MEETING

STATE OF CALIFORNIA

ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT

SYNTHETIC TURF SCIENTIFIC ADVISORY PANEL

CALEPA HEADQUARTERS BUILDING

BYRON SHER AUDITORIUM

1001 I STREET

SACRAMENTO, CALIFORNIA

FRIDAY, MAY 31, 2019

9:30 A.M.

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

PANEL MEMBERS:

John Balmes, M.D., Chairperson

Edward Avol, M.S.

Deborah Bennett, Ph.D.

Sandy Eckel, Ph.D.

Amy Kyle, Ph.D.

Thomas McKone, Ph.D.

Linda Sheldon, Ph.D.

OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT:

Lauren Zeise, Ph.D., Director

Jocelyn Claude, Ph.D., Staff Toxicologist, Special Investigations Section, Pesticide and Environmental Toxicology Branch

Sam Delson, Deputy Director, Office of External and Legislative Affairs

Carl DeNigris, Acting Chief Counsel, Office of the Chief Counsel

Allan Hirsch, Chief Deputy Director

Miguel Macias, Student Intern, Pesticide and Environmental Toxicology Branch

David Ting, Ph.D., Chief, Pesticide and Environmental Toxicology Branch

Patty Wong, Ph.D., Chief, Special Investigations Section, Pesticide and Environmental Toxicology Branch

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

PRESENTERS:

Randy Maddalena, Ph.D., Lawrence Berkeley National Laboratory, Department of Energy

ALSO PRESENT:

Robert Blink, International Carbon Black Association

Denise Kennedy, DK Enterprises

Steve Krauss, CRM

Mike Peterson, Gradient

Robina Suwol, California Safe Schools

I N D E X

P R O C E E D I N G S

DIRECTOR ZEISE: Okay. Good morning, everyone. It's 9:30. The webcast is on, and so I think we'll start -- get started.

So I'd like to welcome everyone in the room and on the webcast to this fourth meeting of the Synthetic Turf Scientific Advisory Panel meeting.

I'm Lauren Zeise. I'm Director of the Office of Environmental Health Hazard Assessment. And before I introduce the Panel, I'll just briefly note that we're very excited about today's meeting. We're going to be looking today at the methods by which we are proposing to calculate exposures to synthetic turf, as well as looking at the chemical analyses that have been conducted by Lawrence Berkeley National Labs, and OEHHA staff have been working with the labs. And so we're going to have some discussion on that. So we're really looking forward to the Panel's input, the audience's input, today's meeting.

So to introduce the panel, we have Ed Avol from the University of Southern California; Tom McKone from I guess retired or are you now in a special position with the Lawrence Berkeley National Labs and UC Berkeley?

ADVISORY PANEL MEMBER McKONE: Rehired retiree.

DIRECTOR ZEISE: He's a rehired retiree. Very good.

CHAIRPERSON BALMES: And emeritus.

ADVISORY PANEL MEMBER McKONE: And emeritus.

DIRECTOR ZEISE: And emeritus -- professor emeritus of UC Berkeley.

ADVISORY PANEL MEMBER McKONE: Yeah.

DIRECTOR ZEISE: Okay. Welcome.

And our Chair, John Balmes, from UCSF and UC Berkeley. And Sandy Eckel from USC. Debbie Bennett from UC Davis, and Linda Sheldon, who's retired from U.S. EPA. Great. So welcome, everyone.

I'd like to introduce the OEHHA staff starting at the Panel's far left Sam Delson, our Deputy Director for Communications; Carl DeNigris, our Acting Chief Counsel; Allan Hirsch, our Chief Deputy Director; David Ting, Branch Chief of the Pesticide and Environmental Toxicology Branch; Patty Wong, known to us all as the leader in OEHHA of this study, the synthetic turf study; Jocelyn Claude working in that section. And so that's the OEHHA staff.

All right.

CHAIRPERSON BALMES: Could I just ask, I think our court's reporter mic just be on, because we're hearing it.

THE COURT REPORTER: (Shakes head.)

CHAIRPERSON BALMES: No. Anyway, you're timing was -- it's not you.

DIRECTOR ZEISE: Well, all right. So I'm going to sit very still and see if the sound changes.

CHAIRPERSON BALMES: No, it was typing.

DIRECTOR ZEISE: It was typing.

And then from the labs, we have Dr. Randy Maddalena from the Lawrence Berkeley National Lab, and Hugo Destaillats also from the National Lab.

So just some housekeeping. The drinking fountains and the restrooms are located out the back door and to the left down the hall on the right side.

In the event of a fire or any other reason to evacuate the room, just please leave out through the exit signs at the back, go down the stairs, and we'll find ourselves across -- walk across the street. And we'll be taking lunch -- a lunch break, a little break this morning and in the afternoon.

If members of the public have digital media they want to show during their 3-minute comment period, if you could please bring the external devices to one of the OEHHA staff persons to upload the files before the lunch break, that would be great.

And the meeting is being recorded, transcribed, and broadcast via the web. So please identify yourselves and speak clearly into the microphones.

And so now, I'll turn the meeting over to Dr.

Balmes.

CHAIRPERSON BALMES: Thank you, Lauren. And I want to thank your whole team for preparing the document that we had the opportunity to review in advance of the meeting. I was glad that I had a long flight across the country yesterday, because I was able to get through most of it. So it's a lot to digest, and I look forward to the presentations that relate to the sections of the document.

SO is this our fourth or fifth meeting?

DIRECTOR ZEISE: It's our fourth meeting

CHAIRPERSON BALMES: Fourth meeting. I think each one has been very helpful, both hopefully to the OEHHA team that's working on this project, but also to the public to understand what the OEHHA team is doing. I also appreciate my colleagues' comments in the past and for being here today, and I look forward to a rich discussion with -- after each presentation.

So there will be an opportunity for the public to comment in the afternoon. Each commenter may speak for a maximum of three minutes. That's standard in this auditorium. I'm the physician member of the California Air Resources Board. And unless we are overwhelmed with people that want to testify, we limit to a maximum of three minutes. Blue cards are available on the back table. Please fill one out, if you'd like to speak, and

turn it into Miguel Macias.

Internet participants may send comments via email to syntheticturf@oehha.ca.gov, and staff will read aloud about the comments up to three minutes each as time allows. So we do encourage those of you who are participating remotely to participate in that way.

So I think with that set of opening comments, I'd like to turn the mic over to Patty -- Patty Wong.

(Thereupon an overhead presentation was presented as follows.)

DR. WONG: Good Morning. Thank you, Dr. Balmes.

So my name is Patty Wong. I work for OEHHA on the Synthetic Turf Study. So I will start today's discussion by providing an overview of our study.

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DR. WONG: The OEHHA study consists of multiple study tasks. Here is a brief outline of each task. And you can see this is the timeline of the study. And we have been ongoing since 2015. And we have four -- today is the fourth meeting of the scientific Advisory Panel.

And let's look at the tasks.

Task 1 involves consultation with expert and the public. The Panel has been meeting annually since 2016, and today is the fourth meeting. In the initial stage of the project, OEHHA has held a series of workshops to meet

with local community stakeholders.

In the past few years, OEHHA has been in communication with federal agencies and international bodies involving the crumb rubber study, the tire crumb rubber studies. And in the last year, OEHHA has met with U.S. EPA, U.S. Environmental Protection Agency; the ATSDR, Agency for Toxic Substances and Disease Registry; NTP, National Toxicology Program; Health Canada; and National Institute for Public Health and Environment, RIVM of the Netherland -- of the Netherlands to share information on the tire studies.

We also met with researchers from UC Davis to consult our non-targeted analysis protocol.

So details of the progress of our workflow between each task will be discussed in the next slide. Here is just a brief overview.

The Task 2 involves focus on identification of chemical of concern and hazard for synthetic turf field and playground constructed with recycled tire crumb rubber.

The Task 3 involved in this developed a exposure scenario, which involved identifying the field user categories and their activity or behavior on these fields or playgrounds. And then we use it to assess their exposure.

Task 4 involve characterization of chemical exposure on synthetic turf fields and playgrounds, which include collecting and characterizing the composition of samples from fields and playgrounds.

Task 5 is to develop Biomonitoring and Personal Monitoring Protocol. Data on the chemical and exposure obtained from Task 3 and Task 4 will provide knowledge, including scientific literature search will guide the development of this protocol.

Task 6 is the assessment of human health risk from exposure on synthetic turf fields and playgrounds. So we are progressing in Task 2 to Task 6. And we are working on chemical analysis. Identifying hazards for chemical and also working on the exposure assessment tasks.

Combining the knowledge and the data, OEHHA will assess the potential human health risk and hazard from exposure to chemicals released from synthetic turf fields and playgrounds. At the conclusion of this study, OEHHA will complete a report documenting the risk assessment.

So today, we'll focus on discussing Task 2 and Task 4 for chemical characterization of crumb rubber, and also Task 3 for Exposure Scenario Development in the morning.

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DR. WONG: So two years ago, Dr. Kyle suggested we should roadmap about how the whole study relate to each other in terms of the tasks. So last year, we presented a roadmap and we updated for this year.

So before we go into the roadmap, just housekeeping, the colors on the legend, the yellow represent the items that we have discussed in 2016 and 2017. The green -- the middle kind of gray-green is the items that we discussed in 2018. And the brown box is the one that we're discussing today.

So this is kind of a complex flowchart.

Okay. Okay. Let's look at the work tasks and how they relate to each other, how each task interact with each other. So other than the Task 1, which I described about consultation with expert and public, this flowchart cover Task 2 to Task 6.

So Task 2 is hazard identification. This task involved Identifying chemical of concern for our study and research their potential -- potency criteria and health endpoint and hazards. And we have discussed this information in 2016-17, and we'll continue today.

OEHHA conducted a thorough literature search on synthetic turf, crumb rubber, and tire-related studies. We constructed a tire-related chemical database, the little barrel down there we have discussed in the past,

and we will continue today.

In the database, we identify chemicals related to tire, but we also add chemical that has been ongoing in the federal study, their chemical that they find.

Using this chemical list as a guide, OEHHA staff has been collecting from existing database on toxicity and potential data for chemical potency data for chemical that has been detected in field sample.

And today, we'll discuss the use of this chemical database in our targeted and non-targeted chemical analysis of the crumb rubber samples, which is a crucial part for the field characterization study, Task 4.

So next is Task 4. It involve in characterizing the field. OEHHA received input from the Panel in the '16 and '17 meeting, and we modified our protocol for field sampling accordingly, and we implement the protocol. We finished sampling the fields and playgrounds in the summer last year. And we have completed all the sampling on the fields and playgrounds.

So we have collected environmental data, including temperature, particle counts, ozone, relative humidity, solar insolation on and around the fields and playgrounds. In addition, we also collected air and particulate matter and crumb rubber samples from each field.

In the last meeting, we discussed the preliminary date for inorganic analysis of crumb rubber, and also some of the environmental data collected on and surrounding the field, and we presented it to our Panel and the public.

Currently, we are working on identifying the chemical constituents in crumb rubber. The understanding of the chemical composition of crumb rubber will help guide our bioaccessibility measurement of these field samples. The bioaccessibility measurement can be used to derive the level and the nature of the chemical people might expose while using the field and playground.

We are currently working on targeted and non-targeted chemical analysis. And today, we are seeking input from our Panel on our approach on the non-targeted chemical analysis.

The -- so the non-targeted and the target chemical analysis will provide data for chemical concentration, which we are -- since we haven't fully identified a chemical, so it won't be in our discussion today. That's why it's kind of blue on the barrel.

The next task is the exposure scenario development. Last year, OEHHA received the Panel's input on protocol and preliminary data of our time activity behavior study of soccer players on synthetic turf fields in California. The time activity study has been completed

in the summer last year and we have analyzed the data.

So currently, OEHHA staff is evaluating the potential pathways of human exposure on the turf fields and researching the exposure parameter that can be used.

So combining the results of the time activity study and the literature research, the chemical identity, the concentration data from Task 4, we are developing model and exposure equation to estimate the multi-route exposure dose for player on field and playground.

In today's meeting, we will summarize the exposure pathway along with the exposure equation and the parameter. And we are looking forward to input from the Panel and the public.

Sorry.

The equation and exposure risk and -- sorry. The exposure and the risks will then be summarized in the human health risk assessment report, which is our next task here, the Task 6. And the chemical and exposure data will also be used in the development of the biomonitoring and personal monitoring protocol, which is Task 5 here. So this is the summary of our roadmap for the turf study.

CHAIRPERSON BALMES: So thank you, Patty. And I want to thank you for walking through the study roadmap. At first glance, it appears very complex, but you walked us through it very well. And it also shows how much work

has been done so far. I just want to congratulate you and your staff on all the -- and collaborators at all the work that's been done so far.

So I turn to my fellow Panel members, any comments about the overview of the study at this point?

Okay. Well, thank you. Oh, go ahead.

Just push the button there.

ADVISORY PANEL MEMBER SHELDON: This is Linda Sheldon. Just clarify for me at the end, Task 5, it says apply knowledge on exposure and chemical data, evaluate feasibility of monitoring processes. That means that you are not going to do monitoring for that. You're just sort of going to make recommendations as to what would be feasible, is that right? Am I understanding that correctly.

DR. WONG: We are going to develop the protocol is -- for the scope of this study at this point, we are covering the development of the protocol. Yeah, but we are not doing the actual measure in the study.

ADVISORY PANEL MEMBER SHELDON: Okay. That's why -- I just wanted to make sure I understood.

Thank you.

CHAIRPERSON BALMES: So Jocelyn, are you next up to present?

DR. WONG: So in the next section we'll discuss

the synthetic turf field exposure model. Let me introduce our staff toxicology of OEHHA, Dr. Jocelyn Claude.

(Thereupon an overhead presentation was Presented as follows.)

DR. CLAUDE: Okay. Thank you. Waiting for the slides the open up.

Okay. Good morning. So in this section, we'll talk about the synthetic turf field exposure model. So I'll briefly review the exposure pathways that we will consider in our assessment, and give a brief summary of the time activity study Patty mentioned that was conducted. Then I'll move on to discuss the equations that we'll use to estimate exposure dose, the parameters that will go into there, and the data that we'll use to derive their values.

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DR. CLAUDE: So here shows a timeline of the development of the exposure scenario development. This little line shows where we are today. So we're here at this meeting. We're going to discuss how the data we gathered will be used.

A little background on the study. OEHHA collaborated with UC Berkeley and the University of Arizona to the conduct study with IRB approved study protocols and designs. Data was collected from soccer

players via a survey and videotaping in late 2017 to early 2018.

The reports from those studies can be found in the meeting materials appendix, where they have more information the protocols that were used and more information about the data itself.

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DR. CLAUDE: So this slide just provides a quick summary of what was collected. So we had 1,069 participants complete our online survey and in-person questionnaire. We had nearly equal numbers of males and females, ages 4 to 71 years old, and from multiple ethnicities. We received responses from athletes who play in each of the four main soccer positions, which are forward, defender, midfielder and goalkeeper.

The questions captured information on how often they play or practice; and on-field activities, such as how often they dive, slide, or fall; also, information on their warm-up activities and exertion levels during activity, which is how much time they spend resting versus running around on the field. We also collected information about their history, including like when they started to play.

Forty of those participants also participated in the video study. The age of these participants was from 7

to 22 years old, half were male, half were female, almost equally distributed amongst the four soccer positions. And we had video from an equal number of practices and games.

So participants were videotaped through the course of an entire practice or game, and the video data were analyzed to gather information on their contact frequency and duration, with the field and other objects, such as water bottles or hand-to-mouth activity. Analysis also noted how often they fall, slide, or dive. And data in the video also -- were also analyzed for exertion levels.

So these data are used to derive the parameters for the inhalation, ingestion, and dermal pathways, as you can see shown here.

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DR. CLAUDE: So this slide shows the conceptual site map of the exposures that may occur on the fields. Last year at our meeting, we went into more detail about each pathway and the field user categories that are considered for each pathway. More meeting -- more details can be found in the meeting materials. But briefly, I'll just summarize what we're looking at here.

So the synthetic turf field components, including the crumb rubber, the backing, and the grass blade are

considered as the sources of exposure. And through various media and environmental activities, exposure can occur through inhalation, dermal, or ingestion pathways.

The inhalation exposure is shown here in yellow. This occurs when chemical vapors or airborne particulates from the field are breathed in. Dermal exposure is shown in blue. And this occurs when chemicals are transferred from the crumb rubber onto the skin and are absorbed. This can be a direct mechanism through -- with direct skin tox -- skin contact with the crumb rubber or indirectly, where chemicals or particles get transferred onto the skin from another object.

Ingestion is shown in green. And this occurs when crumb rubber particles get into the mouth and are ingested. It can be an accident -- it can be a direct pathway where ingestion is accidental or intentional. And it may also be indirect where chemicals or particles get transferred into the mouth through a carrier such as a hand or an object.

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DR. CLAUDE: So now, we'll move on to how exposure dose will be estimated and how we'll use the exposure data to do that.

So an exposure dose is the estimated amount of chemical that is experienced by a field user as a result

of activity. Shown here at the top is the general skeleton of the dose equation. The dose is equal to a concentration in media times the intake rate times the time spent on field.

So chemical concentrations in air and crumb rubber, including bioaccessibility measurements will be measured in the field study and will be used for the concentration parameter values. Different media will be covered in different pathways. Air concentrations will be used for inhalation, and crumb rubber chemical concentrations will be used for ingestion and dermal pathways.

The intake rates are derived from the available data in the literature and the time activity study. Different pathways will have different factors for this parameter, so you'll have breathing rate for ingest -- for inhalation, ingestion rate for ingestion, and then dermal loading for dermal exposures.

Considerations will be made for parameters that may be affected by age, gender, or the field user category. Exposure times are derived from the data gathered in the survey. This is the time spent on field by the field users. Considerations will also be made for age, gender, and field user type in the development of this parameter.

Once calculated, the exposure dose will be used to estimate the non-cancer hazard and cancer risk for a chemical. I will briefly go over how those calculations will be made and how the dose will be used, but the main focus of our discussion will be on the specific dose equations for the pathways that we will consider and development of the parameters.

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DR. CLAUDE: So shown here is the general skeleton of the hazard quotient equation. The hazard quotient of a chemical is the ratio of the non-cancer dose to a chronic reference level, or REL as it's shown here.

The cancer dose corresponds to a daily exposure of a chemical. And the chronic reference exposure level is a daily intake amount at or below which no adverse non-cancer health effects are anticipated to occur. This level is designed to be protective for continuous long-term exposures.

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DR. CLAUDE: Shown here is the general skeleton for the cancer risk equation. The cancer risk for a chemical is an estimated probability of adverse human health effects occurring from exposure to a chemical. The risk is equal to the non-cancer dose, times a potency factor, times an age sensitivity factor, times an exposure

duration over an averaging time.

The cancer dose represents a lifetime exposure dose of a chemical. The cancer potency factor is used to estimate the increased risk of a chemical in an exposed population from a lifetime exposure to that chemical.

Age sensitivity factors are weighted factors that consider the increased sensitivity to carcinogens during prenatal and early postnatal life stages, as compared with adult life stages.

The exposure duration is the years of exposure. And the averaging time is the period over which that exposure duration is averaged

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DR. CLAUDE: So now we'll get into each specific pathways equations. So we'll start with the inhalation pathway. So the non-cancer exposure concentration for inhalation is shown here. This is a special scenario that applies for this pathway. As you can see, this equation does not follow the general format that we just discussed.

Typically, concentration values for long-term near continuous exposures, such as with a residential scenario, are considered for the chronic inhalation non-cancer assessment. This, however, is not the case with synthetic turf field users. They're only on or near the field for a few hours a day for a few days per week.

So for this reason and adjusted concentration of a chemical is used to estimate exposure for the partial period of the day that they are on the field.

This parameter is derived by multiplying the concentration of a chemical in air that was measured in the field study by the exposure time. And the values for exposure time are derived from the survey data that I previously discussed.

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DR. CLAUDE: Shown here are the values for athletes that we received in the survey data. Differences are found between gender and age. And the data are separated based on the season and for practices versus games.

Presented here are the media 95th percentiles only. But the full range of the data distribution can be found in the meeting materials. So limited data was collected on the younger age group from 2 to 6, but you can see that central tendency for other players is to spend about 1 to 2 hours per day on a field for either practices or games, and higher estimates range from about 2 to 6 hours per day.

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DR. CLAUDE: These are the exposure times for coaches, referees, and bystanders. No data was collected

on these groups from the survey data, but OEHHA has made assumptions about how they're anticipated to behave. And then the data for athletes what used to derive these values.

So coaches are assumed to be on the field anytime the players are on the field for both practices and games. And referees are assumed to be on the field during games anytime the athletes are. So for these two groups the responses for all survey participants were analyzed to estimate the exposure times.

Child bystanders are assumed to be present at the fields during practices and games of older siblings. Data for survey participants ages 4 to 16 were used to derive their exposure times. The adult bystanders are assumed to be present at the practices of games -- at the practices of children ages 4 to 16 and at all games. So data for participant -- survey participants ages 4 to 16 was used to derive exposure time for practices, and then data for all the participants is used to derive the exposure time for games.

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DR. CLAUDE: So this equation here shows the estimation of cancer exposure dose for inhalation. You can see this equation follows the general format that we talked about. You have a concentration, an intake rate,

and an exposure time. We just discussed the air concentration.

So next the inhalation absorption fraction, this represents the fraction of the dose that is absorbed in the absence of chemical-specific data. OEHHA will assume a value of 1 according to our guidelines. The values for the inhalation rate normalized to body weight are adopted from OEHHA guidelines.

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DR. CLAUDE: Those values are presented here as they are found in the guidelines. These rates are calculated in consideration that different levels of activity will require different levels of energy expenditure and will thus affect the inhalation rate. We recognize that field users may engage in various levels of activity. Athletes may engage in activities that involve resting or standing, light activity such as walking, moderate activity such as jogging, and high activity such as running.

Coaches and referees are anticipated to engage in resting, light, and moderate activities, while bystanders are anticipated to engage in resting and light activities. And just a note, the age groups presented here are unique to this pathway, based on the availability of the inhalation data. The age groups for the inhalation and

dermal will be -- we will use our traditional OEHHA age groups.

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DR. CLAUDE: So back to our main equation. The exertion level here represents the percentage of time on the field that a user spends performing activity at a specific intensity level. Data from this survey will be used to derive this parameter value. We already talked about the exposure time.

So next the exposure frequency. This represents the days per week spent on the field by field users. Survey data is also used to estimate this parameter value.

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DR. CLAUDE: So shown here is the data collected on exertion level in the survey from the athletes. Once again, the median and 95th are presented here. The full range can be found in the meeting materials. Differences were found between gender and age. And again, the data are separate by activity intensity and for practices versus games. Limited data was collected on the youngest age groups once again. And you can see the range of the data for each of the groupings vary within the group.

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DR. CLAUDE: So exertion values for coaches, referees, and bystanders. Not data was collected for

these groups. So once again, OEHHA has made assumptions about how they're anticipated to behave. Coaches are assumed to spend practices walking around and jogging on the field, while they are anticipated to be standing, walking, and jogging on the sidelines during games.

Referees are not assumed to be present during the practices, but are assumed to spend time during games standing, walking, and jogging. For both practices and games, child bystanders are assumed to be sitting or walking around on the field sidelines, while adult bystanders are assumed to be sitting watching the field activities.

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DR. CLAUDE: So this table here shows the exposure frequency data that was collected in the survey. Once again, differences between gender and age and the date are separated by season and for practices versus games. Players tend to spend 1 to 2 days per week on the field for practices and games each. Higher estimates range from 2 to 6 days.

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DR. CLAUDE: So here shows the exposure frequency values for coaches, referees, and bystanders. No data were collected for these groups, but OEHHA made the same assumptions as we made for exposure times to derive these

values.

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DR. CLAUDE: And so now we're going to pause. We'll have a short discussion and ask the Panel if they have any questions or input for the background and inhalation we just discussed. So I'll turn it back over to Dr. Balmes.

CHAIRPERSON BALMES: So thank you, Jocelyn.

Any comments or questions from the Panel at this point?

I'll turn to my left first. Dr. Bennett.

ADVISORY PANEL MEMBER BENNETT: I just had a clarifying question. Are we talking about the toxicity values and how those are being selected at a later point today? Because they're sort of in there, assuming we have them for all of the chemicals, and I didn't know if that was a point of discussion for later.

DR. CLAUDE: No, we won't talk about any toxicity values at this meeting.

DR. WONG: Okay. As we are still developing the chemical list, we -- the toxicity criteria and the value we'll be discussing in late -- in the future meeting.

ADVISORY PANEL MEMBER BENNETT: Okay. And so at that point, we'll also talk about how we'll sum up against across multiple chemicals and so forth?

DR. WONG: Yeah.

ADVISORY PANEL MEMBER BENNETT: Okay. Great.

And then I just had a question on some of the extreme values in the pamphlet that you gave us. I mean, they had people reporting 24 hours on the field.

(Laughter.)

ADVISORY PANEL MEMBER BENNETT: So it's just like one person that didn't get the survey or --

DR. CLAUDE: Yeah. That's one of our questions for discussion that we'd like your input on. So we did receive, you know, like 7 days per week or 24 hours per day. So it's kind of like how do we handle those values. We don't know if it's --

ADVISORY PANEL MEMBER BENNETT: Seven days a week seems realistic.

DR. CLAUDE: -- question yeah -- so how do we put a limit on what's reasonable, you know, to consider?

ADVISORY PANEL MEMBER BENNETT: Okay.

DR. CLAUDE: So, yeah, we recognize that we do have some extreme values, and how do we particularly handle them.

ADVISORY PANEL MEMBER BENNETT: And then I had a question on the slide for the third trimester, you showed the moderate breathing rate. I'm assuming that's a pregnant bystander?

DR. CLAUDE: Um-hmm. Yeah. That's --

ADVISORY PANEL MEMBER BENNETT: And why wouldn't they be light?

DR. CLAUDE: So the breathing rate during pregnancy it's derived from the moderate activities of someone 16 to 30 years old.

ADVISORY PANEL MEMBER BENNETT: Okay.

DR. CLAUDE: It's based on physiological differences that occur during pregnancy that you're breathing rate would kind of -- yeah.

ADVISORY PANEL MEMBER BENNETT: And then my final question is on -- is there any consideration that a lot of times the referees are also players, so it might be like a referee that's --

DR. CLAUDE: Yeah, so when we do the --

ADVISORY PANEL MEMBER BENNETT: -- a player and a referee.

DR. CLAUDE: -- as you mentioned like when we talk about we can do multiple chemicals when we get to doing the risk assessment, if they participate in more than one user category at the same -- you know, at the same, or previously, and earlier in life, we'll take that into consideration as well.

ADVISORY PANEL MEMBER BENNETT: Okay. Great.

DR. CLAUDE: Yeah.

CHAIRPERSON BALMES: Go ahead.

ADVISORY PANEL MEMBER SHELDON: Hi. This is Linda Sheldon.

I may be asking questions that were answered in one of the previous SAPs, but I would like some clarification. So first of all, what is the goal of this exposure assessment? Because whether it's to do a risk assessment for all populations that are near crumb tires is different than do we want to distinguish differential exposures between soccer players -- you know, soccer players in an epi study.

And, you know, in an epi study I think -- and this is out of my area of expertise, but I think you want to be able to understand differential exposures, and therefore adults, and kids, and the players might not be on the field at the same time.

If it's merely for a risk assessment, it might be different. And so, again, I think what we do depends upon what the goals are. The other thing is, is that as you look at your task of assessing feasibility for biomarker studies, et cetera, I think that you need to say, you know, what and how -- how am I seeing it for groups differently also. So I think that that's really an important thing.

I also think that -- and again, I don't know if

this is appropriate or not, but you are focusing exclusively on the soccer field. And I think that at some point, you need to estimate exposures that are non-soccer related relative to the rest of the population, because you may find that these exposures are not any greater than some of the other exposures.

You know, in our experience, diet is always a very important exposure. And again, it doesn't mean that it's -- that you need to do it here, for looking for turf related. But I think what you need to understand is again what risk is coming from that. Again, I don't want -- I don't want, at the end of the day, for you to see exposures for soccer players and not have it normalized to something else. And so that's really the point.

The last thing is, is that on the dose, depending upon how the -- you know, what route and pathway it is, not only will it have a different dose, but it may be hitting a different target organ. I think PAHs are a really good example of this. Inhalation exposure for PAHs can lead to cancer and lung cancer, but dietary ingestion, which is often much higher, you know, goes immediately to the gut and is transformed.

So I think that as you look at dose, you need to understand what the target is going to be and do the different routes make any difference?

That's pretty much what I have.

Thanks.

CHAIRPERSON BALMES: Ed. Oh and hi. Before I turn over the floor to you, Ed, I would like to have Dr. Amy Kyle introduce herself.

ADVISORY PANEL MEMBER KYLE: Hello. Speak.

I'm Dr. Amy Kyle. I'm sorry I was late. Glad to be here.

CHAIRPERSON BALMES: And Dr. Kyle was my colleague for many years at the University of California, Berkeley.

So Mr. Avol.

ADVISORY PANEL MEMBER AVOL: Thank you, John.

I have a couple questions just about the layout and the planning on this. And I apologize if these were questions that were addressed in earlier sessions, but it seems like they're going to be germane as you move on.

So going back -- rolling back to -- even to Figure 4.1, here are athletes, and, you know, sort of what were in the pathways and what were considered unimportant, et cetera. The -- on the athlete, the first table on the -- oops, we're spinning back there.

Oops. Sorry for -- okay. So the first column an athlete, these were -- were these validated or based on any video data yet or were these just sort of, you know,

sat down and sort of conjecture before you went out -- sort of proposed before you went out into the field and actually visualized this, because I'm -- I guess I'm -- my question has to do with the -- sort of the Xs for the athletes, and, you know the -- particularly, two of the Xs.

DR. CLAUDE: So last year when we presented it, and it was kind of this is what we think will happen. But based on that and the video data that we received in the exposure study, we did update it. So pathways that we didn't see occurring the check or X may have changed.

ADVISORY PANEL MEMBER AVOL: So this is validated based on what you actually captured in the field?

DR. CLAUDE: Yeah, this is based on what we've done after looking at the video and exposure study.

ADVISORY PANEL MEMBER AVOL: Okay. Good. Thank you.

And then in terms of -- in a similar way, the exposure times that were assumed, the hour or two hours, et cetera, were those also -- those were just collected by survey. But then were those reviewed or sort of validated by some sort of reality check based on what you saw in the videos that you collected?

DR. CLAUDE: So the exposure time, we didn't collect in the video data. We didn't collect any

information on exposure times. That was just in the survey, like Debbie mentioned from the extreme values we have. So the data presented is just analyzed what we have. Like, some -- I think the question it was actually you type in the number. So if people accidentally maybe put more than 7 or more than 24, those data values were definitely kind of ruled out as kind of might be -- those are incorrect can't have more than 24 hours.

ADVISORY PANEL MEMBER AVOL: Right. I mean, I guess I --

DR. CLAUDE: So, yes.

ADVISORY PANEL MEMBER AVOL: I mean, I certainly agree with Debbie that people unlikely spend 24 hours on the field.

DR. CLAUDE: Yes.

(Laughter.)

ADVISORY PANEL MEMBER AVOL: But not withstanding that outlier, it seemed to me that based on the experience that I've seen, and my children, et cetera, playing soccer, that the -- some of the values, particularly for the values of, you know, teens and young adults in terms of competitive sports, or club soccer, or whatever, some of those hours seem low.

And so I was just curious if there -- you know, what it was based on, whether people were underreporting,

or if, you know, some review of that was made? Because it seemed like one can easily envision a scenario in which teenagers or young adults are -- well, actually, not even teenagers, but anybody playing in the club sports system, for example. So we talk about 10 year olds on up, through high school, into college on weekly matches, weekly competitions, there might be two or three matches in the course of a day as they work their way through a competition. So they would spend for each of those matches an hour or two on the field at a time. So one would expect that there might six or seven hours, you know, sort of showing up another than the two or three that were reported.

DR. CLAUDE: And that could be, maybe, possibly what we have. We do have those six-hour values what people are reporting. Maybe they do have multiple games in a particular date. The survey was asking them in the past year. So if that occurred in the past year, they may have. That may be why it's recorded as six hours per day, but we don't know.

ADVISORY PANEL MEMBER AVOL: Okay.

CHAIRPERSON BALMES: Could I just interrupt for a second? I think in addition to raising important issues like we're doing, it would be helpful if we could provide some advice about how to deal with these difficult issues

too.

ADVISORY PANEL MEMBER AVOL: Okay. Fair enough. Thank you.

CHAIRPERSON BALMES: That's to all the Panel, not just you Ed.

(Laughter.)

ADVISORY PANEL MEMBER AVOL: Point well taken. Yeah, point taken. I guess the -- in terms of recommendation, it seemed like the obvious one would be to sort of maybe validate that by the actual video that you have. If it's already been done by the University of Arizona, they may provide feedback. But otherwise, I'm not sure how you go back and correct it. Again, there's obviously going to be some editing with regard to the 24-hour/7-day a week sort of aspect. But the ones that are sort of within the range of feasibility, it's much harder to know how to treat those.

Let's see, I guess just the other observation, I was a little surprised by the male-to-female differences that, I guess, were reported. I have both boys and girls, daughters and sons, that have played and -- you know, in the club system. There really wasn't much differentiation sort of how much time they were on the field. And yet, what you see reported is different, so I thought it was an interesting observation. I don't have a recommendation

for that. It just -- I was surprised that it seemed like women were -- had less time sort of being reported.

But I think those are all my comments with the -- with one other comment that in terms of this report being released and accessible and it Obviously reflects a lot of information just to make sure that there are units provided for the tables and data that, you know, in all the appropriate places to help the reader to follow along.

Thank you.

CHAIRPERSON BALMES: Thanks, Ed.

Dr. McKone.

ADVISORY PANEL MEMBER McKONE: Yes, I want to pick up on -- and I think Dr. Sheldon has made some key points - I'm sort of picking up on these - in terms of the pass-off of information. So I think the exposure assessment is pretty focused, and probably correctly so, on what goes into somebody. And actually, the exposure dose is a rate during some exposure time, which we're learning is some activity. I think where I -- I think there's a need to be very careful, and maybe carry more information is in the pass-off to the risk assessment.

And again, we're not reviewing that, but the way you presented it is you just go from the exposure dose, which is the, you know, milligrams per kilogram or milligrams per day that's passed off to a comparison to

either a REL, reference exposure limit, for non-cancer or a cancer potency. And I think there are some questions that will come up. You know, these are not -- but we're not really looking at lifetime. We're looking at fairly short periods of time, so -- and also the pathway or the route of intake is certainly ingestion for many chemicals is much different than inhalation. And I think dermal tends to be more like inhalation, because it's going in to the bloodstream without going through the liver and being transformed rather quickly into byproduct chemicals. You have this first pass.

So I mean that's the reason you want to probably sort of don't aggregate all the routes together. So I don't think you can go from exposure dose to dose without saying this is a dermal exposure dose is the inhalation.

But then the other question is, is it might be useful to also talk about the intake, how many milligrams are taken in over a certain time period. Because I think when we start getting into health effects, you may want to have that information available. It's there. It's just that if it gets suppressed, if everything gets aggregated into some rate, and that rate is averaged out, you're swapping out, where that's a rate over a season maybe -- a soccer season. I don't know how long they go. Or it's over much less than a lifetime period. And I think there

are some methods that will come up in risk assessment for sure looking at it.

So it -- so the recommendation, if I want to be concrete, is don't just sort everything and aggregate everything as an exposure dose without recognizing there is a time period associated with that exposure dose. I'm not talking about the exposure time, the amount of time on the field, but the ex -- the lifetime period, or the annual period, or some time factor, which really isn't here, that might be relevant to the health effects or could be, if we have better data for some of these chemicals.

So it's just a matter of storing. You know, when you pass it off, store not just the exposure dose, but the route by which it goes in the route of intake and some information about how long that individual was exposed at that rate.

CHAIRPERSON BALMES: Dr. Eckel.

ADVISORY PANEL MEMBER ECKEL: Great. Thank you. Dr. Sandy Eckel from USC.

So I had a couple of comments again coming from a statistical viewpoint. So thinking about the issues of the online survey and some of these more outlying values, a couple of my comments and suggestions are, if there's only a handful of outlying values, I think, you know, it's

pretty clearly some of those are an issue, and we can be probably more safely exclude those.

But if there are larger numbers, you know, one idea is to potentially look across responses on the same survey, if -- you know, if someone responded that they did 24 hours of activity, you know, if they also have sort of unusual responses for other the other questions, that might help you make decisions about whether to use their data or not.

And I also noticed that it seems like these unusual outliers were related to age, and that kind of teenage respondents were kind of responding these more unusual values. So it would be harder to ascertain values for that population than other populations. So that might be something to think about.

CHAIRPERSON BALMES: The teenagers don't sleep either.

(Laughter.)

ADVISORY PANEL MEMBER ECKEL: And as Dr. Avol talked about, there was these interesting differences by sex. You know, part of me wonders if there was some response by us or maybe the representativeness was different by sex. And, you know, you could potentially thinking about weighting responses to try to get samples that are more representative of the population overall.

Just some possible ideas.

And then I also had a question. I can't quite recall. I remember seeing, you know, at a previous meeting discussions about how the air was sampled at the fields. But I just wondering, if you could remind me, because this is an important input for the dose calculation for inhalation, was it sort of a time period average exposure -- concentration of air or was it -- like I just want to make sure that you're kind of accounting for, you know, heavy activity on the field and potentially kind of plumes of dust that might be coming up during activity?

So that was a question I guess.

DR. WONG: So in terms of sampling the air, we sample the air an hour before any activity. And then we put it -- actually, there's four different air stations, and out the field -- on the field behind the goal box, and before -- one hour before activity, and then we have three hours of activity to potentially collect the plume.

And we always try to put it downwind from the goal box.

ADVISORY PANEL MEMBER ECKEL: Okay.

DR. WONG: And then another hour after all the activity. So we try our best to collect the sample that potentially represent the breathing. And we also collect

the air sample at different heights. I'm looking Dr. Maddalena, because he's our field person as well. So we try to cover the horizontal, the temporal, and then the vertical distribution of the air as well.

ADVISORY PANEL MEMBER ECKEL: So that raises a question for me. Do you account for, you know, smaller children, you know, being lower to the ground and not in these air concentration?

DR. WONG: Yeah, that's why we collect the multiple levels, so we collect the different breathing zones for different age.

ADVISORY PANEL MEMBER ECKEL: Okay. And then the concentration in the air that's input into these equations will be sort of a three- or four-hour period average, is that what's used then, or...

DR. WONG: Every half an hour -- half an hour per one hour -- one hour per sample.

ADVISORY PANEL MEMBER ECKEL: Okay.

DR. WONG: So are we going to talk about it later today the air samples?

Yeah, we have another section about sampling the air and analysis of the VOC, volatile organic chemicals, later today.

ADVISORY PANEL MEMBER ECKEL: Okay. Thank you.

CHAIRPERSON BALMES: Dr. Bennett.

ADVISORY PANEL MEMBER BENNETT: I was just thinking based on what Dr. Avol was saying, I mean when I looked at the medians and the 95th percentiles, I was kind of looking at them like, okay, those medians look like a rec. player. And then I was looking, okay, the 95th percentiles look like my friends kids, because my friend's kids all play competitive.

And it made me really realize that, you know, it's almost like you couldn't really do a probabilistic analysis with this. You would have to use straight up 95th percentile values, because you're really looking at two populations. And so those same ones that are spending more time on the field are also probably those ones that said they were -- had a greater proportion of their time in high activity, because they're obviously the ones that are pushing more.

And so, in a way, I kind of feel like you've got two populations in the same distribution. And I don't know if you have information as to whether they were recreational players or competitive players?

DR. CLAUDE: We do. We have information on whether they were recreation or competitive, and we -- these all also -- we have all positions here as well, too.

ADVISORY PANEL MEMBER BENNETT: Because it might make sense to analyze the competitive players separately,

because they are going to have consistently higher values. And I bet that's probably explained in the difference between the males and the females is just the -- simply the percent that were competitive versus rec., not really that they're different.

CHAIRPERSON BALMES: Go ahead, Ed.

ADVISORY PANEL MEMBER AVOL: So I just have a process question. Is this the time frame in which we should be addressing the -- these other sections that support these tables or are we going to step through the different sections of this report throughout the day?

DR. CLAUDE: We're going to talk about ingestion next and then dermal -- the dermal pathway.

ADVISORY PANEL MEMBER AVOL: But we're not ong to step through the, for example, section 4 or section -- you know, I mean step through the sections of it?

CHAIRPERSON BALMES: This is section 4.

ADVISORY PANEL MEMBER AVOL: This is essentially the Section 4 presentation?

CHAIRPERSON BALMES: We've just done the first part -- the first pathway, is inhalation.

DR. CLAUDE: This is the part. Yeah, we're going to have just a little discussion --

ADVISORY PANEL MEMBER AVOL: Okay. So if I have questions about inhalation from section 4, I should ask

them now?

CHAIRPERSON BALMES: If you're -- yes, about inhalation probably now.

ADVISORY PANEL MEMBER AVOL: Okay. So I'm sorry. So may I ask one more question?

CHAIRPERSON BALMES: Of course, Ed.

ADVISORY PANEL MEMBER AVOL: Okay. Thank you.

So I have a question for you on Table 4-17, which gets at sensitivity factors for ages. And it refers to -- it's on page 4-27 of the document. So the age groups I assume are supported by previous published work, it looks like, that you've done. But I was -- because the age sensitivity factor sort of drop off from 16 on up, I mean, the mid-teen years are an interesting year in terms of lung development, because you're sort of capturing girl's maturation in lungs development in the late teens, but you haven't quite caught up with the boys, who are still growing.

And so in terms of sensitivity factors, I was curious as to, you know -- because you've sort of downscaled how important the boys are, because you chopped it at 16 as opposed to going to somewhere conventional like, you know, into the early 20s or to 21 or something like that.

CHAIRPERSON BALMES: As a board certified

pulmonologist, I can support what Ed says. You know, like everything else, girls mature faster than boys in terms of lung function. So it actually does continue. Actually, it continues in girls past 16 too, but especially boys.

ADVISORY PANEL MEMBER AVOL: But I guess my question is sort of the -- 16 sort of chops it right in the middle of when they're still developing.

CHAIRPERSON BALMES: I would agree that I'd be more comfortable with, you know, actually early 20s cutoff.

DIRECTOR ZEISE: Maybe I can interject here. So theses age sensitivity factors are applied to the cancer estimate. So they're not applied to non-cancer outcomes. And they're to addressed the increased sensitivity to cancer, and they were reviewed by the Scientific Review Panel for the Air Resources Board and OEHHA.

But we can look at those issues further. We will look at those issues further. But I just wanted to emphasize that actually it's for the cancer endpoint. And in deriving the reference levels for the non-cancer endpoints, enhanced susceptibility at different life stages is also considered, but there isn't a separate factor like this for it. It's in the assumption of the variability factors that you assume in that reference exposure level calculation.

Does that help?

ADVISORY PANEL MEMBER AVOL: That helps. Thank you.

CHAIRPERSON BALMES: Thank you, Lauren.

Any other questions?

Oh, Dr. Kyle.

ADVISORY PANEL MEMBER KYLE: I have a couple comments that I hope fit at this time, and if not, please cut me off. But one is about this issue of how to appropriately portray the susceptibility or sensitivity, you know, at younger ages. You know, I didn't particularly come to that in this table. But overall, that cutting that at 16 and applying it only in some cases, I understand it comes from some guidelines that were reviewed at a certain time and in a certain context. But in this time and context, that seems insufficient to me.

So I don't know that this is the time to get into that detail but, I -- since we're talking about it, I'm going to say I have that concern also more broadly. I bumped into it in a different table on a different page, but I think it's the same issue.

The second thing I wanted to say is related also, I think, to some of these comments. And that is in thinking about this as a public science document, and a

public science process, I think that the issues about how it's too much aggregated really need to be addressed, because I -- I think that there -- that a lot of this stuff people could understand, if it was broken out in pieces. But nobody can -- nobody understands rates adjust -- values adjusted buy body weights and rates.

You know, it's just -- it's understandable to someone who -- without quantitative training generally. And so -- and I also think that it would be good if people could plug in their own numbers, in terms of how much time they spend on the field, you know, that we not embed that so deeply in here that it's based on your study.

It would be better if -- if I'm a soccer player, which I was for many years, I would want to look at -- take my numbers and plug them in and say so what would this mean for me?

And then we don't have to -- did someone say this already?

Yeah. Okay. She's nodding like I've already heard this, Amy. Hurry up.

(Laughter.)

ADVISORY PANEL MEMBER KYLE: So -- and then you don't have to worry as much about whether your time activity study is correct, right? Because people can do the -- figure it out -- look at it from what they do.

So -- and maybe you need to plug in your weight too. You know, maybe there's some other things like that.

But I do think this is going to be -- the way it's presented is too aggregated in terms of the ways that have been mentioned but also conceptually. And there's no reason not to break it out into one step at a time and make a friendly picture of it, so that people can understand it. And then after that, you can combine it all up into rates, if you must.

I had one other thing that I was going to bring up. Oh, yeah. And that is, did you -- and maybe I missed this. I didn't see it, but I have to admit, I haven't read every single one of these pages fully. Did any of the take-home exposure issues end up in here, or was that excluded, either through stuff that ends up accumulating in cars or in, you know, in washers, or at home?

I didn't see it in here, so I'm just wondering.

DR. WONG: So multiple questions. One question at a time. For -- in terms of like plugging your own weight, plugging your time, how will I be in terms of the overall exposure? We have a lot of discussion within OEHHA how we should present the risks and the exposures at the end for the report, so the public can understand. And also for the individual who are interested in how am I in terms of relative to the others, if I play two years

versus my whole life? We're aware soccer can be a whole life scenario.

So we are in active discussion on how we should present the risks. And we definitely want to bring the Panel back in the next time to fully addressing how we should present the risks and how we should do the risk assessment in the terms of the scientific world we understand, and also the public can have better understand at how we communicate to the individual.

So we are looking at different ways of presenting it and how we can be interactive. Now, is the stage of people all going on the Internet and want to do -- can do things on their personal. So we are thinking about the approach to address your suggestion. We take it very seriously.

And the second about the take-home exposure. In our survey, we do have questions about how much you have see in your car, where did you see in bathroom, how much you estimate, how long do you -- before you go do your shower?

So we have those questions. We did not put it in this presentation. It's something we are considering thinking how we can address this pathway. It's a much more complex pathway than just playing on the field. So we'll look into it and see what we can do. We do have the

survey data for it, yeah.

CHAIRPERSON BALMES: So, thank you, Patty.

So we're scheduled for a short break now. Is that something we still want to do?

Does the court reporter need a break?

THE COURT REPORTER: (Shakes head.)

CHAIRPERSON BALMES: Well, if we don't need a break, then, Jocelyn, maybe you want to move forward.

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CHAIRPERSON BALMES: So now we're going to do the ingestion pathway.

DR. CLAUDE: Yes. Okay. So. Now, we'll move on to the ingestion pathway. So the non-cancer exposure dose and cancer exposure dose equations are shown here in the table. You can see these equations once again follow the general format we discussed. They're concentrations, intake rates, and exposure times.

So the bioaccessible concentration of a chemical from the crumb rubber is a value that's measured in artificial biofluids to mimic stomach conditions from the samples collected in the field study. This concentration represents the amount of a chemical that is available to be absorbed into the body.

The gastrointestinal relative absorption factor is a fraction that represents the amount of a chemical

that is absorbed by the GI tract compared to the amount that's available for absorption. Unless chemical-specific date are available, OEHHA will assume this value is equal to one. And that 100 percent of the bioaccessible chemical will be absorbed by the GI tract.

The ingestion rate is derived from literature and information from the exposure study. This parameter represents the amount of crumb rubber that is ingested per day normalized to body weight.

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DR. CLAUDE: It is the sum of the ingestion rates for the direct and indirect pathways. We'll talk about the direct ingestion rate first, which represents crumb rubber that is incidentally or intentionally ingested. These values are derived from literature and anecdotal evidence.

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DR. CLAUDE: So it's equal to the ingestion amount derived from various recent crumb rubber studies in the literature and anecdotal evidence from soccer players divided by the body weight.

And so ingestion amounts vary from point 0.01 to 10.4 grams of crumb rubber. The last two columns 3.55 and 10.4 grams represent the weight of one teaspoon one tablespoon of crumb rubber respectively, which players

have reported to be amounts that they may possibly ingest. The check marks here indicate which values will be considered for which field user category.

And OEHHA body weight values, as presented in guidelines, are adopted for the body weight parameter, unless athletes provided one in the survey.

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DR. CLAUDE: So next is the ingestion rate for hand-to-mouth activity. So this represents crumb rubber particles that are ingested after the hand comes in contact with the field and then touches the mouth. These values are derived from the literature and data -- and video data from the exposure study.

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DR. CLAUDE: So here shows the equation to calculate the hand-to-mouth ingestion rate. This parameter is a function of the adherence of crumb rubber to the hand, and then the amount of particles that are able to be transferred from the hand.

So the adherence factor describes the amount of crumb rubber that will adhere to the skin per unit of surface area for the hand. These values are adopted from a literature study that measured particle loading onto various body parts of soccer players who played on a field with crumb rubber infill.

The part of the hand that is assumed to be in direct contact with the mouth is assumed to be four fingers. This represents about four -- this represents about 10 percent of the total surface area of both hands. Data on the surface area was taken from the EPA exposure factor handbook to derive this parameter.

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DR. CLAUDE: The hand-to-mouth transfer factor describes the fraction of crumb rubber that will be transferred from the hand into the mouth. For this study, OEHHA will adopt a value of 0.5, as seen in OEHHA guidelines. This means that 50 percent of the crumb rubber on the hand would be assumed to be transferred into the mouth. The number of hand-to-mouth contacts was derived from the time activity study, the video data.

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DR. CLAUDE: Shown here is the adherence factor of the hand as taken from that literature study I mentioned, Kissel et al.

Here shows the calculated surface area of the four fingers that are assumed to be in direct contact with the mouth. These values were calculated by multiplying the surface area of both hands by 10 percent.

And here shows the hand-to-mouth contacts per hour for field user category. For athletes and young

bystanders, the values were derived from video data of soccer players and archived video footage of young children playing outdoors on natural turf. It is anticipated that playful behaviors on natural turf would be similar to those on synthetic turf, so these values would reasonably represent the exposure that children may have.

Data on the number of hand-to-mouth activity -- hand-to-mouth contacts for adults is very limited, since this type of behavior is considered more important for children. These parameter values were adopted from a recent observational study of adults that determine the hand-to-mouth contact frequency of workers performing desk work or paperwork throughout a one-hour period of the day. While engaged in dust work, the assumption is that one's hand would be engaged and thus unavailable for hand-to-mouth contact.

Conversely, while in between such tasks, which was also measured in the study, one's hands are anticipated to be free and available for contact, similar to a bystander, coach, or referee scenario. So values for this parameter were adopted from this study for bystanders, coaches, and referees.

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DR. CLAUDE: Next, the object-to-mouth ingestion

rate. This rate represents crumb rubber -- this represents crumb rubber particles that may be ingested after an object has been in direct contact with the field and then touches the mouth. Video data and literature data were used to derive this parameter.

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DR. CLAUDE: So here's the equation to calculate the object-to-mouth ingestion rate. It's a function of adherence of crumb to the object, and then the amount of particles that may be transferred from the object into the mouth.

So the adherence factor for the object describes the amount of crumb rubber that will adhere to the object, after contacting the field. OEHHA did not measure any adherence factor for objects in our field study, but toys and pacifiers are anticipated to be the most likely types of objects in such an activity, since video data did not show players engaging of many activities of this type.

Toys and pacifiers can often be made of materials, such as plastics and silicone, which may act in a manner similar to the skin. So we propose to use the adherence factor for the hand as a surrogate in this case.

The part of the object that contacts the mouth is assumed to be limited by the area of the mouth. The mouth area is assumed to be 1/9th of the surface area of the

head. And data of -- for the surface area of the head was taken from the exposure factor handbook.

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DR. CLAUDE: The object-to-mouth transfer factor describes the amount of crumb rubber that's transferred from the object into the mouth. For this study, OEHHA will assume 100 percent of crumb rubber on an object will be transferred into the mouth.

So for young child bystanders, archived video footage is used to estimate the object-to-mouth contacts that may occur on the sidelines. It's anticipated once again that these behaviors would be similar to those that would occur on synthetic turf fields and would be reasonable to represent their exposure on turf fields.

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DR. CLAUDE: So this table shows the calculated surface area of the object that would reach the mouth. These values are derived by multiplying the surface area of the head taken from exposure factors handbook multiplied by 1/9th.

And then this table shows the object-to-mouth contacts per hour for child bystanders. No differences were found due to age or gender for the data. And athletes, coaches, and referees, and adult bystanders are expected to have negligible exposure through this pathway,

which is why they're not included here in the table.

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DR. CLAUDE: So lastly, the hand-to-object-to-mouth ingestion rate represents crumb rubber particles that may be ingested after the hand touches the field, then an object which ultimately go into the mouth. These parameter values are derived from literature and video data.

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DR. CLAUDE: So this is the equation for the hand-to-object-to-mouth ingestion rate. It's a function of adherence of crumb rubber to the hand, and then the amount that may be transferred from the hand to the object.

The part of the hand in direct contact with an object may very based on the type of contact. Video data shows that objects involved in this type of activity are dietary objects such as water bottles or food. OEHHA will use the assumption that one hand will be used when eating or drinking on the field. Young children are also assumed to touch objects such as toys or pacifiers after their hands have contacted the field. So one hand will also be assumed for this kind of activity.

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DR. CLAUDE: The fraction of the amount of crumb

rubber lost from the hand prior to transfer on an object describes the amount that is lost from the hand after activities such as hand washing or wiping hands on clothing before handling an object.

Following OEHHA guidelines, a value of 0.25 is adopted for this parameter. OEHHA will also consider using a value equal to 0, since opportunities for hand washing may not be readily available at the field.

Additionally, athletes or bystanders may wipe their hands on clothing or towels that have been in contact with the field surface and may be saturated with crumb rubber.

The number of hand-to-object-to-mouth contacts per hour for athletes and young bystanders is derived from the video data.

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DR. CLAUDE: So shown here is the calculated area of the hand in contact with an object. One hand is assumed, which is equal to 25 percent of the total surface area of both hands. So these values were derived by multiplying the total surface area by 25 percent.

This table shows the derived hand-to-mouth contacts per hour for athletes and child bystanders from the video data and archived video data. Coaches, referees, and adult bystanders are expected to have

negligible exposure through this pathway.

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DR. CLAUDE: So all of those ingestion rates that we just talked about, they're all summed together, and then that value is plugged back into our main equation here.

--o0o--

DR. CLAUDE: So then moving on. The exposure duration represents the years of exposure. Values are shown here for the age groups.

--o0o--

DR. CLAUDE: The averaging time as mentioned earlier is the time over which the exposure duration is averaged. This value is equal to 70 years by default.

And then the exposure time and exposure frequency, we talked about these earlier. They represent the hours per day and days per week that field users spend on the field. The data presented before were in different age groups, so now we have the data with the four OEHHA age groups, as you can see here.

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DR. CLAUDE: So this table shows the data of the exposure times based on these age groups, differences between gender and age. And again, the date are separated based on season and for practices versus games. So the

central tendency is about one to two hours a day for practices or games, while higher estimates range from two to six hours. For coaches, referees, and bystanders, the values are the same as those presented in the inhalation pathway.

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DR. CLAUDE: So here is the exposure frequency. Differences between gender and age, data separated by season and for practice versus game. Players tend to spend one to two hours per week each for practices and games, while higher estimates range from two to six. And again, the exposure frequencies for coaches, referees, and adult bystanders will be the same as those previously presented in the inhalation pathway.

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CHAIRPERSON BALMES: So thanks, Jocelyn. So now the ingestion pathway discussion is open for comments.

Dr. Kyle.

ADVISORY PANEL MEMBER KYLE: Thank you for going through that. That's very helpful actually to go through these. So this might be my same point made a different way, but why do you -- why -- I don't see why you embed the body weight throughout this. It just makes it harder to understand. You know, what's a rate per body weight? I mean, when people think about their ingestion, it's not

dependent on their body weight.

DR. WONG: Yes. We do have the ingestion amount in the equation. And the whole equation at the end is the dose per body weight.

ADVISORY PANEL MEMBER KYLE: I know. But why don't you put it in at the end? That's sort of my questions. Because I think as you put it in here throughout and describe it as a rate, it's just mind-bogglingly unintuitive, because you don't usually have a -- the ingestion is not related to your body weight, right?

DR. WONG: Yeah.

ADVISORY PANEL MEMBER KYLE: So it sort of goes back to, if you put things together that make it impossible to understand, then it doesn't serve the -- kind of the public purpose. So I just can't even think of a reason to put the body weight in at the beginning. So that's my question, I guess.

CHAIRPERSON BALMES: I think this might have been based on a recommendation of Dr. McKone's in the past, but...

(Laughter.)

DIRECTOR ZEISE: From about -- may from about 20 years ago too, and it's still today.

ADVISORY PANEL MEMBER KYLE: So it may be for a

difference audience.

ADVISORY PANEL MEMBER McKONE: So, no, this is -- this is a really good point. And it's -- it gets us -- so, you know, risk assessment is entirely based on rate per body weight. But I think you raise a good point about what's public facing is should it be something that people could understand.

Maybe I'll give you a story. I was involved in a risk assessment at the National Academy for communities that had been exposed for a short time, like a couple of weeks, to fairly high levels of zinc cadmium sulfide. We don't know anything about it. We tried to do a risk assessment for cadmium. We found out the communities didn't really understand what we were doing, right?

I mean, we did a nice risk assessment. We did cumulative -- or we did cumulative intake over the period, didn't the lifetime equivalent, and calculated the risk. And, you know, it doesn't -- and I have to say it doesn't make sense when you come up with a number like 1 in 100,000.

So what we ended up doing was for the public document, we calculated their cumulative intake over the event, compared it to their cumulative intake of cadmium, which is everywhere in the environment, right -- it's in your food. It's in -- and explain that. And then that --

they didn't know how we did risk, but they said, oh, well, we took in only like 1/100th of what we would take in in a year, and much less in a lifetime, and we took it, so you can show them that their intake went up for one month -- that month they were high, but on an annual basis.

And then we said your risk is entirely based on your cumulative intake over the year, because this is not a chronic effect -- or it's not an acute effect. It's chronic.

I mean, they kind of understood that. And so I think this -- it gets to this point about what's public facing versus what's needed for a risk assessment. And I think we have to document -- I mean, OEHHA has to document this. But it might be useful to -- and I think it's what I was trying to get at earlier is carry along the cumulative -- you know, just tell people, all right, we did all these calculations, and this is how many milligrams of whatever you took in, phthalates and -- and if you weigh more, then this is more important. And maybe just give them a tool so they can figure out all the variations. Otherwise, nobody is going to go through all this.

So if you give them their cumulative intake, then they can understand different routes, even though we have to say, you know, ingestion doesn't equal inhalation, but

they can look at a kind of a number that we say this is -- and then they can say things like, oh, phthalates, okay, what's that number? I don't know. OEHHA should do this, but somebody else could say, well, if you're an average person and you use this shampoo, or you use this makeup, right, this is your annual intake of phthalates, right?

So you can go, oh, you know, my two hours a day on the field is this, my use of brand X of shampoo is this, or, you know, you can start getting a sense. And to me, it gets to what's the public understands in terms of risk. And I -- my experience is they have a really hard time when you say 100,000. But they understand more when you say, okay, this is something you're exposed to, and this is what you get from this activity, and this is what you get from that activity. And even though from a risk perspective, the cumulative intake over a year or two years may not be what we can use, we do use it someway. We just average it out.

So anyway, I don't know if that's useful, but I think --

DIRECTOR ZEISE: I think it is a --

ADVISORY PANEL MEMBER McKONE: I mean, I think it's a point we're getting to that this is -- I mean, from my -- I look through all these tables and go, yeah, that's the way I do it, and, you know, we need all these things.

But I am concerned that this is really hard to track. And people want to know is what am I getting, and how bad is it, and did you account for what I do? Like, did you account for my time. I stick my hand in my mouth all the time. I don't take a shower. You know, make sure that is conveyed as -- in a clear way.

DIRECTOR ZEISE: And I think we're getting a number of really helpful suggestions in terms of communicating and how we need to break this down more in communicating with the public when we're talking about risk. I just want to speak a little bit to the science side of the body weight issue.

So, you know, we're looking at soccer players that are -- I think we even have a survey from one that's between two and six. We teenagers. We have adults. And they're of different ages. And so some of the intakes, even some of the ingestion rates, by small people, children, the dose really is dose per body weight. That's how we calculate it. So we're taking this little person and putting maybe even a greater dose. They're getting a greater intake. So we want to normalize the intake in order to calculate dose. And then in terms of breathing rates also, there's greater breathing rate per body weight. So it's a -- the younger -- the smaller you are oftentimes. So it's our -- also our way of adjusting for

age differences, so --

ADVISORY PANEL MEMBER KYLE: But your just -- I mean you're incorporating age as the way to look at those different rates, not weight.

DIRECTOR ZEISE: Well --

ADVISORY PANEL MEMBER KYLE: So I --

DIRECTOR ZEISE: -- maybe if we laid this out a little bit more, you'd see why that was there. So that age adjustment factor is for cancer, that's independent of the body weight issue. And deriving that factor --

ADVISORY PANEL MEMBER KYLE: Yeah, I understood that.

DIRECTOR ZEISE: -- you know, amount per body weight was Addressed. And yet, we still saw, even after addressing exposure differences of, you know, young animals versus -- or young versus older, we did still see increased susceptibility to cancer. So there this is this body weight issue we need to probably explain better, but --

ADVISORY PANEL MEMBER KYLE: Yeah. No, I'm not disputing that. I understand why you have to adjust for body weight. All I'm saying is when you're discussing the ingestion rate, to present that by body weight is very counterintuitive. And it's not actually a rate based on body weight. It's a rate based on time or something like

that.

So -- okay. So I have a second point. This is simpler. And that is I would really recommend we not use Greek letters in here. You know, because a lot of people look at that Greek letter, they don't know what that is or even how to say it. And so why put in that barrier to anybody being able to even read this equation? So that's a minor thing, but I would recommend that.

CHAIRPERSON BALMES: Any other questions or comments from the Panel?

Dr. Bennett.

ADVISORY PANEL MEMBER BENNETT: Both Linda and I are over here discussing our concern and questions regarding the table on slide 22, the ingestion, direct ingestion rates. We have questions on this one, too.

Okay. Because I -- we've got the exposure factors handbook pulled up, and, for example, the -- for, you know, kids two to -- one to two, sort of the central -- or two to six, the central tendency is 60 milligrams, which would be just over that 0.05 grams per day. So the 0.01 seems really low. And we're wondering where that came from, right? Because that would be 10 milligrams, which is 1/6th of the amount in the exposure factor handbook.

DR. CLAUDE: Yeah. So these values they came

from the two studies, the RIVM and the ECHA. They're previously published recently 20 -- both 2017, yeah. These are the values that they've used in their assessments. The child bystander -- they're typically used for athletes, the coaches, referees. The child bystanders that -- I don't know if that's suppose -- the check may not -- that may be for the adult bystanders. It may be an incorrect place. Because the lower ones are for the -- more for the adults than the children.

ADVISORY PANEL MEMBER BENNETT: Okay. And, for example, the soil-pica estimate in the exposure factors handbook is 1,000 milligrams which is -- oh, wait a second. Never mind. I was doing that wrong. I was thinking that was the same as the 10 grams, but I guess that's actually fine. So that would be 1 gram. And for the child bystander, you do have a value that exceeds that with the 3 grams. Okay.

ADVISORY PANEL MEMBER McKONE: Just, can I make a comment on that?

ADVISORY PANEL MEMBER BENNETT: Yeah.

ADVISORY PANEL MEMBER McKONE: So these are -- these are not -- I mean, so the exposure factors handbook intends to capture the daily intake of soil, right, for a child. And I think this is intended to capture just the amount of intake during an event.

Now, again, my -- given what's in the exposure factors handbook, you could question whether it's reasonable that it would not be as high as the daily rate, but if it's -- if there's documentation.

But, you know, if the intent is this is not total soil ingestion on a daily basis, this is the added ingestion -- or the amount of that ingestion that would take place at an athletic event or a site.

ADVISORY PANEL MEMBER BENNETT: Well, then that gets to the other question on 37, I'm a little bit confused by the equations on slides 36 and 37. Are they the same?

Okay. So, first -- well, okay, let's look at the cancer one. So this has got the exposure time. So are you then multiplying -- it doesn't seem to be divided or normalized to anything. And the ingestion is per day, and the exposure time is expressed in terms of hours per day. So how does that work? Are you then somehow dividing by 24 hours to get the fraction of the day? I mean, that makes sense for the mouthing if you're doing rates by hour. But the ingestion rates are per day, in that table conversion factor.

DR. CLAUDE: Yeah, that conversion factor there I have, it just says conversion factor. So some -- that conversion factor is the -- it's the conversion to get

that into -- to match.

ADVISORY PANEL MEMBER BENNETT: Yeah, but then why if -- but then what you're effectively doing is that you're saying that these child -- you know, all of these direct ingestion rates, you're then effectively dividing those by 10, because if you're taking the exposure time and dividing by 24 hours, and those are per day. So for the direct ingestion pathway, you wouldn't want to normalize by the exposure time, right? Because these aren't hourly, these are given in their table as grams per day. So it doesn't make sense to then normalize them by the exposure time.

That totally makes sense when you've got contacts per hour and dah, dah, dah, you want to deal with how long you're there. But if you're starting with a gram per day measure, you don't want to then reduce that by the exposure time over the 24 hours. So that doesn't make sense.

DR. WONG: It does.

ADVISORY PANEL MEMBER BENNETT: It does?

DR. WONG: It does. That's why we are showing the panel, because the ingestion -- like the soccer player that report is per event how much they eat during event, like a table tablespoon. I agree.

ADVISORY PANEL MEMBER BENNETT: Right. Right.

You're saying these RIVM one. The was based on something where it was per event at the field, right?

DR. WONG: Sorry?

ADVISORY PANEL MEMBER BENNETT: So like this 0.01 grams per day, that's if the child spent the en -- 24 hours on the soccer field or is that per time that the child is at practice?

DR. WONG: That's the assumption that made by RIVM per day.

ADVISORY PANEL MEMBER BENNETT: Right.

DR. WONG: Yes.

ADVISORY PANEL MEMBER BENNETT: So if that's an assumption per day, why are you then multiplying it by exposure time over 24 hours?

DR. WONG: Yeah, that's why I say we agree with your --

ADVISORY PANEL MEMBER BENNETT: Oh, oh, oh. You agree.

DR. WONG: We agree, yes. We agree.

ADVISORY PANEL MEMBER BENNETT: Okay. I'm sorry. You were telling me that -- I thought -- I misunderstood. I thought you were defending it. I'm like, no.

DR. WONG: Yes, we agree.

ADVISORY COMMITTEE MEMBER BENNETT: Okay. Okay.

CHAIRPERSON BALMES: I'm glad we had a meeting of

the minds here.

DR. WONG: Yes.

ADVISORY PANEL MEMBER BENNETT: And then I had another question on the non-cancer exposure dose. I always thought for the non-cancer you didn't multiply it by the exposure duration over the averaging time, because you're worried about the exposure over the course of a year to get a non-cancer health effect, I thought.

DR. WONG: It's a chronic exposure, but the doses represented is the daily dose.

ADVISORY PANEL MEMBER BENNETT: Right. So why are you multiplying it BY the exposure duration over the averaging time? Because if the child is 10 and you're then dividing -- you know, they've been exposed for 10 years, and you're dividing that by 70 years, you're basically saying, on average, they're getting 1/7th of that. And for non-cancer chronic health effects, I always thought the convention was you were worried about their typical exposure and didn't then -- during the time that they were exposed, because that's -- you know, these non-cancer is how much can your body take and process without having the non-cancer, because it's compared against, you know, a particular value. It's not -- and so if you're being exposed to that amount every day over the life that you've had so far, it doesn't make sense to

multiply it by the exposure duration over the averaging time, because you're exposed to a lot more than that per day during the life you've had.

DR. WONG: Yeah, the averaging time here is this -- not the 70-year normally use for cancer. It depends on the life stage used to adjust that if you have, for example, the third trimester, you have an ED of a quarter a year, the exposure -- the averaging time is actually averaged for that period of time.

ADVISORY PANEL MEMBER BENNETT: So where you have your age group and you have exposure duration year, that's also the same thing as you're averaging time? Your exposure duration equals your averaging time for all periods?

DR. WONG: In general, yes, for non-cancer. The U.S. EPA put it in. We adopt the equation -- the general equation here. In residential scenario, they account for people who live there and they take vacations. So that's why the averaging time is not as exactly the exposure time. They consider 365 days for the averaging time, but for 350 day for the exposure duration, because people take vacations. But in this scenario is different, because we assume that people in the field, whenever they're on the field, what's the daily exposure. So they will correspond to same age, the life stage.

ADVISORY PANEL MEMBER BENNETT: Well, it's just really confusing to have it --

DIRECTOR ZEISE: Yeah.

ADVISORY PANEL MEMBER BENNETT: -- the way it's presented, since then on the next side you say default value 70 years for the averaging time.

DIRECTOR ZEISE: Yeah. I think that we -- you know, when we --

ADVISORY PANEL MEMBER BENNETT: Yeah, it just looks like it needs cleaning up.

DIRECTOR ZEISE: -- write it up in the report, I think we need to -- we've received a number of comments about how hard it is to follow. So I think -- what I'm hearing is a recommendation that we really carefully step people through the calculation and make sure that if we're switching averaging times in the middle of an explanation, that can be pretty confusing, so we'll take a look at that.

Thanks.

ADVISORY PANEL MEMBER McKONE: Can I -- this is where I go back to the point where, you know, there's what you need to do a risk assessment. And I agree you have to follow the -- if you start playing around with the terminology in the protocol of a risk assessment, you'll get the wrath of the entire risk assessment community.

But this idea that may be to help make sense of this have another column, so you can report the dose here, had is actually kind of a dose rate. But then something that people could grasp, like the cumulative intake in a season or a year. And again, this is not what you're basing -- it is what you're basing the risk assessment on, but it's a number that people could grasp. And I would probably put an either milligrams per kilogram, which again people are going to have a hard time with. But that's really the relevant number, because of the age sensitivity and age differential, but maybe put both numbers, and then say, well, they're so different because body weights change so much.

But, I mean, somewhere there's going to be a table with these non-cancer exposure dose, and the cancer exposure dose. And I don't know how hard it is to have one more column just to say for clarity, or to help you understand, this would be the typical intake in. And I don't know if the right number is a season, or a year, or something -- something that would be relevant to a soccer player, that's like, oh, this is what I would. In here, it's so many milligrams.

And it's not going to be useful to do a risk assessment, unless you know how to translate that backwards. But it would -- and it's actually a neat way,

I think, to -- even for us, I mean, when I look at all these different rates and -- per body weight, it's hard to audit. It's much easier to audit an integral quantity than it is a rate or make sense of a rate.

I mean, rates are hard to get -- I mean, for most people, not for engineers.

DIRECTOR ZEISE: Their minds around, yes.

ADVISORY PANEL MEMBER McKONE: And it might address some of the concerns that we have here without -- again, I would never suggest altering the way you present the risk calculation, because it opens you up to really significant attacks about like reinvesting risk assessment.

CHAIRPERSON BALMES: Linda, did you want to say something?

ADVISORY PANEL MEMBER SHELDON: Yeah. First of all, to address what Tom said, you know, I think it's the way all of us think of different things. Being an exposure person, I look at the amount that goes in during a period like you do. I would, first, give that, and then say, you know, this is what you get over a season, but now let's translate this into what is a health risk, where we have to go exposure to dose.

So it sort of gives what people are talking about, in terms of what you're exposed to or what you

bring into your body, but now we're taking the step further,

Now, my other comments, and they're a little -- at a little higher level. Let's go back to page 27, the one that shows the checks and what the risk amounts are. You did get those -- that data from two different references. And I guess my question is, is how did they develop that data, you know, the 0.01 grams per day, the 0.05. Again, was it taking other data?

I always have a lot of trouble with ingestion, the indirect, the hand to mouth, all of this, because there are so many assumptions that go into it. And there's -- you know, you just don't know what to do with it.

In my former life before I was retired, I was, you know, the Science Director of one our labs. Our labs did a lot of modeling. They did PBPK models. They did exposure models. And what I was always told is not only do you develop the model, but how do you evaluate that model to give some confidence in what those levels are?

This is an extremely difficult thing to evaluate, but I think some thought needs to be given to how do you evaluate it? And also -- you know, so just when you take all of your assumptions, and look, and say what is the ingestion that's brought -- that you get the crumb rubber

in, how many, you know, milligrams a day are you estimating for each of these groups? You know, does it agree? Does it not agree?

And then I would also say given the different exposure pathways, what is the relative magnitude of each of these pathways? So if this is 1/100th of inhalation, then maybe it's not so bad that you have all these assumptions. If it's 100 times what the inject -- what the inhalation rate is, then, you know, you need to make sure that you have it right.

And so I just -- you know, it's -- it is the perpetual issue with exposure modeling. It's not new to you. But is there anything that you can do for this study to give yourself more confidence in what you've done?

And then the other thing is just sort of really trivial. Some place reading through it, they talked about mouthpieces. And I remember when my kids were playing soccer, they'd dangle these mouth pieces in, out, every place, wipe it on their arm, wipe it on the ground, put it back in their mouth. Some people -- I mean, this is the way to look cool, right?

(Laughter.)

ADVISORY PANEL MEMBER SHELDON: And there's nothing in here that looks at these mouthpieces. And I don't know if it's important or not, but you did -- there

was a sentence on it. Then I said, oh, yeah, mouthpieces. And then that was the last I heard of mouthpieces.

So, you know, just think about those again or take that sentence out, so nobody else thinks about it.

(Laughter.)

ADVISORY PANEL MEMBER SHELDON: Thank you.

CHAIRPERSON BALMES: Dr. Kyle.

ADVISORY PANEL MEMBER KYLE: I think this goes back to three or four points ago. But I'm still hung up a little bit on this averaging time of 54 years, is that right? Or exposure time of 54 years and averaging time of 70 years.

Is that what we're applying for non-cancer effects? I'm just -- I'm asking, because I don't really understand. It doesn't -- it doesn't seem quite clear in here anywhere that I can see. Maybe I won't put you on the spot to answer that. But, I mean, are there concerns we would have for a 16-year old girl based on a 54-year exposure and 70-year averaging time? It doesn't seem to make sense, so...

DR. WONG: I'll try to answer it. Based on the non-cancer, we -- I think we do have an error -- a typo here. The averaging time is the average for the period of exposure. So if you have a 54-year, which is 16 to 70 years old, your exposure duration is 54 years, and you're

averaging for the 54 years of the exposure.

And then we can actually look at for the whole 70 years for the exposure, and for different life stage by segment.

ADVISORY PANEL MEMBER KYLE: Well, that doesn't make sense to me, because the health effects you would have -- you would be most concerned about for non-cancer effects for a 16-year old girl would be shorter than that, shorter duration.

DR. WONG: You mean -- sorry, I --

ADVISORY PANEL MEMBER KYLE: Well, suppose you were worried about reproductive effects.

DR. WONG: Okay. So, like I said, we are looking at the daily exposure dose. So we'll be -- what we are doing with according to guideline is you have age group of 16 to 17. So we look at the activity, and we look at the body weight, and we take a daily base for the 54 years, and then we average it out for the 54 years of the exposure.

ADVISORY PANEL MEMBER KYLE: And I think this comes back to my question before, is this really an appropriate method to use for young girls?

DR. WONG: We are listening. So we are looking for input on how we should address it for -- this is a very special study, not like normal residential exposure.

So we would love to have your input on how should we handle this -- this kind of estimation that's a traditional way, and how can we more appropriately present the risk to the public to the point that it looks reasonable and also scientifically reasonable.

So we are listening and we hope that to get input from you, everybody.

ADVISORY PANEL MEMBER McKONE: Yeah. Can I offer some -- so, I mean, there are the protocols for risk assessment, which are constrained by the fact that we really for risk assessment we use lifetime cancer risk, because we don't know how to do less than lifetime. But we know how to make some adjustments for more sensitive age groups.

So I think where the confusion is is how you make that adjustment, whether you adjust it by altering the averaging time to much less than lifetime or the exposure duration. I mean, either way. So you have this factor at the end of the equation, which is for cancer. For non-cancer, they're just comparing the exposure rate to an acceptable rate. The REL is a rate of exposure, milligram per kilogram day that is below any -- you know, has a sufficient margin of safety with respect to harmful effects.

So on the non-cancer side, it's comparing a rate

to a rate, right? A rate that's okay versus the rate they get. And hopefully, they're -- the rate they get isn't way up over what's the reference exposure limit.

On the cancer side, it gets difficult, because we're trying to look at a slope factor that's based on lifetime equivalent dose. And the -- so the ED over AT, the exposure duration over averaging time, is sort of this mechanism for adjusting that. And so you could either use some defaults for those and then say I'm -- we're getting into the risk assessment, but it's where you make the adjustment to account for higher sensitivity. And I think that's where the question is, is -- and how to make that very clear, if that's what's being done.

And again, I think a little bit of this is a consequence of the way risk assessment protocols were developed. You have to -- that's the standard equation. You know, it's your exposure turned into a lifetime equivalent, but I think for a couple of reasons. One, it's just perception. It's difficult to tell people that, oh, you were exposed to these chemicals and we're going to average it out over your lifetime, because, you know -- but if they get cancer, they're probably not going to -- they may get it in 10 years, right?

I mean, there's these perception issues about, well, I don't want you to average it out over the next 50

years or whatever is left of my life. I want you to tell me what the risk is now. And again, the sensitivity is the key to get at that, is to say, yeah, you know, normally in cancer we average everything out to a lifetime. We have to because of cancer potency factor.

I'm thinking -- and again, this is getting technical. I mean, one way to get around this is to -- I don't know if you can follow the protocol of going to a margin of exposure with a benchmark, in which case, you get rid of the -- you might be able to get rid of the -- you could report the rate versus a rate that is a point of departure for cancer risk assessment.

It might be a little more straightforward as a way to communicate this. I'm sorry, I'm getting into things that are kind of technical within the risk assessment.

But going away from a can -- well, I mean, you could still use a cancer potency, because it really comes out of a benchmark. But, I mean, California has a protocol for using a point of departure in a cancer dose response function. And that -- I mean, again, then the two would look more similar. It would be comparing a dose rate to a dose rate that we know over a lifetime leads to cancer, and then you can make some adjustments for that.

We're getting into things that really are risk

assessment related, but they do feed back into the exposure.

DIRECTOR ZEISE: Yeah, I think we're going to have to be much more careful in terms of how we march through and show the calculation. We could potentially look at the issue of margin of exposure, and, you know, see how that helps.

I'm also hearing though that there is this issue of this shorter duration exposure and concern about reproductive effects. And I think that, you know, we're talking about 16 year olds, teenagers, and so forth. And I do think that, you know, we do have approaches that can look at these less averaged exposures. In fact, under some of our programs, we look even for at a single day, depending on what the chemical is.

So I do think we have some more work to do looking at those sorter duration issues, in terms of peak exposure over short periods of time. So we'll follow up on that, and I'm sure have more discussions about how do we better express what we're finding.

CHAIRPERSON BALMES: Any other questions or comments before we move on to dermal exposure?

Oh.

ADVISORY PANEL MEMBER BENNETT: I just wanted to clarify. So there is a realization that including the

exposure duration over the averaging time for the non-cancer, that's just not part of the -- even though you guys were going to reduce the times, that's just not part of the standard convention for risk assessment for non-cancer is what Tom was saying as well, because you compare it to the reference dose. So that will be removed, right?

Even -- I mean, I think it's just confusing to have it in there, even if you adjust the time, because it's not -- as far as I'm aware, it's not standard to put the exposure duration and averaging time in the non-cancer. That's a thing only for the cancer.

ADVISORY PANEL MEMBER KYLE: There's no REL for crumb rubber, right?

DIRECTOR ZEISE: Well, we do have chronic reference exposure levels that are over longer duration that are sort of averaged concentrations and averaged dose.

ADVISORY PANEL MEMBER BENNETT: Right.

DIRECTOR ZEISE: But I think we need to lay this out better, and probab -- and I think potentially giving some case examples of how it plays out for the different kind of exposure reference level, so we do have short-term reference levels. We have acute. We have chronic. And so I think we're -- we might be -- there might be some --

it might not laid out as clearly as it could be in this document. And I -- what I'm hearing is we need to sort of step through and lay these out before giving entire equations on how the calculation works, so that people can follow how, for any particular kind of time duration reference dose, we're making the calculation.

Is that -- does that help?

ADVISORY PANEL MEMBER McKONE: I'm just -- are these equations actually correct on slide 37? I mean, the first one looks like a cancer one. The second one looks like a non-cancer one. I think they got switched. That's why everybody is confused.

Go to slide 37. I mean, the first one looks to me like a cancer --

ADVISORY PANEL MEMBER BENNETT: Yeah, that's what I was trying to say.

ADVISORY PANEL MEMBER McKONE: -- expose dose. And the second one is what you would do for a non-cancer exposure dose.

ADVISORY PANEL MEMBER BENNETT: I'm still worried about the exposure time for that...

DR. WONG: Yeah, hear your input and we definitely -- there's some potential error here that we will go back and definitely look at the equation in depth.

ADVISORY PANEL MEMBER KYLE: I wonder also

whether I -- you might consider adding an age group between 16 and 70. When you look at -- this is on slide -- I can't read the number -- 36, I think, your little age group table with the exposure duration. It goes from 14 to 54. I mean, it's kind of -- it's kind of hard to explain. You know, when get to be -- go from 15 to 16, you know -- or actually 16 is in both groups. So I guess for 16 you can pick either number.

But, you know, I mean, that wouldn't seem to be a tipping point from going from 14 to 54 right then. So maybe a thought about another group here would help you think through some of these issues about what's different, and -- because I really -- I think people are worried. Most worried about young women, you know, in this study. I'm most worried about young women. And so that -- maybe that would help.

Thank you.

CHAIRPERSON BALMES: So maybe we should move on to the dermal route of exposure.

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DR. CLAUDE: Okay. So the final pathway. So dermal. So once again here are the equations. They have the general -- better?

Okay. So we have concentration, intake, and exposure time.

So now we have the dermal exposure dose will depend on a bioaccessible concentration of the chemical in crumb rubber, particle loading onto the skin, and the area of exposed skin that will come into contact with the field and the exposure time.

So we already discussed the duration, averaging time, exposure time, and frequency. So the bioaccessible concentration of the chemical represents the amount that's available for absorption into the body. It will be measured in crumb rubber samples collected in the field study using artificial sweat, and sebum biofluid extracts.

The absorption fraction parameter describes the amount that is absorbed across the skin. In the absence of chemical-specific data, OEHHA will assume a value of 1 and that 100 percent of the dermally bioaccessible concentration will be absorbed.

The dermal load is a measure of the amount of particles that will adhere to the skin.

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DR. CLAUDE: It's derived by multiplying a weighted adherence factor times the exposed skin area times the event frequency.

The event frequency describes the number of field events a field user may participate in in a day. OEHHA will assume a value equal to 1. This assumes that users

do not reenter the field or enter another field at a later time of the day once particles have been washed off of the skin.

The exposed skin surface area is normalized to body weight is the amount of skin that's available for contact with crumb rubber particles.

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DR. CLAUDE: So this parameter is the sum of the fraction of body area for each exposed body part multiplied by the total body surface area over the body weight.

So the fraction of total body surface area will vary with each body part. Fractions may change throughout childhood for -- through growth and into young adulthood. And they may vary based on age and gender. Values for this parameter were adopted from the EPA exposure factors handbook.

And although the exposed body parts may vary based on season and the type of uniform field users wear, such as shorts versus long pants, or short versus long sleeves, OEHHA will assume that the total body surface area is available for exposure for athletes and young bystanders. This is based on anecdotal evidence from players that crumb rubber can get underneath the clothing. For coaches, referees, and adult bystanders, only the legs

and arms, including the hands, are assumed to be exposed.

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DR. CLAUDE: So shown here is the data table for the percent of the total body surface area for various body parts. We have the head, trunk, arms, hands, legs, and feet.

And this table shown here represents the total body surface skin areas available in the U.S. EPA exposure factors handbook. For both of these parameters, values are gender and age specific.

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DR. CLAUDE: So back to this main equation. The final parameter is the weighted adherence factor, which describes the amount of crumb rubber adhered to the exposed skin.

--o0o--

DR. CLAUDE: It's -- this factor is a weighted sum that's based on the surface area of each exposed body part and the adherence factor for that specific body part.

So due to physiological differences of the skin for certain body part areas, there may be differences in the adherence for different parts. Values for this parameter were taken from the Kissel et al. study that we discussed earlier. They measured particle loading onto skin for athletes on fields with crumb rubber infill.

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DR. CLAUDE: Shown here are the factors for the body parts that they measured, the hands, arms, legs, face, and feet.

This table here shows the calculated weighted adherence factors that are based on the area of exposed skin. So for athletes and child bystanders, they're derived assuming the whole body is available. And for athletes -- for adult bystanders, coaches and referees, the arms and legs are assumed to be exposed. Values are age and gender specific.

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DR. CLAUDE: So this slide is just to quickly wrap up our discussion. So we just spent the morning, we discussed the exposure dose equations for the three main pathways. So we talked about inhalation and the non- -- the non-cancer exposure concentration, and the cancer exposure dose. We also talked about the ingestion and dermal pathways and their non-cancer and cancer dose equation.

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DR. CLAUDE: So now we would like to get input on the to Panel on what we just heard. We have some questions here to help facilitate discussion. Many of them have come up already, so I'll turn the discussion

back over to Dr. Balmes to facilitate.

CHAIRPERSON BALMES: Did you want to comment about that?

Dr. Zeise and Dr. McKone had a little discussion about the -- what slide is that?

ADVISORY PANEL MEMBER McKONE: So I'm looking at slide 41.

DIRECTOR ZEISE: Well, so he's look -- Tom is looking at the dermal, but I think in the ingestion some of the confusion is that we didn't show the sigma in the summing up of doses over different age intervals. Maybe that was adding to the confusion in the dose calculation for chronic exposure. But maybe Debbie and I can talk offline and kind of try to resolve it with staff.

ADVISORY PANEL MEMBER BENNETT: Yeah. I think what Tom was pointing at it looked like they just had the equations backwards. That was what I was trying to --

ADVISORY PANEL MEMBER McKONE: Well, I'm -- I'm still trying to get through -- so if you go to slide 41. So a cancer exposure dose is typically a lifetime equivalent dose, because that's the cancer potency. It has to be multiplied by a cancer potency. So it would be milligram per kilogram body weight over a lifetime. So we have the crumb rubber -- so I'm worried about is, let's see, the DL is dermal loading, milligram per kilogram body

weight day.

But if you multiply that by the exposure time, hours per day and the frequency days per week, you get hours per week, right? I mean, I guess -- I'm still having trouble following how that leads to a -- what we would want for a cancer potency calculation.

The same one -- the same problem with the ingestion one.

DR. CLAUDE: So I think some -- so there are conversion factors in the equations. I didn't go through each of them what they are, because they're not all the same.

ADVISORY PANEL MEMBER McKONE: Oh, okay. So the conversion factors take care of getting us --

DR. CLAUDE: Yeah. So some of those conversation factors take into account going from this --

ADVISORY PANEL MEMBER McKONE: Get us to a Lifetime equivalent for those.

DR. CLAUDE: Yeah.

ADVISORY PANEL MEMBER McKONE: Because the units aren't going to come out, unless the conversion factor is -- right? Because we have, let's see, hours per day times --

DIRECTOR ZEISE: And again with the dose, what you want to be doing is you want to be waiting for the

cancer side the particular dose during that age period by the sensitivity factor.

ADVISORY PANEL MEMBER McKONE: Okay.

DIRECTOR ZEISE: And then you take each of the doses during the different age intervals and you sum them up after they've been weighted appropriately. So it's a little confusing to try to wrap your mind all around. We're just showing one age segment really.

ADVISORY PANEL MEMBER McKONE: Yeah, I got it.

CHAIRPERSON BALMES: Dr. Bennett.

ADVISORY PANEL MEMBER BENNETT: I have another question on the dermal. So it looks like on slide 45 we're calculating the dermal load. Are we -- where do we look to see what's absorbed? Do we have things absorbed through the skin. And then I was confused by the event frequency events per day. Are we sort -- I'm kind of assuming they have one practice.

DR. WONG: So here's the daily --

ADVISORY PANEL MEMBER BENNETT: Oh, oh, oh, there it is. Okay.

DR. WONG: So it has another step to go further. And then we will have the bioaccessibility concentration to plug in before we get to the absorption.

ADVISORY PANEL MEMBER BENNETT: And then how are we getting the event frequency, events per day? Wouldn't

that just be one?

DR. WONG: We assume to be one, because we assume that even they may have multiple games. They are not going to wash their hand, and they come back to the next game.

ADVISORY PANEL MEMBER BENNETT: Okay.

DR. WONG: So that's all our practice is more like a continuous, so we assume a event per day, not necessarily a game per day.

CHAIRPERSON BALMES: Dr. Sheldon.

ADVISORY PANEL MEMBER SHELDON: I've got a question. So all of this assumes that the crumb -- the tire crumb rubber is the vehicle for transmission. You don't have any -- you know, so things have volatilized off the field, they've gone onto your skin, and there is a constant absorption through the skin. You have not included that. And there's always the vehicle of the crumb rubber, is that right?

DR. WONG: We assume the relative contribution for the transmission through the vapor is lower than the actual adhesion.

ADVISORY PANEL MEMBER SHELDON: Okay.

DR. WONG: We considered the vapor pathway is lower, less predominant.

ADVISORY PANEL MEMBER SHELDON: Yeah. You might

do a little back-of-the-envelope calculation --

DR. WONG: Yes.

ADVISORY PANEL MEMBER SHELDON: -- just to make sure the assumption is correct.

So on this, you know, concerns or other parameters needed, I guess to me the question is, is, you know, kids that do play soccer do slide, do other things and they abrade their skin. Is there anything to take into account that? And the other thing is is that given the popularity of sunscreen now, does that do anything to adhesion factors? I mean those are sort of -- and I'm sure you're smiling like, of course, we've thought of this before. Yeah.

(Laughter.)

DR. WONG: Yeah. The -- we're not sure the Kissel study was actually where the dose participant wear sun block or not. We are aware of that if you have sun block or lotion or the skin, you do have more adhesion.

That's why we're pulling off, it's like help us out. The model is -- that was very complicated. We -- we're not sure at this point how we can model it. I'm sure the literature search can help and listening to input from the Panel. That's why we're here.

And some -- the abrasion. We heard a lot about the abrasion. We're aware of that. It's just serum is

another very complex matrix. And we -- we can look at how we can measure the bioaccessibility of the this rubber. And when we talk to player, we go to videotape, we see people abrasion. When we -- it's not a comfort, but most of the player told us, if you've got a cut, you've got an abrasion, you're supposed to clean it up, and you're supposed to get off the field, according to requirement of coach. And we've seen player pay for the game with bleeding knee.

So that's something we're aware. We're looking for how we can model it. We are looking for how we can deal with this pathway.

ADVISORY PANEL MEMBER SHELDON: So over the last 15, 20 years of my career, we were always trying to do measurements of exposure, and then related to biomonitoring data, and see if we could get closure on anything.

And, you know, the biomonitoring data always showed higher levels of exposure for almost all chemicals. And I was always trying to figure out what was the exposure pathway I missed, what was the thing that I left out?

And that's why I'm asking these questions. You know, if you finally get back to trying to close the loop, then the question is is what might be the major

contributors. And, you know, I think right now, you just put a list of other major contributors, you know, if we ever go back to verifying. But it's always been this conundrum.

DR. WONG: We agree.

CHAIRPERSON BALMES: I think Dr. McKone agrees too from previous work he did in terms of pesticide exposure.

Mr. Avol -- oh, okay. Go ahead.

ADVISORY PANEL MEMBER McKONE: I just --

CHAIRPERSON BALMES: You've got to push it back on.

ADVISORY PANEL MEMBER McKONE: I mean, so I think the confusion I had, so maybe others will have it too, is that in the inhalation -- I mean, the ingestion and the dermal exposure for the non-cancer, you have ED, exposure duration, over averaging time. And early on when we talked about your protocol for doing cancer risk assessment, you also used ED and AT, but those are cancer related.

And I think you can get around a lot of confusion by just maybe putting a subscript or superscript that in these later equations, this is the exposure duration you used for non-cancer, right, and the AT. That's what was hard for me, because I see ED and AT, I'm always thinking

cancer, because that's the way you introduce it. Those two terms were first used way back on slide something, 21, to introduce the protocol for doing cancer risk assessment.

Yeah. So here, that's the general equation for cancer risk assessment. In a way, these EDs and ATs have a different meaning. In cancer what you're trying to do is -- is do a cumulative intake. So the top part of this equation is the cumulative intake over an exposure duration, which you then normalize by the averaging time typically lifetime.

When you use it later on, you're looking at a non-cancer effect where you're trying to figure out what's the appropriate exposure duration and averaging time for another kind of effect. I think you would be better served to use slightly different or just even superscripts, right, C and NC, because you're using different assumptions and actually technically different EDs and ATs in both cases. That would help me a lot.

Maybe I just get confused easily.

DR. WONG: We agree totally.

CHAIRPERSON BALMES: Oh, sorry. I think Mr. Avol is next.

ADVISORY PANEL MEMBER AVOL: SO I have a question and a comment actually. And this sort of reintroduces

some comments that have been made earlier in a different vein. And that is this assumption on slide 42 about one event per day. And I think that's probably appropriate for recreational sport players. But for any child playing on a club sport, any high school athlete, other athletes that are involved in tournaments, et cetera, they typically have multiple matches per day.

And so I think one event per day undersells what the potential exposure is. Moreover, I think your assumption that after the match they wash off the material and it sort of resets to zero is not quite correct, because they may -- they may or may not wash off the material. But in the course of participating in the match when they have multiple matches in a day, they may abrade the skin. And so now they've broken the initial external barrier of the epidermis, and so they now have a more potentially viable pathway for exposure.

So resetting it to zero isn't quite I think what you want to do, because they've already now surpassed the initial threshold. Now, they go out and play again, they already have a raw opening. The only reason they get pulled off the field, which you mentioned before, is if they're outright bleeding, and then they'll be pulled off the field.

But if it's just sort of torn up, they will play,

and they will play with that scrape on. And I think -- and then they're being -- they're at a higher level of exposure. And I don't think you're capturing that in this multiple events.

CHAIRPERSON BALMES: But Ed, do you have a suggestion about how they could do that?

ADVISORY PANEL MEMBER AVOL: Well, I think that -- again, I think this tends to underpredict what the exposure might be. So I think you may want to either separate out recreational sports from competitive sports and calculate a value for either, for the two separately.

And with regard to the competitive sports, I think this is going to be a multiplicative factor of that, whether -- if you cannot, based on either the video or, you know, some other means get some idea of how often this is like to occur, to ascribe some frequency to it, I think you're going to have to put in some sort of safety factor, a multiplicative factor just to account for it and acknowledge that it exists, because it does, in fact, exist. And if you ignore it, you're -- you're avoiding what the true exposure is.

DR. WONG: Yeah. We -- like we said, when we go through the videotaping, we saw people bleeding and they still played the whole game. So, yeah, we're trying to capture and learn when we go to the field and put it back

to this equation.

I totally agree with you that that sport -- especially club sports, they play multiple games per day. And we are not assuming that they play one game a day here. What we're assuming is they don't wash their hand between games, so they would have the continuous loading.

And, of course, we need to learn more about how long they play, how many games they play per day for the club. I think that can help us to have better gauge on their exposure.

ADVISORY PANEL MEMBER AVOL: But again, once -- I mean, once they play -- participate in a match, and they've abraded the skin -- we're not talking about hands now, but maybe the forearms, the shins, et cetera, once they've abraded now, that material may stay on or may be new material introduced. But now it's a different sort milieu, because now the first level of skin is sort of missing. So now they don't have to -- you don't have to worry about that impervious barrier. Now, you're already open and things are -- and I think you're doing -- in a different dimension now.

CHAIRPERSON BALMES: It probably is the kid that was playing 24 hours that's also playing bleeding.

(Laughter.)

CHAIRPERSON BALMES: Dr. Kyle is next, and then

Dr. Bennett.

ADVISORY PANEL MEMBER KYLE: I may have to ask your permission to bring up the subject of underwear.

(Laughter.)

ADVISORY PANEL MEMBER KYLE: But I don't know if this is in the exposure factor handbook. I bet not, but...

(Laughter.)

ADVISORY PANEL MEMBER KYLE: You know, in my experience and other women I know, a lot of the exposure is in your underwear, and not your exposed skin, because the stuff gets in your clothes, and it's held there. And so this whole idea of exposed skin versus not, I -- I think it's going to underpredict. Maybe less for men, because they have less constrictive underwear way. I don't know, but -- and I don't want to get too far into this in this forum. But I do think it's significant, or it could be significant.

And we -- I don't know if anybody has done anything on it. I know it's come up before. We have discussed this briefly at a past event. So I wish I had an exact suggestion, but I don't. But I think maybe more of the skin potentially is impacted by this material than what you're estimating from what you're calling exposed skin.

DR. WONG: Yeah. We talked to players and they do -- with your permission, to talk about underwear.

(Laughter.)

DR. WONG: They do --

CHAIRPERSON BALMES: You have my permission.

(Laughter.)

DR. WONG: Thank you. They do tell us that it get into my underwear. It get into socks, into my shoes. That's why in our assumption here for dermal uptake, we assumed the full body. Even though, they're wearing long sleeve we are looking, we assume, the full body. These particles goes through the skin. I was on the field. It went into my underwear too.

So I -- we are aware of that and we try to be on the protective side to assume the full body available to contact with these crumb rubber particles.

ADVISORY PANEL MEMBER KYLE: Thank you for that clarification.

ADVISORY PANEL MEMBER McKONE: Comment on that.

There is a recent paper looking at the effect of clothing. I'm blanking on the name, but --

ADVISORY PANEL MEMBER BENNETT: Glenn Morrison.

ADVISORY PANEL MEMBER McKONE: Morrison -- Glenn Morrison did a study on the -- so, I mean, you could make you assumption and then show what he found about the

relative attenuation by clothing. I don't think you should use -- you know, say, oh, clothing is going to be protective, but say this is what we assumed. And just to show that that is not way off base, here's what Glenn Morrison found in his study on the effects of clothing.

CHAIRPERSON BALMES: Dr. Bennett.

ADVISORY PANEL MEMBER BENNETT: So, I mean, I feel like a big part of the problem -- well, I feel like some of what Dr. Avol was talking about, in terms of the scratches and so forth, I feel like some of that's almost accounted for, because they assume the fraction of absorbed across the skin is 1, which seems really high to me. And so that's assuming that all the chemical that gets on the skin is going in. And so that seems like that would apply to abraded skin. But then on the flip side, the adherence factors of the crumb rubber to the skin seem super, super low, because we know that there is a whole bunch of literature back from the nineties looking at moist skin versus dry skin, and seeing so much more adhering to moist skin.

And then also, now suddenly it's under the sock. Well, it's going to adhere to the skin. It's got a sock pushing it up against the skin. I'm going to use the sock example.

And also, I'm just even puzzled even on the

Kissel thing, the arm is an order of magnitude lower than any other body part in terms of the adherence factor. So I think that adherence factor has a big problem.

And then I'm a little bit confused, because actually I don't see any references in terms of time. I mean, part of the reason I was kind of okay with the event frequency being event per day is it seems like there's just some amount of crumb rubber getting to the skin. And it doesn't seem to have anything to do with how long you're out there or anything. I'm not even seeing how this dermal exposure is increased if you're there for several hours or just one hour.

So I guess there's just -- I have some just general confusion on the dermal and some specific concern about the adherence factors.

ADVISORY PANEL MEMBER SHELDON: So I may have a really bad thought. This is Linda Sheldon. So let me -- I don't want anybody else to have this bad thought.

And the reason I think it might, so we talked about the fact that there may be things that we are really underestimating exposure on. And, you know, granted, you have to go with, you know, the best you can do with the kinds of exposure assessments and risk assessments that people do.

You know, you have spent so much time and effort,

especially on the analytical portion and bringing state-of-the art analytical techniques in doing all of that in there. And then we've got this area where it's like, well, you know, we're just doing what we've always done, because that's what we have to do.

And, you know, it might be useful to look at what might be, you know, even a separate section or separate part that says so here are some other potentially high exposure scenarios that, you know, we have not considered. And this might be what -- you know, this could be estimated exposures.

To me, the good thing about it would be it would take into consideration all the thoughts and all the things that you have, you know, sort of put together in your mind, but it might give a quantification to it.

The other thing is is that for a study that is this large and you have spent this much time and effort to it, I think it's important not just to address what is the study question, but to be building upon the science. And, you know, that section could say, so here are the things we couldn't address. Here's, what we've estimated. This might help other researches build upon the science. So those things would be good.

The bad part about it may be is that you may be doing too much mea culpa, too much uncertainty, and it may

negate what are the findings you have. But, you know, it's a thought. It may be a bad thought, but it might bring into consideration some of these things we've been talking about.

CHAIRPERSON BALMES: Any other comments, questions?

Well, thank you, Patty and Jocelyn. I think we're scheduled to take a lunch break now. And should we be back at --

DIRECTOR ZEISE: Back at 1:00

CHAIRPERSON BALMES: -- 1:00 o'clock.

So for those online, we'll be taking a break for the next hour and eight minutes, but we'll start promptly at 1:00. Thank you, all.

(Off record: 11:52 a.m.)

(Thereupon a lunch break was taken.)

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

(On record: 1:15 p.m.)

CHAIRPERSON BALMES: So we're going to start again our afternoon session. I apologize for the Panel starting 15 minutes late. We all went to lunch together, and, you know, we were waiting for the check, what can I say.

(Laughter.)

CHAIRPERSON BALMES: So I guess our next presentation is from Patty on non-targeted chemical analysis.

(Thereupon an overhead presentation was presented as follows.)

CHAIRPERSON BALMES: Go ahead Patty.

DR. WONG: I'm waiting for the projector to warm up. So good afternoon. Thank you for continue with the meeting with us.

The next section we're going to go through is the non-targeted chemical analysis, which is a crucial part for the field characterization study for synthetic turf field and for playground. And in this section, Dr. Randy Maddalena from the Lawrence Berkeley National Lab and I, Patty Wong, will be presenting.

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DR. WONG: So a section of introduction. The

field characterization study here is the timeline. Again, we start in 2015 and now we have our fourth meeting in 2019 in May. And we start our sample collection in fields and playgrounds. And we -- under the guidelines -- guidance from the Panel, we have developed a protocol, modified accordingly, and we went in and sampled 35 fields and four playgrounds. We finished in summer 2018 and we have discussed the data last year.

Using the manufacturer's sample from multiple recycled facilities, scientists from Lawrence Berkeley National Lab developed targeted and non-targeted analysis of VOC. And we are currently working on other classes of chemicals. The VOC analysis of the field air sample and inorganic analysis of the field crumb rubber samples has been completed. And now we are working on the non-targeted chemical analysis of the crumb rubber extracts.

The non-targeted analysis is used to expand our knowledge on the chemical composition of field samples. The list of chemical targets that we identified in this process will be selected for -- based on priority and then confirmed using reference standard.

And the concentration quantified by using the standard can be used to derive the exposure. And also, the chemical identity will be used to assess exposure of

chemicals on fields and playgrounds.

Okay. The chemical identified in non-targeted analysis will be prioritized. I already say it.

I think that's it. So the target chemical will be used to guide our bioaccessibility measurement, as well as for the analysis of our SVOC sample, the particle sample, and the crumb rubber sample, and used to quantify the concentration for potential exposure calculation.

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DR. WONG: So before we go on, I would like to go a little bit about our -- the OEHHA tire-related chemical database, because it's one of the fundamental lists we're using for this non-targeted analysis.

As I mentioned in the overview, OEHHA compiled tire-related chemical list to assist our targeted and non-targeted chemical analysis of field samples. The list contains chemicals that are from -- reported from literature reports from government, literature papers from scientists, and on the tire-related study, on turf study. And I want you to notice that not all the studies actually confirmed the chemicals. Some chemical suspect they do through the database match, some are confirmed.

We also communicate with the federal agencies that are working on the crumb rubber study, and we obtained information from them to expand our list.

We also have info -- obtained information from the Tire Manufacturer Association and the carb -- International Carbon Black Association on the ingredients going into tire manufacturing process. We search the internet to look for chemicals that are advertised as used for manufacturing tires. And we put these chemicals into our chemical -- tire-related chemical database.

And as an ongoing process, the result coming from the non-targeted analysis, the chemicals will be entered into this database to expand our knowledge on the tire-related chemicals. And it will be used to guide our field sample analysis.

--o0o--

DR. WONG: So as I said, both the targeted and non-targeted analysis are ongoing. The goal is to identify chemicals that will be analyzed in all the field samples. And we have conducted targeted chemical analysis in these class of chemicals, including polycyclic aromatic hydrocarbons using gas chromatography/mass spectrometry, GC/MS in selective ion monitoring mode, the SIM mode.

We also conducted non-targeted analysis on the VOC in air, and we selected a chemical for our targeted analysis of the air sample obtained from field. We have done the inorganic analysis on the crumb rubber sample from fields.

So for non-targeted analysis, the classes of chemicals we are looking at is the volatile organic chemicals, semi-volatile organic chemicals, continue with the polycyclic aromatic hydrocarbons. These are the chemicals potentially in the emission from crumb rubber, as well as from the solvent extracts of the crumb rubber. So we are analyzing it based on different settings of the GC that can achieve a different class of chemical.

There's also another class of chemicals, which is the polar organic chemicals don't usual behave well in the GC/MS analysis. And we are using LC/MS, liquid chromatography/mass spectrometry analysis to look at these polar solvent extract of the crumb rubber.

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DR. WONG: So I would like to show -- have overview on the workflow for the overall non-targeted analysis we are processing. Each step will be discussed in depth in the following discussion.

So crumb rubber, we obtained it from the manufacturer, as well as from the field. We create composite sample from the field. So they contain a diverse -- chemicals of diverse properties from very water soluble organics, which can be charged - These chemicals usually are less volatile - to the more non-polar, less polar chemical or non-polar organic chemical. They can be

of various level of volatility. So VOC, SVOC, PAHs, they have various volatility.

So we subjected the crumb sample to different experimental set-up to collect emission of volatile organic chemicals from these samples. And then the vapor was analyzed by using GC/MS for non-targeted chemical analysis.

And using organic solvent extraction, we analyzed the non-volatile, semi-volatile, and volatile chemical using GC/MS under different settings, also for the non-targeted chemical analysis.

The results of these analysis subject through suspect screening through database. They through the NIST database search for potential tentatively identified chemicals, and we compile a list of these chemicals. And details of these chemicals is in the binder material for today's meeting.

We also extract the crumb rubber using polar solvent. Now, we are looking at more aqueous with a 10 percent methanol in water, try to extract out the polar constituent in the rubber. And like I said, these chemicals is being analyzed or has been analyzed using LC/MS.

Unlike the GC/MS, which has a very well established protocol and database for doing non-targeted

analysis, LC, the liquid chromatography/mass spectrometry for non-targeted analysis is kind of in an emerging field. And it requires protocol development for -- to fit our study. And in this section we'll go through how we analyzed these chemicals.

And then at the end, we've consolidated these chemicals into a tentatively identified chemicals list. And by going through prioritization, buying the reference standard, we confirm some of the chemicals, and the process still ongoing.

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DR. WONG: Here is a summary table on the various matrix or samples that we have prepared. We have prepared polar extract, non-polar extract. And also from the non-polar extract, as well as from some of the emission, we look at the PAHs. So -- and then we have aldehyde/ketones and then VOCs that we look at in the field air. And each of these matrix of chemical classes, we use different instrumental analysis to consider to analyze and come up with the chemical potentially or confirm being in the matrix.

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DR. WONG: So this is the introduction.

CHAIRPERSON BALMES: Yeah. Turn on your mic though.

ADVISORY PANEL MEMBER KYLE: When you say confirmed versus unconfirmed, what exactly does that mean in this context? And let me guess, and then see if I'm right. Does that mean that from the various spectra and so on, you can identify what the peak is? Is that what confirmed means or not?

DR. WONG: We'll go for more detail, yeah, but there's a little bit difference between confirm and not confirm. When you first have the LC/MS, you go through -- you come up with a spectrum with all the peaks. And then you can go for a database to try to identify what is that chemical.

And without putting in a real chemical reference standard into the same equipment is called as a tentatively identify, so it's unconfirmed. That can be potentially some chemical with similar pattern, because they are analog of each other. They have different -- just a little bit difference in structure, but it's not actually the chemical.

They can give out similar pattern on the mass spectrometry. So that's why we call those unconfirmed. But once we check it through the analysis, we match the spectrum, it looks correct on the retention time, which we go in more detail, and the spectral data, then we call it a confirmed chemical.

ADVISORY PANEL MEMBER KYLE: Okay. Thank you.

DR. WONG: Sure.

CHAIRPERSON BALMES: Dr. Bennett.

ADVISORY PANEL MEMBER BENNETT: I had a question. So it looks like you're doing a sample of new tire crumb rubber and then a sample that's composite to do the non-target identification, and then develop a target list. After the target list and the standards have been bought, are you planning on analyzing multiple use samples to look at variability in levels or are you only ever analyzing the composite?

DR. WONG: So the composite -- let's roll back a few years ago when we first start the meeting, we heard it loudly from the -- it's a very, very good advice that we should look at what is in the rubber before we move on, so we start the solvent extraction. And this is -- the manufacturing sample is before it goes into the field. And then we create two composite samples from four different fields each. So it's eight fields. It's to help us identify the target.

And then once we got the target list, we buy the reference, and then we will analyze each individual field --

ADVISORY PANEL MEMBER BENNETT: Okay.

DR. WONG: -- with some samples last year, with

different age, different location.

ADVISORY PANEL MEMBER BENNETT: Great.

DR. WONG: We try to look for pattern, yeah.

ADVISORY PANEL MEMBER BENNETT: Okay. Great. That's what I thought. I just wanted to make sure.

DR. WONG: Yeah.

DR. MADDALENA: Okay. So it's my turn.

(Thereupon an overhead presentation was presented as follows.)

CHAIRPERSON BALMES: Dr. Maddalena, yes, go ahead.

DR. MADDALENA: Thanks for kind of getting us started. It's good to be able to be back in front of you guys today. We always learn a lot from this end of the table from your perspective.

Today, at lunch I asked Patty -- I'd suggested that if I was sitting in your seat, the first thing I'd want to see is so show me the numbers. Let's stop talking methods and show me the numbers. But for this particular study, that comes at the end. And you're going to get the numbers, but that's going to come at the end.

And so the point of these presentations, although they seem to be very method centric, they're really designed to try and make sure we fully vet our approach. When those numbers do come out, then we've built them on a

very solid foundation. So that's kind of my intro.

I'm going to talk and go into a little more depth about what Patty has suggested is our roadmap, our plan. And you'll see increasing levels of sort of complexity as we cycle through this. The VOC analysis was probably a fairly simple analysis to be done. And I'll talk more about that. Bit it was in a controlled environment before we even went to the field.

The -- what we're calling the SVOC analysis, it gets much more complicated very quickly. And so I wanted to kind of build up slowly into the process for non-targeted analysis, identifying what's there when you don't know what's there, the process we are taking. So I wanted to build up slowly. So I will be switching back and forth periodically between the -- some of the results from the targeted analysis as a comparison just to give -- to make a few points along the way.

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DR. MADDALENA: So here we go. Here's an overview of a -- of the presentation.

I remember you said talk straight into the mic, so I'll stop looking at you, and I'll look at the mic.

Sample collection methods. I'm going to go over that. Again, we've done this before, and you guys -- you've all seen this before. But it's important I think

to package up what we're going to talk about in the non-targeted analysis with where these samples come from, because ultimately that's what's important. Our numbers at the end of the day, are they really representative and relevant to the problem at hand?

So we did some laboratory-based tests, including chamber -- controlled chamber emissions studies, some direct thermal desorption, the stir-bar extraction is like the small step towards our availability studies. So the stir-bar extraction was done. And we did some aging as well in that laboratory-based study.

And then went to the field and spent a fair amount of time in the field covering a lot of different locations. So the samples collected from the field are both from the surface and from the air. So you have direct crumb material collected from the fields and you also have air, which would capture volatilization. And I'll talk a little bit about a question this morning of integrating times and spatial variability. So we'll make sure we have a good understanding of that, and then go from there.

Now, we've got samples in the cabinet. We go to the analysis and the first step is extraction. And so I'll talk a little bit about those steps before I even come to the date analysis part. And that's where we're

going to really focus most of our attention.

I'll say it now, and then I'll try and justify it as we move forward, the whole point of this is to create a very strong linkage between the numbers that we find and the chemicals that we identify, and the crumb. And so, you know, the environmental samples it's a little more difficult. But when you actually take the material right out of a manufactured bottle or collect it out of a chamber, where all you have in that chamber is the target material, there's a pretty tight linkage. And so that's kind of the whole point is the sample collection has a lot to do with how relevant the data is.

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DR. MADDALENA: So what's that?

I can see. You guys have it in front of you, right?

CHAIRPERSON BALMES: Yeah.

DR. MADDALENA: Okay. So this is what we tested. Looking at the laboratory-based experiments again, the first thing was the emission's chamber. The only thing that went into that emission chamber was our material of interest. And so we had crumb infill material manufactured fresh from the production lines and then turf blades with the backing included. So it's a very simple -- simple -- as far as complex mixture, but it's a

very simple structure.

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DR. MADDALENA: We built these little experimental units in 6-inch squares, the representative depth of a real field using turf and crumb, and added in -- added them in appropriate balance as far as to represent the field --

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DR. MADDALENA: -- and then put them into our emission's chambers, which are highly controlled systems. They're as far away from the real world as you can get. But we control the temperature, the humidity, the airflow through the system, so we can close the mass balance when we measure chemicals. And what we measure in this system is with high confidence from the material we're testing. And that's an important piece of information as we're moving forward.

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DR. MADDALENA: For the samples collection in the laboratory, the second one we did, and we've talked about this before, again making the point of the direct connection, we put the crumb material itself into a cell, or a small straw, if you will, and put that straw right directly into our instrument. So in this case, it's a one-to-one connection between what's in the -- in that

straw and what goes into the instrument. So the signal we get out the other side is directly connected or linked to that.

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DR. MADDALENA: The third sort of sample collection method, so I'm kind of working through this fairly fast, because I think we've all seen this before. But I just wanted to make a -- you know, a quick reminder.

The third one was a -- the stir-bar extraction, where you have a semi-aqueous phase. It's a mixture of organic and aqueous, but it's a -- it's on the -- we use the word "polar" and "non-polar". Basically, that boils down to whether it likes to be in water or whether it likes to be in oil. And most chemicals sort of fall along this spectrum. So it's really not a very sharp cut line. But for this experiment, we used water with a little bit of methanol in it, and then a stir-bar. And in that stir-bar, that stir-bar sort of acts as a sorbing environment. So as material is extracted from the crumb into the liquid, it's very rapidly taken up into this stir-bar, this artificial surface in the water.

And that goes directly into, again, one of these sampling tubes or straws that go right into the instrument. Again, a very tight link between the material we're testing and the chromatograms that come out the

other end of that test.

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DR. MADDALENA: So then the -- we moved our sampling to the field. And just as a reminder, the question this morning was what was the integration time? It's always about an hour. So the samples for VOCs were collected for an hour, spread across the day, spread across the field, on field, off field, and at different heights above the field. So we got a lot of spatial, temporal, stratified variability captured in these hour-long samples.

The semi-volatile chemicals, because of their nature, they required essentially a 3-hour sample. So at each field, you have some spatial variability because you've got a couple of them spread across the field, you've got one off the field, but it's integrated over a longer period of time, because you needed a larger sample volume in order to see these compounds.

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DR. MADDALENA: So, in summary, I said it up front, the laboratory sample collection method is so tightly linked to the material of interest, that we have a lot of confidence that when we see a peak or when we see a potential chemical that we know where it came from.

The field, it gets more complicated. But in the

field, we were able to capture things like variability, spatially, temporally, height-wise, so it was important to have those too. And at the end of the day, some of the things that we saw in the chambers, specially for the VOCs, we didn't see them in the field. And there's obviously reasons for that. As things decay, as they volatilize, as they, you know, transform in the field, you may not see. Just because you've identified it in a chamber doesn't mean it follows through the whole process.

So at the end of the day, that final list may have things that you've seen before that have fallen off the list, because they're not in the field itself

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DR. MADDALENA: So very quickly, and I don't want to go into a lot of detail here, the sample extraction for the VOCs, in this case, all of them were the same. And it was the thermal desorption extraction. So whether it was collected on a stir-bar, directly put in the sample tube, or collected air in the field, they all went through the same. So there's no variability in the analysis side of this problem.

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DR. MADDALENA: It's all directly linked. So then we get to the data analysis. And this is where, for the most part, we want the Panel to really think hard

about whether we're following the right path, particularly for some of these remaining tasks in the SVOCs, the non-target analysis.

So as a little background, there are really two approaches. We use the word "targeted" and "non-targeted". Essentially, all that means is if it's a targeted analysis, you're telling me ahead of time what I'm looking for. And then I do my analysis and then I look at a chromatogram. I'm going to give you sort of the anatomy of the chromatogram on the next slide. I look at that chromatogram and try and find out if that sample or that chemical is in there.

For the non-targeted analysis, it's the reverse of that. I have a chromatogram and I have a peak that we think is fairly clean, and we want to try and put a name to that peak. And so you're coming at it from two different directions.

Ultimately, the strategies sort of converge on what we mentioned before, you want to have a pure standard at some point that you could run through your system and confirm what you've found.

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DR. MADDALENA: And so with that, I want to just kind of work through sort of a first-year analytical chemistry, just to get everybody on the sort of same page

on what we can do, and as we - I mean, I guess I could say - get down into the weeds or get down into the turf and how far can we go to really see things before some of the other factors come into play and uncertainties just get too great. At some point, the uncertainties can't be ignored.

So when I talk about a chromatogram, this is what I'm talking about. And this is essentially a sample that you put in an instrument and the -- all of this science is already developed. So in a lot of cases, we're just driving the machine. But there are pieces that -- or factors that go into this process that are important and will ultimately dictate how much we can figure out from a sample.

The first one is the peak resolution. So when you have a chromatogram, you might have a -- one of these peaks that pop up. And it has a really nice -- you know, the baseline is running along nice and flat. And then you get a peak and it goes right back to baseline and you're like that is a nice peak. And so we know that from a lot of the science that went before, that that's a very pure chemical that creates that peak.

And so when your detector provides a finger print, you can be quite sure it's a very clean finger print that would do good in matching.

Environmental samples, you rarely get the first. You more often get the second, where you have multiple peaks. Whether you know it or not, this one -- this example you can actually see a shoulder on a fairly nice peak. And that shoulder clearly there are two things there. And there are tools that we have to go in and start separating those. But we don't even always, if the things -- if the chemicals elute very closely together, this is going to affect our ability to identify them.

The second thing that comes into play is what's called signal to noise. And so what you have is in any analysis, you have some baseline variability. And that variability has some scale or some size.

So when you have a signal that comes out, or in this case a peak, you can figure out sort of how much your signal is relative to your noise. And you get down below somewhere on the order of 10 to 15 and it gets a lot harder to figure out what's what. So you'll see in some of our samples later on in these talks that there are a lot of peaks in these samples. But in a lot of cases, they're very close to that noise level, and it becomes very difficult without additional chemistry to figure out what those peaks are.

The next thing is really an instrument-related limitation. And that's, what we call, a dynamic range.

It's basically how much can you see in a range of concentrations before either the detector gets swamped out or the lower limit of the detection is reached. So it's everything in between there.

We can control that a little bit, by our sample size, by what we put into our instrument. But we can't always control that across the range. And like in the chromatogram that's on this picture, there are a couple of fairly large peaks. And those peaks are clearly related to crumb. The benzothiazole is the second large peak there, and we've talked about that before.

Well, I can't change this analysis by -- I can't bring those small peaks up anymore without saturating the detector using -- from the larger peaks. So again, constraints of working with real samples.

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DR. MADDALENA: The next one that we deal with, and the last one that I'll talk about, is just basically complexity. When I showed you that first peak how it was nice, and well resolved, and a good shape, and we have a lot of confidence in that peak being a very pure chemical, and we could feed that into our identification systems.

The problem is we're dealing with what we see in this next chromatogram often. We see peaks that aren't well resolved. Not only aren't they well resolved as you

get these baseline humps that come out that are sort of unresolved compounds - and we'll talk -- we see a lot of this in the LC analysis, and we've come up with some strategies to go after that.

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DR. MADDALENA: So in summary, the four -- for us, the four main things that limit our ability to get down deeper in the turf and identify more peaks are the resolution of the chemical -- of the chromatogram, and there are limitations on how long you can run your chromatogram. So you don't want to run over like an hour and maybe an hour and some. And you could change columns, but that may get better resolution for per some and not the other. So you just optimize and do the best you can.

The second one is signal-to-noise. That's basically worked out. You can't really reduce the noise that much. You could increase the signal, but you're limited by that dynamic range on how much you can increase the signal, until you go into chemistry. And chemistry takes a long time and a lot of money. But you can take these samples and effectively split them up, and take the bigger things in one path and the smaller things in another. So there are techniques, but they're difficult, time-consuming, and sometimes extensive.

And then the last one that we just struggle with

a lot is the complexity issue. And again, you can handle this to a certain degree with pre-analysis chemistry. You can -- the unresolved peak that we often see in these samples are a mixture of alkanes, which are just normal organic chemicals that don't have a lot of functional groups on them. They don't have double bonds. They don't have halogens or anything extra on them, but they have a lot of ways to put themselves together.

So you can have a 12-member alkane that goes in all kinds of different shapes, depending on how you connect those atoms together. And those all move at just slightly different paces through the column, and you end up with this sort of a blob that is hard to distinguish, and you need to actually mathematically separate that from your analysis.

So the point is you can improve and address all of these limitations, but they obviously are going to take some extra time.

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DR. MADDALENA: So now with that background, I'll kind of walk you through the process that we use in our -- identifying our non-targeted analysis, identifying compounds. And I'm going to start with the VOCs, because that's somewhat of a cleaner system to work in.

First example is a fairly dominant peak in this

particular analysis. And this in an emission's chamber of a fairly fresh crumb material. And so we've got the peak here that shows up. It's pretty well resolved. It's a good strong peak. And we pull that out of the instrument and create a mass spectra --

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DR. MADDALENA: -- or the mass spectrometer create a mass spectra for us. So when you put this peak into the detector, the molecule always blows up the same. It always breaks apart the same. And there are libraries that you can compare that finger print to, so you can put an identification on it.

So we feed this into the database that we have. And we have one of the more current databases. They revise those periodically. And it gives you information mathematically, which I don't want to go into, on how well it fits with everything in that database, and brings to the top the ones that match the best. And so you're actually matching spectrum. Here

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DR. MADDALENA: And in this picture, you see the red lines on top, the blue lines on the bottom. Those are the finger print. Those are the pieces of that molecule that come out at that given retention time. And going back, the likelihood or the match factor here is really

high. It's 940 out of 1,000.

So, in fact, it's a really, really good match. But again, we're dealing with a very clean spectra. And another thing to look at here is that probability column. That's kind of -- that's mathematically the likelihood that benzothiazole and not the next best choice. And so you do end up with a really good -- yeah.

ADVISORY PANEL MEMBER BENNETT: This is Debbie Bennett. What did you go to do to get from the peak to the fingerprint? I missed that.

DR. MADDALENA: Oh, that's internal. That's mathematics. So that peak is being recorded continuously by your software on your instrument. So the instrumental analysis is recording that peak. When that peak goes into the mass spectrometer, which is your detector, it's bombarded with elec -- with charge. And so this molecule gets excited, and it just can't handle that charge, and it always breaks apart in the same way.

And in this case, it breaks apart with this -- this sort of histogram that you see. There's a lot of pieces of it that are 135 units per charge. And so that's how it breaks it apart. And it's this fingerprint of all of these pieces that's recorded in a database by a number of different organizations. We use NIST's database for this work.

And so that information is recorded continuously. And then when you go into do your non-targeted analysis, then you use sort of feed that in either automatically or you say give me an answer for this particular peak, and that's where it does the matching.

This is the results of the matching. And it shows you again a very nice clean peak. The probabilities were really high, so we've got a lot of confidence. But ultimately, you'd still want to run a standard, in which case we run a standard to confirm it.

So this is kind of what the whole package looks like, all those little windows are. Pieces of information on how well you did on your non-targeted analysis.

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DR. MADDALENA: That's easy, right? This is -- the problem is most environmental samples are not that clean. And so we end up with situations where we have, like this little shoulder on the peak on the side here. Again, this is an analysis or a sample that was collected from an emissions chamber from crumb rubber, so it's clearly related to crumb. The weak peaks, they don't resolve very well.

The problem with that is they -- they're in the chamber together when you break them apart. And so you've got this mixture of ions that come about.

There are a lot of options that we could do to kind of improve this separation, this resolution. I talked about them before. But ultimately, the easiest one is just mathematically try and separate those. And we didn't do -- build the software. We just use the software. But it's fairly straightforward as far as it sends all of these ions at any given retention time into a library, and then it statistically matches up traces.

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DR. MADDALENA: So if one mass-to-charge number goes up and another one goes very closely correlated with it, then it matches that as one compound and throws everything else away, right? So it's just a mathematical approach to cleaning up spectra.

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DR. MADDALENA: And at the same way -- you know, the same way we did previously with the raw spectra from the instrument, we can do the same thing with the cleaned up spectra. And that's just a little bit more uncertainty, but it still provides a very nice way to get down to, you know, identifying more and more peaks at lower and lower, and dirtier and dirtier levels, or messier and messier chromatograms.

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DR. MADDALENA: So going through the VOC process

this way we ended up back and forth several times. At this stage, there are no more remaining tentative ones on our list. They're all confirmed. And so with the VOCs and I'll throw into the mix the carbonyls as well, mostly that's formaldehyde and acetaldehyde. Some of the more volatile carbonyls. So I'll throw those in as well, because they're also confirmed and we end with 78 compounds on our confirmed list now.

And I think that list is in the meeting material, so you can refer to that list if you want to get specific names and such.

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DR. MADDALENA: So in summary, I wanted to point out at first that the chemicals that we're measuring just from our approach of sample collection are highly specific to crumb. Specific particularly in the lab work, but also in the field, they're highly specific to that field, whether it's crumb related or not.

The targeted analysis that I talked about, it generally reduces down to chemicals that we've -- we have particular interest in or are particularly high in the sample. And we used -- we -- at that point, and to address Debbie's question earlier, we basically train the instrument moving forward. Once we have a chemical identified, we don't have to go through this again. It's

got a retention time. It's got a finger print. It's on our instrument at the very same time every time. And we train the instrument to look at that point, and does the work for us. So that's nice.

The downside is there's always other things in your analysis. We may do 30 fields and that 31st field has something else there that we didn't expect. And so you always have to continue to circle back through and look at your chromatograms and make sure there's nothing new popping up that needs your attention.

So in the non-targeted analysis, I spoke of the things that kind of control how good we can do with that, and the process of getting from a sample to essentially name. And then ultimately it is up to us as analytical chemists to go in and confirm that with pure standards, if available. That approach on the non-targeted analysis especially for these more controllable samples, they'll give you 80 to 90 percent of the, I'll call it, mass, but in reality, it's just the response from the device, from your instrument.

So it will cover a good fraction of the response. And the rest of that is so close to the signal-to-noise threshold, that it's really hard to get much better.

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DR. MADDALENA: So that's kind of the overview.

Should we stop for questions on the VOCs first, because the -- okay. We could stop there, and clarification, or drill down into questions.

CHAIRPERSON BALMES: Thank you, Randy. That was very helpful. For a non-chemist, I think I understood most of what you said.

Any questions or comments right now before we move on?

Dr. Bennett.

ADVISORY PANEL MEMBER SHELDON: Yeah.

CHAIRPERSON BALMES: Sorry.

ADVISORY PANEL MEMBER SHELDON: On the -- you know, looking at the VOCs and the tire crumb, you were using 25 degrees C in your chambers. Is there a reason you didn't go higher than that? That seems like a sort of gentle approach?

DR. MADDALENA: Yes. Yeah. We did go higher than that.

ADVISORY PANEL MEMBER SHELDON: Yeah.

DR. MADDALENA: We spoke about that I think at the last meeting we had.

ADVISORY PANEL MEMBER SHELDON: Oh, okay.

DR. MADDALENA: Sorry. No, that's okay. And we also the -- even more difficult -- or the more challenging extraction was where we put the crumb directly in the

instrument.

ADVISORY PANEL MEMBER SHELDON: I was going to say --

DR. MADDALENA: And in that case, we did go to very high temperatures?

ADVISORY PANEL MEMBER SHELDON: Okay. What temperature did you use for those what you did?

DR. MADDALENA: That ramped up from representative temperatures in the 40 to 50 C range all the way up I believe to 150 C.

ADVISORY PANEL MEMBER SHELDON: Okay.

DR. MADDALENA: You go much farther, you start getting thermal decomposition and it's really not relevant.

ADVISORY PANEL MEMBER SHELDON: Okay. Even at that point did you get thermal decomposition or --

DR. MADDALENA: It was approach that. It was definitely approaching that. The things you're starting to see were --

ADVISORY PANEL MEMBER SHELDON: Okay.

DR. MADDALENA: -- indicative of what you would think of a breakdown product and not necessarily just volatilizing off of the system. So it's -- again, it's a judgment call. But all of those peaks filtered back into our decision process to kind of identify what we wanted to

target. And then --

ADVISORY PANEL MEMBER SHELDON: So --

DR. MADDALENA: Yeah, go ahead.

ADVISORY PANEL MEMBER SHELDON: Okay. So the other question is is that you said that was it in these rubber -- you know, crumb rubber samples, were you able to identify 80 to 90 percent of the peaks? I mean, are all of those peaks actually in libraries that you can identify or were there a lot of spectra that it was just like, you know, we don't have that in our database?

DR. MADDALENA: In most cases, they are in the database.

ADVISORY PANEL MEMBER SHELDON: Oh, good.

DR. MADDALENA: Surprisingly, they are. You can identify them using the approach I talked about down to the isomer level, which means a chemical that has --

ADVISORY PANEL MEMBER SHELDON: Right.

DR. MADDALENA: -- a very similar structure, like the example I showed you with the benzene ring and the three methyl groups.

ADVISORY PANEL MEMBER SHELDON: Um-hmm. Um-hmm.

DR. MADDALENA: It could have been any number of -- any one of three different structures. And you just can't tell them apart, as you move that around

ADVISORY PANEL MEMBER SHELDON: Okay. Yeah.

Back in the olden days, they didn't have so many spectra in those databases, but now it --

DR. MADDALENA: It's tremendously rich, if you --

ADVISORY PANEL MEMBER SHELDON: -- but it's rich. Okay.

DR. MADDALENA: If you find it in manufacturing or in the environment, there's a good chance it will be in one of these databases --

ADVISORY PANEL MEMBER SHELDON: Okay. That's great.

DR. MADDALENA: -- at this stage.

CHAIRPERSON BALMES: Dr. Bennett.

ADVISORY PANEL MEMBER BENNETT: So am I correct interpreting the -- on slide 20 you were able to get -- you found roughly 67 peaks and you were able to buy standard and confirm them all or there's some that were unconfirmed, and so you crossed them off, because you couldn't -- they weren't what they -- you thought they were?

DR. MADDALENA: No. In this case, it's the first. It's -- we did. And in fact --

ADVISORY PANEL MEMBER BENNETT: Wow.

DR. MADDALENA: -- we had a lot of the already in our -- we see a lot of things anyways, and we had standards. We had calibrations. A good fraction of those

chemicals that we saw, benzothiazole for example, it's our normal analysis. I mean we run it. And so we saw it. So we shouldn't -- I mean, we don't get a lot of credit for doing anything fancy there. That's -- that was there.

There were a lot more that we identified. And for various reasons, we ended up with the 67-ish peaks that moved forward in the analysis that actually --

ADVISORY PANEL MEMBER BENNETT: So you were -- you were -- you ended up buying like half a dozen or a dozen additional standards and then confirming?

DR. MADDALENA: It's probably a couple dozen additional.

ADVISORY PANEL MEMBER BENNETT: Couple a dozen.

DR. MADDALENA: Yeah, 20 to 30 additional.

ADVISORY PANEL MEMBER BENNETT: And then that was pretty much everything. Like, you didn't -- there weren't any big peaks when you were done that you didn't know what they?

DR. MADDALENA: Correct.

ADVISORY PANEL MEMBER BENNETT: Wow, that's great.

DR. MADDALENA: Yeah. And I'm talking now about the controlled samples, the field samples that were a little bit messier, but at the same time they were still quite low concentrations, so that the number of peaks that

actually were resolved that we were able to work with were small.

ADVISORY PANEL MEMBER BENNETT: So the 67 VOCs included the when you stuffed the stuff in the tube when you did the -- put it in the chamber --

DR. MADDALENA: Started there, yeah.

ADVISORY PANEL MEMBER BENNETT: -- and when you did the stir-bar.

DR. MADDALENA: Right. Right.

ADVISORY PANEL MEMBER BENNETT: From the three of those, you had the -- okay.

DR. MADDALENA: And we evaluated what we found in the field as well to see if there was anything else standing out that we didn't already have in our list. And for, an example, I mean, if there was a -- if there was an alkane or some branched alkane that clearly showed up, there's an approach we use to throw those off the table and not track them further, because they're not toxicologically relevant. And they don't contribute to any other issues that we're worried about.

And so there was some decisions made iteratively back and forth with the various players to wind down to that one list. And, in fact, they're all confirmed. And that's kind of the good news. So the next section you'll see a lot more show up in that column to the right.

And so I wanted to start here, so if anybody fell asleep, you would be left with the impression that we did -- yeah. Okay. Let's move on.

CHAIRPERSON BALMES: I think Dr. Kyle has a question or comment.

ADVISORY PANEL MEMBER KYLE: It's related to this. If some other guy did the same thing, would they be able to estimate this 80 to 90 percent number in the same way? In other words, is there a way -- a common way that you're -- that one you -- a guy like you -- there's no one like you, but, you know, somebody else doing this can quantify what part isn't -- you aren't able to identify? You know, you're --

DR. MADDALENA: That's a great question for the next section. I think we did really good in this section. But as far as the VOCs, the answer is, yes, there --

ADVISORY PANEL MEMBER KYLE: Yeah. Well, I'm asking is there a method for that, because --

DR. MADDALENA: Exactly. That is not --

ADVISORY PANEL MEMBER KYLE: -- my point --

DR. MADDALENA: What I showed you was over-the-counter methods definitely. Any contract lab could do that.

ADVISORY PANEL MEMBER KYLE: Including quantifying how much you couldn't find?

DR. MADDALENA: They would come up with a similar number, yes?

ADVISORY PANEL MEMBER KYLE: They would come up with a similar number?

DR. MADDALENA: Yeah.

ADVISORY PANEL MEMBER KYLE: Because I think this is actually part of what needs to be written up is results of this.

DR. MADDALENA: That's exactly. And that's what, at lunch today, I -- can we -- and it's too soon for actually showing numbers, okay. So we --

ADVISORY PANEL MEMBER KYLE: You mean, you're not going to get to the numbers today? When you said the end, it's not today?

DR. MADDALENA: The end of the numbers comes with the report.

ADVISORY PANEL MEMBER KYLE: Oh. Okay.

DR. MADDALENA: The numbers come with the report.

CHAIRPERSON BALMES: They want to bring us back for another round.

(Laughter.)

DR. MADDALENA: And I'm a contractor, so that's just my understanding of it. I might have misinterpreted it. But my understanding is that the numbers actually -- we want to vet this method very well now. And we're

looking at chemicals and names. We're working on names of compounds. Those are the important things at this stage. And then the numbers will be in the report itself. And then we'll -- yeah, I think we'll probably be here again one more time. And that will by the funnest meeting, because that will have all of the numbers, all the information.

DR. WONG: I want to respond back to Randy say he's a contractor.

DR. MADDALENA: Thank you.

DR. WONG: He's a collaborator and he's the leader of the lab. So he has been the instrumental master mind on this chemical analysis.

DR. MADDALENA: Thank you.

CHAIRPERSON BALMES: But when the decisions are made, he's a contractor, right?

(Laughter.)

DR. MADDALENA: Yeah.

ADVISORY PANEL MEMBER SHELDON: And this is just a quick question. I mean, you know, we had pages of names of chemicals that you gave us, so they have been named.

(Laughter.)

ADVISORY PANEL MEMBER SHELDON: Were there any -- so based on what you started out and people said was in the crumb rubber, did it pretty well match what you found?

Were there any surprises? Were there any disappointments? Just for those of us who want to hear a little data.

CHAIRPERSON BALMES: Without numbers.

DR. MADDALENA: Oh, yeah, yeah. Actually, it should not have been a surprise, but the dilution in the real world is such that if you can measure it in a chamber, the chromatogram I demonstrated -- or illustrated earlier on is somewhat exciting. I mean, there's a lot -- there's a fair amount of stuff there. But when you go to the field and try and track those, it's really just the major two or three peaks that continue to survive to where you can -- where we see -- again, this is qualitative, you see it trend from low to high, to where you can really link it to this source.

The question about the crumb itself, now that's a little more tricky. And that's what we're going to spend the next couple hours or hour talking about. Yeah. That's a little trickier. And I think there are things that are of interest that we can continue to chase. And I don't want to go into too much detail, but certainly you're opinion is --

CHAIRPERSON BALMES: Chemists always want to continue to trace something or other.

DR. MADDALENA: Right. Right. Give me a number, and I'll see if I can get below it.

(Laughter.)

DR. MADDALENA: The Europeans, I don't know if Patty shared the background, but they just settled on let's just look at PAHs, because clearly you see PAHs, polycyclic aromatic hydrocarbons, in crumb material. And we do, too, right? We see it. And so they just focused on that and took the easy path and said let's regulate that. And if the crumb is above a number for the PAHs, then we'll track that as our threshold. And so there are different ways from different approaches to deal with that.

And, you know, that's certainly one we're seeing. And one of the questions I'll ask later is should we look closer and see more, because -- so anyways, yeah, we'll circle back to that. Did that somewhat answer your question, your curiosity part?

CHAIRPERSON BALMES: So are we ready to move on to non-polar constituents?

No, no. It's quite already, Linda.

--o0o--

DR. MADDALENA: Yeah. It's a good discussion. Thank you.

So the non-polar chemicals, again, in reality, it's a continuum, right? We use non-polar to represent those things that we could see on a gas chromatograph, a

GC. And so I'll talk a little bit about the approach we used for non-targeted analysis of the chromatograms from the GC of the crumb -- crumb material.

And let's see, so again, I'll follow a similar pattern as I did last time. I want to convince you that the Samples we're looking at are relevant. And then I want to kind of sort of fill you in on the extraction approach that we used, in order to make sense of the data, because that ultimately will tell you how the numbers we see relate back to the crumb. And then I'll talk it in reverse order this time. I have it listed as targeted and then non-targeted.

I'm going to flip that around and just talk about the non-targeted first. And I'll finish with the targeted. Because the only targeted, at this stage, is the polycyclic aromatic hydrocarbons, because it was a -- it came down a different path. It was, you know, thou shalt look for those, because those are important. Let's look for those.

And that actually for a chemist, that's always even easier. That's easier to go out it -- at it that way.

--o0o--

DR. MADDALENA: So sample collection. In this case, we're just looking at the crumb itself. The crumb

was either collected from the manufacturer right out of the bulk products at the manufacturer and brought it to the lab where it was extracted and analyzed as we received it. There was no sieving, or washing, or treatment in advance.

What we call the installed crumb rubber was harvested from the fields and we've talked about that at previous meetings, as far as how representative the number of fields were geographically and then spatially across the fields, and then moving on and off the fields. So we talked a lot about that. But the crumb itself was harvested from the field itself, and again analyzed as received. So if it had -- take that back. If there were big pieces of things in there that were clearly not related to our project, then those things were removed.

In general, they didn't make it in there, because the -- we were harvesting that material ourselves. But in some cases, there were pieces of paper or other things that just weren't relevant to the study, so those were physically removed. But other than that, everything was analyzed as is. So if it had sand in it, or cork, or other soil material or pieces of blade, we would analyze it as received.

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DR. MADDALENA: The analysis -- extraction and

analysis approach followed this pathways that's shown on the screen now, where we started with a known amount of material from the field or from the manufacturer. And we loaded in these little cells that seal up, and they're designed to go to very high temperatures and high pressures. We don't run it at that rigorous of a conditions in -- for these particular experiments. But the cells once they're loaded or fed into this instrument -- and there was some -- this circle at the top left of the picture of the instrument is there to represent the fact that there was some iterative process here, because we didn't want to rely on a lot of cleanup, or fractionation or enrichment steps.

We wanted to make this as closely linked from crumb to sample as we could. And so we had the liberty to adjust the amount of material we extracted. So we would -- we extracted different amounts of material and ran it through our system until we got that dynamic range sort of fit as best -- as much as we could, and then moved forward with that volume of material in the cell -- the extraction cell.

The extraction itself, again everything went through this one type of an instrument. And it's designed to just -- if you've been around for a while, I mean, we used to use a soxhlet extraction, which is a lot of really

fancy glassware and boiling. And it's like, you know, a distillation type approach.

This is somewhat of an automated version of that process. It's faster and cleaner. So we had two different pathways coming out of this instrument. The first one was the organic solvents, what we're calling the non-polar, but it essentially is just what came out in organic extract.

And the second one that Patty will talk about is the semi-aqueous phase extraction, which would go to the liquid chromatography analysis. The instrument we used is listed there. The main point I wanted to show is that, number one, we didn't change the material at all. We didn't do any cleanup, or separation, or adjustments in the material itself, or fractionation of the extract for that, so that the extract went right from the instrument right into the analysis.

And one important thing about the method that I'm talking about now is the detection limits for this method are on the order of three orders of magnitude lower than the detection limit for the volatile organic chemicals. And there's a lot of reasons for that. I don't need to go into too much detail. But you can actually see more in these samples than you can in the volatile organic chemicals for a number of reasons.

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DR. MADDALENA: So the non-targeted analysis -- so basically, the process we follow for non-targeted analysis is very similar to what I just went through and described to you. The differences are that the molecules are often more complicated, because they're bigger. They have more functional groups on them. They're at much lower concentrations, because they're not volatile or, in this case, they're being extracted from something, so we have control over that.

But it allows -- but in order to get really good detection limits, you really almost have to look at or look for specific compounds. So we really want to do our best to take things from this targeted to the -- from the non-targeted to the targeted column, because once we get there, then we can drill down really deep, and actually get good confident numbers. So that's one of the driving factors to push us down this path to try and identify as much as we can.

But the real challenge in this SVOC, whether it's on the LC side or the GC side is the complexity of the chromatograms. And the three-dimensional plot sort of shows you all that's going on in this GC mass spec analysis with retention time running along one access, the height and color of the columns. And you'll see these

three-dimensional plots again on another access. And then the mass-to-charge ratio going in the last direction there. So you've got all these things happening at once that make it difficult to analyze and identify things.

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DR. MADDALENA: And you really deal with this complexity thing as well. And the complexity changes with whether it's from the manufacturer or whether it's been in the field for a while.

Yeah.

ADVISORY PANEL MEMBER BENNETT: Is this like a time-of-flight instrument or no?

DR. MADDALENA: No. That's just software that actually shows you the three dimensions. So, you're right, you could do this -- in fact, what we're going to talk about with the LC/MS is a two-dimensional mass spec, where the --

ADVISORY PANEL MEMBER BENNETT: The time-of-flight one?

DR. MADDALENA: -- the first dimension is the non-ionized or non-fragmented version of the molecule. And then it goes into a second dimension, similar to time-of-flight, but this one -- this instrument is even more sensitive than the time-of-flight. I don't think that instrument is a time-of-flight, is it?

DR. WONG: It is --

DR. MADDALENA: It's an ion chamber or ion trap.

DR. WONG: It is an ion trap. I don't want to say it wrong. What's the name. Orbitrap.

DR. MADDALENA: Yeah, so the instrument, we're not using a time-of-flight, but I understand your question. And this picture is just the complexity of a standard chromatogram with fragmentation. So you have fragmentation going in the direction. I had to make it smaller, so you don't see the axis. I'm sorry. I'm sorry about that.

But, for example, at just past the 12 there on the retention time, you see a line of peaks going into the screen, that's a mixture and fragmentation taking place all at the same time. So that makes sense.

ADVISORY PANEL MEMBER BENNETT: (Nods head.)

DR. MADDALENA: Okay. So circling back. In the case of the SVOCs, often the extracts are tremendously complex. And in an analytical chemistry lab, you don't always see this complexity, because there are often steps taken before it -- the instrument is run. So there are chemistry steps where you separate things out, you remove things you're not interested in, and then just look for specifics.

But for the discovery phase of this, and the

targeted and non-targeted -- for the non-targeted, in particular, we did not want to take anything out ahead of time. And so you get very complicated chromatograms. The field chromatograms tend to be more complicated than the ones from the manufacturer for obvious reasons. You have things settling on the field. You have aging. You have sunlight, things taking place in these samples. So it's -- creates a lot more variability in what's in the sample, and so you get these unresolved peaks.

And as shown on that mass spectra -- or the 3-D spectra previously, they are just complicated, and you have to just work through that complicated mix.

--o0o--

DR. MADDALENA: Sometimes you get lucky. You still get fairly cleanly resolved peaks as shown in here that you can send through the process in a similar way. But when I put this up here, my first glance was, yeah, it's a great peak. But, in fact, there's something right there where the circle is as well. And so, again, mathematically you could send that through the system. And this is commercially available software.

In fact, this one is -- I believe it doesn't even cost, if you buy the other database software. This is developed as well. But what this software does, as I talked about with the VOC analysis -- I don't -- no, I

didn't do this with the VOC. So this is a new piece.

What this software does -- anyways, I think I did talk about it -- it de-convolutes the spectra, right? And so it find things that elute together and rebuilds a spectra, even in a very messy system and allows you to send that spectra through a library and match the cleaned up spectra.

--o0o--

DR. MADDALENA: Often, in -- almost always, it's not as good as a clean VOC same, but it still gets you close.

So I'm not going to go through that whole process again, but that's the main tool we use. The next tool that's available is chemistry, and we're trying to, you know -- at least in this stage of it, we're trying to avoid that to a certain degree.

So I'm going to talk a little bit about the targeted analysis and then we can go into questions.

In the targeted analysis, the reason we can do so good, our labs can do so good is -- and knowing what you're looking for, a good example is the PAHs, the polycyclic aromatic hydrocarbons. The method has been around for a long time. There's an isotopically labeled standard for a large number of these compounds. So you actually put an internal standard in that's closely linked

to the chemical that you're looking for, so your targeted compound.

In this case, you -- we ran that liquid injection without cleanup and looked for 18 or 19 specific polycyclic aromatic hydrocarbons. There's hundreds of them, right? There's hundreds of them. These 18 or 19 have been used by the EPA for 20 years. They're the poster child for PAHs and that's what we continue to go back to.

But the point is there's a lot more. Whether there's tox data to go with those is another question. But there are a lot more and this is just an indication of the PAHs in the system.

Patty indicated -- or mentioned SIM analysis earlier. And so when we're doing these SVOC analysis and we have a target that we're after, we can train the instrument to just look for that target and ignore everything else. And so you end up with a chromatogram that actually looks fairly clean, because you're only looking for a dozen mass ions and ignoring everything else.

And so you can -- you can really do a nice job getting down to super low levels, and, you know, femtogram levels -- high femtogram, low picogram levels on the column, which is -- even when I was in school working for

Tom, that was absurd. You couldn't. And so this is -- this is good stuff, and it really allows you to go well below what you would need for a risk assessment with high confidence.

CHAIRPERSON BALMES: Could I ask you this one question, so I don't forget it later. You had mentioned Europeans are focusing on PAHs.

DR. MADDALENA: Yes.

CHAIRPERSON BALMES: Are they focusing on a battery, or a like 18 like this, or are they focusing on the many hundreds of PAHs, or do you know?

DR. MADDALENA: They lean towards a smaller set, yeah.

CHAIRPERSON BALMES: Yeah.

DR. WONG: Yeah. They were look -- either I don't remember correct -- I remember correctly.

CHAIRPERSON BALMES: Ballpark, yeah.

DR. WONG: We have a meeting with them. They -- I remember probably it's around eight chemicals they were -- eight they were looking at.

CHAIRPERSON BALMES: Okay.

DR. WONG: And they actually say now they had to go back and revisit the issue.

CHAIRPERSON BALMES: Thanks.

DR. MADDALENA: Okay. So continuing the targeted

analysis. This particular analysis, another point to sort of take home in your decision make -- or in your critique of the methods is that in this particular analysis, because we're just looking for this class of compounds, we miss everything else. And so if I wanted to do phthalates, for example, I would have to do another run or I would do another run and focus on phthalates, and then another run. And so the instrument time is greatly increased if you're targeting specific classes of compounds.

The bonuses or the high -- the good side of that is that once you get a targeted analysis, a lot of this is automated. And so that helps kind of balance out the more instrument time, sometimes lead to less analyst time, if that makes sense.

--o0o--

DR. MADDALENA: So at the end of the day with the GC/MS side, what we're wear calling the non-polar extracts and the targeted compounds that we started with, it bumps us up to 130 confirmed compounds. There is a handful in there that are not confirmed, quite a nice handful. 182 peaks that we've got tentative identification through the following -- through the process that I described here that have not been confirmed.

And we'll talk in a few minutes on how to

prioritize how much we confirm and how much we don't. So, for example, if one of those is an alkane, or I noticed on the peak on the table earlier that argon somehow got through that list of unconfirmed compounds, and I don't know how argon got through the list. It came out of the instrument. It was seen by the instrument, and it -- unfortunately, I didn't catch it in time. So, yeah, there are 182 there. I would say 181, if you remove argon, because I could probably do that right now. But the question is how do you prioritize quantifying those or targeting those to put them into the other column, and if you do or not?

--o0o--

DR. MADDALENA: So, in summary, targeting chemicals sort of helps us get better vision. It helps us look closer, look at lower concentrations, and with a lot more confidence, if it's a targeted compound. The tradeoff is when you're targeting things, sometimes you don't see other things. You get under the street lamp, the cartoon earlier sort of shows.

The sample enrichment is an option for bringing low level concentrations up. But we were hoping not to need that, and we've been successful thus far in not having to -- enrich is a simple way of saying concentrate things. So I evaporate the solvent off and try not to

lose the chemicals I'm interested in. And that gives me a higher response. But we -- we're essentially running these compound as extracted without a lot of those steps.

The other one that's fairly easy to implement, but it takes some time is our concern about that unresolved hump. That would probably be greatly diminished if we did just one cleanup step of the sample, but we would essentially lose all of the alkanes in that one cleanup step.

So in this stage of the search and discovery phase, the non-targeted analysis we chose not to do any cleanup. And the picture you see on the side, I -- unfortunately, the scales went away. But for the full scan, you kind of need big peaks to see in the full scan. The selected ion monitoring does some cleanup for you and allows you to just look at specific molecules.

So that's kind of the overview of where we're at with our process of populating that table with confirmed and tentative chemicals. And then you've got a long list of chemicals in a table that we're still working back and forth on.

CHAIRPERSON BALMES: Dr. Avol -- Mr. Avol, why don't you go first.

ADVISORY PANEL MEMBER AVOL: So I have a question in terms of your prioritization, and going forward with

identifying these, thus far, unidentified peaks, but peaks that do -- that you're tar -- potentially targeting for more discrete analyses. Are you thinking about looking at these in terms of toxicological classes or based on some biological input or are you looking a this from sort of a chemist standpoint that here's a peak that I don't -- I can't discretely identify, so I want to identify this just to know what it is.

DR. MADDALENA: Yeah. The -- I was just handed a note. I'm not sure what it says, but --

(Laughter.)

DR. MADDALENA: -- I'll answer anyways, and then I'll -- I hope I -- I hope I answer it correctly.

So when you say a peak, in general, we've -- on our tentative list, we've got names associated with those peaks. And I think your question was how do we prioritize confirming those names? And, in fact, the toxicology plays into it. The size of the peak plays into that decision. So there's several things that play into that decision. You can scan through the list fairly quickly and find a lot of things that are almost certainly of insignificant toxicological importance. And those could go to a lower priority. There are some things that we just don't know and there may not be toxicological information for it. So those are sort of in this middle

range.

And I think we'll look at a -- we'll revisit this topic in the next -- at the end of the next presentation too, so we can kind of get more information. But that's -- my answer is that, yeah, we are trying to prioritize it based on several factors, toxicology being one. So that -- does that answer your question?

ADVISORY PANEL MEMBER AVOL: Yes.

CHAIRPERSON BALMES: I just might jump in, Ed. In the next presentation at the end, slide 16, are the questions for discussion, where they actually want our input on all these questions. So you jumped the gun a bit.

DR. MADDALENA: Yeah, so that's what was on the list. I just put the glasses on.

CHAIRPERSON BALMES: Any other comments or questions?

ADVISORY PANEL MEMBER BENNETT: I had a quick clarifying question. So the 32 on the -- on the previous slide, those were your targets that you had purchased before you started this whole project, right? And then 182, you haven't purchased any of what suspect you saw or the 32 ones that you've already said, okay, we saw this and we want to go back and confirm it, or --

DR. MADDALENA: The 32 are ones that we either

had standards in the lab that we were able to confirm it right away or we purchased those standards, because they were, for whatever reason, rose to the right away. So those are confirmed

ADVISORY PANEL MEMBER BENNETT: Okay. So that you've already started prioritizing. You didn't have a target list going in.

DR. MADDALENA: No, entirely -- not entirely. We didn't have it entirely, especially for the SVOC side. We didn't a target list going in, because we didn't do SVOCs in the chamber as a -- sort of a reminder. So we did -- going into this, it was a matter of running that extraction and then starting from scratch.

ADVISORY PANEL MEMBER BENNETT: And then did you not -- so the 32 that you confirmed, were those all successful or did you have some that you're like, ooh, we thought it was this and it wasn't, and it became an unknown at that point or would the one -- the first 32 all correct?

DR. MADDALENA: The 32 are ones that have been correct. They weren't all correct off -- right offhand. There were some that we ran and didn't see.

ADVISORY PANEL MEMBER BENNETT: Okay.

DR. MADDALENA: And we'll talk about in the LC side, it actually happened a little more often, where we

purchased standards, ran the standards, and thinking we going to find peak A, but all of a sudden, hey --

ADVISORY PANEL MEMBER BENNETT: It wasn't.

DR. MADDALENA: -- that's peak B. It's there. We got lucky. We weren't buying the standard for peak B, which was a smaller peak, but it seemed to match up. So there is some intuition that goes into it as well, when you start looking at different versions of benzothiazole, for example, different functional groups on that particular structure. They may be little smaller concentrations, but it's like hey, that might be there.

ADVISORY PANEL MEMBER BENNETT: And then do you --

DR. MADDALENA: It may not be the peak you're looking for, but it could turn out.

ADVISORY PANEL MEMBER BENNETT: So I know with time-of-flight, if it's got something that's in kind of the halogen column, then it's -- like, the -- your probability of being right is much higher. Is there something similar with the technique that you're using. And then of these 182, did you have a lot of things to have something from the halogen compound -- column or no?

DR. MADDALENA: I don't think so. Not a lot of halogens, but a lot of --

ADVISORY PANEL MEMBER BENNETT: Yeah. Okay. I

mean, I wouldn't think so --

DR. MADDALENA: -- nitrogen, sulfur.

ADVISORY PANEL MEMBER BENNETT: -- for the crumb rubber. So it's going to be all these weird ones then.

DR. MADDALENA: Nitrogen and sulfur, oxygen obviously, those guys show up. And so you've got -- but not a lot of halogens, no.

ADVISORY PANEL MEMBER BENNETT: Okay.

CHAIRPERSON BALMES: So maybe just one last question from Dr. Sheldon.

ADVISORY PANEL MEMBER SHELDON: Well, I've got two questions.

CHAIRPERSON BALMES: Well, two questions. Okay.

ADVISORY PANEL MEMBER SHELDON: So the first one is is when you did your extractions, you did an extraction in hexane acetone and then you did a methanol water, were those sequential in the same sample?

DR. MADDALENA: (Shakes head.)

ADVISORY PANEL MEMBER SHELDON: Okay. Good. Because I was going to say -- that's good.

Then, you know when it comes to the --

DR. MADDALENA: No. I shook my head for the radio. No.

ADVISORY PANEL MEMBER SHELDON: What?

DR. MADDALENA: I'm sorry. I realized I shook my

head and -- I know he's trying to record it, and it didn't help.

ADVISORY PANEL MEMBER SHELDON: Oh. Oh. Okay. Well, the answer is no, so that you're not --

DR. MADDALENA: Yes.

ADVISORY PANEL MEMBER SHELDON: Okay. Good.

Okay. So the next thing is is that, you know, on this hump thing. As you say, it's all alkanes. Actually, your last bullet says it all, you know, it makes the performance of the column worse. It degrades the instrument more. I would think that if you fractionated, and got rid of all the alkanes, I don't think there are any really toxic alkanes that we're concerned about in that area that you're going to just make your life easier.

And you already have the data that shows -- you know, even if you don't throw them out, you're not going to detect anything there. So I would think just getting rid of that alkane hump would give you the opportunity, if there are other compounds there, to identify them. And I think the tradeoff between cleaning up and not having to re-cleanup, and re-cleanup, and reclean-up your instrument would be a whole lot better.

So if you had a question about that later, you have my answer on that. You should just get rid of the alkanes.

DR. MADDALENA: Outstanding. Thank you. Appreciate that.

ADVISORY PANEL MEMBER SHELDON: Can I ask one more question?

DR. MADDALENA: Yeah.

ADVISORY PANEL MEMBER SHELDON: What was the percentage of things that you identified versus the total hump of stuff you had there? I bet you it was probably about 5 percent?

DR. MADDALENA: Well, it depends on how you draw the baseline on that hump, right?

ADVISORY PANEL MEMBER SHELDON: Oh, okay.

DR. MADDALENA: Because if you draw the baseline and follow the hump and ignore --

ADVISORY PANEL MEMBER SHELDON: And ignore the hump?

DR. MADDALENA: -- ignore it a little bit to a certain degree, yeah, it was very -- it would have to be a very small number if you actually included that in there.

ADVISORY PANEL MEMBER SHELDON: Okay. Thanks.

CHAIRPERSON BALMES: Okay. I think we better move on. Is Patty presenting the next...

CHAIRPERSON BALMES: No break at 1:50.

(Laughter.)

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DR. WONG: So I can start talking. We just did a beautiful presentation on how automatic you can do with the GC/MS non-targeted analysis. I'm not saying it's easy. The next picture we're going to show the non-targeted analysis of polar constituents.

As I said, polar chemicals, they behave differently and they require the liquid chromatography/mass spectrometry, which is not as established for doing non-targeted analysis.

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DR. WONG: So like I said, most of the polar chemicals, because of it's high solubility in water, they're not suitable for GC/MS gas chromatography/mass spectrometry analysis. So we choose using the LC/MS the liquid chromatography/mass spectrometry.

The idea is the LC/MS results will complement with the GC/MS to look for different portion or different class of chemicals, so to provide a comprehensive analysis of the field samples. So like I said, this is more like a research when we go to the LC/MS non-targeted.

To make it more efficient and more standardized, we developed a two tiered non-targeted approach to analyze the LC/MS data. And we also apply advanced computational tools try to improve the success of identifying candidates of unknowns. LC is different, because we don't have data

rich on experimental spectrum like the GC. We do have some available. So we'll go into that a little bit later.

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DR. WONG: So with the tier 1, we start with a suspect screening analysis. So we use three different database to look for chemical that -- basically, these three databases have a different focus on chemicals of interest.

The first one is the OEHHA chemical list that we introduced earlier. These are the tire-related chemicals. So we are really looking at under the lamp post, whatever people has been reporting. And with the current information, that's -- we are accumulating.

And then the next one we look at is a proprietary software compound discoverer. It is self search ChemSpider database, which contain a huge number of chemical structures. And some of these or many of these are pharmaceutical, pesticides chemicals as well. And we also searched the U.S. EPA database, the chemical dashboard, which search the DSSTox database is a collection of chemicals that's of U.S. EPA's interests, chemicals like pesticide, environmental contaminants, pharmaceutical, food additive, high production volume chemicals, et cetera.

So here, I want to illustrate how we do the tier

1 analysis.

Sorry.

ADVISORY PANEL MEMBER KYLE: I think it would help if you could advance the slides. Oh, here it goes.

DR. WONG: Yeah, I'm going.

So, for example, this particular chemical we look for is one 1,3-Dicyclohexylurea is example. Here's the workflow how we look for tentatively identify -- how we tentatively identify these unknowns in the crumb rubber extract.

Remember, these are polar extract. We inject it into the LC/MS. The system we choose to use is a linear ion trap, orbitrap system, which provide a very high accuracy on the molecular weight, molecular mass -- mass of the molecular ion. Sorry, I have to take it back.

And some of the study has report this equipment has a very sensitivity with a detection limit at the level of 0.5 to 20 ppt level of chemicals in wastewater.

So we inject it to LC and using the software come with the LC/MS, Xcalibur, we extract the signal and we plot it in 3-D. We'll have other 3-D chromatogram later to go for more detail.

But here's example. We have a peak at around 30 something minutes. And the mass ion and Z ratio is 225.1967. So the machines is very accurate. So we take

this mass ion and then we put it through a compound discoverer. It will convert it back to the neutral mass, and it will search for the ChemSpider what are the chemicals in the database that has this mass ion or this molecular weight? We also truncated to two decimal place and go through a mass -- molecular mass match in our database. Now, we're looking at tire-related chemical.

So luckily for this particular chemical, we have one hit. It's the dicyclohexylurea. I want to make it -- yes, dicyclohexylurea. And we put this chemical in the tentatively identified chemical list, because we haven't confirmed it.

To make it in which we might not be a tire-related chemical, we also put in the U.S. EPA DSSTox database. And now because of the high accuracy of the molecular ion and we put it through all the decimal place, and we go through the search. And, of course, it come up with more than one chemical.

So we select which dicyclohexylurea to buy and we purchase the reference standard. And we have confirmed it based on the retention time, as well as the mass spec fingerprint.

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DR. WONG: So for the manufacturer's sample, one sample in a single scan in our liquid chromatography/mass

spec, and it -- of course, it come up with multiple peaks. And by searching the ChemSpider database using compound discoverer, it's more like a semi-automatic search.

The database itself has 72 million chemical structures. It come up with 700,000 possible, based on the 225 -- 224 molecular weights. And we research it through the DSS database, which has 850,000 chemical structures in the database. It come up with more than 80,000 chemicals for that particular molecular weight.

We searched through the OEHHA -- sorry. I take it back. It was a whole scan, not just the 225. It's the whole scan with all the peaks. They come up with 800,000 possibilities of chemicals.

We searched through the OEHHA tire-related chemical list. It -- we used Excel to just match all the molecular weights come out, and we find 250 chemicals as a possible candidate. And we have selected 27 of the chemicals for our first attempt to buy and to confirm the unknown chemicals.

And these standards go through three different passes of possible how to analyze it and confirm. Go back to the GC/MS to look for if that chemical is there. It go through the LC/MS with two different ionization methods, the positive versus a negative. Some of the chemical structures are more easier to be ionized under the

positive mode versus the other is more in a negative mode. So it depends on the structure of the chemical and the functional group on this -- on the chemical. So as we have shown here, this is like -- it's, I would say, almost impossible, pretty much impossible to go through the 700 or the 80,000 possible chemicals to look for what is -- what we don't know or what we might know.

So because of that, we develop a tier 2 analysis.

CHAIRPERSON BALMES: Before you go on to tier 2, did you say how you picked those 27 to purchase initially?

DR. WONG: Yes. We -- I didn't. That's actually the question at the end, but we did have a lot of discussion back and forth with the lab. Multiple things considered is if the chemical is tire related, it's there for a reason. Do we see in the manufacturer's sample as well as the field sample? Do we see it with a reasonable size peak?

And then this another one -- oh, is this supposed to show up in the LC? Because some of other chemical shouldn't -- it's just -- it's just not so non-polar. It should not be in the extract -- or being a polar extract. So with all those factors in, we pull up our first attempt is to let's get some standard and see whether the method works. Yeah.

CHAIRPERSON BALMES: Thank you. That was very

help.

ADVISORY PANEL MEMBER SHELDON: Can I ask a question? I'm not clear on all of this. So here, the number of possible chemicals came when you had truncated the mass of that particular spectra to two decimal points, is that right?

So you --

DR. WONG: I said it by mistake. This is a full scan --

ADVISORY PANEL MEMBER SHELDON: It was a full scan --

DR. WONG: -- one sample.

ADVISORY PANEL MEMBER SHELDON: But how far, how high resolution was it? Because the higher your resolution, the lower number of chemicals there are going to be. So how high a resolution was your scan?

DR. WONG: It's a very high resolution that the scientists who run the instrument tell us.

ADVISORY PANEL MEMBER SHELDON: But you --

DR. WONG: One to two ppm difference accurate mass --

ADVISORY PANEL MEMBER SHELDON: But you said on the slide before that you truncated --

DR. WONG: We truncated to match with the OEHHA list. We did not truncate it when we go through the DSS

search for the ChemSpider search.

ADVISORY PANEL MEMBER SHELDON: Oh, okay. Okay. That's what was I trying to -- and then the other thing is is that this was in the positive or the negative ion mode?

DR. WONG: This is the positive ionization.

ADVISORY PANEL MEMBER SHELDON: So, in fact, you were getting mass fragments not just the molecular weight mass -- the molecular mass. Because a negative ion, you don't break up into mass fragments, is that right?

DR. WONG: Both of them break up for the --

ADVISORY PANEL MEMBER SHELDON: But negative ion is much less susceptible to that. So you are getting -- all of these things, you're getting many different fragments. So that's also sort of complicating what you're doing.

Okay. Thank you.

DR. WONG: Yeah, we show --

ADVISORY PANEL MEMBER SHELDON: I just -- I just wanted to understand what you -- what you were doing.

Thanks.

DR. WONG: Yeah. So this is the positive scan of one sample with a full scan with all the peaks the possibility come out.

CHAIRPERSON BALMES: Thank you, Patty. Why don't you keep going.

DR. WONG: Okay.

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DR. WONG: So of the 27 target we put in, so far we have confirmed 18 of them. You can see there's several different classes of chemicals. And this -- again, this is only the positive mode. We have not finished with the negative mode.

And we see that there's a benzothiazole group of chemicals. We have acids. We have aldehyde. We have a lot of amines and amides in it. We're not just seeing one specific class of chemical.

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DR. WONG: So as I said, we need to have a tier 2 to look further down to what we can identify. So, in the tier 2, we use cheminfomatics tools to assist in identifying candidates. We use both of the MS1, which is the molecular mass. The first level of the mass spectrometer data. We also use the fragmentation data, which is the MS2 data. Now, we're looking at the different fragments of the chemical.

And by using the LC analysis, we injected, and visually inspect the peak. We take out the MS2 data. Now, we put it into the cheminformatic tool, and then look for a spectral match. And then the Chem tool tell us these are the potential candidates and how could they

match from 1 to 2 all the way down.

And then we pick the top 2 candidate into our tentative identifying chemical list and prioritize it, and go through the confirmation process.

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DR. WONG: So we have checked out five different cheminformatic algorithms.

The first one is the MetFrag. U.S. EPA is incorporating this particular software tool into the DSSTox database. We test it out, and there's -- we also want to test out different tools, because they have different focus, they have different spectral information.

The GNPS, the next one, Global Natural Products Social Molecular Network focus on natural products. The XCMS focus on pharmaceuticals. Compound Discoverer has their only little database. And then also the Competitive Fragmentation Modeling ID, which is a tool that train on 11 very diverse database. And it collects spectral data from it and also generate in silica spectral data for chemical. So it has a hybrid. So we choose to use the CFM-ID for the reason here.

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DR. WONG: Here is the result. Since already have 18 chemicals, we have the spectral data. So we know what's that chemical. Now, we take those data back into

the cheminformatic tool. We have fragmentation fingerprint. Do you give me -- the chemical name as the top candidate?

So it's a validation method to see how well this model behave in our chemistry world. Different chemistry, different chemical might have a better database -- different database, so we track -- try to test the CFM-ID.

Luckily, CFM-ID predict pretty well. Of the 18 chemicals, 11 of the standards show up as the top candidate. Five show up as 2, but we do have 5 -- sorry, 2 show up as the number 2, and 5 is not on the candidate list, because they have a first screen is what is this molecular weight, and they pull out all the chemicals from the database, and then they match it.

So the five chemicals we have not even in that candidate list. While we use MetFrag, which is a total in silica, they predict the spectrum of data, we have none hit for our 18 chemicals, so which -- that's why we choose the CFM-ID for our tier 2.

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DR. WONG: So I'm going to go very quickly on showing how the data look like the data we used for our non-targeted analysis and use the CMF-ID as our tool to identify these unknowns.

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DR. WONG: Okay. So I'm going to let it start spinning. Look at the bottom is a LC chromatogram with retention time. The predominant peak is at 27 minutes. The Y axis is the intensity of the current. And we thought that we have very sharp peak at 27 minutes. You can look at the 3-D chromatogram. They actually consist of at least five predominant relative high peaks with different m to z ratio.

So that's the ability of this equipment has a very high resolution. And even in the LC side don't have the resolution, being two mass spec in tandem, we actually have the MS2 data, and we can have the resolution based on the m to z ratio.

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DR. WONG: So again, this is the chromatogram for LC for the manufacturer's sample. I want to show you how the field site composite Sample look like.

Again, we see a hump here. Just very similar to the GC side. We have a lot of chemicals in there. Now, the question is how do we draw the baseline to find out where -- how high the peak is. So we put in the 3-D.

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DR. WONG: We're going to spin it again and look at it. Actually, the hump may not be as bad as the GC issue, because we can resolve it by the m to z ratio. And

you can see that within the hump, we have some peak that is pretty sharp, really well defined, because we do have the MS2 data in it. And also, the m to z ratio able to resolve the peak a little bit better.

And one thing I want to point out here is you see a very different pattern on peaks between the field sample and the manufacturing sample. The predominant peak is different. It shift to more earlier time. And we have a series of peaks in behind, which we're actually able to see and identify what are those chemicals.

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DR. WONG: So I mentioned about negative mode. We also do negative run. We're in the process of finishing the data. We also collect MS2 data, the fragmentation data, for the negative ion, that we be -- we are in the process of analyzing it.

Again, you see the LC chromatogram how it resolved in the column just by retention time. And this is the positive mode for manufacturing sample. We have two different composite samples. They look fairly similar in this. And then you look at it, this is a negative ion mode. There's a shift on the lower peak. The predominant peak is the later time, is different -- in a different position.

It suggests that, because we use the same LC

system, if the chemical are there, it will show up in two different ionization mode, it would be -- still show up at the same retention time. So if they show up with different retention time, we're sure that they're different chemicals.

So the data here, the pattern here suggests that we probably should run our field sample in both modes, because we are actually capturing different class or different chemicals.

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DR. WONG: So again, let's look at the positive and negative mode for comp 2. This is composite sample 2. You can see on the screen, when I look at, the green side. The green is a positive mode, which is the screen on the left-hand side now, and brown, which is the negative mode. And you if you look at the 3-D, we -- for this particular composite sample, we captured a much wider spread of chemicals in the negative mode, and also we got a lot more peaked in the negative mode than the positive mode.

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DR. WONG: So this is just to show how complex the LC and also how the technology can help us in identifying the unknowns. And so far, we haven't analyzed any tentative chemical for the negative ionization mode. So based on the positive modes, so far we have identified

70 -- sorry, 47 peaks with 47 tentative chemicals in our database.

And that bring up to 228 unique chemicals in our tentative identified chemical.

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CHAIRPERSON BALMES: So rather than read all these questions, I'll have my colleagues look at this. Do you want to say anything in general about the questions for discussion before we launch into discussion?

DR. WONG: Yeah. We are looking at your input on how we approach it, because we tried to use the database to screen it, which is a quicker way. But then chemical informatics has their own shortfall, because the model -- it depends on the model focus. You may or may not get the chemical. So we would like to have your input on how we better approach it or anything that we might have overlooked.

Also, we prioritize the chemicals based on different factors, and we would like to have input. Did we miss anything? What is the best way how we select the chemical in a different level of looking at these tentative chemicals? I think that's the main point.

CHAIRPERSON BALMES: Thank you, Patty and Randy. And I just want to say, from me, I think you did a really great job of going through complex material. And because

we have to have time for a public discussion, I'd like to keep our discussion right now to about 10 minutes, and then we'll come back after the public discussion to have a -- I'm sure we won't be done in 10 minutes with these questions. But I think that's a way of making sure that we incorporate the public.

And there are probably a number of people both in the audience and on the internet that have been waiting patiently. So would that be okay?

So who wants to start off?

ADVISORY PANEL MEMBER KYLE: I do, because I have a simple one. May I?

CHAIRPERSON BALMES: You may.

ADVISORY PANEL MEMBER KYLE: This is all very impressive and I think I got about 80 percent, so that was excellent.

(Laughter.)

ADVISORY PANEL MEMBER KYLE: But there's something that's important about this that we haven't talked about, I think. And that is in the context of this project, ultimately, we have to decide what a level of due diligence is here, you know, for the State to do this. And, you know, it can't be infinite and it has to be enough. And it has to be the right amount of enough here, because the State is paying to get this done. You know,

they're paying people to put this stuff in these.

And so some vocabulary from what you all are doing about how to talk about that I think it's going to be important. Do you understand what I'm saying? And I'm just going to say that, because I don't have a suggestion. You know, I have to mull this a little bit more. But it's an additional thing to just getting these results. It's like how do we describe how much we did of what the uncertainty is.

Thank you.

CHAIRPERSON BALMES: Did you want to -- did you want to respond to that at all at this point.

ADVISORY PANEL MEMBER KYLE: I'm not asking them to respond.

CHAIRPERSON BALMES: Okay. All right. Linda.

ADVISORY PANEL MEMBER SHELDON: So there are two things. With the polar organics, it's sort of interesting, because I -- now, correct me if I'm wrong, but from my -- the -- my old brain, polars tend to degrade a lot more rapidly than those things that are not in polar. And so my question is is that knowing what you do about -- you know, the samples look completely different from the crumb and the other, and they look more similar in the others. And so I guess is there a way you can start to sort of look and say, you know, are all of these

tire crumb things really just degrading in the environment to something else? And if they are, then, you know, how do we deal with that? Because that may be something important to consider, when and if you actually do the non-polar analysis.

The other thing is is when it comes to prioritizing chemicals for confirmation, again, when you're trying to look at risk assessment, and a lot of these chemicals don't have the toxicity criteria. And Lauren, you may -- you may not agree with this, but I do know that, you know, in EPA, they do structure activity analysis.

And, you know, maybe what you want to do with that whole slough of non-polars and things that you're not dealing with as a structure activity analysis, and say which ones are potentially toxic, and then go from there. And so that might be another thought. But both do you do them because they -- you know, do you even bother because they degrade or given the ones that have degraded, you know, are any of them potentially toxic, and, you know, then proceed from there.

DR. WONG: That's one of the reasons when we sample, we sample fields of different ages. And we want to capture if chemical degrade and also environmental deposition into this rubber. And we believe some of the

components are deposition, some are degradation. We totally agree.

We're actually surprised to see these field samples has so many polar chemicals. And they seems to be hanging there or they are deposited onto it. So like I said, yeah, like, you suggest, it's very good idea to look for chem -- look at the chemical as a class, especially for chemicals that has weaken database or toxicity. We are looking into how we -- first of all, we have to find what are these chemicals, and then we're looking how to bin this chemical into different classes, and looking for alternative methods on how can we address the toxicity issue here.

So everything are going --

ADVISORY PANEL MEMBER SHELDON: Well, and those count -- those field have been in the environment for one to three to 10 years, and they are sinks for everything that's out in the environment. So, you know, you also have that which is an issue.

And I don't know if you deal with it saying, well, they're a big sink and we have to deal with it or, you know, this is not really the tire crumb that we're worried about.

DR. WONG: I think we're going to need to have a very in-depth discussion on what it means. But

definitely, we're looking at it from the exposure point of view. People are exposing to this chemical. That's how -- at this point, how we look at it.

CHAIRPERSON BALMES: Dr. Bennett.

ADVISORY PANEL MEMBER BENNETT: On Linda's comment about the degradation, I think there's some Swiss tools that do degradation products that you can then integrate in with some of these methods and try and look for degradation products. And so maybe taking like your tire-related thing, running they through the Swiss software that predicts the degradation products, and then looking for those might be a way to help understand what's in the field.

So I was just surprised, because on the LC, I know that at UC Davis we've -- I work with Dr. Young, who's got one of the LC time-of-flights. And I know he uses a bunch of Agilent databases for suspect screening on the LC, because he's got like the Agilent MassHunter of Forensic Toxicology Database with 8,000 chemicals, a water contamination one with 1,400. Is this just a different machine and Agilent doesn't have those databases or did he -- or is that something that he purchased in addition or...

DR. WONG: This is a thermo scientific orbitrap.

ADVISORY PANEL MEMBER BENNETT: Oh, it's not the

Agilent --

DR. WONG: So It's much sensitive than the TOF.

ADVISORY PANEL MEMBER BENNETT: Okay.

DR. WONG: And also, it's much more accurate. And the reason we do these two, because LC world is -- doesn't have standardized protocol. Each fragmentation or retention time is going to be method dependent and also your equipment dependent.

These database in general, they collect experimental database and you can compare the best you can. You may not get 100 percent match. Not like the GC world is so petty. That's why it's critical that once we get the suspect, we confirm it with our reference standard. Then we know exactly this is it.

We don't get 100 percent match on the suspect, but we do get 100 percent match on our standard versus our sample we suspect. So it's only if you run it through the same equipment.

And the CFM-ID itself do have more than 200,000 unique chemicals and has experimental data embedded in it to get a in silico spectral data. But they don't necessarily means the exact same condition we're running this profile on the software, the energy on the equipment. So it's going to generate different pattern.

ADVISORY PANEL MEMBER BENNETT: Okay. And then

on the tox data, I'm assuming it -- because it said that you were doing some of the EPA databases. So I'm assuming you're doing all that sort of in vitro ToxCast. You're using that to kind of rank some of the toxicity of these chemicals, because you can kind of poll those databases of those compounds that they've done the high throughput in vitro screening, and that might be a quick way to get some tox prioritization on some of these.

DR. WONG: Yeah. We are looking into that. We do pull -- we are collecting those information.

ADVISORY PANEL MEMBER BENNETT: Okay. And then I had a list. I had a comment tool on QSAR tox models. Like Linda and I had a list of ones that I thought might be useful that I can give you.

DR. WONG: Definitely.

ADVISORY PANEL MEMBER BENNETT: Okay.

DR. WONG: So to get back to your degradation, if you look at the peak, we have a range of peaks. We have identified tentatively those are polyethylene glycol. And as it age, it break down losing a -- one of the carbon as it go. That why it's like a ridge. You have peaks after peaks in the very diagonal pattern, so it helps us look for also degradation.

CHAIRPERSON BALMES: Mr. Avol.

ADVISORY PANEL MEMBER AVOL: So possibly in a

vain attempt to stay within your ten minutes, let me jump around on a number of things. First of all, very impressive set of wide-ranging analyses. I think, you know, the underlying theme or a common theme that we come back throughout the morning and the day has been this notion of how you're going to more effectively communicate this in the document. And I think that's an issue here.

You provocatively identify in a couple of these things in -- you know, for example, in slide 13 that the spectra between the samples looked different, as well as on the negative and positive sides being different. And so it raises the question of sort of how reproducible this is when you do this on the same sample, and how variable it is in the number of field samples that you have. And it even raises the question of how many field samples do you have? I mean, we have some fields that are new, that are old, that have been out in the sun, et cetera, that have been refurbished.

And so from the public's perspective, I think we want to know what is the range? I mean, you can analyze -- you can get this incredible spectra out of one field. But what does that tell us about -- you know, what does a composite mean?

DR. WONG: Yeah. Great -- very great comment and question. We are at the stage of identifying targets, so

that's why we create a composite sample to capture what are other ions, or metals -- sorry, what other chemicals that is in the rubber that's releasable?

We are not -- once we get the target list, we'll move on to the field sample. Then we'll look at the reproducibility, accuracy, the concentration versus the ID, the age across the field. Those are the issues that we have to deal with once we final the chemical, we find a reference, we'll move on the field. And definitely, that's a very important question to address.

But we're at the stage of what do we have before we go into the field sample? And we have repeat this analysis -- this run in some of the samples. And we have persistently seeing those predominant peak. I would not say they're exactly the same every time. But most of the predominant peak, we see it. We see it most of the time.

ADVISORY PANEL MEMBER AVOL: Okay. So again, when you actually get to the communication part, "most of the time" needs to be sort of defined.

(Laughter.)

CHAIRPERSON BALMES: Okay. Well, more discussion to follow the public comment period, but I think we should move into the public comment period now.

So do we have to say anything special to the folks online?

Yes. I just would remind those who are participating by internet, you can send comments via email to syntheticturf@oehha.ca.gov.

While we're awaiting any internet comments, I have about five here. Again, there will be a three minute time limit. And no special order. Why don't I ask Robert Blink to come up.

DR. BLINK: Hi. Dr. Bob Blink, occupational medicine practice in California. I also do some consulting through the International Carbon Black Association.

I had some things I was going to say, but I've rewritten them after the second half today. And I would like to focus on the communication part that will be coming soon. And I think that, you know, the science involved here is so impressive and so complicated, that even for people who are used to analyzing and reading about these sorts of things, its quite a struggle. And I think the 80 percent estimate is a good one.

So in communicating to the public, I think I would really stress, if we can, to explain things in a way that people can understand in plain English. If I'm a parent and I have a child who comes home with covered black crumbs -- I mean, the crumb rubber crumbs in his or her underwear, that's what I'm concerned about and not the

fine points of the -- of how extractions are done.

So, number one, hazard assessment versus risk assessment, where we're identifying chemicals that are conceivably present, that may be a hazard. But at the concentrations that they're actually found, it's almost certainly not a risk for the vast majority of these. And I think that's really important to communicate, because that's what people are going to want to hear.

Anyway that you -- the precautionary principles that were used to set up the assumptions and estimates that are being used. I think understanding what the precautionary principle is and why that's important to the readers is also important.

And any uncertainties in the study, such as whether harsh extractions are really relevant, as to whether abrasions actually we understand what the absorptions might be. I think that delineating those clearly in a strength and weaknesses section of the report in a way that people can understand would be important.

And then as much as possible, if risks can be communicated in English, like don't worry about it or risk one in a million, or risks are similar to what might be found in an office setting or in a home setting, or whatever those plain English comparisons could be, I think that would be very useful.

Anyway, wonderful work. Thanks, everybody.

CHAIRPERSON BALMES: And thank you Dr. Blink. Those were I think insightful comments.

Okay. Again, no special order, Steve Krauss.

MR. KRAUSS: Thank you. I'm Steve Krauss with CRM Rubber. I'd like to actually, first of all, thank all the participants of the study. I know it's been a long exhaustive process. You guys put a lot of time and effort. And as well as to the advisory members, we definitely value your insight and feedback. I think it's really critical to a process like this.

And so that being said, we really look forward to, you know, getting the ball over the end zone and when we get to an actual conclusion and final analysis. I think, you know, as a vested member, you know, from our company's standpoint looking at our employees, employee safety, and then just as a parent, a father who has kids that play soccer as well, I'm very interested to see the final conclusion and analysis.

I also agree with Dr. Blink, I think putting a cap or summary on this that helps the non-technical person understand and relate to, you know, how this -- how maybe exposure or hazard assessment relates to other consumer products, or maybe child safety -- or child products would be really helpful.

A couple of other things. Throughout today, we've talked about artificial fields. And I think a couple of questions I have is throughout your study and your samples that you pulled from the fields themselves, did you guys evaluate what part of the composition was sand as opposed to crumb rubber?

So generally in fields that are being installed today, about 3 pounds are -- per square foot is crumb rubber, and 6 pounds sand infill. So you have kind of a 1/3 ratio crumb rubber, 2/3 sands. So when we look at some of this ex -- when we talk about different exposure, or inhalation, or maybe risk associated with cuts and abrasions, are we talking about the mix composition or are we looking at just the crumb rubber of the composition? So are we diluting maybe your formula and maybe what -- how much you think is being consumed of the mix as opposed to just crumb rubber?

So just something, feedback in just thinking about and making sure that it's representative of the total. Are we talking about the infill composition or just the rubber?

And lastly, I think, you know, we've heard a lot of great comments and feedback from the Advisory Committee today and throughout this process. One thing that I get a little bit concerned about is a lot of attention has been

talked about about maybe different extreme situations or extreme variables. And I want to make sure that we just don't couple extreme variable on top of extreme variable, that down the road you don't have a final analysis that is not necessarily representative of what the common exposure or the general health risk is.

So thank you for your time, and again, I really appreciate all of the hard work and dedication you guys have all put into this study. Thank you.

CHAIRPERSON BALMES: So thank you, Mr. Krauss. Does staff want to respond to his question about the sampling, you know, and how much the sand versus the crumb rubber there is in the samples?

DR. WONG: We ask -- we have questioned and asked the people who owned the field or installed the field how much sand you put in? Is it pure rubber? We have field that's pure rubber. We have field that is sand and rubber mix. And we have field that is cork and rubber mix.

So we have those documents. But when we sample, we sample where we can get down and get to the file. So when we analyze it, we analyze this, this is exposure unit. People expose it as a unit from the turf, from the soil, from the fiber, or from the rubber, or from the sand. So just how we analyze it.

CHAIRPERSON BALMES: SO just to make sure I'm

clear, so if it's two parts sand, one part crumb rubber, then there would be an effective dilution of the crumb rubber?

DR. WONG: It could be. It could be or like the sand has other ingredients in it.

CHAIRPERSON BALMES: Yes.

DR. WONG: And also, the sand and the rubber, they eventually -- the sand is heavier, the rubber is lighter, so they do -- most time we see it separate. We try to scoop the surface. We don't want to break the turf, so we try to scoop it to the most surface layer. But sometimes when we dig further, we do see a lot of sand. We agree the observation.

CHAIRPERSON BALMES: Okay. Just a quick comment.

MR. KRAUSS: Quick comment. One last thing is unfortunately I don't know that this particular study will compare synthetic fields to that of natural turf. I think it's really important what are the other alternatives that are being used out there, whether it's natural turf, whether it's artificial turf with cork, with other different types of infills. There's husk. So there's a lot of different other variables that are getting implemented in these artificial turfs. I would really think it would be beneficial for the public to know what's the health risk of all these other option alternatives as

well, not just crumb rubber.

So thank you.

CHAIRPERSON BALMES: Okay. So our next speaker is Robina Suwol. Did I say the name right?

MS. SUWOL: Yes.

Good afternoon. And tremendous thank you to the science panelists, and to the OEHHA staff, and the collaborators for your time and commitment. A special thank you to Patty and Jocelyn for all of your hard work on this.

We also join with everyone who's also made the suggestion, if there's a way to take this incredible data that's been created and information and to make it more easily understandable in a format for the public, I think that would be really helpful.

I have just a couple of comments here today. And then I received a couple of texts from some young soccer players and they asked me if I could make those comments.

So my other comment here though from California Safe Schools is that with -- in regard to risk assessment. You know, we all are aware that it doesn't take into consideration preexisting conditions, sensitivity to toxic chemicals, or cumulative impact of other exposures.

And truly, the bottom line on all of this is that tires are considered to be so highly toxic, that they

cannot be placed in landfills. And yet, when they're ground, and they're used on children's mats, athletic fields, pathways, or playgrounds, your own studies, as well as other -- many other studies continued to confirm that they contain toxic substances. They're not removed when they're ground.

And this continues to be deeply disturbing for us. And we hope at the very least that while these studies continue, and we want them to and are grateful for them, that OEHHA might consider posting at sites that contain these crumb rubber that would provide information to the public about possible exposures and ways to avoid them.

And I know the precautionary principle was mentioned earlier. And in 1998, our organization spearheaded an effort with L.A. Unified that created the most stringent pesticide policy in the nation for schools. And it embraced the precautionary principle. And it was not our suggestion, it was the district. There was some information at the time that indicated there was concerns about herbicides. And so for 20 years, Roundup has not been used at any of their thousand sites, 28 cities, or 704 square miles. So I would hope that that's something we can all consider here.

So the text that I received from the soccer

players who've played on fields all over the country and all over California said, "The possibility...", and this is the quote, "...for injury was heightened due to the extreme temperatures and often unevenness of the fields. I remember crying on the field running to the sidelines where my mother would douse my red blistered feet with ice and with tweezers remove the crumb rubber from my shoes and socks". That was her quote.

And then the other young lady that contacted me via text asked me to please read this to you. And that is, "For so many children, athletes, and adults who play or participate in recreational activities who have so little to give asking them to give up their health and bodies is unconscionable. Please help us".

Thank you so much.

CHAIRPERSON BALMES: Thank you, Ms. Suwol.

And our final in-person present -- or testimony would be from Mike Peterson.

MR. PETERSON: Hello, everyone. And I'd like to reiterate the thanks to both the staff and the Panel for all the work they've done here.

Going last, I think a few of my comments have actually already been taken. But just introduce myself. I'm a toxicologist and risk assessor. I've been asked to be here on behalf of a coalition of rubber recyclers and

synthetic turf manufacturers.

The reason they probably asked me to be here is because I've been studying the issues associated with recycled rubber and synthetic turf for six or seven years now. And just last year, in fact, we published a peer-reviewed study in the literature in Environmental Research. We called it a comprehensive multi-pathway risk assessment of crumb rubber. After going through this conversation and watching you guys and what you've done, I'm thinking about maybe writing the editor and asking them to revise that to "mostly comprehensive", because what's being done here is wonderful work.

A couple comments here. I think one thing, I noticed, Dr. Eckel, you talked about the exposure study outliers and how these -- that staff might look at those. I think that's a great recommendation, because that leads right into number two. I've heard over-conservatism talked about once already. We all know as risk assessors we want to be protective. We want to -- we want to make sure we don't underestimate the risk.

But at the same time, the flip side, if we start having 95th percentile, after 95th percentile, after 95th percentile, pretty soon we're talking about a person that doesn't exist. And that we need to be careful balancing those two things. So I think that's something for staff

to consider.

Finally -- oh, I still have three minutes. How did that happen?

Finally, communication.

CHAIRPERSON BALMES: You have less than a minute.

MR. PETERSON: Oh, less than a minute. Good.

One thing left. Communication has also been mentioned. And one thing we did -- and, in fact, when I commented, I think it was at the first one of these meetings, I was hopeful that we would do some natural soil comparisons. Apparently, there wasn't the money for that. I thought a number of the Panel members agreed that that was a good idea. It didn't happen. But what we did in our assessment is we went to the USGS soil concentration website. We looked at urban background and rural background concentrations in air and we compared chemical exposures in natural soil versus our risk assessment results for synthetic turf.

And I thought that gave a very good baseline for people without a lot of expertise in one in a million or one in a hundred thousand to at least have some relative comparisons.

So I don't know if you do that or dietary exposures, like I believe Dr. Sheldon mentioned, or something. But give some real-world comparative risks

that will help people in -- laypeople interpret these results. I think that's really critical.

CHAIRPERSON BALMES: Thank you.

MR. PETERSON: I think that's it. Thanks.

CHAIRPERSON BALMES: Do we have any comments from the internet?

DR. CLAUDE: So we received several comments.

The first one they sent a -- they sent us a PDF, but they also provided us with a brief synopsis of the Safe Healthy Playing Field's Coalition comment, which I will read. The full comment for posting is sent in the email -- the attached PDF file as requested by OEHHA staff.

Please note it has come to our attention that some comments made from the 2018 meeting were delayed in their posing by over a month. We ask that they be posted in a timely fashion, along with other submitters. That's from Carol Antone for California Safe Healthy Playing Fields.

This is the excerpt of the PDF. HS -- SHPFC has the following five fundamental concerns regarding the study and its transparency:

The Advisory Panel and members of the public asked that granular convection, the Brazil but effect, be taken into account when sampling. This is significant,

because of the increased surface area and the suspension of the finer particles, and consequently their uptake, intake, and absorbency factors. The OEHHA study administrators were asked not to wash and thus alter some of the field samples.

Unaltered comparative samples were also requested to be taken from the bottom of a new tire crumb bag before it was spread on field. Apparently this was not done and/or the crumb material was washed before testing, thus eliminating the potentially most problematic material.

The OEHHA study did not take samples in recommended areas of the fields. As indicated in the OEHHA materials, sampling was not done at the areas of the soccer field which had the highest impact, as was recommended. Areas, such as the corners and in the penalty kick area were apparently excluded. This is significant because these areas are most impacted by powerful repetitive foot strikes and are most frequently repaired and need to be regularly replaced with new crumb material. New material contains the highest concentration from the full range of particulate sizes, including the dust.

Lack of transcripts. The Advisory Panel supported the releasing of transcripts. Yet, no written meeting transcripts of the meetings prior to the 2018

meeting have been made available.

Lack of sampling transparency. Neither the public nor the media, or any other objective public representative, were allowed to witness any sampling of the fields.

Lack of testing transparency. A request to observe laboratory --

CHAIRPERSON BALMES: Okay. I think probably we've already exceeded the three minutes. So we can enter this into the record, so -- but I wanted to know if Randy and/or Patty would want to address the original concern? Can you go back to -- yeah -- about sampling and washing.

DR. CLAUDE: Right here.

DR. MADDALENA: Yeah, the comment about washing the samples. There was no washing done. We analyzed as received. And that was one of the points, we didn't want to modify the sample.

CHAIRPERSON BALMES: And also the field samples were not washed either, right?

DR. MADDALENA: Correct. The field samples were not washed.

CHAIRPERSON BALMES: You took big chunks of paper and stuff out.

DR. MADDALENA: Yeah. They were analyzed as received. And the sampling method was designed to be as

representative across the field as we could, so...

DR. WONG: And also, the sample location we do have target some of the high-impact areas right in front of the goal box.

CHAIRPERSON BALMES: Thank you. Do we have another one to read?

DR. CLAUDE: So from -- question from Olenna. Her first question what are the limits that you're going to use for specific chemicals to consider them to be low level? For example, RIVM in cooperation with ECHA, says the general concentration limit set under REACH for eight carcinogenic PAHs in crumb rubber mixtures are insufficient for protecting those who come into contact with the granules, while playing at sports facilities and on playgrounds.

The proposal suggests a combined concentration limit for the eight PAHs of 17 milligrams per kilogram. The current concentration limits applicable for supply to the general public are set at 100 milligrams per kilogram for two of the PAHs, and 1,000 milligrams per kilogram for the other six.

The eight PAHs are benzo[a]pyrene, benzo[e]pyrene, benzo[a]anthracene, chrysen, benzo[b]fluoranthene, benzo[j]fluoranthene, benzo[k]fluoranthene, and dibenzo[a,h]anthracene. So what

are the numbers that you are going to use to assess the risks?

CHAIRPERSON BALMES: Is that a question you want to take on, Patty?

DR. WONG: I think we need a very in-depth meeting when we go to the risks and how we assess the chemical concentration risks.

CHAIRPERSON BALMES: Next question. Oh, this is more from Olenna. Okay.

DR. CLAUDE: So her second questions. I see that your testing is in-lab testing to extract chemicals. Are you going to do an infield studies. For example Dolores Park in San Francisco, which has renovated playground in 2012 has a very worn playground surface. Since there's no real regulations, no proper maintenance was conducted, except for patching the biggest holes. But the whole surface has small cracks with the black bottom layer picking through. It poses choking hazard, tripping hazard, and also dangerous chemicals from the bottom layer can come up in direct contact with children. It heats up on sunny days to over 140 Fahrenheit, which fills the air with carcinogenic fumes.

Can you test in place? There are many other playgrounds with broken surfaces at your disposal if you can't come to San Francisco.

Third question. Industry representatives and manufacturers say that crumb rubber is safe for children to play on, because the manufacturing process binds the various components of tire, including carbon black and solvents, into a matrix that makes it impossible for them to leach out. Is this true?

Her fourth question, the U.S. Consumer Products Safety Commission declares that synthetic turf is exempt from child safety standards, because it is not a child -- a children's product. If it acts like a children's product, and it is marketed as a children's product, and it is sold as a children's product, would you recommend for it to be regulated like a children's product?

CHAIRPERSON BALMES: So, do you want to answer the second question, Patty?

DR. WONG: In terms of selection, we actually picked two Northern California fields two Southern California fields of different age, trying to cover the hotter area, the colder area. And we did it in the summertime during the hot days. So we tried to capture the fumes that are coming up from the rubber, and also with different age. So we cannot specifically say where we went, because of privacy issue, but we did try our best to cover it.

CHAIRPERSON BALMES: Thank you, Patty.

DR. CLAUDE: A question, comments from Nick. Thank you for your time and effort creating protocols for the tire crumb study. Your 500-plus page report confirms that OEHHA has found 126 chemicals, many known to have significant health impacts. Does OEHHA have the authority now to mandate that at every field, playground, walking path, or area with crumb rubber that signs be posted alerting the public to potential chemical exposures?

Under OEHHA's authority, could the recent chemical findings be sufficient to encourage the State to halt the use of tire crumb immediately on fields, playgrounds and paths? I understand the plan was for OEHHA to create a study protocol and -- for tire crumb, but what you have confirmed is alarming.

CHAIRPERSON BALMES: Patty, do you want to say anything?

ACTING CHIEF COUNSEL DeNIGRIS: The program --

CHAIRPERSON BALMES: You should identify yourself for the --

ACTING CHIEF COUNSEL DeNIGRIS: Oh, sorry. Carl DeNigris, the Acting Chief Counsel for OEHHA.

The short answer is no. That's outside the scope of our authority and outside the scope of the study.

CHAIRPERSON BALMES: Anymore?

DIRECTOR ZEISE: Yes. I guess -- Hi. Lauren

Zeise. Yes, I think just to add that, you know, we have a ways to go in terms of looking at concentrations. And that's the next step. And at the next meeting, we'll have a lot more information regarding the degree of possible risk.

CHAIRPERSON BALMES: From Shirley.

DR. CLAUDE: From Shirley. I'd like to submit the following re: the meeting today on crumb rubber.

NASA graphs show the steady increases of temperatures. In some states like California, this has already resulted in creating critical situations. What liability do schools and parks have as to what temperature is safe for children when playing on these fields?

With wildfires worsening every year, and the reality that firefighters are unable to stop them from burning communities, it is concern that these fields will burn and release all the chemicals into the air, water, and soil. Have these very real external threats been considered? Please seriously reconsider anymore installation of crumb rubber.

CHAIRPERSON BALMES: I'll make a response to point two about the wildfires. Yes, if these artificial turf fields burn, nasty toxic materials will be released. I mean, we're already measure PAHs just from exposure to ambient temperatures. But I just -- when communities

burn, there's a lot of other stuff that emits toxic materials, houses, cars. So, yeah, when our communities burn, it definitely is a problem in terms of toxic emissions.

And again, as we discussed with the last question, OEHHA doesn't have the authority to stop installation of crumb rubber. I do think the point about whether higher temperatures are going to cause more problems related to emissions from artificial turf fields, crumb tire fields is an issue that I'm sure will be addressed in the final report, at least in -- qualitatively.

DR. CLAUDE: So from Mary. Thank you in advance for responding to these questions. With the data that was gathered on babies and children, who will establish what the levels of safe exposure are for those age groups or are established adult levels to be used?

It is reported that crabgrass and other weeds can grow in these fields. Were any fields tested in areas where weeds would be more likely to grow and weed killer such as glyphosate would be used?

Since synthetic turf does not absorb rainwater but drains and gets into storm sewers, what are the impacts from the long list of chemicals included in the report on aquatic live and drinking water?

When crumb rubber fields degrade and have to be replaced, where do they end up?

Does the use as a playing change the classification of tires as hazardous waste and the crumb rubber would end up in a non-hazardous waste landfill?

CHAIRPERSON BALMES: Are you going to say something, Patty?

DR. WONG: If you want me to.

In terms of pesticide use, we have survey question for the user and we have document whether they spray anything or what kind of chemical they spray on the field. And it will show up in our Chemical analysis.

CHAIRPERSON BALMES: So I should have said this earlier, but really all the comments that we're getting from our internet participants will be enter into the record.

Jocelyn, could I ask you how many more do we have?

DR. CLAUDE: I think two or three. I'm not sure of the exact number.

CHAIRPERSON BALMES: Okay. Can we go to the next then.

--o0o--

DR. CLAUDE: So there's three left after -- two -- three left including this one.

So regarding the Synthetic and Playground Studies Overview May 2019 update, Task 7, Human Health Risk Assessment, we have the following questions:

What is your worst case exposure?

What is the logic of the risk assessment?

How will you communicate your interpretation of the risk for the children to the parents and to the children who are exposed?

Who decides what risk is acceptable?

Are you proposing there is an acceptable risk?

How are you going to deal with Amy Griffin's data?

CHAIRPERSON BALMES: And I think we can take these questions into consideration with our discussion of the questions that staff has already posed us.

So maybe the next.

--o0o--

DR. CLAUDE: In today's -- from Gene.

In today's presentation, how is it determined that dermal uptake is probably not a predominant pathway for the synthetic turf, e.g. crumb rubber and turf backing, in regards to gas emission? Why is there no place on the field sampling diary template form for notating how old, duration, the tire crumb on the field is? Or, when, where, and how often the additions of fresh

tire crumb wear?

The listed bystanders do include residential households living adjacent to these fields. Many fields are located within tens of feet upwind of houses in the neighborhoods that are exposed to the off-gassing and particulates 24 hours day long for the lifetime of the field.

Why was the question ask what ethnic group best describes your child?

CHAIRPERSON BALMES: Any responses, Patty?

DR. WONG: We have a survey on how -- when we communicate with the field owner, we document when was the last refill of crumb rubber, how was it maintained, when was it installed? So the question number two, we do have those information.

CHAIRPERSON BALMES: Yeah. So again, we'll take into account these comments.

ADVISORY PANEL MEMBER McKONE: Just quickly, the one on dermal uptake of gases. There's a large literature on the relative effectiveness of gas transmission through skin versus lungs, most of it done by the military worried about, you know, poisonous gases.

But it's been well demonstrated that there's orders of magnitude difference between a gas phase. I'm not talking about particulates on the skin surface, but

gas phase.

CHAIRPERSON BALMES: Yeah. The question was about gas.

So there's one more from Kelly on the internet.

DR. CLAUDE: Yes. And we just received a card from Denise, if we have time after this one.

I would like to ask the Panel, knowing what you know now and knowing that most of the parents that send their children to play on these fields may never have heard this study, much less understand its findings, would it be reasonable and prudent to request that the summary in the final report include a recommendation that operators of these fields warn about the chemicals found in these fields to the most vulnerable users, or at least the sick and infirmed, as well as any potential risk of harm that they may present to their health?

Again, even though some of these chemicals are listed by OEHHA and the International Agency for Research on Cancer as hazardous, I'm not speaking of a Prop 65 warning, just a compassionate recommendation in the final report.

CHAIRPERSON BALMES: I think that OEHHA staff has been listening closely to the comments about communication. And it's too early to say what will be recommended in the final report, but I think OEHHA -- I

can speak for the agency, even though I'm not part of it here, is going to make a major commitment to having information that will be helpful to the public. And if there's a necessity for a warning about other kids playing on synthetic turf made from crumb tires, there will be such communication.

Fair to say?

We have one more in-person presentation I think we have time for. Denise Kennedy.

MS. KENNEDY: I, too, would like to thank all of you for all of your efforts that you've put into it. It's been really good. I've listened to most of it back at the office today, but it's been really good.

I have four comments. I've been in this industry, tire recycling, 31 years, and work with everybody across the country.

So first thing I want to comment is on landfilling. One of the comment -- or one of the individuals said that we aren't landfilling. I believe it's -- I do the market study for CalRecycle. I believe it's 19 million tires are landfilled. Those are shredded tires. They don't take whole tires. So we do take them to the landfill.

The second thing I want to bring up is I'm not aware of any synthetic turf field that uses just tire

rubber. It's either got sand, or something with it, or an organic. And I truly do agree with what Steve said, I would like to see us do a comparison. There are new uses -- new organic uses in place of rubber, which is fine, but we don't even have the testing on all those yet, which is a little scary to me.

And then the third thing is -- well, I did the alternatives. The other one is the extreme variables. I believe Linda it was you today said, maybe you don't want to bring up the bad issues or something like that. My fear is for the industry, every time we kind of hang that message out -- and I'm not saying you said to do it.

But every time we put that message out there, everybody is afraid to do anything else. It's just the perception and it's the tone. It's definitely hurt the industry. We've lost -- we're down 30 percent. And mostly California is probably impacted more than anybody else in the whole country.

But we'd just like to kind of button this up as soon as we can, because either we're going to move on or we're not. And everybody as an investor, the recyclers don't know how much inventory to keep, because all of a sudden one day when a report is going to come out and someone is going to say we can't or we can.

So it's changing the business model and it has

hurt some companies from staying in business.

So I just want to say that. Okay.

CHAIRPERSON BALMES: Thank you, Ms. Kennedy.

So I think this closes the public comment period.

And, Patty, if you could put back up the questions for discussion that you wanted the Panel to address.

And I guess I'll take Chair's prerogative of starting off with a question I saved. I don't know that much about many of the chemicals on the long list, but I do know a fair amount about PAHs. And they're pretty nasty compounds in multiple ways. Some are carcinogens. So I'm just throwing this out sort of as a devil's advocate here.

So the Europeans you tell us are focusing on the PAHs, and a relatively small number, even though they may be re-examining that. So I'm just going to throw this out. Why not do something sort of like that here?

DR. WONG: They were in a very time restriction to come up with a conclusion. They close all the fields, the 100 fields in Netherlands and they are committed to come up with a report in the very soon future -- I mean, at that point.

So they were restricted on how much they can do. They picked the most toxic carcinogen. When we

communicate with them, that they went to the risk assessor that what is the best way to address this imminent issue with a quick response. So that was the approach they do.

I think -- I'm not the risk assessor. That's a different approach based on the time and also the project they were required to commit.

ADVISORY PANEL MEMBER SHELDON: So I want to make a comment about this, because in the mid-nineties, EPA did a study of children's exposures to chemicals. And we did 300 children in North Carolina and in Ohio. And it was a probability sample and it was young children. And we did multi-media, we did air, food, water, house dust, dust wipes, et cetera.

And the levels of PAHs in children's homes are extremely, extremely high. The house -- PAHs in house dust are very high. I think that if we make recommendations about PAHs, we need to be able to look at outside other exposures of PAHs. I mean, just as when people talk about the wildfires in California and the effect of PAHs of burning crumb rubber, well, PAHs are a combustion by-product.

It is the PAHs formed by the combustion of hundreds of thousands of acres of wood that is going to be the bigger problem. And I think that whenever we do a risk assessment, we need to look at not just what we are

assessing, but we do need to understand what is there every place, to -- so that we can do a reasonable job. We do need to understand cumulative risk, but we do need to look at exposures and risks from the data we understand everywhere. So, you know, I just am trying to make sure we look at all of it.

CHAIRPERSON BALMES: I actually don't disagree with you. I wanted to throw that out as a --

ADVISORY PANEL MEMBER SHELDON: Oh, okay.

CHAIRPERSON BALMES: That's why I said devil's advocate.

ADVISORY PANEL MEMBER SHELDON: Oh, I didn't hear that part. I thought you were just a devil.

CHAIRPERSON BALMES: I said devil's advocate.

(Laughter.)

ADVISORY PANEL MEMBER SHELDON: No.

CHAIRPERSON BALMES: Wow.

Who wants to go next.

Dr. Bennett.

ADVISORY PANEL MEMBER BENNETT: I was -- this is back to the big giant peak that you had, especially for the composite field sample. And, I mean, it just seems like that is going to be so hard to analyze. And I'm assuming that's the composite from lots of different fields. Did you look at a single used field and does that

have less of a giant mass of things, and are there less chemicals if you look at them one at a time, so it might be easier to identify?

DR. WONG: So you're talking about the LC or the GC?

ADVISORY PANEL MEMBER BENNETT: The LC.

DR. WONG: The LC we have a hump. But when we do the 3-D, because it's tandem mass spec, we're actually able to get the hump off and spread it out, and we see individual peaks. The hump is generated by almost like a ocean of chemicals with very low amounts, and almost continuous in molecular weight. But we do see individual peaks that pops up within the hump. And having the 3-D resolution we were able to identify the peak and go with the MS2 data, the finger print, to identify these chemicals.

We do run -- we did run individual sample. The Idea having a composite sample, it was from four fields. So we have eight different fields for two different composite samples. It's to collect all the chemicals fingerprints, if we can identify these unknowns now, when we go through it to become the target list. When we go for each field, hopefully, we'll cover -- most of the chemicals will show up in each individual field.

ADVISORY PANEL MEMBER BENNETT: Okay. Okay.

DR. WONG: And if we have other chemical pops up, we'll go back to the mass spec and look for what are there, and then see if we can confirm it again and bring it back to the table.

ADVISORY PANEL MEMBER BENNETT: Okay.

DR. WONG: So did I answer the question?

ADVISORY PANEL MEMBER BENNETT: Yeah. No, I just was throwing it out there, because I thought some of it might be that there was just different chemicals on every field, and that was just making it harder to see, and identify things.

And then I had one comment on the exposure distributions, just because the public comment noted some concerns about using the high percentile values, but I really do think we do -- you know, if you could go back and relook at the exposure durations and percent of breathing and do that for the competitive players, as opposed to the recreational players, because if it's two different populations, we do want to be able to look at the more exposed population. And maybe doing it by the high percents isn't the -- you know, the cleanest way to do it, so I just wanted to say that.

And then on the toxicity, you know, I know that we're worried. We've been talking about the PAHs and the fact that they're carcinogens. But I think that, you

know, I know -- I noticed a couple compounds that we'd found in other studies that, you know, had indication that they were endocrine disrupting compounds and some of these in vitro testing, and the QSAR type testing. And so, you know, I think we do need to kind of expand out when we're thinking of toxicity and look at some of these other types of endpoints that we're going to get off some of these high throughput assays or the QSAR techniques. Because I think that, you know, there are kind of easy tools, there are first estimates, but it would help make sure that we're not missing anything in a sort of a cheap or relatively inexpensive way and that might be useful.

DR. WONG: Totally agree. We are looking at all kind of not just existing data, all kind of alternative method how we can base on different chemical structures, look for the toxicity based on the chemical database, how we can draw a link between chemicals. We're not limited to carcinogen. We're definitely interested in all kind of toxicity.

So we already look at some of the chemicals that do have tox criteria for non-cancer risk some are repro.

CHAIRPERSON BALMES: Dr. Eckel.

ADVISORY PANEL MEMBER ECKEL: So I just wanted to sort of echo comments also. So I definitely agree that if there is a bimodal distribution on some of these variables

indicating the more recreational versus the more -- not professional, but the more --

CHAIRPERSON BALMES: Competitive.

ADVISORY PANEL MEMBER ECKEL: -- competitive -- there we are -- players, I definitely encourage thinking about those as two populations that need to be studied.

And then my second comment is I get the impression this is maybe the next phase, but right now, when you're in this phase of identifying chemicals, and then in the next phase actually analyzing each field sample, I would encourage you to think thoughtfully about how to then summarize across fields the concentrations of these -- or the quantification of these chemicals. You know, a simple average might not really be reflective, especially if some of the compounds are found only in a certain field and not the other field. I think it's going to require some careful thought for thinking about how to input those into the exposure models.

DR. WONG: Yeah. Definitely. And also address the uncertain issue of reproducibility of these sample. Statistics is going to help us try to dissect all these data.

CHAIRPERSON BALMES: Dr. McKone.

ADVISORY PANEL MEMBER McKONE: Well, there's this question on priorities. And I think this really gets into

a little bit of decision analysis. And particularly, it's the core of risk assessment is, you know, it's not going through the formalism of risk assessment at its end. What we should communicate to the public is -- what we're trying to find out is, you know, you want to make sure you're discovering what's possible that could go wrong and be complete, but not overreact anywhere, and sort of -- it's like a --it's like a game theory or playing cards, you want to figure out what's possible, and you want to know where to put your resources. You never have enough resources to go after everything.

And I guess it's kind of a comment on the Dutch approach -- or the -- you know, the approach in the Netherlands, the RIVM, which is one way to do this is take something you know well and that you're worried about, and then regulate on that.

The danger with that is it is -- sorry, about your -- you know, refer back to your lamp post again, but it's always going where we know something. And it doesn't offer the opportunity to find something that actually might be a problem. So when you set up these -- I mean, so it would be easy to say, you know, anything that's toxic, I'm looking at your priority list, toxic, tall peak, tire related, detected multiple samples, sure, that's easy.

So something -- you know, if you have a check box - ding, ding, ding - it meets all of these. Probably you want to put it in a bin. I guess the thing you have to think about though is what about something that is not -- we don't know if it's toxic, there's no toxicity data, but, wow, it's got a tall peak, it's tire related, it's in multiple samples. Do you want to say, oh, well, it's not toxic, throw it out? No, you probably want to put it maybe not in the first bin.

And so I think you -- to prioritize, you need this kind of -- and again, I can't offhand tell you exactly what the weighting scheme would be. But I think a lot of people would say, well, anything that meets all of these factors, or your priority examples, certainly belongs in a high priority bin.

The trick with binning, of course, is if you're careful, right, you do everything. And then you've -- it hasn't served you at all, any. But if you don't do it well, you -- you know, there's this tradeoff between you don't want to be so precautionary, I guess in a way, or protective, that you end up with no useful information. You just say we have to look at everything, because it all meets our criteria.

On the other hand, you don't want to have some chance of excluding something that might be important.

And I'd always say, you know, a chemical that's fairly new, it's a fairly high concentration, it looks like it's important, but we don't know about toxicity. Well, there's a lot of chemicals that we don't know their toxicity yet, right?

So you always have to be careful not to make toxicity number one. Certainly, if you know the toxicity, it helps. So again, I can't say exactly how to do this, about you want to do this in a way that things -- so that you do a priority list. Hopefully, it's not 2000 chemicals, because it's not going to help you make decisions. And if it's four or five, I think that's dangerous too, because there's a likelihood you missed something important.

So I think there needs to be a little bit of -- and it has to be transparent. I mean you actually have to explain how you set sort of a filtering -- it's a filtering scheme. And there's some people who are really good at this. I mean, it's like Google and YouTube. I mean, all these marketing places do this all the time. They now how to steer you -- I mean, Google knows exactly how to steer you to something, because they're looking at how to set priorities on your previous behavior. So it's a doable kind of decision science, but you have to figure out how you're going to do it.

PANEL MEMBER McKONE: So I shouldn't be talking about commercial products. There are people who know how to market things based on decision making behavior classifications.

CHAIRPERSON BALMES: Mr. Avol. And, Tom, turn off your --

PANEL MEMBER AVOL: So I'd echo the comments that Dr. McKone made with regard to selection approaches. Although, I'm not sure I'd encourage you to follow YouTube's example.

(Laughter.)

ADVISORY PANEL MEMBER AVOL: But in any case, I think that, you know, obviously, you have to make some decisions here. We're not going to have complete information. Perhaps you can look at reactive chemical groups as indicators of what you might -- you know, based on other information you have, even if you don't have it fully defined here, and that might be an indicator, or families, et cetera. But I think you're going to have to come down to some sort of decisions. And at the end of the day, we're not going to know this completely. So I think, you know, prioritizing this clearly is going to be an issue.

The other issue that you want to come back to is the communication part of this for the public. I think

that it's important for this, which is an incredible amount of high quality science, to be interpreted and interpretable to the public. And so I think what I -- and some of this we'll obviously await the latter stages when you get to the risk assessment portion of the study, but some of this can be done now.

I mean, you can start a narrative that has a paragraph for each of the elements that you've done thus far to describe what it was you did in a way that is approachable, that describes what you did, and admits, you know, here's what we did in a few sentences that explains this, transfers this information, and makes it approachable so people can understand why these were done, how this kind to be, et cetera, and give them some level of confidence in this.

And then again at the end, risk communication is going to be important. Often what's done with many of these studies, is a lot of resources are devoted to doing the work and there's not a lot of resources devoted to the risk commun -- to the communication for public communication at the end.

And I think that, you know, as we think through how this is all going to be done, there should be some commitment to outreach, to sharing this with the -- to thinking about how this is going to be shared informative

ways and to make that -- incorporate that as a part of this whole program, because I think that's going to be the big part at the end and is really going to help set the tone for what we've learned here.

CHAIRPERSON BALMES: Before I recognize Dr. Kyle, I'd just like to say I heartily agree with what you just said, Ed. And I'm usually in this room for California Air Resources Board meetings and it's the same problem with, you know, CARB. In general, CalEPA isn't particularly good at outreach in terms of our information, whether it's regulatory or advisory.

So I totally agree that just as much attention has to be paid to public communication as to the actual science. Maybe not the same dollars, but attention and resources do have to be committed.

So with that, Dr. Kyle.

ADVISORY PANEL MEMBER KYLE: Thank you.

I have two comments, one related to this, and that is you can wait till the end to figure out the communication, which I think is what everyone is saying. And I think it's also not just how you communicate the science, but doing the science in a way that can be communicated.

And so when you're doing like things in different places, give it the same name, don't make people learn the

concept -- the tame concept with five -- with five different names in your document. Take apart the pieces in ways that you can draw a picture of, you know. Like this is the part about the stuff coming into your mouth. You know, this is that part. So -- and don't put it together in ways that may be good for some analytic process, but are totally incomprehensible to people.

You know, I've -- and I've discussed that before, so, you know, I totally agree with this. I do a lot of work in this area. Of course, I'm a proponent of it. But I think in this case, it's more than the communication at the end. I the think there's part of this that needs to be reconceptualized about what are the understandable components of this that we can give names to, draw pictures of, and then use in a consistent and not obscure way. So that's my one comment -- first comment.

My second comment is maybe at odds with everyone else up here. But, you know, this might be a risk assessment thing. You know, I do not worship as much at the shrine of risk assessment as many of my colleagues. And that's well known.

(Laughter.)

ADVISORY PANEL MEMBER KYLE: And I think of it a little more as a children's health question. And a principle in children's environmental health is when

you're designing environments for children, you want to use things that you know about -- materials that you know about and that you know are safe. It's just a fundamental principle.

If you're building a day care center, you know, you want to build things out of some material that is characterized, and known, and with coatings, and so on that you know what they are, so you're not walking in saying, gee, I have no idea what's in here. I wonder if it's going to hurt the kids.

And I would like to also assess this in light of that. You know, we're using an uncharacterized -- or not previously characterized material, or not very well characterized whose composition also may change over time at the source of origin as well as in the environment, and that can have a lot of toxic components. And it just -- you know, I think there's some point where you say does that make sense in a children's environment that you're deliberately creating?

And I'm not thinking it does, you know, the more I hear about this. But I think that's an additional consideration besides how you do a risk assessment on all of this. That's my opinion.

And thank you.

CHAIRPERSON BALMES: Dr. Sheldon.

ADVISORY PANEL MEMBER SHELDON: Yeah. I'm -- I had thought about saying this before, but once people came up and said, you know, 95th, 95th, 95th percentile, you can get to really extreme exposures. Have you thought about probabilistic exposure models.

Five years ago when I was at EPA, they were making those models much, much more user friendly and rapid. I mean, at -- five years ago we were able to do 100 chemicals like in -- you know, in less than a month. And I think it might be -- you know, you might look into it, see what's there, see if it's practical, because that sort of eliminates some of the issues of having to look at extreme values.

The other -- you know, my modeling friends are going to think I've been converted and taken up their mantra, but, you know, it does two other things. It allows you to understand what are the factors that are causing the highest exposures and it also gives you information on what is the greatest uncertainty -- important uncertainties in your model. So it might be provide, you know, both a more reasonable way to estimate it and some information on if there are high exposures, what are the risk mitigation methods that you can take?

So, you know, I -- and they're not as -- at least five years ago, I don't they were as cumbersome as they

were to begin with, where it took five years to do one chemical.

CHAIRPERSON BALMES: Tom, go ahead.

ADVISORY PANEL MEMBER McKONE: Yes. I just want to add to that comment. I should say I did a lot of promotion of probabilistic --

ADVISORY PANEL MEMBER SHELDON: Yes.

ADVISORY PANEL MEMBER McKONE: -- uncertainty analysis. And I would say it's a good idea, but I want to focus one of the things Dr. Sheldon said, which is if you're hesitant and don't have the resources to do a full blown uncertainty variability analysis, one of the most important things to do is to look at your assessment of exposure and just flag things that are uncertain and important.

For example, dermal absorption, you know, it's -- that's an uncertain factor and it might be important, right? I mean, it drives the whole dermal uptake, the assumption that roughly 100 percent of what's loaded on the skin -- the chemical, 100 percent of the chemical loaded on the skin in the soil goes through. That's key. And so you don't just say that was our assumption. You say it in one place that's our assumption. Later on you say, when we're comparing these, this is what drives -- you know, this is the uncertainty. And if we knew more

about it, this could go up and down a lot.

And that saves you. I mean, you can do that exercise, and it saves you having to buy all the software and do all of this really convoluted stuff. And I actually think, having done a lot of probabilistic assessments, in the end, what you're really trying to say, you don't want to show somebody these smeared out curves with all this uncertainty and variability. You want to say boom, boom, boom, this is important and we don't know it well, so we assumed it's this. And if it changes, that's going to change some of our conclusions.

I just think that's a more effective way of doing that sort of thing. But it is critical, I think, to flag things that are drivers in the final analysis.

CHAIRPERSON BALMES: Any other comments?

So, I would just agree, as Tom already stated, that the factors that you have listed here in terms of prioritization, you know, all make sense. And it's just a question of how you deal with those chemicals that don't meet all these criteria. And I think you've gotten good suggestions from people who know, you know, more about risk assessment than I do.

I also don't worship at the shrine of risk assessment. I actually find it too based on assumptions rather than empiric data. So I just have a conceptual

problem with it, but I know you have to do it.

So, Dr. Bennett.

ADVISORY PANEL MEMBER BENNETT: I just had one other really practical consideration on your factors to prioritize chemicals. I mean, when you're looking at these and you have some on the borderline and the standard is $300 or the standard is $10, that also might be a factor that would go into your decision-making process.

(Laughter.)

CHAIRPERSON BALMES: And then you could save resources to devote to public communication.

ADVISORY PANEL MEMBER BENNETT: Okay. Maybe not. You're right.

(Laughter.)

(Discussion off the record.)

CHAIRPERSON BALMES: I think -- yeah, I think we're probably ready to quit with that little outburst.

DIRECTOR ZEISE: Should we wrap it up.

CHAIRPERSON BALMES: Yeah. So I'm going to turn it over to Dr. Zeise for final comments.

DIRECTOR ZEISE: Well, I really have to thank the Panel for all of the absolute fabulous late -- including the late Friday input. It's been --

(Laughter.)

DIRECTOR ZEISE: It's been -- we -- you've given

us a lot to think about. You've given us a lot to actually move forward and take into consideration. So we really appreciate all the great input.

And also, the audience and those both in the room and on the web for the very helpful comments. And then finally, of course, I want to thank the people from the Lawrence Berkeley National Lab and the OEHHA staff for just doing such fabulous work.

So thank you all. And we'll call it a day.

Thank you.

CHAIRPERSON BALMES: I'll take the Chair's prerogative to have the last word. I forgot to thank all of the OEHHA staff and collaborators, sometimes contractors, and the public for their input. It's a lot of good work and a lot of fruitful thought.

Thank you.

(Thereupon the Synthetic Turf Scientific Advisory Panel Meeting adjourned at 4:04 p.m.)

C E R T I F I C A T E O F R E P O R T E R

I, JAMES F. PETERS, a Certified Shorthand Reporter of the State of California, do hereby certify:

That I am a disinterested person herein; that the foregoing OEHHA Synthetic Turf Scientific Advisory Panel meeting was reported in shorthand by me, James F. Peters, a Certified Shorthand Reporter of the State of California, and thereafter transcribed under my direction, by computer-assisted transcription.

I further certify that I am not of counsel or attorney for any of the parties to said meeting nor in any way interested in the outcome of said meeting.

IN WITNESS WHEREOF, I have hereunto set my hand this 11th day of June, 2019.

JAMES F. PETERS, CSR
Certified Shorthand Reporter
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