally, if someone older than 18 is in the room with a Panelist who are attending remotely, you must disclose the presence of that person and their general relationship to you.

So I guess we could take a moment -- we're supposed to take a moment to ask remote attendees if anybody over 18 is in the room.

PANEL MEMBER QUINTANA: (Shakes head).

CHAIR McKONE: No. Okay. Great.

So, today actually, it's a relatively short meeting, but full of all kinds of really useful information and hopefully some good discussion.

We will first hear an update on Program activities in the first part of the meeting up to the break. And then the Panel will also hear from Program staff and guest speakers about monitoring methods for

microplastics and examples of State efforts regarding microplastics.

There will be time for questions from the Panel and audience after each presentation. If SGP members wish to speak or ask questions, please raise your hand. I will call on you at the appropriate time and then you can ask your question and provide a comment. If online webinar attendees have questions or comments during the question periods after each talk, you can submit them via the Q&A feature of the Zoom webinar or by email to biomonitoring @O-E-H-H-A.ca.gov. That's biomonitoring@oehha.ca.gov. We will not be using the chat function during the meeting and it will not be monitored. So you can't use that to ask questions. 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 period and discussion sessions, please use the "Raise Hand" feature in Zoom webinar and McKenna Thompson 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, 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 time. 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, I want to introduce -- we're going to move on to our first presentation. And I want to introduce Nerissa Wu. Nerissa leads the Exposure Assessment Section in the Environmental Health Investigations Branch, that's EHIB, at the California Department of Public Health, and is the Program lead for Biomonitoring California. She'll provide an update on current Program activities.

(Slide presentation).

DR. NERISSA WU: Thanks so much and welcome, everybody. It's nice to see everyone here in person.

[SLIDE CHANGE]

DR. NERISSA WU: I will be giving an overview of the Program covering community-focused studies and our surveillance work, laboratory work, and our outreach and communications activities.

[SLIDE CHANGE]

DR. NERISSA WU: So starting with our community-focused studies, ACE, BiomSPHERE, and CHAIRS-LA, I'm really happy to announce that Kelly Chen's work on the association between consumption of fish and serum PFAS levels, which we've talked about in prior meetings, it has just been published in Exposure and Health. So we've been able to release that, along with a two-page fact sheet that summarizes the findings. And we also have a second lay-friendly piece, which I have an example of up here, which highlights the key messages in Vietnamese and Chinese, the two languages in which the study was conducted. And this postcard is going to be sent out to study participants, as well as made public -- publicly available. So all of those things are available on our website.

[SLIDE CHANGE]

DR. NERISSA WU: And I just want to point out that our website is also available -- the ACE portion of the website is also available in English, Chinese, and Vietnamese relevant to our study participants.

[SLIDE CHANGE]

DR. NERISSA WU: For BiomSPHERE, we're planning on having a community meeting in the spring to discuss results of the study with participants and the surrounding

community. We have our results return evaluation interviews and focus groups coming to a close. As a reminder, we've been working with UC Merced and the California Asthma Collaborative to assess our results return materials and that includes a pilot use of the Silent Spring's DERBI platform. They have finished the interviews. They're wrapping up the analyses of the data, so we will have them here at a later SGP meeting.

And relevant to BiomSPHERE, we also have a couple of publications in preparation which we'll also hear more about as they progress.

[SLIDE CHANGE]

DR. NERISSA WU: For CHAIRS-LA, which is a collaboration with UCLA, and Yale, and USC, we have completed participant enrollment and the first round of sample collection. So the study was able to successfully recruit 180 participants that live in the Wilmington, Carson, and Torrance area. Participants wore Fresh Arm -- Fresh Air wristbands and they also had information on health indicators, like blood pressure and lung function collected. And of that 180 participant group, 86 participants agreed to be part of the biomonitoring portion of the study.

So from those participants, we collected two different samples, two first-morning voids on consecutive

days - those are urine samples - this past fall.

[SLIDE CHANGE]

DR. NERISSA WU: For the next steps, those samples right now are at the Environmental Health Lab and they are currently analyzing the samples for metals, and specific gravity, and creatinine. And then following our usual protocol, we'll follow up with participants who have elevated levels of arsenic, mercury, and cadmium.

Then looking forward the aliquots are stored for potential analyses of VOCs and PAHs. And then we hope to be back out in the field in fall 2026 to collect two more urine samples from the participants. And we'll have a much more detailed update on the CHAIRS-LA study at a future SGP meeting.

[SLIDE CHANGE]

DR. NERISSA WU: We also have a number of surveillance studies in progress, including CARE, MAMAS, and STEPS. For CARE-2, we're about to return speciated arsenic data in the next month to all of our participants. And then we have this data from CARE-LA and CARE-2 that we're continuing to analyze.

We're making progress on work related to the MAMAS data, and that's both with regards to PFASs and hexachlorobenzene, which you've heard about at our last meeting. And STEPS samples, we're hoping to have PFAS

data on our first county coming up soon.

[SLIDE CHANGE]

DR. NERISSA WU: I just want to talk a little bit more about CARE data. As we have more data available to us, we're adding this to the CARE Study report. And this is a report we've described in the past before. Rather than try to fit all of the information about the CARE Study into a scientific paper, we've created a report. So we have detailed study design, and methods, and data available in this one downloadable report. It's available in English and Spanish on our website.

And typically when we get data from the labs, our priority, of course, is to get results return out to participants. But then we work on creating summary statistics, which includes things like geometric means, confidence intervals, detection frequencies. And that all goes up on the web as soon as we can get it out publicly.

The CARE report includes a lot more information, including weighted and unweighted data, creatinine-adjusted and unadjusted. And for some of those analytes, we also have it stratified by parameters like race, age, sex, income, and education, along with adjusted percent changes compared to our reference groups. So we're working on getting additional appendices added to this report, which will include data tables for speciated

arsenic, phenols for CARE-LA, and the metals for which the stratified tables were not initially included.

And I'm talking about this, because as part of CARE and STEPS in our upcoming surveillance, we want to create a protocol by which our data tables are getting out very quickly, so that people can use them. We want them in a format that's accessible, but also the most usable for other researchers.

So one of the things that would be great to get feedback from the Panel or for other users of our data is what is the format of data that's most useful to you, whether that's weighted or unweighted, the raw form, and, you know, what type of data and how would you like that formatted to make it most useful for you and your collaborators.

[SLIDE CHANGE]

DR. NERISSA WU: Oh, here we go. Okay.

So I have mentioned future surveillance a couple of times. We are actively starting to prepare for a new surveillance effort. So as part of that, we have started meeting with the California Health Information Survey, or CHIS, to start planning how this might be designed, how we might interface with the CHIS protocol. And in the meantime internally, we're working on a lot of the nuts and bolts issues, things that we want to have in place to

maximize our program efficiency, so that we can handle a large-scale effort on an ongoing basis.

So this includes exploring different ways of collecting blood and serum samples, looking to standardize protocols for the whole biomonitoring process, from field work, lab processes, data analyses, data reporting, and, of course, results return. And as part of that, we have piloted the online system for getting results back to participants.

[SLIDE CHANGE]

DR. NERISSA WU: Oh. Okay. Thanks.

So for -- with regard to our exploration of sample collection methods, we ran an Intra-Program Pilot Study, known as the IPP, in order to test out different methods of sample collection. Usually, we use these IPPs to look at different lab methods. But in this case, we're evaluating micro-sampling devices. I have a couple actually of the devices here, if anyone wants to take a look at them.

In our studies, we've historically relied on phlebotomy to collect blood samples, as do most other biomonitoring programs, but bringing in contract staff on a part-time and limited-term basis can be challenging for us administratively, so we've been looking at different options.

So we ran a sample collection event in December. We had 40 people enroll in this. And each participant was asked to provide serum and whole blood samples collected through venipuncture through a TAP method - you see the TAP device on top - and then through a Tasso device, which is the red one below, so six samples total. And we designed the protocol to try to answer, can we collect sufficient sample volume? And are those samples of acceptable quality to our lab? Are the devices acceptable to participants? Is it more painful or less painful than phlebotomy? And then are there differences between the venipuncture- and device-collected samples? And that might be because of contamination from the devices. It could be because there was a difference between capillary and venous blood. These are different things that we will be looking for when we have the data.

[SLIDE CHANGE]

DR. NERISSA WU: So the samples are at the lab. We don't have lab data to share yet, but we have learned a lot just from the process of collecting the samples. With regard to participant experience, we did survey participants at the time of sample collection, and then we solicited feedback one month later. We're still compiling that data. But we have heard that most participants, over 75 percent, found the devices easier to use than

phlebotomy. It was quicker. It was less painful. We did have some participants who did prefer venipuncture, but we also heard that about half of the participants were left with a mark on their skin even weeks after the sample was collection -- collected.

And for some participants that was a little bit of a deal breaker that you could still see a mark on their arm. So that's something we're continuing to examine.

As far as volume goes, we were able to get samples for most participants using the devices. Although, for some people we did need to do a second or even a third attempt. Of course, venipuncture is also not a hundred percent. You sometimes have to look for a second stick. And then we did encounter some issues for participants who had fast clotting blood and found that there might have been a little less success with older participants. So things we're considering again.

So again, the samples are at the lab right now for metals and PFAS analyses. And we will evaluate the samples for usability and for contamination, and then differences between the different devices. Right away, we did have some concern with blood clotting too quickly in the EDTA tubes for people particularly who took a little longer for the sample to collect. We're worried it didn't get mixed with the EDTA quickly enough. And so we'll be

looking to our labs to let us know if that impacted the quality of the samples.

[SLIDE CHANGE]

DR. NERISSA WU: One of the other things we're really putting a lot of energy into exploring is this use of an electronic platform for results return. DERBI is a platform that was created by Silent Spring Institute. And they've, of course, done extensive work on developing participant experiences and evaluating it.

So we wanted to use our own materials, see what the platform looked like with Biomonitoring California materials and evaluate the impact on our staff, as well as on participants.

[SLIDE CHANGE]

DR. NERISSA WU: So internally the process of creating paper results packets is quite labor intensive. The use of an electronic platform such as DERBI would really simplify the process. We'd still do the data processing step, but it would eliminate the need to produce and mail out all the paper packets. And this is particularly helpful in a study for which we have hundreds of participants and multiple chemical panels, which might be coming out at different points in time.

For staff, we would eliminate the need to verify mailing addresses and conduct multiple rounds of packet

generation. And for participants, they would have one log in where they would repeatedly log in to the same site to see additional results.

On the participant side, we have heard from participants that our results are a lot to look through, and so the DERBI platform does enable participants to either survey their materials or to click on links and go deep into their material. It allows it to be a lot more configurable to how they want to access the data. And for us the online system allows us to track how people are looking at their data, which would help us understand a little better about what is useful to our participants.

[SLIDE CHANGE]

DR. NERISSA WU: So moving on to the labs. The labs are also working on expanding and improving our lab methods. They're supporting our various IPP studies to develop our lab and field methods. From the IPP sampling, PAH metabolite results have been returned to us and are about to be returned to participants using the DERBI system. And we just got VOC metabolite data, which we'll be getting back to participants soon.

And then we have aliquots from an IPP sample collection that are at the Emory Lab for analysis of short and ultra-short PFASs, and we should have that data in the next couple of months.

[SLIDE CHANGE]

DR. NERISSA WU: Just an example of how this method refinement is useful, how the IPP is used for method refinement. Our PAH method that was used in the last IPP round, now has a unique standard per analyte rather than one internal standard that's used for all analytes. And so that matched internal standard is able to address some of the issues we've had, such as matrix effects and losses during solvent evaporation, and instrument fluctuation. So this should improve the precision and accuracy of the method.

[SLIDE CHANGE]

DR. NERISSA WU: Other than IPP, the labs are busy working on CHAIRS, 187 samples. And we're on track to have all those samples analyzed by May. CARE-2, we're hoping to have phenols analyzed for the CARE-2 participants. And then for STEPS, I had mentioned before Orange County data should be released to us soon.

[SLIDE CHANGE]

DR. NERISSA WU: We want to talk about outreach and communications, I have mentioned some of the things that staff is busy working on, things like results return, and additions to the CARE report, but there is a lot of effort going into developing social media content now to better disseminate our study findings. This is an example

of a post that we put out on the FREES Study, on the intervention study with foam replacement in furniture. And that re -- that reached new audiences of more than 10,000 people, because of reposting by State and county agencies.

This came out, I guess, a few weeks ago, but we actually also had an Instagram, and X, and LinkedIn post that came out on the fish and PFAS work. And we're hoping that that also gets reposted to reach some broader audiences.

[SLIDE CHANGE]

DR. NERISSA WU: And then in addition to study-specific information, the team is also posting more generally on environmental health issues, building environmental health capacity in the public. And we recently posted about World Environmental Health Education Day, which again was reposted by a number of organizations. And it's through this network that we're really able to reach many more people. I just want to note that our outreach team was just featured in a CDPH 2026 Social Media Best Practices Guide, serving as a benchmark for the Department's external collaboration -- communications. So that's a great recognition for our staff. And it's the Outreach and Communications group, as well as our broader staff that really gets all of this

work done. So I just want to acknowledge all of their hard work.

[SLIDE CHANGE]

DR. NERISSA WU: I didn't even get the time message. I'm right on time.

(Laughter).

[SLIDE CHANGE]

DR. NERISSA WU: Anyone with questions at this point?

STEPHANIE JARMUL: Make sure they turn the mics back on.

CHAIR McKONE: Thank you very much, Nerissa. So we'll begin with just clarifying questions first from the Panel and then from the audience, but these are just short questions of clarification. Once we finish that, then we'll move into a more open discussion with more in-depth questions. So hold your profound questions.

(Laughter).

CHAIR McKONE: This is just for points of clarification. First of the Panel.

Yes.

PANEL MEMBER FIEHN: Thank you, Nerissa. It's fantastic like always.

I wonder -- you know, I'm really interested in this DERBI feedback loop. What about, you know, people

who may not have their own cell phone or have difficulties with internet access, will they get still written forms in these cases?

DR. NERISSA WU: Yeah. Always. We're aware that the online format is not accessible to everybody. And actually some of the UC Merced feedback to us will be on how DERBI was perceived by participants. But DERBI also has a function where you can print out a report.

PANEL MEMBER FIEHN: Okay.

DR. NERISSA WU: And the program would always make that available to participants.

PANEL MEMBER FIEHN: So you also mentioned that there were issues with laboratory activities in terms of internal standards that, you know, until now, they were not individual internal standards. Are those studies now in question? Are they going to be repeated?

DR. NERISSA WU: I don't think they're in question, but it just improves the precision of the method. But for questions about the method, I think I'm going to see if Jianwen is here. He's not here in person. Jianwen, if you're online maybe you could address Oliver's question.

STEPHANIE JARMUL: We'll come back to that one.

DR. NERISSA WU: Yeah, we'll come back.

CHAIR McKONE: Yeah, Amy.

PANEL MEMBER PADULA: This is Amy Padula. I just had a question about the microsampling devices. I was wondering if they can be self-administered in future studies, and also how they could be stored, or shipped, or if that were a possibility?

DR. NERISSA WU: Yeah. I think they are mostly used in self-administered applications at this point. There's a real growth in these different devices, because there's a lot of over-the-counter monitoring of health that's going on, so that's mostly where the market is. But, of course, it's exciting for us that people might be able to take samples on their own.

They -- I can show you -- and apologies for people online. We do have samples of them here. You can attach an EDTA tube, which then you detach and could put in your freezer, and then you could have shipping materials to send that back.

For serum separator, you would need to spin it down right away, so that would be less feasible for somebody at home, but you could do whole blood sampling, for example, if there were a disaster where you wanted to go in and sample people right afterwards. They would be able to do that on their own and then maybe ship those back to a central location.

You asked another question.

PANEL MEMBER PADULA: You answered it. Thank you.

DR. NERISSA WU: Okay.

CHAIR McKONE: Other questions.

Lara.

PANEL MEMBER CUSHING: Hi. This is Lara Cushing. Thanks for the great presentation as always. I had another question on the microsampling. I was just wondering could you say more about how you evaluate them for potential contamination? Are you like also doing phlebotomy and then comparing between the two?

DR. NERISSA WU: Yeah. So for each participant, we collected whole blood and serum via phlebotomy, as well as from the two devices. We also screen the devices ahead of time at the lab. They took them apart, checked the blades, checked the -- you know, whatever touched the sample to see if there were PFAS and metals in the devices themselves. And then we will -- we ran blanks. We collected a number of blanks and we'll check those as well.

CHAIR McKONE: Okay. More clarifying questions from the Panel.

If not, we could take -- if there are a few brief -- this is short clarifying questions before we move into discussion from the audience.

Okay. We're on schedule. We can now open it up to broader questions.

STEPHANIE JARMUL: Jianwen is --

CHAIR McKONE: Oh, you do have one. Sorry.

DR. JIANWEN SHE: Hi, everyone. This is Jianwen I heard Dr. -- Professor Oliver have a question about PAH result. Could you repeat your question, because I -- somehow I missed the part of it.

PANEL MEMBER FIEHN: Sure. I was surprised that the Program didn't have individual standards for the individual targets of analysis, because it's kind of common practice to do. So, Nerissa said it was usually just one internal standard for bulk of other reported targets. And I wonder how we look at that if, you know, that is maybe common in PAH analyses? I mean, not that I know, but I think it usually should be that you have internal standards for every compound that you measure or at least you say, oh, you have at least reported these or have correction factors. So that's this question.

And then, of course, following, you know, the report -- the data that had been reported before, how much can we now trust them?

DR. JIANWEN SHE: Thank you for a very nice question. And at the beginning, this method was developed part of 15, 16 years ago, PAH. We have three or four

group of PAH, two rings, three rings. Three rings have the two group of chemical, fluorene and anthracene. And the four rings I believe is pyrene.

So, at the beginning, we need to customize make the standards. So for each -- for each homologue group I called isomers, two rings, naphthalene, 1-naph, 2-naph. The other three with three rings -- a lot of them with the three rings, fluorene, three anthracene metabolite, and the pyrene only one. So the total line of them, we use full internal standard. It's -- on the GC-MS, actually relative -- like you are already recognized, GC-MS the relative response effect between the isomer is not that big, but we also do a calibration. We use -- we use the line of the target standard against the full of the isotope label standard at beginning, so that the -- produce the result with close value. We call it quality assessment done, with the CDC's PT samples, and also with our quality control samples. So I think that the result is very good regarding previous samples.

As you know, with the Deuterium standard that stability is not as strong as the carbon standards. Last few years, we find Carbon-13 standard become available. So you see from this table, we have more Carbon-13 added on. So the method is more robust at this moment than the Deuterium standard, because the hydrogen and Deuterium

might switch sometimes, but we do not see any quality issue. The solution, as you mentioned, we calculated the relative response back. Yeah.

PANEL MEMBER FIEHN: Thank you.

DR. JIANWEN SHE: Thank you.

CHAIR McKONE: With this, we've moved into our more substantive discussion. Thank you. And we can go into other areas.

I remind the Panel that like -- I think on one of the earlier slides you were asking for input on how to present analytical results, what are some ideas, yeah -- for that. There was one request. Oh, yeah.

PANEL MEMBER FIEHN: Oh, yeah... Yeah. Yes, formatting.

DR. NERISSA WU: Yeah. We -- I mean, our website currently has -- I mean we are starting to post more creatinine-adjusted and weighted data, particularly for our surveillance. But, I mean, there's effort and there's space on the website. And so, figuring out what is the priority, what is mostly used would be helpful. And even whether these APC-adjusted percent change kind of information is valuable to other researchers -- I think that would be great.

CHAIR McKONE: Any thoughts from the Panel?

Timur.

PANEL MEMBER DURRANI: This is Timur Durrani. I don't use this for research, but I use a version of something similar for NHANES for explaining results to patient populations. And so having unweighted is helpful and it looks similar to how the NHANES data is presented in that we're able to show by age, and sex, and things like that. So that would be helpful, recognizing this is for adults only, but that's how it's used.

DR. KATHLEEN ATTFIELD: Well, I just want to clarify that ours are posted similarly to NHANES and that the NHANES data is also weighted --

PANEL MEMBER DURRANI: Okay.

DR. KATHLEEN ATTFIELD: -- But we break it down further by different demographic groups. So if you're more interested in male levels, or female levels, or different age groups, I think it's -- so far, it's only been in this report structure, not part of the interactive database that we have online, but open to suggestions.

PANEL MEMBER DURRANI: Okay. Thanks. And, yeah, so if it's in the same --

DR. KATHLEEN ATTFIELD: Oh, I'm sorry. I'm supposed to introduce myself. Kathleen Attfield from California Department of Public Health.

PANEL MEMBER DURRANI: Thanks, Kathleen.

So, yeah. So that I -- I think this same format

then, that's helpful. That's what we're using. That's how I use it.

DR. NERISSA WU: Great. Thank you.

CHAIR McKONE: Yeah. Oliver.

PANEL MEMBER FIEHN: My lab is very much engaged in public exchange of data. So we host multiple databases, multiple software issues, not so much for these types of chemicals, but for other chemicals. And what we find most useful when we exchange data with other resources is that the data are there in raw format as well, not just in aggregated, not just in summarized, not just -- you know, but the raw data, so that we can use novel algorithms perhaps, that we can look at diversity of variance of data sets, so that is for us most helpful.

DR. NERISSA WU: Great. Thank you.

CHAIR McKONE: Other input?

Yes.

DIRECTOR THAYER: Kind of following up on that. So, you know, at U.S. EPA, the former computational toxicology and exposures -- you're probably aware, many of the staff have gone to Underwriter Labs Chemical Research Institute. And they're kind of reenvisioning sort of the data repositories and have asked us specifically about like exposure information that may be available from California, and thinking about that formatting to make it

exchangeable. So we can kind of follow-up offline if that's of interest.

DR. NERISSA WU: That would be great. I mean, our data is only as useful as it is accessible to people, so any input into how to enhance that would be really awesome.

CHAIR McKONE: Oliver.

PANEL MEMBER FIEHN: Oliver Fiehn with another follow-up. Sorry. I haven't look at the downloads. I'm sorry. I should have. But for all chemicals, they need a so-called international chemical identifier in here. If it doesn't have it, they should have it, right? Just saying. That's for database people normal, but maybe not in this case.

STEPHANIE JARMUL: Jenny has a question.

CHAIR McKONE: Oh, okay. Jenny, I can't see you.

STEPHANIE JARMUL: Jenny. Go to Jenny.

CHAIR McKONE: Jenny, yeah, go ahead.

PANEL MEMBER QUINTANA: Hi. Can you hear me?

CHAIR McKONE: Yes.

PANEL MEMBER QUINTANA: Okay. Great. Yes. I actually had a similar comment to Oliver just now about the identifier. Another thing just in the report itself, I think that we should make sure that the demographic difference between CARE's and underlying populations is

really featured -- (phone rings) -- sorry about that. So -- just because NHANES really is more population based. And so if it looks like NHANES, it might also imply that the population is as representative, which, as we know, it was unable to be unfortunately in the study. So I just think a little more just emphasizing that piece. I think, what we don't know, I guess, would be helpful.

DR. NERISSA WU: And that is described in the report. And that's why the APCs are based on weighted data to -- weighted to the population. And, of course, you're correct that there are biases in how our participants were recruited that cannot always be weighted away, but we made every attempt to both make it as generalizable, but then describe the biases that might be in the data.

PANEL MEMBER QUINTANA: Yeah. Yeah. I saw the weighting, which was well presented. I just wanted to -- I thought maybe a little more for the average person, not realizing that perhaps adding a bit more about that, because it does bias the data a little bit?

DR. NERISSA WU: Sure.

CHAIR McKONE: We only have -- oh, we just have a few minutes. I want to make sure we formally open it up to public comment now, if there is some.

Yeah. Wait for the microphone

NANCY BUERMEYER: Thanks very much. Nancy Buermeyer with Breast Cancer Prevention Partners. Again, great job for the Program getting all this work done. As an advocate who uses the numbers to pass legislation, the thing that's most useful for me is not the geometric mean. It doesn't mean anything to people who are trying to do policy. The percent detection is super important and I have found it very hard to find at the NHANES level. It may be there somewhere, but I'm not sophisticated enough to find it on the tables. The other thing that would be helpful is you're testing for individual PFAS, and you're going to do a detection level for -- or detection percent for each of those individual PFAS.

But to the extent you could say for the 25 PFAS we tested for, we found it in at least one of them in X percentage of the entire population. Because again, people on the ground don't really care whether it's PFOA or PFOS, or any of the other acronym mess that I don't know what they mean. So those -- that would just be my comment from an advocacy perspective.

DR. NERISSA WU: That's always helpful to hear. I did not include a screen shot of the CARE fact sheet, which is the at-a-glance the CARE study. And that's where we might have more aggregated information, like 99 percent of people in this study, or 99 percent of this population

have at least one PFAS, and I think an average of seven PFASs in their body.

So we are putting a lot of effort into getting more of that aggregated messaging out. So great to hear your feedback on it.

CHAIR McKONE: Okay. Other comments, Panel, public?

I just -- I mean, before we break, I just -- I was curious about the little microdevices that -- sort of those are kind of like little suction. What keeps them attached?

DR. NERISSA WU: Yeah. There's a little bit of a vacuum when you -- when you first -- there's a button you push and that creates the vacuum. And the different devices have either a lancet or a different kind of razor in there, which opens the skin, but then there's the suction that pulls out. It's not very strong and we're only collecting 500 microliters. It's not a lot of blood, but it's enough for one or two panels being run in the lab.

CHAIR McKONE: So you're saying it leaves a mark. I mean, I know that when I was a child, I had one of those little suction darts.

(Laughter).

CHAIR McKONE: And I put it on my arm, and then I

had a little red mark, something like that.

(Laughter).

CHAIR McKONE: I mean, but if you put a suction around, you're going to get a -- some reddening. Is that a -- that's not a problem?

DR. NERISSA WU: I mean, I think people described it at as a bruise or a mark. It's -- I don't know how -- like I don't know if I would describe it as a scar, something that's permanent. I don't know if others want to weigh in on this who were part of the IPP.

STEPHANIE JARMUL: Well, just from what I heard -- this is Stephanie Jarmul -- it lasted for maybe about a week there was mark, and then it did go away. But it was a lasting mark on people's arms that they weren't super thrilled about.

CHAIR McKONE: Okay. I was just curious about whether that affects the willingness of people to use it, but it is just a little like -- not a bruise, but a little redness.

I guess -- oh, we're on schedule, right, for a break?

So, with that, we -- we're going to end the Program update section and we're going to take a 10-minute break. So we want people to return promptly. We'd like to start again right around 1:55.

(Off record: 1:46 p m.)

(Thereupon a recess was taken.)

(On record: 1:56 p.m.)

CHAIR McKONE: Alrighty. So we have to finish up one item from the last session. Apparently, just as we were quitting or adjourning, a question came in and we really don't want to exclude a question that is of interest, so we have one question of clarification that came in online.

STEPHANIE JARMUL: And the question was from an anonymous attendee. This is Stephanie Jarmul.

Do both devices leave a mark or was it just the Tasso+ device or TAP microsamples?

DR. NERISSA WU: The responses we got on the survey indicated that both could leave a mark. I believe that TAP left a more profound mark. I'm looking at Mylanah, because she -- oh, sorry, the Tasso left a little bit more of a mark. But again, we're still -- we're still looking at the data to see if there was one that was significantly better, but we did hear from both -- from participants that both devices were leaving a mark.

CHAIR McKONE: Okay. Thank you.

So for the afternoon -- for the next session this afternoon, we are going to be hearing from three speakers on the topic of microplastics. Our first presenter is

Jeff Wagner. Jeff is the Chief of the Environmental Health Invest -- sorry -- Environmental Health Laboratory Branch. Today, he will be providing an introduction to the session, "Microplastics: Monitoring Methods and Examples of State Efforts."

Okay.

(Slide presentation).

DR. JEFF WAGNER: Okay. Well, thank you. Looking forward to this session on microplastics today.

[SLIDE CHANGE]

DR. JEFF WAGNER: I'm going to start with some introductory remarks and then get into some of the issues relevant to the Program potentially, including definitions of microplastics and pathways, in as much as they relate to the biospecimens we might hope to collect. And then talk about some measurement methods that we've used in our CDPH Laboratory on strictly environmental microplastics measurements, but I'll talk about how that relates and then summarize the results.

[SLIDE CHANGE]

DR. JEFF WAGNER: So as many of you know microplastics, at this point, have been detected in pretty much every environmental compartment, air, soil, biota, and wildlife, food, water, and more recently human blood, urine, and tissues. So there are still some considerable

uncertainties in the field, including the health effects. There's studies coming out that are exploring what various effects like inflammation and neurological effects could be for microplastics, but it's still a relatively young field. Even the definition itself of microplastics could be thought of as a young definition and the measurement methods are evolving.

And finally, the migration of microplastics in the human body to various organs and the dependence of that migration on particle size is one of the uncertainties in this field. And the figure on the right is an example from inhalation of microplastics. That's the particular route that I'm most familiar with from my years in air pollution. And it's complex, but just the simplified way of saying it is that particles smaller than two and a half microns are going to end up in the lower airways. Higher will end up in the upper airways and swallowed and therefore represent yet a different target pathway.

So, yeah, these are the types of issues that need to be resolved I think as we continue to work on this subject. So both my organization and Department of Public Health, as well as OEHHA, DTSC, and the Water Boards are -- have all been working on microplastics. And the Biomonitoring Program is currently gathering information.

[SLIDE CHANGE]

DR. JEFF WAGNER: So in a little bit more detail, the OEHHA effort is focusing and evaluating health effects of microplastics in drinking water and bottled water. And there's a new State bill that requires OEHHA to do this. And they're working on some additional complexities, like the fact that microplastics actually represent a contaminant suite, a multidimensional one that I'll go into a little bit in the definition.

And then also, they are planning to conduct a literature review, convene an expert workshop, and implement a risk assessment framework.

[SLIDE CHANGE]

DR. JEFF WAGNER: So on the right, it's just like a screenshot of the resolution from Water Boards from 2020, where they defined microplastics specifically in drinking water as essentially solid polymers that range from 1 nanometer to 5,000 micrometers and inherent in the definition is a provision that this is subject to change in response to new information, which I think is good, advances in analytical techniques and/or the standardization of the methods.

So typically, studies thus far have reported the plastics in terms of several different common polymers. These are just on the screen are a list of some of the

more common ones, like polyethylene, polypropylene, polyester, nylon, et cetera, but there's many more. And it even tends, in most studies, to include modified natural fibers, like rayon.

[SLIDE CHANGE]

DR. JEFF WAGNER: So looking at sort of a simplified diagram of how pollutants in general are taken into the human body and then the pathways that they would take towards biospecimens that we might collect, I think is useful for thinking about microplastics. I have drawn a solid box around blood and urine, because that's most commonly the biospecimens that we look at in our Program, but there's several other potential candidates that could be looked at, depending on feasibility and whether we expect microplastics to end up there.

So I've drawn solid arrows to inhalation, ingestion. Those two routes seem to be most likely. I'm not aware of how dermal absorption could be relevant to them, but I just left it as a question mark. Likewise, with several of the biospecimen endpoints. It seems like -- and we'll hear a bit more about this from the other panelists, but it seems like urine and blood are again good candidates, but there are others, perhaps milk for example.

[SLIDE CHANGE]

DR. JEFF WAGNER: And then finally the methods, by which microplastics are analyzed and quantified. In our lab, we predominantly use microspectroscopy. We had so far nine publications on method development, dating back to 2011. And as I mentioned earlier, these are all in environmental matrices with the addition of fish tissue and consumer products.

But the method, with some modifications, is totally applicable to human specimens as well. And it involves semi-automated microplastic identification and size measurement, which, as I mentioned earlier, is fairly important of individual particles. And since you're doing individual particles, even if it's an automated technique, you get counts per sample, and then these can then be converted with some assumptions into mass microplastics per sample.

The two major tools are Raman microspectroscopy and FTIR, Fourier transform infrared. They have slightly different detection limits that you'll notice only go down, best case, to 1 micrometer. So that's a significant limitation, if you're looking for things particularly that you expect in the human body to be smaller than that.

Typically, these methods are supplemented with optical microscopy, which provides a lot of good information on these individual particles. You can see

the picture, fairly small picture, of a couple of microplastics from one of our studies. And you can see that they're clearly from the ocean, they have little microorganisms growing on them. But often, maybe the study won't care where the microplastics came from. But if they do, this is a great technique.

Size, color, co-present contaminants in each individual particle. It's really good for that type of a study. In occasion, we'll supplement it with electron microscopy, which can go down into the nanosize range, which is great, but unfortunately it's not a definitive method to identify the polymer type.

But in general, what these methods do is they take a spectra, like you see at the bottom, and compare it to a reference library, in this case for polyethylene.

[SLIDE CHANGE]

DR. JEFF WAGNER: In general, I would say that these methods are very expensive and slow. But as I mentioned, they're ideal for source ID and interpretation.

In the upper right, you can see images of flame retardants in microplastics adhered to upholstery fibers, which is really interesting, particularly if you want to do like a intervention, both the source and the co-present flame retardants. But I will say that in addition, another limitation is the potential for contamination,

since plastics are everywhere, particularly in our labs. So what that means is that blanks are really important, QA, and even just looking at any detection plausibility.

And I'll just mention also in this slide are a microplastic that blocked a tiny fish's GI tract. It's kind of sticking out of the stomach. That would be, I believe, a pretty acute impact of that microplastic, because the stomach was empty otherwise.

And on the lower right is a microplastic composed of teflon, which was shielding a soldered wire terminal inside a vaping device.

[SLIDE CHANGE]

DR. JEFF WAGNER: I'll just briefly mention pyrolysis GC-MS as the emerging method we're looking at. It has the advantage of being rapid. No special sample prep.

(Technical difficulties.)

[SLIDE CHANGE]

DR. JEFF WAGNER: Okay. So I'll summarize by saying that the challenge to us is to define specific health and biomarker relevant microplastic analytes, in terms of things like total microplastics versus specific polymers and whether that's reported for specific particle sizes. We do have uncertainties for all of the above that we're working on resolving.

And I just wanted to mention that Biomonitoring California already has methods for several different microplastic associated chemicals, like fluorinated compounds, plasticizers, flame retardants, and metals.

Our measurement methods we've used so far in our laboratory are: count-based microspectroscopy, which is costly, but informative; mass-based pyrolysis GC-MS, which is an emerging alternative; and then there are some newer methods, such as flow cytometry, which you'll be hearing about, I hope, from some of the other panelists, that are also promising. And for all of the above, just to keep in mind that blanks, QC and reference samples are essential.

Thank you.

(Applause).

CHAIR McKONE: We're behind schedule a bit, but we do have ten minutes allocated for questions both from the Panel and from the audience, but we will begin with Panel questions.

Oliver.

PANEL MEMBER FIEHN: I am only vaguely informed. Thank you for the introduction and review. So, I always thought that it's very much about the shape of these microplastics. So what is the best method to look at shapes, like how pointy they are, and how ragged they are, and whatnot.

DR. JEFF WAGNER: Yes. I think that is an excellent point. And I hope I don't break it again by advancing the slides backwards, but if you -- okay. Well, some of -- some people may be able to see that there's a picture of -- that I showed before of a stomach with a fiber -- plastic fiber. And that's a perfect example. In that case, the smallest dimension of the particle was key and the longest dimension was also key, because it meant that the particle got in, but it didn't get out. And that type of thing, fibers are notorious for that. Particularly with asbestos and fiberglass inhalation, shape means everything. It's almost the only thing.

So I do think shape measurements are probably not reported in all cases. So I think that's a good point.

STEPHANIE JARMUL: Jenny has a question.

PANEL MEMBER QUINTANA: Hi. This is Jenny Quintana. I guess in terms of prioritizing, I was wondering how much work is being done at looking at the source and type of particles in an important target organ, and I'm thinking of the brain specifically, which I know has been done on autopsy? How much work is being done on looking at those and then trying to figure out how to monitor those, because they have a direct relevance to getting inside the brain, or if you have any comments about that? Thank you.

DR. JEFF WAGNER: Yeah. I think paying attention to the target organs and the target health effects that you're most interested in is really important going forward, because it's one thing to just report the presence of microplastics, but to talk about the plausibility of them ending up in something like the brain, the shape, size, yeah, I totally agree. And I believe I skipped too fast over -- I was going to mention in my biological pathway slide, that there was a dotted arrow going from the nose to the brain. And perhaps some of the offer panelists will be talking about that dotted pathway.

CHAIR McKONE: Okay. Other questions, audience, Panel?

Oh, yeah. Timur

PANEL MEMBER DURRANI: This is Timur Durrani from UCSF. A question for you on the routes panel slide that you had with hair, teeth, and nails. Can you talk about your perspective of trying to determine external contamination from anything that's being part of the matrix?

DR. JEFF WAGNER: Are you talking about like environmental exposures that end up on say the hair, teeth, nails, and didn't directly get there from -- through the human body?

PANEL MEMBER DURRANI: Right.

DR. JEFF WAGNER: Yeah. I think that's -- that is definitely important for those three and also perhaps perspiration. We've talked about that in internal meetings in the Program as to how you sort that out. I think there are some studies that try to quantify the two components separately and try to figure out which is more important.

For microplastics in specific, I personally have a hard time imagining them ending up incorporated in things like perspiration, hair, teeth, and nails. However, as we start getting down to the nanoscale, I guess -- I don't know if it's possible. That's very small.

PANEL MEMBER DURRANI: We -- in the clinical realm, we get asked these questions of people who will get these hair samples and things, not so much from microplastics, but for other things, metals and some other things. And so all -- the question always comes up of how did -- how is the sample prepped, how -- what -- how were they -- you know, how -- they're are some, you know, sort of famous examples of things of having external contamination, cocaine being one of them and metabolites to cocaine. So I didn't know if that was a sim -- if there are similar issues here or if you found it inherent

and you felt like, okay, this would have been incorporated somehow rather than from some external source and we're confident that in our sampling, preparation, and so forth that we can determine the two or are we?

DR. JEFF WAGNER: I think that's a good point and I think that one line of defense for trying to understand those questions is whether or not you're looking at a parent compound or a metabolite. And in this case, I don't know -- I don't know if there's a relevant metabolite, but that would be a good question. Yep. And lab cleanliness for sure. Yeah.

CHAIR McKONE: Okay. Yeah, Amy.

PANEL MEMBER PADULA: This is Amy Padula. I just had a question. I was wondering the kind of more emerging alternative of using GC-MS methods sounds maybe more amenable to kind of biomonitoring. But I was wondering if it can be anchored in some of the other work that you've done with the microspectroscopy. Excuse me.

DR. JEFF WAGNER: Yes. No, I think that's a very good point. And there have been studies that run subsamples of a particular sample with both microspectroscopy and GC-MS.

Yeah. I think that's important, because a vast majority of the reports that have come out so far have used that microspectroscopy. So to establish continuity

and it's a reality check. But I do think that even if it didn't run both types of methods, the GC-MS -- the pyrolysis GC-MS field is pretty devoted to using standards, not just -- not just like reference library hits, but actual standards to anchor their numbers in reality.

PANEL MEMBER PADULA: I guess I'm also curious to -- of maybe the importance of anchoring it also with -- I think you mentioned the other, you know, chemicals monitored in blood or urine that are, you know, plastic related. And then how -- I guess are there ways to really kind of harmonize them in a way that gives -- provides more validity, because I guess with all of -- with emerging methods to quantify it, it also seems like, well, if we're quantifying different things, how do we -- how do we better understand this to make sure that we're aiming for the same type of thing that we're measuring.

DR. JEFF WAGNER: And so, are you thinking that if you could quantify some of the plasticizers and flame retardants, all those things at the same time as the plastics, that that would give a more complete picture?

PANEL MEMBER PADULA: I mean, to me I think that would. I'm just wondering if that's -- if that's being done or --

DR. JEFF WAGNER: Yeah. I would love for one of

the other panelists who has more experience with GC-MS techniques to weigh in on that, but my understanding is that since you're basically incinerating everything on the way in, that that might limit the types of compounds you can detect. With FTIR and Raman, it's definitely possible to analyze all those -- all those things at once. Yeah.

PANEL MEMBER PADULA: Thank you.

CHAIR McKONE: Okay. I think we're going to cut off at this -- because we do have a 20-minute period at the end for a broader discussion, but I think we're a little behind, so we'll move on.

So, next we'll be hearing from Dicle Yardimci. Dicle is a Senior Hazardous Substance Engineer with the California Department of Toxic Substances Control, Safer Consumer Products Program. Dicle has been leading the microplastics and consumer products screening research effort at DTSC. She will give a presentation on the DTSC efforts on microplastics in consumer products.

Okay.

(Slide presentation).

DR. DICLE YARDIMCI: Thank you. It doesn't let me share my screen. If you could unshare. Thank you.

Thank you for the introduction. Hello, everyone. I'm Dicle Yardimci. I'm with the California DTSC Safer Consumer Products Program, and today I will give you an

overview of what we have been doing on microplastics.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And this presentation summarizes the publicly available information that's available on DTSC's website and I do not have any conflict of interest to disclose.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And I will give you a quick overview of DTSC and the SCP Program, then we will talk about microplastics, hazard traits, and their exposure potential and I will then give you a brief overview of our preliminary research on microplastics in various consumer products and we will have a Q&A at the end.

[SLIDE CHANGE]

[SLIDE CHANGE]

DR. DICLE YARDIMCI: DTSC has three different programs, including the Site Cleanup, Hazardous Waste Management, and Safer Consumer Products Program. And in 2008, California Green Chemistry Law created -- went into effect and it created the Safer Consumer Products Regulations, SCP regulations for short.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: SCP regulations took effect on October 1st of 2013, which then created the SCP Program. And our mission is to promote the development of

products that are safer for people and the environment. While we do that, we evaluate harmful chemicals and safer alternatives to those harmful chemicals, and also avoid regrettable substitutes. Our program promotes innovation. This is a transparent and science-based program, and our regulations are enforceable throughout the state.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And our program regulatory framework has four steps. First step is the candidate chemical list. These are the chemicals of concern that are listed by authoritative bodies or DTSC can also add chemicals to this list. And these are essentially a menu of chemicals we can regulate in consumer products.

Second step is the priority products. These are consumer products that contain at least one candidate chemical from Step 1, and that has the potential to cause harm. For us to list a consumer product, as a priority product, we have to go through a rulemaking process.

And the third step is manufacturers of the priority products, evaluate safer alternatives to the candidate chemical in their product and submit that to the Department.

And the last step is regulatory response. This is a range of possible regulatory actions to protect human health and the environment.

Steps 3 and 4 falls under compliance and enforcement efforts. And if you would like -- if you are curious about the details of each step, you can find more information on our website.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: Going back to the priority products. For us to be able to list a consumer product as a priority product while rulemaking, there have to be two criteria need to be met. The first one being there are -- there must be potential exposures to the candidate chemical in the product. And the second criteria is one or more of those exposures must have the potential to contribute to or cause significant or widespread adverse impacts.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: Our product-chemical prioritization process is a several year process, so it is not a quick fast process, so it takes -- it is a lengthy process, starting with conducting screening research and doing early public engagement at a public workshop and the public comment period. We then look at that feedback internally and decide if we need further research. Then we release a more comprehensive critical document, which we call a profile, which then we propose a priority product. And after this step, we hold a pre-rulemaking

workshop followed by a public comment period.

And then we are mandated to go through an external scientific peer review. These are the subject matter experts in the field must review our technical document before we can initiate a rulemaking. And the rulemaking itself takes one year. And all the steps prior to rulemaking can take a couple of years as well, so this is a long process. I wanted to acknowledge that.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And now, we will talk about today's topic of microplastics, their hazard traits, and exposure potential.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: As most of you know, there's no universally accepted definition of microplastics, but there's the general consensus that microplastics are plastics that are less than 5 millimeter in their longest dimension. And microplastics currently are not on our candidate chemical list. Last year, we initiated a rulemaking to add microplastics to our candidate chemical list. Important notes here, we cannot regulate consumer products that generate microplastics before microplastics are officially listed on our candidate chemical list, by a rulemaking.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And there -- microplastics are typically categorized either primary or secondary. Primary microplastics are the ones that are intentionally manufactured for specific products or applications, such as microbeads and personal care products or they can be secondary coming from fragmentation of larger plastics such as tire wear particles.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: Most microplastics exhibit the hazard traits of environmental persistence and they can be mobile in environmental media. And depending on their physical chemical properties, they can also exhibit additional hazard traits, such as carcinogenicity dermatotoxicity and wildlife impairment.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: So this is a conceptual model, which shows some of the sources, pathways, and Environmental fate of microplastics once they are released from consumer products. Please note that this doesn't include every single source, pathway, or environmental fate. So this is just giving you an example of microplastics can come directly from the households via human consumption, can end up in the environment, in surface water. They can also come from wastewater treatment plants or leach from landfill, as well as

agricultural products and biosolid. They can be carried via air, dust, wind, and rain.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And there are reasons we are concerned about microplastics because they're persistent and mobile in the environment, and they're widespread. They're everywhere. They're in remote locations. They are found in drinking water in the air, the beverages, and on food humans consume. Because of their small size, they can be consumed by humans and other organisms. They can also taken up by plants via water and soil. And there is potential for adverse health impacts in organisms and humans that are exposed to microplastics.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: As I mentioned, microplastics are -- can be inhaled from air. They can be ingested from the drinking water, food, and beverages. There is also a potential for dermal exposure via contacting products with microplastics, and also from household dust.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And there is potential for human adverse health impacts. However, as the previous speaker mentioned, the state of science is currently evolving in this field to understand the human health

impacts of microplastics exposure better, but there are studies already in the literature showing that microplastics have been detected in human blood, lungs, placenta, testes, breast milk, and stool samples.

Children, pregnant people, and workers are some of the vulnerable populations that are exposed to microplastics on a frequent basis. There is also potential for environmental impacts on wildlife exposure to microplastics, because they have been detected in every ecosystem, air, water and soil.

And depending on the size, shape, and color of microplastics, wildlife can mistake microplastics for food and feed on them. Microplastics can transfer through the food chain and plants can uptake microplastics from water and soil.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: There is also potential for wildlife adverse impacts from exposure to microplastics. And there are plenty of studies in literature showing exposure to microplastics can cause physical stress and damage, changes in gut microbiota, inflammation, oxidative stress, and immune responses in organisms that are exposed to microplastics.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And now, I'm going to do a

quick overview of our preliminary research on microplastics and various consumer products.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: For those of you who are not familiar, every three years, we do release what we call a Priority Product Work Plan. This Work Plan contains different product categories we will be working on within that three-year time frame. Our most current Work Plan, 2024-2026, we added a policy priority called to reduce the release of microplastics into the environment during the product's life cycle. We also did a new product category for products that contain or generate microplastics. Based on this policy priority and this new product category, we started evaluating products that has the potential to generate microplastics.

Now, we are in the very early stages of our process. If you recall from the beginning of my presentation, we are in the very first step. And before doing research, we also reached out to industry, government agencies, academia, and some nonprofit organizations that are subject matter experts in the field to get their feedback.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: We also reviewed regulations and work done by other government agencies, such as Ocean

Protection Council's Statewide Microplastics Strategy, CalRecycle's Plastic Pollution Prevention and Packaging Producer Responsibility Act, as well as European Union Commission regulation on microplastics.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: Because microplastics are in so many products, we had to start somewhere. So based on this consultation and our findings, we started with an initial product list and then based on what we found and -- for feasibility for SCP, we did narrow our product list and conducted further research. And we held a public workshop on these products at the end of last year. The products that were -- we haven't conducted for the research, that doesn't mean we won't go back and look at them, so we may revisit them in the future.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: In 2025, we released a public background document, so this is published on our website, which lists the different products that has the potential to generate microplastics, that we had looked at. We also recorded the public workshop, so that's also available. The recording is available on our website. And in January of this year, we closed the public comment period, so this is a written public comment period. And the comments we received from this past workshop are also

available on our website as well.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: As I mentioned, we started with an initial list of product categories first. And this list included lots of different product categories, such as agricultural products, aquaculture products, artificial turf, personal care products, building products, cigarette filters, cleaning products, food contact articles. We also looked at furniture, glitter, motor vehicle parts, nurdles, personal protective equipment, floral products, synthetic textiles, and toys.

So this was a very big list of products with some of the product categories having multiple products under. And then based on our consultation with the experts and also our own findings from doing a quick research on these product categories, we narrowed our list.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And our narrowed list of products included artificial turf infill, children's toys containing primary microplastics, plastic film mulch, single-use cigarette filters, water-based interior wall paints, cleaning products, and food contact articles, that we conducted further research and we held the workshop on.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And the types of cleaning

products we looked at were three distinct product types. The first one being intentionally added polymers in laundry and dishwashing detergents. The second one was polymeric fragrance microcapsules in laundry detergents and fabric softeners. And the third one water-soluble polymers in laundry and dishwashing detergent pods.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And for the food contact articles, we looked at six different food contact articles, including plastic beverage bottles and caps, baby feeding bottles, wrappers for snacks and candy, cling wraps and films, plastic tea bags and polystyrene foam foodware.

Now, because of the time allocation, I won't be able to go into every product in detail on our findings. But if you are interested, these findings are available in our public background document, as well as in the workshop recording that I can share the links in the chat.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: So the key takeaways here. Many consumer products contain or they have the potential to generate microplastics. And most of these microplastics are persistent, mobile, and widespread in the environment. Therefore, there is potential for both human and wildlife exposure to microplastics. And there

is also potential for adverse impacts to humans, wildlife, and the environment for the exposure to microplastics.

And there has been ongoing research on safer alternatives in some of these products. And the next steps, we will be reviewing the public comments we receive and internally decide if we need additional research. And we will potentially list some of those products that can generate microplastics as priority products via rulemaking.

Again, I would like to remind everyone, we cannot regulate the priority products that can generate microplastics before microplastics -- adding microplastics to candidate chemical list rulemaking has been finalized.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And the type of data that will be very helpful for us for listing priority products in the future to know the source of microplastics, such as polymer types, and also product types, and human exposure studies to show potential for human exposure.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: There was a big team worked on this microplastic efforts. So I would like to thank everyone who helped with this project, as well as the subject matter experts that we have consulted with throughout this process.

[SLIDE CHANGE]

DR. DICLE YARDIMCI: And we will have a Q&A session, I believe five minutes. And this is my contact information and our SCP email if we can't get to your question today. And you can sign up for our E-list to get updates about our SCP Program. And also, if you're interested in career opportunities, those are available on our website as well.

CHAIR McKONE: All right. Thank you, Dicle. That was very informative, very interesting.

(Applause).

CHAIR McKONE: So we have five minutes for Panel and audience questions. These are really quick short questions. And then we will follow that up with an open discussion and input. So, we'll begin with the Panel questions.

Carl.

PANEL MEMBER CRANOR: Thank you for the -- for the two presentations. The microplastics seem worrisome. There's clear exposure. They show up in different organisms. Have there been -- this is really a naive question. Have there been studies as to what dysfunctions they might cause in animals or whatever that have concentrations of microplastics in their organs? Is there a macro worry from the micro events that are happening?

I'd like to know more about that?

DR. DICLE YARDIMCI: Sure. Great question. So one of the -- especially for humans, there is no like safe limit that I know of that has been set, but I would like to make --

PANEL MEMBER CRANOR: Can you speak up a bit. I think you're too far from the mic.

DR. DICLE YARDIMCI: Can you hear me?

PANEL MEMBER CRANOR: Now. Now. Speak closer to the mic.

DR. DICLE YARDIMCI: Can you hear me?

STEPHANIE JARMUL: Yes.

DR. DICLE YARDIMCI: Okay. I didn't actually move, so I don't know what happened there. So for humans, there is no set limit for a safe microplastics exposure limit that I know of. The one nuance I'd like to make for our program, we don't need to quantify a safe limit. We just have to show potential for exposure and adverse impacts for us to be able to list a consumer product and regulate it.

And for animals, there has been plenty of studies in the literature showing adverse health impacts, but again I'm not sure if there is actually like limit determined. Maybe some other folks on the call have more definitive answer for you.

CHAIR McKONE: Questions from the Panel?

I just -- myself I have a question and we'll move on.

So, in terms of the fate analyses, these are different from classic transport and fate, where the -- it's solution chemistry or something. These -- I assume these are -- their fate both in the environment and in humans must involve some sort of binding perhaps to different proteins or different tissue types. Is that what you're looking into or have you -- have you quantified what the sites of binding and persistence actually are?

DR. DICLE YARDIMCI: Great question. Again, so Safer Consumer Products works very differently compared to like California Biomonitoring Program. So we don't like look at exactly like how it binds to the tissues. Like we don't go into that depth. We collaborate with other agencies and we also look at literature search to look at the publicly available information and then consult with the subject matter experts in the field.

The only regulatory mandate we have to show there is potential for exposure. So we don't do any kind of risk analysis or we don't have to quantify a safe limit for microplastics for us to regulate consumer products.

CHAIR McKONE: Okay.

DR. DICLE YARDIMCI: I would love to answer the question, but, yeah, I don't have that information.

CHAIR McKONE: Okay. Thank you. Questions from the audience, or online?

The Panel?

PANEL MEMBER PADULA: The is Amy Padula. I guess this question is about the ongoing research of safer alternatives. I was wondering if you're -- if anyone would be looking into compostable plastic bags, in terms of the kind of new alternatives to plastic? I'm wondering if they are truly compostable or whether there are any microplastics that remain from those products?

DR. DICLE YARDIMCI: So we did receive some public comments regarding the compostable alternatives. We are currently reviewing them. But just to give you a more clear picture, we are in the very first step of early engagement. So we are not going to look at alternatives to a specific product until we propose a priority product and go through rulemaking. And once it's officially listed via rulemaking, then we will be talking to the manufacturers of those products for potential alternatives.

We are looking at like a couple of years. This is assuming the microplastics are added to our candidate chemical list via a rulemaking first. So we can't really

do much until that rulemaking has been finalized. Then we will start listing products. And at that point, the rulemaking itself for a product is going to take another year. At that point then, we will be talking to both the manufacturers of those products and also people who are experts in the field to look at potential alternatives. So this is going to be a couple years down the line.

DR. AHIMSA PORTER SUMCHAI: Dr. Ahimsa Porter Sumchai. Cellophane is a biodegradable wrap that is made of cellulose. It's plant based. All of us use it. I wonder what work has been done with regard to any potential toxicity it has. It's not recyclable, but, you know, it appears to be a safer alternative to plastics used, especially in food wrapping.

DR. DICLE YARDIMCI: This is great. And I would really encourage you to reach out to us. Either you can email it to me or our SCP inbox. We are actually gathering this type of information. And once we start looking at releasing profiles for priority products, we w-o-u-l-d like to know as much information as possible about these alternatives. That can then help us determine a safer alternative, not a regrettable substitute.

CHAIR McKONE: So we have time -- I mean, I think we moved into open discussion now. And I think it's a really -- I want to expand on this question a little bit,

on the question of consumers who are looking for information. There are many people who want to know is this product safe, or is this product not safe, or at least, you know, what are the recommendations? Is DTSC moving toward a point where they might be able to actually identify in more detail what products result in fairly limited generation and persistent of microplastics and what products appear to be associated with much longer lived, much more dispersed and widely transported. I mean, even having a site where we can organize that so people could make product choices.

DR. DICLE YARDIMCI: Great question. So we cannot promote a specific product type or band, but we have a separate effort going on to encourage manufacturers to voluntarily disclose some of the safer alternatives in products. Once we move forward with microplastics added to our candidate chemical list and we start looking at like products deeper, at that point, we are going to encourage manufacturers to submit what safe alternatives they consider. And those will be, at that point, published on our website, but it won't be like a specific product or brand. It will be mostly naming the alternative.

And that process is voluntarily. But once we do rulemaking on a specific priority product, then

manufacturers must conduct an alternative analysis. So that's actually mandatory, but we do both. So if you -- if they were to submit us their voluntary safer alternatives, those will be published on our website. But I can't really give you a timeline, because this one is bound by the rulemaking of the -- adding microplastics to the candidate chemical list. And then the product has to go through its own process, which takes -- which can take two or longer years to complete it.

CHAIR McKONE: Okay. Thanks. We have another -- since you're not here with us, I don't know what you can see, but we have another question from the audience.

ALEX OKRUT: Hi. This is Alex Okrut from the California Department of Public Health. I'm interested in learning about when plastics release microplastics. Is it during everyday use, or is it during degradation, or well there -- is there some mechanical mechanism? Thinking of, for example, a sandwich bag made of PE that lives in my household for maybe a week and then it probably sits in landfill for years. Is this -- are there studies?

DR. DICLE YARDIMCI: Great question. And the short answer is all of those routes. So heat being one of the main contributor to fasten the microplastics through these -- let's say for your sandwich bag, if you microwave that with food in it, it is likely to transfer

microplastics into your food faster as opposed to keeping it in a cooler condition, such as storing it in a fridge.

So use, waste is definitely one of the routes. Once it ends up in landfill, it will continue to generate secondary microplastics, because it's going to be exposed to sunlight, water, wind, microorganism activity. So it's going to continue to create micro -- generate microplastics.

So -- and mechanical one, you have just mentioned. So an example would be that plastic water bottle. When you open close the cap, that would be a mechanical stress you apply, that can release microplastics into the water or any other beverage in that plastic bottle. So all of those routes essentially are the ways to it.

CHAIR McKONE: Other questions online or -- oh, sorry. Lara.

PANEL MEMBER CUSHING: Hi. This is Lara Cushing. Thanks for the presentation. I was curious if data from Biomonitoring California has ever been used in the rulemaking process or this screening process that you use, since, you know, part of the requirement -- sorry.

DR. DICLE YARDIMCI: Yeah, I think leading the --

PANEL MEMBER CUSHING: Can you hear me?

DR. DICLE YARDIMCI: -- microplastic efforts,

that's the program-wide question, I would have to check with SCP management on that. I don't have the answer for you. Oh, there's --

DR. ANNE COOPER DOHERTY: Yeah. Hi. I'm Anne Cooper Doherty and I'm with the Safer Consumer Products Program and I lead our Chemical Evaluation Unit. I don't have exact statistics, but was just going to say that we definitely use the data from Biomonitoring California quite frequently. I know I reviewed at least a document in the last couple months that highlighted it. So it's something that we frequently look towards, because as Dicle said, we have to show the potential for exposure in California. And so, Biomonitoring California data is a huge win whenever we can have it and use it.

So we definitely use it that way. And also chemicals that on your priority list for monitoring are automatically added to that first step that Dicle talked about, the candidate chemicals list. So classes like quaternary ammonium compounds, or, you know, bisphenols and things like that are automatically on our list and available for us to potentially regulate, because of the prioritization efforts that you all do. So definitely heavily used in our program. So thank you.

DR. DICLE YARDIMCI: Thank you, Anne Cooper.

PANEL MEMBER CUSHING: Yeah. Thanks. Just -- I

guess I was just thinking is there anything that would be particularly useful in this instance around microplastics from the biomonitoring perspective to support the rulemaking process that we should be thinking about.

And then I had a sort of unrelated question as well, which was it just seems very cumbersome to have to go product by product. So is there some mechanism where you can regulate like a class of products, so it's not such a whack-a-mole type of -- you know, because it seems, you know, many years to go about this rulemaking process. And I love that this is happening and I'm wondering how we can facilitate it to happen faster.

DR. ANNE COOPER DOHERTY: Yeah. I think on the candidate chemical listing for microplastics themselves, that rulemaking is, as Dicle said, you know, already under way, and they're in the kind of final stages of that. In terms of rulemakings for priority product listings themselves, I'll let Dicle speak to that.

In terms of product by product, I mean we can define the scope of the products as large or as small as I think we want. It's honestly oftentimes a function of our capacity to handle the resulting influx of responsible entities that come with any listing. We are a relatively small program. We've recently doubled in size, so we're up to 75 or so, but we're still relatively small, given

the wide scope of consumer products within the state.

So, it's often just how much we can handle at any one time, because it's fairly intensive to walk the manufacturers through our process and ensure compliance and all that work. So that's often a big factor in how we're kind of sectioning things off. We're also looking at things like what the evaluation of alternatives entails. You know, a lot of times the products can be very different, and so looking at an alternative to microplastic or the plastic in one product may be a completely different process than in another product. So that can also inform how we might divvy up the rulemakings, so -- and, Dicle, if you want to speak to helpful information.

DR. DICLE YARDIMCI: Yeah. Thank you Anne Cooper for the great summary. Another factor would be typically, which might not be the case always, the manufacturers of those products are going to be different. Then that's another factor that we may divide up the rulemaking, but we can use the bigger technical document for the -- on the basis for our rulemaking. But once we get into the alternative analysis process, that's going to be different depending on the product type.

DR. ANNE COOPER DOHERTY: And Dicle, did you want to speak about the types of data that's helpful?

DR. DICLE YARDIMCI: Yeah.

DR. ANNE COOPER DOHERTY: I think that was your next to last slide.

DR. DICLE YARDIMCI: Yeah. It was kind of towards the end. So, we want to showcase the potential for exposure coming from a certain product type. So knowing the polymer type, the product type, backtracking the microplastics to the source is very helpful for us, but then I do understand that's pretty challenging to do once it's in the environment. And then the other one, if you are putting human exposure as our basis for the proposal for rulemakings or human exposure routes is another important one that California Biomonitoring I can see coming to help support our argument as well.

CHAIR McKONE: Other questions from the Panel.

STEPHANIE JARMUL: Hi. Stephanie Jarmul. I just wanted to comment that DTSC's SCP's work is also very useful to Biomonitoring California. It's a two-way street. It's really helpful to learn which types of products these chemicals are in or even microplastics, if we ever were to be able to biomonitor for microplastics. It would be helpful to know where they're coming from and what the exposure sources are for, you know, our questionnaires, et cetera, and how we design our studies. So thank you for all your work you do too.

CHAIR McKONE: Any questions?

I have one, if there's not more. I have -- so I have a question a little bit different. What other entities, well the federal, but other states, Canada, but particularly Europe, what's going on in these other areas that might be of use, or would be something you could profit from, or share information, particularly in the EU? I'm assuming the EU is pretty aggressive in this area, because they tend to be pretty much on the curve or ahead of the curve in a lot of these areas.

DR. DICLE YARDIMCI: And you are correct on that one. So in 2023, EU passed a regulation on intentionally added microplastics in various products. And manufacturers already started working on some of the alternatives to comply with the EU regulations. And whenever there is a bill introduced in California, that is actually heavily impacted by what's done in the EU, because that's kind of the argument that manufacturers push back on, so which can impact how the regulation is going to shape up in California.

And some of that information is -- also could be useful for us, of course. But a lot of these products they have a transition period, so six years or eight years. So it's going to be several years down the line before we can see the impact, like how their regulations

play out, but that doesn't mean, you know, we're going to start -- still start doing things on our end.

In terms of like the -- for example, for the food contact articles, like if we did looked at FDA resources, but right now, they are not doing anything in the near term regarding microplastics specifically. That was the information also on their website.

I think the bigger fronts would be like State of Washington and Oregon typically are the other two states are going to be the leading states, in addition to California in this field, because they're typically ahead of the game compared to the other states from my experience, like working here for other harmful chemicals as well.

CHAIR McKONE: Okay. Thank you. Unless there's other burning questions or comments, I think we can move on now to our third presentation. Our next speaker is Matt Campen. Matthew is a Distinguished Professor at the University of New Mexico. Dr. Campen is an expert in the systemic impacts of inhaled toxicants, especially wildfire smoke on cerebral vasculature, placental development, and cellular aging. He'll give a presentation on current methods for detecting microplastics in humans.

(Slide presentation).

DR. MATT CAMPEN: All right.

STEPHANIE JARMUL: Hi, Matt. We see your presenter view. This is Stephanie. If you could switch it.

DR. MATT CAMPEN: Again?

(Laughter).

DR. MATT CAMPEN: I had it right the last time. Better now?

STEPHANIE JARMUL: That's great. Thank you.

DR. MATT CAMPEN: Okay. And when I move it, it moves, right?

STEPHANIE JARMUL: Yes.

DR. MATT CAMPEN: Oh, yeah, I can actually see it on the screen. This is cool. Okay. So thank you for inviting me. Thank you for that introduction.

I'm in a different position and really have -- I've appreciated this conversation so far. And what I want to say is welcome to the beginning of a science. And this audience is a regulatory body that really depends on rich knowledge that we just don't have in the world of microplastics right now. And I'm leaving it sitting on this slide, because these little flakes that you see in front of you that are all universally like less than 200 nanometers long. These are about the size of viruses. And my view, which is -- which is not in press yet, which is -- which is still very contentious, is that this is the

predominant form of plastic in the human body, as we view it from my laboratory.

[SLIDE CHANGE]

DR. MATT CAMPEN: I'll point out financial disclosure, my research funding comes from the NIH exclusively. I am a scientific advisor for Circulate Health, which is a company that's interested in plasmapheresis. And you may construe some of what things I say as leaning towards that as a viable option for all of this. I do not think so. I'll just leave it at that.

[SLIDE CHANGE]

DR. MATT CAMPEN: We've heard about primary and secondary microplastics. And that's -- those are important definitions. Most of what we believe from my Program's perspective is that secondary is the predominant concern. You have these things we throw away. We talked about the plastics you throw away. It sits in a landfill. I like to use this plastic bottle as a prop. I can empty and refill this 10,000 times and not detect a meaningful change in the mass of this product, but eventually the entire mass of this is getting thrown in a landfill and a lot of it's going to turn into microplastics. How that circles back into our world to get into our diet, whether it's through groundwater, or irrigation on fields, or what have you, I don't know that that's been worked out fully,

but those are sort of the concerns we have from a -- from a mass transfer basis leading to exposure.

But what I will say is that when we talk about this distinction between the nanoplastics and the microplastics. We know from the field of nanomedicine, where people try to deliver drug to the body by wrapping them in polymers like PLA and PLGA, we know that it's the nanoscale stuff that really gets into the body efficiently, can actually get to the brain and other organs. So 100, 200 nanometer spheres of wrapped drug, surrounded by polymer, that gets into the body. But stuff that's the size of cells or bigger than cells, it really doesn't get absorbed that well.

And so, the problem we have right now is that so much of our science has been driven by the world of environmental research, ecological research. Plastics were -- microplastics were first discovered by Richard Thompson in the ocean, and for a long time, it was an oceanographic story. But that has been led by technology like FTIR and Raman spectroscopy, where they just can't see small enough things to be relevant to the human body, much less so -- or to the human health.

And so, a lot of the stuff I'm going to talk about is just at the edge of science. We don't know yet. And I think that explains a lot of the uncertainty that

you all are feeling with regard to how to -- how to monitor this, how to regulate this stuff.

[SLIDE CHANGE]

DR. MATT CAMPEN: And the concern we have - I think everybody here appreciates this - is that this has been an exponential growth curve of the production of plastics on this earth. And from the time it's produced to the time it's degraded could be decades, generations of humans. So even if we were to do something as dramatic as stopping production today, it would still be two or three generations of humans before the formation of microplastics from those products stopped happening, or at least leveled off.

[SLIDE CHANGE]

DR. MATT CAMPEN: What is the state of evidence for micro and nanoplastics causing human health outcomes? It is not strong. There is very little research. Most of it is observational. Most of it is associative. I like the comment earlier that there's a lot of rodent studies out there where we don't know if it was the right dose, or the right particle, or polymer. We just have a lot of uncertainty in this field right now.

It's a new field. You know, we knew back in the 1930s pretty confidently that smoking cigarettes caused cancer in humans. But it wasn't until the 1960s, some 30,

35 years later that the Surgeon General actually did something about that.

We're in a situation where Richard Thompson discovered microplastics in the ocean in 2004, but the first evidence that these were in the human body was Antonio Ragusa's paper in 2021 where he showed these plastic particles in the human placenta.

Currently, the information is of low quality, the methods for detection are innovative and cool. And I -- as a research nerd, I really get into this stuff. But as a person who wants solid answers, I've got to say they're unvalidated. There's a lack of consensus from lab to lab about the beth method -- best method, especially on the digestion process and how we eliminate concerns about biometrics interference. So skepticism remains warranted right now.

There is optimism in the sense that there's a lot of really brilliant people and higher -- highly resourced labs getting involved right now. So I'm going to -- I'm going to talk about this just big picture for a couple of slides. I do want to -- I always like to pull back. I think this audience is very aware. We're talking about microplastics and nanoplastic particles. The plasticizing chemicals is a whole different bag and it's much more well established and robust science. Not the same thing.

[SLIDE CHANGE]

DR. MATT CAMPEN: So two years ago, almost to the day now, Raffaele Marfella, Giuseppe Paolisso came out with this really seminal paper. It was not a perfect paper by any stretch, but it was really seminal. And what they did was they were extracting carotid arteries from humans who were having that done for surgical intervention. And they used pyrolysis GC mass spec to measure the total amount of polyethylene and polyvinyl chloride in that carotid artery lesion. And it was a pretty big study. They had a lot of data. They basically identified haves or have nots. If they could identify polyethylene or polyvinyl chloride in the -- in the carotid, they counted them as with micro or nanoplastics or patients without nanoplastics.

And they found really clear distinctions in terms of inflammatory factors, but most critically they found that the patients who had micro and nanoplastics detected in that carotid artery plaque, those individuals were 4.5 times more likely to have a subsequent cardiac event over the next three years. And it's associative study, right? So you don't know if there's something about their disease that just led to greater uptake of those plastics. So, it's either that this is a very good biomarker for risk or that it is an actual driver of disease. And we don't know

what it -- what it is right now, but there were concerns expressed. The pyrolysis GC mass spec method has important considerations about accuracy and reliability. Of course, it's an associate -- associative study and does not assess causality.

[SLIDE CHANGE]

DR. MATT CAMPEN: What I will say is that since that paper came out, there have been a handful of rodent studies where mice who are vulnerable to developing atherosclerosis do show that plastics in the chow ingestion primarily is the exposure route. It does seem to promote growth of vascular plaques. And so this is Tim O'Toole's group. He's at University of Louisville. And he's shown in a -- it was a brief letter in Research -- Circulation Research. Polystyrene could cause this, but also he's recently shown that polyethylene or polyvinyl chloride can cause this.

A researcher at UC Riverside recently published that's Jingjing Zhao a similar study. There's a group at my institute who has similar data. And Brian Kim at Stanford is also moving forward with it. So we're starting to see that, yes, that human associative study is being buffeted by some real controlled exposure studies in rodents that helps to clarify all this. And does give you some indication that there might be some causality with

cardiovascular disease.

[SLIDE CHANGE]

DR. MATT CAMPEN: So this method of pyrolysis GC mass spec, our group came around to this because of some of the weaknesses in many of the other methods. So we heard about using vibrational spectroscopy, that's FTIR and Raman spectroscopy. And the first speaker talked about how, you know, you're really limited to particles around 1 to 5 micrometers or larger. And from our perspective, that just doesn't reflect what gets into the body. I mean, we all know about PM2.5. So whenever, you're breathing stuff, the ultrafine particles that are 100, 200 nanometers are much more relevant to what gets into the body. And the same is true in the gut. What you actually absorb in the gut is going to be much, much smaller than that.

So our group came around to wanting to use something that was more cumulative for very, very small particles, the nanoscale range. We also felt like a mass concentration unit would be much more important than contem -- you know, when we contemplate the size of the particle or the shape of the particle, those are neat. But you think again back to PM2.5, its just a mass concentration.

EPA has struggled to incorporate, you know,

particle counts or other characteristics of particles, and nothing really holds up when you're trying to get to some risk assessment that's viable for, you know, policy framework. So our feeling was mass concentration might be a more useful metric. So this is -- this is an overview of what we've been doing.

[SLIDE CHANGE]

DR. MATT CAMPEN: And it starts with chemical digestion of tissue. We use potassium hydroxide. It's a very, very strong base. You could use acid. Other people use hydrogen peroxide as an oxidant or enzymatic digestion. Different strategies have different strengths and weaknesses. But ultimately, we digest the tissue and leave the solid particulates, which are mostly plastic from our analysis.

We spin. We pull down that as a pellet. And the solids from that are then added to this little stainless steel cup, put in the pyrolysis system. Those solids are combusted and they release gases that are indirect indicators of the original polymer. So, for instance, with polypropylene, we're looking at a chemical called 2,4,6-trimethylnonane. For nylons, we're looking at caprolactam. There pyrolysate indicate -- pyrolysate indicators. And this is important, because it's indirect and there's some vagaries when we're talking about fresh

plastics versus the aged plastics that we think is in the body.

[SLIDE CHANGE]

DR. MATT CAMPEN: Our group recently stud -- actually, again this is now a year old. We published this in Nature Medicine. The gist was we've been seeing a lot of animal studies, but we wanted to know, well, what's actually in the human body? Can we -- can we benchmark animal doses for controlled exposures against something we can actually measure in the human body. And it's tough, because we came up with some answers. We still don't know if these answers are really stupendous enough to use as a benchmark.

But we acquired brain, kidney, and liver samples from autopsies from decedents. Samples were collected from a 2016 cohort and a 2024 cohort. These were relatively well balanced in terms of age of death, in terms of sex and cause of death. What we found was using again this pyrolysis GC mass spec method was that the concentrations in the brain were far higher than what we were seeing in liver or kidney. And from 2016 to 2024, there was a significant increase in the -- what we measured in the liver and in the brain, not so much in the kidney.

I do like to point out that the orange dots you

see here for the brain in 2016 were independently run by another lab in -- at Oklahoma State University. They had a pyrolysis GC mass spec just confirming that these are the values you get with this digestion method.

[SLIDE CHANGE]

DR. MATT CAMPEN: Again, the demographics you can see from 2016 to 2024. These are, you know, random samples that came into the Office of the Medical Investigator. So they tended to be relatively young because these was -- a lot of these were accidental deaths or drug overdoses. Bias towards male, but a relatively even balance. Balance towards -- sorry, was there a question?

Okay.

Balance towards White Hispanic, because we're in Albuquerque. But you can see, you know, cause of death, violence/trauma was about a third of it. Substance use was relatively high. And then natural disease was another third of that population.

[SLIDE CHANGE]

DR. MATT CAMPEN: In doing this study and reporting it, the reviewers asked a couple questions. One was you should really show us a wider range of dates. And this is not an easy thing to just find brains. So we were unable to get older preserved brains from New Mexico, but

we reached out to a colleague at Duke University. And so I call these east coast brains, but North Carolina, Maryland, and Massachusetts. And they span the range from 1997 to 2013. And they are all, you know, lower. It's a noisy metric. There was a lot of variability between people, but they were universally lower and they didn't change the overall trend line of this increase in the brain.

We were also asked to capture and examine dementia cases. And fortunately, our Office of the Medical Investigator does do that on a routine basis. And so they were -- they were sampled almost exactly the same way as the red dots from New Mexico. And you can see that they were all universally much higher in concentrations than what we were seeing in neurologically intact brains. These are all samples from the frontal cortex, which is -- which is also an important point of this.

[SLIDE CHANGE]

DR. MATT CAMPEN: Pyrolysis GC has flaws -- well, not flaws, but it has important considerations when you're interpreting this. And in our study, I absolutely appreciate the concern that lipids can look like polyethylene. And so polyethylene you'll see this is the relative distribution in our tissues, about 75 percent in the brains, the relative amount of different polymers. It

appeared that polyethylene was highly present, highly represented. I think this should be less than 50 percent. So I absolutely think we're overestimating the amount of polyethylene.

On the other hand, polypropylene and polyvinyl chloride, these are not prone to the same interference, so we're not sure how to interpret the forest for the trees with that. The other thing is if you use very, very aged plastic and compare it to fresh plastic, which is potentially what we're doing, you underestimate considerably the amount of plastic.

We use fresh polymers as our control standard for this. And we know using like ocean microplastics that we sort of pulled from the beach, and curate, and we run those. And it can be like 80 percent lower values, even though we're actually measuring one gram. It shows up as two-tenths of a gram.

[SLIDE CHANGE]

DR. MATT CAMPEN: And if you look at all of these different types of polymers over time, polyethylene may be overrepresented, but you can see that polypropylene, polyvinyl chloride, styrene-butadiene rubber, they're all showing these same trends of increasing over this time period.

[SLIDE CHANGE]

DR. MATT CAMPEN: All right. So what's being done about that? Well, you'll see in the popular literature, we're all fighting with ourselves, which is fun. But different labs are coming up with different approaches to digest the tissues more thoroughly. We're doing this as well. We have a revised protocol that allows us a secondary step. So taking that plastic-ladened pellet and washing it again with a secondary solvent enriches the amount of plastics in the pellet that we run. And we actually end up with a much more robust informative chromatogram. I'm not going to get into details of what you're looking at here, other than to show you get a lot more signal after that wash, because you can use more of the original digest.

[SLIDE CHANGE]

DR. MATT CAMPEN: When we do this we do see lower polyethylene overall, but we still see the same trends with dementia cases being substantially higher than neurologically normal. And that holds up for most of the polymers that we're looking at.

[SLIDE CHANGE]

DR. MATT CAMPEN: The other aspect of the study is that we selected -- this is -- this is now looking at 439 biopsies from a single human hemisphere. This is work from post-bacc student Laurissa Barela. And she found

that it was, in fact, the red area you see here is the frontal cortex. That frontal cortex absolutely has the highest amount compared to other regions of the brain, where there's, you know, sometimes a log scale or more lower concentration. So we're working on this. It's very interesting and fun, but it takes a lot of work and this is just an N of 1 human donor.

[SLIDE CHANGE]

DR. MATT CAMPEN: We used a couple of different methods to try to locate where the plastics were. We used a technique called polarization wave imaging, which takes advantage of the birefringence in the particles. And just to sort of back and forth on this one, you can see that they really light up when you use this approach. It was very hard to find these in neurologically normal brains, because they're all very, very small, almost always universally smaller than one micrometer. You can see there's a cluster of particles here. These are nuclei of cells in the brain which could be about 5 microns in diameter. And you can see everything is much smaller than that.

[SLIDE CHANGE]

DR. MATT CAMPEN: But in the dementia cases, they were really obvious. And they were along the vascular wall, as you see on the bottom, as well as in inflamed and

neurodegenerated regions. So this was a nice informative way, but -- of localizing where these particles were. But I want to emphasize it also highlighted that this is a cause effect question now, because dementia is a disease of a breakdown in the blood-brain barrier. And it is a disease of poor clearance and inflammation. And so it could well be that the disease causes a greater propensity to accumulate the plastics, rather than the plastics driving any disease. And I'm -- I know I'm running low on time. I'm just going to highlight.

[SLIDE CHANGE]

DR. MATT CAMPEN: Again using the same type of imaging, we can show that now there's a time effect. We can see these very readily in samples that are contemporary compared to samples from the 1980s.

[SLIDE CHANGE]

DR. MATT CAMPEN: For the sake of this group, there is an ongoing global debate about whether we can measure plastics in blood or other specimens using pyrolysis GC mass spec.

Marja Lamoree is -- has been the seminal leader of this from the Netherlands. And she says, yes, you can measure these in blood. And then Kevin Thomas and Cassie Rauert are out in Brisbane in Australia. And they've just published in 2025 saying, no, you cannot. And our lab --

our lab sits in between these two opinions. I think that this is an opportunity. There's a technology that can be used here. But the concentrations in blood are very, very low.

I liken this to the subway of Manhattan. The subway of Manhattan does not possess the mass population of Manhattan. It's in the buildings and elsewhere. Furthermore, you might have periods where the subway completely empties, like in the middle of the night. So the amount in the blood may be very vulnerable to how recently you've eaten, what you've been exposed to on a -- on a acute basis. But, yeah, this is -- these are data we've had from red blood cells compared to plasma on the bottom. We're still trying to work this out.

We have had more success with breast milk. We find that we can get pretty qual -- pretty good quality data out of breast milk. And we do see, especially levels of PVC and PET, polyurethane, that are above our levels of quantitation and levels of detection pretty consistently, not as much polyethylene. One of the findings from this was that formula, for instance, and cow milk tended to be higher than human breast milk. We're still working on this with our collaborators out on the east coast.

So there's potential here. We're also looking in urine. Urine is quite low. Cerebral spinal fluid is

quite high. There is -- there are other methods as was noted. And I'll talk about --

[SLIDE CHANGE]

DR. MATT CAMPEN: Yeah, this slide. So I think nanoscale flow cytometry offers faster and more useful approach opportunities for measuring this in biofluids. There's also a -- it's a technology called stimulated Raman scattering. If you remember, there was a PNAS paper a couple years back that scared everybody about bottled water. That was -- that was the first sort of demonstration of how that technology could be used. It's unfortunately slow, but it's really like high quality in terms of detecting plastics. And that's Wei Bin and the Columbia group, and Beizhan Yan. They're really doing great work with that technology.

[SLIDE CHANGE]

DR. MATT CAMPEN: Pyrolysis GC mass spec for routine monitoring. I mean, I think we're still in a place where we need more validation of methods. We maybe just need fundamentally different methods, so that we agree, at least as a country, if not as a global community on the best way to do that. It's low to medium throughput with an individual pyrolysis system. You can get through 20 samples a day. We do see a lot of batch variability, so changes in the pressure system and the flow rates, can

have pretty important changes to the chromatogram you get, so it's pretty challenging

And right now, the field -- where the field sits is we still feel like we need to see the particles to confirm that they're particles and not some other chemical that's an indirect readout.

[SLIDE CHANGE]

DR. MATT CAMPEN: So I'll stop and leave it there and try to answer questions. But these are all the wonderful people I get to work with. So, yeah, I'll...

CHAIR McKONE: Thank you very much.

(Applause),

CHAIR McKONE: A lot of information to digest. So now, as we did with the last presentation, we have -- we're going to take about five minutes for questions. Again, these are things of a shorter nature. And then we will migrate into an open discussion of up to 20 minutes. So we again start with the Panel, if you have questions on the panel.

Nothing. I had one that I asked before, but -- so, I mean, in general, and I think you alluded to a lot of this and the unknowns, but when the particles are persisting, when they're in the body, do we really know the sites that they're binding to or how they're binding in cells, in the blood, whether they're just floating

around free, or are they attached to proteins, are they attached to new -- things moving in the blood. And then is there good information about, you know, are they catching a ride or are they just there as individual?

DR. MATT CAMPEN: I can tell you what I think, and it's based on at least a little bit of data from my lab, but it's not necessarily published. As I showed you those little shards that we see when we fully digest and fully disperse these part -- these plastics, we think that, one, they absorb with the fats of our diet and they come in through the lipoprotein system, chylomicrons. Chylomicrons can be 500 to 1,000 nanometers in diameter. These fit inside there exquisitely. We have some mouse data that shows, yeah, if you take fluorescent 500 nanometer polystyrene beads and you put them in a mouse gut, they show up in the chylomicron fraction.

From there, they're going to behave like the lipids of your body, because now they're under that control system. You know, apoproteins will guide it to the liver, to the brain, or whatever system needs that lipid energy. But from there, do they get into cells, do they -- do they -- you know, one of our concerns is that they might glom on with myelin, because that's very lipophilic, but that hasn't held up in some of our recent studies. You know, we look at white matter versus gray

matter and we don't -- we don't see those differences we'd expect.

There's a graduate student at Tufts who's been looking at different cell types in the brain and he shows that these things get into astrocytes. They really -- they really don't get into or cause toxicity through neurons at a high -- like very -- the neurons don't seem to be very sensitive. And this all cell culture. So we're -- but I mean, I love the question you're asking, but, man, talk to me in 10 years.

(Laughter).

CHAIR McKONE: All right. I'll come back in 10 years. You'll have to come back too.

STEPHANIE JARMUL: We have Jenny.

CHAIR McKONE: Okay. All right.

STEPHANIE JARMUL: Jenny.

CHAIR McKONE: Oh, Jenny. Oh, please, go ahead.

PANEL MEMBER QUINTANA: Hi. Thank you for that really interesting talk. I was kind of wondering if your student that you said looked at all the brains or other people doing microscopy, if they see other particles, such as crystalline silica or other particles, and I wonder if differential distribution of those might say whether the particle -- that microplastics are causal or not?

Thank you.

DR. MATT CAMPEN: Yeah, causal. I -- we have used FTIR to look at particles. And kind of what we've seen is 75 percent -- 60 to 75 percent of all solid particles that we can confidently assess are polymer of some sort. Otherwise, they're mineral or some other weird organic. The problem with that is the technology we have to do that is only looking at the large stuff, the, you know, 5 micron type particles. And how it got in there, I don't know, but, you know, random stuff obviously happens.

So, I mean, we see -- we see soot from time to time. We definitely see like lead particles and other minerals, but most of it is -- most of the solid particles are plastic.

PANEL MEMBER QUINTANA: And within like one brain, would they be distributed the same? So if -- you know, I mean in the sense of the microplastics preferentially go some area and not the other. I guess you can't really tell -- sorry -- with all the -- with all the size problem, I was just kind of curious that, you know, maybe if they were shown to be taken up differently, I imagine that being taken up from the gut would be different than going through the olfactory bulb into the brain.

DR. MATT CAMPEN: Yeah.

PANEL MEMBER QUINTANA: And I was -- I'm kind of

just curious about other occupational exposures that have been going on for years where they have particles that probably sit in their brains, but this seems very new and different, so thank you.

DR. MATT CAMPEN: And yet, it's not new. We just are learning about it now, right? The -- that one brain -- and I hate the olfactory bulb idea, because just from a mass transport like you need to eat food to absorb substance en masse. And yet, what Laurissa did -- Laurissa Barela's data shows is that the first sort of like seven sections out of 25 sections going to the back of the brain, the first seven really well represented by nylons. And if you think about how we just live in a cloud of our own making of particles, and the potential that, yeah, maybe it's just the clothes we're wearing on a daily basis are just constantly hitting the nose, and it could be that this one -- and this is an N of 1, that one person may be just loved their polyester track suit. I don't know.

(Laughter).

DR. MATT CAMPEN: So, you know, like I said, in 10 years, we'll have some pretty good answers. Right now, it's all conjectural.

PANEL MEMBER QUINTANA: Thank you so much.

DR. MATT CAMPEN: Yeah, great questions.

CHAIR McKONE: Okay. Lara.

PANEL MEMBER CUSHING: Hi. This is Lara Cushing. Thanks for a fascinating talk. You mentioned how we know so much more about the human health impacts of plasticizers, metals, flame retardants, and things in plastics. Is it -- do we know -- I'm guessing the answer is no, but do we have any sense about what proportion of our exposure to those things is coming via microplastics?

DR. MATT CAMPEN: I think none of it is. It's not a popular take. And there's actually a couple people who really agree with me. Todd Gwynn out of the UK and Mark Weester out of Duke. And the -- our basis for this is the idea that we think that most of the problem is really the secondary plastics, the really, really old stuff. And anything that could leach off of that has already leached off of it, especially when you consider the nature of these little flakes that might be 5 to 20 nanometers thick. Well, that's, you know, 15 to 60 carbon thick. That is -- that is not enough room to fit another molecule of anything.

So those are -- those are where we're coming from. That said, you might be taking up particles of those little flakes that are already agglomerated and they could have taken up things from the environment and sort of packaged them as a slightly larger particle that's an

agglomerate. You know, we're -- we're eating the plastics that the chicken ate and repackaged in their own way. So, there's a whole lot of unknowns about that.

Right now, I'm kind of on the opinion that the plasticizing chemicals are just in the environment and they're coming in on their own, but a lot of people have different opinions and there's papers coming out all the time that are giving us more information on that.

PANEL MEMBER CUSHING: Thanks.

CHAIR McKONE: Um-hmm.

More questions. We can actually move into a broader discussion and comments also at this point, but...

Amy.

PANEL MEMBER PADULA: Thanks. I'm just trying to soak this all up. So you wouldn't necessarily expect then, as we were talking before, of looking at, you know, plastic measurements that we have in biomonitoring, related to plastic chemicals, to necessarily correlate then with microplastic measurements. That's interesting. I'm still observing that all.

I guess my question is I was wondering if you could speak to some of the work that you've done in placenta and what you think that also says about how we can take steps to, in looking at health effects and, yeah, how they get there.

DR. MATT CAMPEN: Okay. The placenta has been an interesting opportunity there. We do see a small trend for the concentration of plastics in the placenta and complications of maternal fetal health. It's sort of low level trends, but, you know, the risk for preterm birth is there, the risk for complicated delivery is there. We haven't seen anything reflecting on fetal outcomes, from what I can tell -- and this is all working with a group at Baylor College of Medicine Enrico Barrozo. What's amazing about the placental work I think really comes from Phoebe Stapleton's lab where she's been able to show that, yeah, these particles easily get to the placenta and they easily get across the placenta.

One of the data points in our study, people sort of overlooked this, but it was a -- it was a stillbirth. And I think the concentrations in the brain were, you know, a thousand micrograms per gram. So the idea that -- you know, I don't want to judge the Panel or the audience, but I'll speak for myself. I'm pretty confident I was born without plastics in my brain some 50 odd years ago. That's not the case today. So it really does, you know, fundamentally alter how to look at the problem.

The other thing I'll add is this idea of the apoproteins and the chylomicrons. The placenta loves those. That's the whole point is they're going to grab

hold of those nutrient packets that you absorbed and take them up and deliver them to the fetus. You can't block it, because then you're going to block all those yummy nutrients and lipids that a growing fetus needs. So we've struggled with how to intervene in any kind of mechanistic way to, you know, protect the baby from that absorption, but I'm not sure we can at this point.

PANEL MEMBER PADULA: Thank you.

DR. MATT CAMPEN: Sorry. That got depressing. (Laughter).

CHAIR McKONE: Others.

Yeah, Carl.

PANEL MEMBER CRANOR: This is perhaps an unusual question. But in a lot of areas, for example, we know lead is very bad for people. But the people that study it say there's no safe levels, so are those -- those are kind of particles or what. So lead could come in particles. Benzene, I don't know, it comes in molecules. But there are the -- the numbers have been driven pretty low too. I don't -- I haven't kept up with that, but I know that Martyn Smith could identify adverse effects at 0.5 parts per million instead of one parts per million.

CHAIR McKONE: I think billion.

PANEL MEMBER CRANOR: Pardon?

CHAIR McKONE: I think billion.

PANEL MEMBER CRANOR: Is it billion? One part per million is the -- is a human health -- adverse human health effects, at least half of that, but maybe it's much tinier. I don't know.

So are plastics like lead or are they like benzene, which are smaller and smaller concentrations of molecules? Any ideas about that you're -- you're very interesting, so since you're here, I'll quiz you.

DR. MATT CAMPEN: So, I mean, my perception right now is -- I don't see enough evidence to say there's a health effect of plastics. I think we're getting there on -- and microplastic and nanoplastics particles, not the plasticizers. Different ball game. The nanoplastic, they're clearly inside us, and yet our population is not showing any major changes in -- I mean, I'm sure there are people that will debate me on this, but no major changes in longevity or health quality. Yeah, it would be nice if we lived longer in this country, because other countries live longer, but, you know, you take out drinking and driving, you take out handgun use, and you take out opiates, and it -- that quickly puts us right back on the normal curve for longevity.

There are a few diseases that have been going up in recent years. There's certain forms of cancer, colorectal cancer early onset, ER positive breast cancer.

There's, you know, multiple sclerosis is an interesting idea. Autism is a political minefield and an interesting idea, but trying to find anything that's really tightly associated with exposure to something that's otherwise inert. I mean, we take little springy wire devices and lace them with polymers and we put it into people's coronary arteries and they get 15 more years of life.

So to throw, you know, plastics out the window, when we can -- when demonstrate -- you know, it's a tough, you know, relative risk versus absolute risk kind of question we have to entertain. So there, I tried to be interesting.

(Laughter).

PANEL MEMBER CRANOR: It's been interesting. Thank you.

CHAIR McKONE: Yes. Question and --

JOSEPHINE DeGUZMAN: Hi. This is Josephine DeGuzman from the Department of Public Health. I was curious to know if you had any experience in finding microplastics contamination in any of the materials you were using or during any of your analysis steps?

DR. MATT CAMPEN: You mean in like procedural blanks, that -- just quality control steps?

JOSEPHINE DeGUZMAN: Yeah. Just maybe the tips that you're using or the, you know, tubes you're using for

sample storage, or during any of the steps, if you happen to come across any microplastics contamination.

DR. MATT CAMPEN: So nothing -- with py G -- pyrolysis GC mass spec, we really don't have great low concentration resolution. We can -- we can definitely see contaminants with FTIR. Here's a -- here's one little plastic particle or another. They're pretty infrequent. What was interesting about the brain study was here we had tissues stored for eight years in plastic jars. You know, they're in formalin, but in plastic jars, and they had significantly lower amounts of plastic as the ones that were only in the jars for like two months -- two, three months.

So, the contamination from those flesh -- fresh plastics into the tissue is quite low. Whereas, you know, like if you're working with a fluid sample -- like, you know, if you're working with river water or some environmental water sample, you're capturing everything. But with a tissue sample, you're really worried about what's inside it. And the stuff that gets exposed on the surface is going to be washed away and not really relevant to the stuff inside it.

And those particles don't penetrate into tissue like a chemical might. You know, there's a physical barrier, so -- but we do. I mean, we use all kinds of QC

procedures. And it is very time-consuming, just sort of adding to the burden of what you have to do when you're -- when you're using Py GC-MS, procedural blanks, tissue planks. We've been trying to use really, really old samples. We've got kangaroo rat brains from 1966 that don't have any of those little flakes that I showed you at the beginning. They've been valuable for a lot of proof-of-concept studies. But trying to get human brains that are that old has been a challenge.

NANCY BUERMEYER: Thank you all for the very illuminating presentation. Nancy Buermeyer with Breast Cancer Prevention Partners. And I am worried about that ER positive breast cancer trend, and particularly among young women.

DR. MATT CAMPEN: Yeah.

NANCY BUERMEYER: And I appreciate being a careful scientist and saying that this is a new science and we don't really know. And as an advocate, which is what I am, not a scientist, it makes me crazy, because in 10 years, you looked at that exponential growth of plastic and waiting for those answers, those definitive answers, in 10 years is going to be well past the time of being able to do anything about the damage that's being done right now.

And when you look at -- I mean, maybe it's all

inert. I personally am not excited about having a lot more plastic in my brain now than I did in 2016. So, keep doing the great work that you're doing, and when people ask, say it's a concern, so that those of us trying to actually do something about it can have the support we need. Thanks.

DR. MATT CAMPEN: And I -- what was your name again?

NANCY BUERMEYER: Nancy Buermeyer.

DR. MATT CAMPEN: Nancy Buermeyer. Thank you for doing your work, because we all have to play our roles. And it kills me to keep my mouth shut about things like this. So I do appreciate your voice in this -- in this forum. Yeah, we're resource limited. We have to do a good job with what we've got. And we're fighting a lot of silly battles because of, you know, the typical antagonists you get in this world. So we'll keep pushing toward.

What I'm pleased about is that, you know, since a lot of our work and some of the other work that's come out over the last year or two, the Grove Collaborative and 5 Gyres did a survey and it showed 80 percent of Americans agree that microplastics are a problem. Good luck getting 80 percent of Americans to agree on anything.

(Laughter).

DR. MATT CAMPEN: So I feel like we have momentum and we have the audience we need right now.

NANCY BUERMEYER: Thank you. And just one last comment, which is one of the things that's hard about the job I do is that the chemical industry demands absolute positive proof of harm before anything can be regulated. Now, we've been able to move forward some stuff, but that level of scientific surety happens almost nowhere, and we really need to take a precautionary approach.

DR. MATT CAMPEN: Yeah. And the chemistry of age-degraded polymers is a mess, and you're never going to get the kind of purity that they're asking -- they're expecting. And so, we already know there's going to be this awful battle. The shards I showed at the beginning, we've already seen sort of the first stages of that being rejected from publication. We're coming back with better data, but yeah, people want these to look like fresh particles, because that's what you can prove.

DR. MARTHA SANDY: This is Martha Sandy. I've got a question. And I'm with OEHHA and I wanted to thank you for your excellent presentation.

I realize it's a very young science and you are -- you know, gave us a little window into what you have done so far. It looked like for a time trend in the brain, the levels of particles kind of jumped after 2016

higher, and that might just be an artifact of the samples and the age, you know. But I'm just -- you also mentioned you've looked at kangaroo rats and you probably looked at other things. Are you seeing a gradual time trend or are you getting an inkling there might be a step function there somewhere?

DR. MATT CAMPEN: I'm seeing so much noise in an assay that needs to be further refined. I appreciate what you're saying. I think it would be relatively easy --like I could -- I could make an assumption that brains from 1920 didn't have any plastic in it, draw zero, and then, you know, all of a sudden, yeah, you start to see that hockey stick function. Need more data. Need more samples. I was hoping we would see more of that with the data we had, but the noise, interindividual variability was too much to really make such a proclamation, but I'm with you on that.

STEPHANIE JARMUL: We do have a comment online really quick.

Jianwen, did you want to unmute.

DR. JIANWEN SHE: Yes. Thank you. And thank you Professor Matthew Campen. This is Jianwen She, Biochemistry Section Chief at CDPH, manage biomonitoring measurement method at CDPH, but not microplastic. I was very interested to learn from you and also the other two

speakers, include our Branch Chief, Jeff Wagner.

I have one question regarding -- first, regarding analytical method, heard from both of you pyrol GC-MS might be weak. So pyrol analysis may be measure the primer or pentamers. Polymer can have different molecular weight. And then so it very had to know what the original microplastic is. It may be a limitation there, but that's one comment here.

And I finish all my three comments and then we can discuss.

The second one, even the same polymers that have different molecular distributions, for example, like say PEG, poly - polyethylene glucaride. So molecular weight can from 400 up to 20,000. That's because distribution depend on manufacturing. So the -- which means a lot of particle could have large molecular microplastic. So that's -- so I don't know how that affect the highest effect and also distribution in the bodies.

Second is for California as a Program, let's say I try to do a biomonitoring of microplastic as a laboratory manager, I need to ask my question is what's the best matrices? Traditionally, we use the urine and the blood right now to do other chemicals, persistent organic, low persistent, and metals. So I can only come out one matrices is that the brain tissue very hard to get

or adipose tissues through biopsy cannot be used for biomonitoring. So only matrices I think is feasible will be feces. I don't know what's your opinion. And is that urine or blood. Feces might be one.

Second, I said -- last question comment about your publication is very high respected journals. We know all of the microplastic -- our bodies is made from plastic, as a polymers, but our body can process that by degrade the polymers. And also the polymer have its fraction, it have precise length, whatever the molecular weight.

And industry microplastic, they're formed by a covalent bond. Our body does not have the capability to digest it or break down, unless it is designed as biodegradable polymers. Our body might have a little bit capability to break down. So my question is many of the plastics, you do have the additive, which does not form by the covalent bond. That doesn't add it. So we were low PBD, BP-BPE is co-polymers that bonded, but there are other additives to -- against oxidation protect the polymer, make it softer, make it harder.

My -- so you find a high level of the co-bonded microplastic near the tissues, brain tissue, here there. But where does this low -- the additive, which is a lot bonded in the polymer. So my suggest -- my thinking is if

we find a very high level copolymers, whatever, formed by the covalent bond, we should also be validated if that chemical microplastic is also made from by insert additives. Are they co -- as a close validation or they reflect the same way in the body. So that's my comment here.

DR. MATT CAMPEN: Okay. So I'll work from the beginning. I think the reason that pyrolysis is kind of a nice opportunity with polymers. Polymers, as you point out, such a wide mixture. You know, I'll share this one image I have up on the screen here, because it's handy. This is using Tim's TOF-MALDI to look at -- this is just showing the molecular weight of on the top, these are the peaks we get from pure polyethylene. It's polyethylene, but look at all the peaks. There's no one molecule that is polyethylene. It's all of these. The one in the middle is really, really old aged polyethylene. So now it looks really different. And then the bottom is a mixture of stuff. And so you start getting, you know, really, really ridiculous trends. And how do you quantify all of this in a way that says how much mass of plastic is in your body.

So, that's why pyrolysis is nice, because it collapses that complexity down to a couple of things that are commonly emitted when you combust this. So, it's --

for polyethylene, we look at a carbon -- 20 length carbon chain. And it works. You know, it's a pretty good linear trend when we do our standard curve. But it falls apart a little bit with aged plastics. We see that the bigger plastics, like the C-20 through C-40, we lose that and we see more of the smaller ones, like only six carbons long. Anyway, it's a long story.

I think that's sort of the first couple points you wanted to address. The best matrix, I'm hoping we can get something good with urine, because, gosh, it's easy. But even then, we're going to have to do really good characterizations of when we see surges and when we see reductions. Is it related to mealtime? Is it related to certain exposures? There's a lot of work that needs to be done there.

CSF is hard to get, but that's been the one that has the most robust concentrations. And the Columbia Group women's group with their Stimulated Raman Scattering, I think they agree with us on that.

DR. JIANWEN SHE: Sorry. Sorry to interrupt. Is molecular over one thousand.... can go through the membrane and --

CHAIR McKONE: I'm sorry. We

DR. MATT CAMPEN: Is this going too long?

CHAIR McKONE: We have to --

DR. JIANWEN SHE: Go ahead and finish. I interrupt you.

CHAIR McKONE: So we're cutting into our public comment period. We have to give people time, so we have to kind of bring it to a close. I mean, you can answer the last point, but I didn't -- but I didn't want to open this into a back and forth discussion, when we're running --

DR. JIANWEN SHE: Okay. Thank you.

DR. MATT CAMPEN: Yeah. Yeah. Yeah. What I'll say for the last question about degrading in the body, we're not sure if they degrade in the body. These things are so old, they might be breaking down and they might have long enough residence time that they're falling apart and that might be part of their pathology. We don't know. But, yes, if you could create plastics that were vulnerable chemically to digestion by stomach acids or enzymes, that would probably be a -- that might be a win for product design.

DR. JIANWEN SHE: Thank you very much.

CHAIR McKONE: Yes.

DR. MATT CAMPEN: Great. Great questions.

CHAIR McKONE: Thank you, everyone. Sorry to cut it off a bit, but we do try to stay on schedule if we can and not cut other people off for the final part.

So this concludes the discussion of microplastics. And we're going to move to the last phase of the meeting, which is our open public comment period. We have scheduled 10 minutes for open public comment, at which time commenters can talk about any aspect of biomonitoring. Webinar attendees can submit comments and questions via the QA function in Zoom or by emailing biomonitoring@oehha.ca.gov. And we will read -- and we will read them out loud. If you wish to speak, please alert us using the "Raise Hand" feature in Zoom -- in Zoom webinar and McKenna Thompson will call on you at the appropriate time.

If you are here in person and wish to comment, please come to the front or raise your hand and I will call on you and ask you to come forward. For the benefit of the transcriber, we encourage you to clearly identify yourself before providing comments and write your name and affiliation at 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.

We are expecting a number of public comments and want to give everyone an opportunity, so we really want to limit each commenter to no more than five minutes.

DR. AHIMSA PORTER SUMCHAI: Dr. Ahimsa Porter Sumchai. And I'm trying to figure out how to configure

this, so that you can see the show-and-tell I brought along with me, as well as the audience. And maybe I can get some help on this. If I turn this direction, can the panelists still --

STEPHANIE JARMUL: Maybe move back a little bit and then they should be able to see.

DR. AHIMSA PORTER SUMCHAI: Here?

STEPHANIE JARMUL: Yes.

DR. AHIMSA PORTER SUMCHAI: Okay. All right. Well, I am the founder, the principal investigator, and the CEO of the Hunters Point Biomonitoring Foundation. And what I brought with me today is what we call the Hunters Point Toxic Registry multi-layer metadata geospatial mapping.

And this map, believe it or not, compiles six years of research that includes human biomonitoring for environmental chemicals, specifically toxic heavy metals. It also overlays six unique geospatial mappings. It is mounted on ArcGIS, powered by ESRI. ESRI is Environmental Systems Research Institute. It is the global market leader in geospatial information.

And what this map does in its visual display I believe comes close to proving exposure. And let me just begin by telling you a little bit about the clusters. There are six unique clusters that are overlapped in this

map. The first cluster I sent you in your agenda, that is the nuclear cluster. It is very specific for residents and workers living within the one-mile perimeter of a radiation-contaminated federal superfund site. It uses alpha spectrometry to detect the energy of known alpha emitters that are products of nuclear fission, so ' Plutonium-238, Plutonium-239, Uranium-235, Uranium-233, Uranium-238. They are all detected in the nuclear cluster.

On top of the nuclear cluster, we have the radiogenic cancer cluster, that is the cluster of people documented to have been diagnosed with cancers that have been proven to be induced by exposure to ionizing radiation. This proof comes from the Atomic Bomb Registry, the Veterans Administration. I was the Environmental Health Coordinator for the Palo Alto Veterans Administration Toxic Registry, and that is one of the first experiences that I had in detecting toxins using biomonitoring. So those cancers you know, brain, breast, thyroid, lung, soft tissue, hematopoietic acute leukemias and lymphomas. So that is the radiogenic cancer map.

One of the simplest and most elegant maps that I'm very proud of. I think I deserve the Nobel Prize nomination for, that is the map that was created when I took a manual posterboard and put a red pin at the address

of a woman who had been diagnosed with breast cancer. And that mapping is called the breast cancer necklace, because it forms roughly a semi-circle within the half mile perimeter of the base, specifically it encircles the Parcel E-2 industrial landfill. This is a landfill that's known to be radiation contaminated. If you Google search circular clusters, you're going to find several in the United States that are encircling toxic dumps and landfills.

So the next cluster is called the South Basin Cluster. I'll speed it up. That was a unique cluster that I identified visually after only about a year of collecting urine samples. And that's where we saw people living within the watery south basin of the base who were coming up with the same four chemicals in their body. In fact, we have three neighbors, you know, who are living within blocks of one another who had the four chemicals. And the chemicals are arsenic, gadolinium, manganese, and vanadium.

And then finally, the last map is the heatmap. That's where ArcGIS calculated the maximum intensity of exposures based on all of these clusters. And ArcGIS determined that the heat of the clusters is within 1.8 miles of the Hunters Point Shipyard federal superfund site.

And then the final mappings, that's where you're seeing your red, and your orange, and your yellow. You'll be -- all of you are familiar with the CalEPA EnviroScreen mappings. Anything that's orange is in the 95 -- oh, excuse me the 90 to 95 percentile, anything in this red is 95th to 100 percentile. So, you know, that it's significant if you're seeing red and orange in this mapping. And there also, the CalEnviroScreen disadvantaged community mapping. You'll notice that we weren't able to upload the EPA EJ screen because this administration has made it disappear.

But my point is that this is geospatial visual evidence of cumulative impact. The CalEnviroScreen 4.0 by the way is also mounted on ESRI and can give you a picture like this. But the unique finding that you see here within the 1.8 mile perimeter of the federal superfund site -- by the way the NPL outline of the federal superfund site is also in the map.

CHAIR McKONE: I think you're going to have to wrap up.

DR. AHIMSA PORTER SUMCHAI: Yeah. So that's the point that I was --

CHAIR McKONE: Thank you.

DR. AHIMSA PORTER SUMCHAI: -- going to make, that I believe that this is a visual display that proves

that all of these disease and chemical clusters of the source is within the one point mile interval of a federal superfund site.

CHAIR McKONE: Okay. Thank you.

STEPHANIE JARMUL: Thank you, Dr. Sumchai for your comments and for all your work. And then we have a couple more public comments.

ARLENE BLUM: I have a very different topic and a short comment. We work right now on antimicrobials and I just wanted to just put in a little pitch for chloroxylenol being designated -- on the designated chemical list.

And a quick story. People may not know is a decade ago, the FDA decided that you did not need antimicrobials in soap. Indeed that they -- soap and water does everything you need and adding antimicrobials can cause a variety of health harm and can contribute to antibiotic resistance. And they decided to eliminate all antimicrobials from soap. But the manufacturers of three antimicrobials asked for a year to show that these three did not cause harm and helped human health. And they said that in 2016, and the three are still in use. Two are quaternary ammonium compounds and the third is chloroxylenol, an organohalogen.

And the -- there's a lot of work at DTSC that may

eventually lead to quaternary ammonium compounds being in soap, being a designated chemical product combination and that they're trying to make the point that if that does happen, then the manufacturers are all going to use the chloroxylenol and that will be in our soap. And it has a lot of concerns that I will not go into, because I think you're going to read -- someone sent a whole health summary and an abstract. But I just wanted to know the history of why chloroxylenol is more important than you would imagine, given that it will probably be the one that continues to be used, so...

CHAIR McKONE: Thank you for your comment.

STEPHANIE JARMUL: Thank you. That was Arlene Blum and --

ARLENE BLUM: Oh, I'm sorry.

(Laughter).

STEPHANIE JARMUL: And we also got a comment from Rebecca Fuoco from the Green Science Policy Institute. She's the Director of Science Communications.

She says, "Dear members of the Biomonitoring California Scientific Guidance Panel, the Green Science Policy Institute recommends that chloroxylenol be added to the Biomonitoring California Program's Designated Chemicals List. This widely used antimicrobial has recently been detected in human breast milk, and --

(clears throat). Sorry -- and animal -- (coughs) -- and animal studies. Link it to endocrine disruption, reproductive toxicity, cancer, neurotoxicity, cardiovascular toxicity and skin harm. Emerging evidence also suggests it can contribute to antimicrobial resistance. Chloroxylenol use is expected to grow as other antimicrobial active ingredients face regulatory scrutiny in California. A formal request is provided below and we welcome any questions."

And we have already posted this comment and the document that was provided to our website so is available under our public comments section.

Thank you.

NANCY BUERMEYER: Super quick. I know we're over time. Nancy Buermeyer, Breast Cancer Prevention Partners. I just want to associate myself with the comments of my colleagues, Arlene Blum and Rebecca. It's great that quaternary ammonium compounds were designated -- or were on the list as a class to avoid those kind of regrettable substitutes, but chloroxylenol provides that potential of a regrettable substitute, if we don't add that to the list, so that it can come under the same kind of scrutiny.

Thanks.

CHAIR McKONE: Thank you for the input. Okay. More comments or is that -- that's the end of public

comment. All right. Well, thanks everyone for your attendance and participation. So now it's time to wrap up. The transcript of this meeting will be posted on the Biomonitoring California website when it becomes available. The next meeting will take place on August 3rd, 2026, from 10 a.m. to 4 p.m. in Oakland. I think probably in this room, right? It's currently scheduled for Oakland. Okay. But it says -- it will be in Oakland, right, for those who have to plan travel.

So I want to thank all the Panel members and audience for participating and making this very interesting meeting, and I now adjourn the meeting.

(Thereupon the California Environmental Contaminant Biomonitoring Program, Scientific Guidance Panel meeting adjourned at 4:08 p.m.)

CERTIFICATE OF REPORTER

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 15th day of March, 2025.

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