

IMPLEMENTATION OF THE CALIFORNIA ENVIRONMENTAL
CONTAMINANT BIOMONITORING PROGRAM: 2010-2012

Appendix C

**Summaries of Recommendations Made by Panel Members at Recent
Scientific Guidance Panel Meetings**

California Department of Public Health
in collaboration with
California Environmental Protection Agency's
Office of Environmental Health Hazard Assessment and
Department of Toxic Substances Control

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October 9, 2009 Meeting of the Scientific Guidance Panel of the California Environmental Contaminant Biomonitoring Program

Panel Recommendations and Meeting Conclusions

The Scientific Guidance Panel (SGP) of the California Environmental Contaminant Biomonitoring Program (CECBP) met on October 9, 2009 in Sacramento. The SGP discussed and provided input on priority chemicals. The Panel also heard presentations on and provided recommendations related to the cooperative agreement with the Centers for Disease Control and Prevention (CDC), the Maternal Infant Environmental Exposure Project (MIEEP), CECBP's collaboration with the Kaiser Permanente Research Program on Genes, Environment, and Health (RPGEH), and future directions for the CECBP. The SGP's recommendations and suggestions on various topics are summarized below. Meeting materials, including an agenda and the transcript, are available on the biomonitoring website (<http://www.oehha.ca.gov/multimedia/biomon/cecbp100609.html>).

CDC Cooperative Agreement

Program staff gave an overview of the cooperative agreement with CDC and explained its objectives. The CDC funding is primarily for the purpose of expanding the state laboratory capability and capacity for biomonitoring studies. Ninety percent of the CDC funding will go to support laboratory activities. The CDC funding is meant to supplement state funding and not supplant it.

One of the objectives of the CDC grant is to assess and track trends for selected chemicals among targeted populations. CECBP will work on this objective primarily through three specific collaborations: Environmental Health Tracking's Imperial County Study, the Cohort of Young Girls' Nutrition, Environment and Transitions (CYGNET) and the Maternal and Infant Environmental Exposure Project (MIEEP). Program staff requested specific input on the chemicals to be included in MIEEP, which is discussed further below.

Potential issues related to sample collection and storage were raised by the Panel. The Panel suggested that Program staff review quality control guidelines and standard protocols and procedures for collecting and storing samples, such as those developed by the International Society for Biological and Exposure Repositories. Program staff indicated that a Sample Management Officer will be hired in order to set up appropriate storage protocols, and that possible storage issues can be discussed again by the Panel once the officer has been hired.

Priority Chemicals

Because the CECBP laboratories do not have the resources to develop methods for all priority chemicals, Program staff requested the Panel's recommendations on which chemicals should be considered for methods development in the near future. The discussion focused on priority chemicals for which the laboratories do not have an existing method and for which methods development is not yet planned.

Diesel Exhaust

The Panel unanimously recommended that Program staff take steps to identify a biomarker of exposure to diesel exhaust and develop a laboratory method for its identification in biomonitoring studies. Following the adoption of the recommendation, there was additional discussion with Program staff about the feasibility of carrying out this recommendation. Challenges include: identifying an appropriate chemical, which is a major research project; expected changes in the composition of diesel exhaust, which make previously considered biomarkers potentially less relevant; and lack of adequate Program funding to take on this research project. Program staff agreed to look into the latest status of research on biomarkers for diesel exhaust and provide an update to the SGP.

Alternative to dialkyl phosphate (DAP) metabolites

The Panel noted that DAP metabolites are nonspecific and recommended considering more specific metabolites of organophosphate pesticides.

Cotinine

The Panel expressed interest in measuring cotinine as a way to quantify tobacco smoke exposure. Program staff noted that measuring cotinine would require a dedicated machine and current resources do not allow for that.

Brominated or chlorinated flame retardants currently not planned for methods development

The Panel expressed interest in measuring more brominated or chlorinated flame retardants for which the Department of Toxic Substances Control (DTSC) laboratory does not currently have methods. Program staff noted that these compounds are not all members of the same chemical class, and many would require completely different methods. The Panel highlighted the tris phosphate type flame retardants and short chain chlorinated paraffins as being of particular interest for future methods development.

Open scan for unknown chemicals

The Panel supported the Program's proposal to screen blood for currently unidentified chemicals, attempt to identify those chemicals, and develop analytic methods to measure them. This analysis for unknowns could be carried out in the future, possibly beginning during the fifth year of funding from the CDC cooperative agreement.

Other emerging chemicals in California

The Panel noted that other chemical hazards may become important in California because of particular programs that will lead to chemical substitution or new chemicals being used. For example, the drive to reduce the use of volatile organic compounds may result in new chemicals being introduced in California. In addition, the increased use of clean energy technologies in the state will potentially introduce new toxic hazards. Program staff encouraged the Panel or any member of the public to bring these emerging chemicals to the attention of the Program.

Maternal Infant Environmental Exposure Project (MIEEP)

Program staff provided an overview of the objectives of MIEEP and the proposed chemicals to be analyzed. Program staff also described the trade-offs of using the State laboratory versus the CDC laboratory. The Panel suggested that the analyses for this project be conducted using the State labs because there would be more value for the Program if the data came from the state labs. This would also allow the state laboratories to demonstrate capacity and capability for these analyses. PAHs were suggested as a measure of exposure to tobacco smoke, since State labs do not have the capability to analyze cotinine. Due to the fact that those sampled in the project are expected to be composed of a majority of Latinas, DDT was also suggested as a possible chemical of interest. The Panel recommended that, since the population sampled will be pregnant women and their infants, estrogenic chemicals, thyroid disrupting chemicals, and neurotoxicants should be included. A home survey was suggested as a possible part of the questionnaire process in order to get a larger quantity of exposure data that would be of high quality. The Panel also suggested administering dietary intake instruments to measure exposures to lead and pesticides.

CECBP Collaboration with Kaiser Permanente Research Program on Genes, Environment, and Health (RPGEH)

Dr. Stephen Van Den Eeden, senior investigator in the Division of Research at Kaiser Permanente presented an overview of Kaiser's Research Program on Genes, Environment and Health. Opportunities for collaboration between Kaiser and CECBP were discussed. The Panel unanimously endorsed collaboration with Kaiser and recommended that the Program continue to explore ways to expand the collaboration.

February 9, 2010 Meeting of the Scientific Guidance Panel for Biomonitoring California

The Scientific Guidance Panel (SGP) for the California Environmental Contaminant Biomonitoring Program (also known as Biomonitoring California) met on February 9, 2010 in Sacramento. The SGP's recommendations and suggestions on various topics are summarized below. Meeting materials, including the agenda, presentations and the transcript, are available on the biomonitoring website (<http://oehha.ca.gov/multimedia/biomon/feb2010agenda.html>).

Program and Laboratory Updates

The new public name for the California Environmental Contaminant Biomonitoring Program (CECBP) was presented to the Panel. "Biomonitoring California" was chosen as being simpler and more accessible to study participants and other interested parties:

Program staff gave an update on progress toward meeting the objectives of the Cooperative Agreement with the Centers for Disease Control and Prevention (CDC). The Panel expressed its support and encouragement for the Program's collaborative efforts with Environmental Health Tracking Program in Tulare and Imperial counties; the Cohort of Young Girls' Nutrition, Environment, and Transitions (CYGNET); the Maternal and Infant Environmental Exposure Project (MIEEP); and Kaiser's Research Program on Genes, Environment, and Health. Panel members encouraged Program staff to continue efforts to study exposures in firefighters. Panel members Luderer and Wilson offered assistance in identifying and accessing firefighter cohorts.

The Panel noted excellent progress made by the laboratories in developing analytical methods and encouraged continued development of methods to analyze new brominated flame retardants. The Panel reiterated the need for a biomarker for diesel exhaust exposure. The SGP also provided some input on the quality assessment and quality control efforts of the laboratories.

Designated and Priority Chemicals

The Panel voted unanimously to recommend adding pendimethalin (and its metabolites, biomarkers, and/or relevant indicator chemicals) to the designated chemical list.

The panel voted 6 to 2 to recommend adding the already designated polychlorinated biphenyls (PCBs) (and metabolites, biomarkers, and/or relevant indicator chemicals) to the priority list.

Panel members postponed a decision on benzophenone-3 as a potential priority chemical. They requested that the Program provide additional information on benzophenone-3, consider chemicals in sunscreen as a general category, and also

investigate the possibility of using total estrogenic load as a measure for biomonitoring.

Updated designated and priority chemical lists with the above additions have been posted (see <http://www.oehha.ca.gov/multimedia/biomon/index.html>).

Proposed New Format for Designated and Priority Chemical Lists

The Program proposed a simpler format for the designated and priority list. The new format would more closely mirror the approach taken by CDC in its Fourth National Report on Human Exposure to Environmental Chemicals. Panel members agreed that the new format improved the readability and accessibility of the lists. Any substantive changes to the lists that are required by the new format will be discussed with the Panel during the May 24, 2010 meeting. The new format will be implemented after the May meeting.

Maternal and Infant Environmental Exposure Project

Program staff presented an update on the Maternal and Infant Environmental Exposure Project (MIEEP; also known as Chemicals in Our Bodies Project), which included an overview of the project design, information participants would receive about the study, excerpts from the questionnaire, and an educational handout to be provided to participants. Panel members gave a variety of suggestions for improving the questionnaire, including evaluating the length of the questionnaire, addressing some design issues (e.g., questions that are likely to elicit a response of "no"), and including more questions on dietary history. Panel members appreciated that the Program developed an educational handout for participants. Suggestions on the handout included adding an overview for context, providing information on remodeling, and clarifying statements about ceramic ware. The Program will take the Panel's input into consideration in modifying the questionnaire and other study materials as much as possible.

May 24, 2010 Meeting of the Scientific Guidance Panel for Biomonitoring California

The Scientific Guidance Panel (SGP) for the California Environmental Contaminant Biomonitoring Program (also known as Biomonitoring California) met on May 24, 2010 in Sacramento. The SGP's recommendations and suggestions on various topics are summarized below. Meeting materials, including the agenda, presentations and the transcript, are available here: <http://oehha.ca.gov/multimedia/biomon/sgp052410.html>.

Program and Laboratory Updates

Program staff gave an update on progress toward meeting the objectives of the Cooperative Agreement with the Centers for Disease Control and Prevention (CDC). This included an update on the Program's collaborative efforts with the Environmental Health Tracking Program in Tulare and Imperial counties; the Cohort of Young Girls' Nutrition, Environment, and Transitions (CYGNET); and the Maternal and Infant Environmental Exposure Project (MIEEP). The new Firefighter Occupational Exposures Project (FOX) was also briefly introduced. The Program's efforts to obtain outside funding and the continuing progress on the pilot projects were acknowledged.

Laboratory staff gave an update on activities since the last SGP meeting. Panel members noted the progress made by the laboratories in developing and validating new analytical methods and were complimentary on the level of precision and accuracy achieved by the laboratories.

Designated Chemical

The Panel voted unanimously to recommend adding triclocarban (and its metabolites, biomarkers, and/or relevant indicator chemicals) to the designated chemical list. Panel members requested additional detailed toxicology, persistence, and exposure information for use in any future discussions on triclocarban.

Priority Chemicals

The Panel voted unanimously to recommend adding parabens that were already designated (butylparaben, ethylparaben, methylparaben, propylparaben) to the priority list.

New Format for Designated and Priority Chemical Lists

Program staff gave an overview of the new format for the designated and priority chemical lists and asked for the Panel's input on specific issues, such as formatting details, revised and new footnotes, and updating information on the lists based on CDC.

The Panel provided the following comments and recommendations:

- Because different isomers can have different toxicities (e.g., cis- and trans-permethrin), it was suggested that the specific isomers be retained on the list.
- There was an inquiry if CAS numbers would be included on the list. Program staff explained that a full technical list that will include the CAS numbers is planned for the future.
- The Panel reviewed and agreed to the revised footnote on diesel exhaust and a new footnote for polycyclic aromatic hydrocarbons (PAHs).
- The Panel approved the Program's proposal to add parent chemicals newly identified by the CDC for a particular metabolite to the priority list in cases when that metabolite is already on the priority list.

Other Panel Input on Chemical Selection

It was requested that the Program include the broad class of disinfection byproducts, especially byproducts of chloramination, in the queue of chemicals being considered for the Panel to review as potential designated chemicals.

Firefighter Occupational Exposures (FOX) Project

Program staff presented an overview of the FOX project. The Panel congratulated the Program on developing this study during the time since the last meeting. Panel members made a number of specific comments:

- Suggestions were made regarding refining the exposure assessment and the questionnaire, such as by obtaining information on pesticide applications at the fire stations and adding questions on exposures at home or at a second job.
- The Program should measure phthalates, which are likely to be found in personal protective equipment worn by firefighters.
- The Program could consider expanding the questionnaire to longer than 15 minutes, if needed, and work with the union and management to encourage rank and file firefighters to take the time to complete it.
- GPS coordinates of the fire stations should be obtained to look at nearby traffic density, truck traffic and other sources for PAH exposures. This pilot project would be a good opportunity to measure a biomarker for diesel exposure, if one were available.

Overview of Draft Public Integration Plan

Program staff presented an overview of the Draft Public Integration Plan and asked for input on specific discussion questions:

- Aspects of our public integration efforts that should be priorities.
- Methods and practices that might be effective for increasing the number and diversity of Program stakeholders.

- Ideas about achieving high participation rates in biomonitoring studies.
- Suggestions of individuals or organizations we might interview to gain insight into effective communication of biomonitoring results.

Panel members recommended that the Program make contact with a range of groups and individuals for insight and ideas on involving the public, including:

- Participants in earlier Program meetings to find out why they are not currently participating in Program activities and how the Program could better engage with them;
- Those who have had success working with environmental justice (EJ) advocates;
- The leadership of community and/or EJ groups; and
- Labor organizations, which represent a diverse cross-section of Californians, and have a commitment to chemicals policy reform. Findings of contaminants in umbilical cord blood are of concern to many occupational groups, especially those heavily exposed to chemicals (e.g., refinery workers).

Panel members also recommended that the Program:

- Inform participants that they need to request their results if they want to receive them;
- Work to ensure that results are understandable to the study participants;
- Be clear with community groups regarding the Program's limited capacity to conduct studies in their communities, to avoid raising unrealistic expectations; and
- Create a Facebook page in order to connect with the public.

Mr. Davis Baltz of Commonweal suggested using the results from the pilot study on cord blood as an opportunity to re-engage individuals who expressed interest in the Program early on but have not attended SGP meetings recently.

Selection of SGP Chair

The Panel nominated and unanimously confirmed Dr. Ulrike Luderer as Panel chair.

November 2, 2010 Meeting of the Scientific Guidance Panel for Biomonitoring California

Summary of Panel Recommendations

The Scientific Guidance Panel (SGP) for the California Environmental Contaminant Biomonitoring Program (also known as Biomonitoring California) met on November 2, 2010 in Sacramento. The SGP's recommendations and suggestions on various topics are summarized below. Meeting materials, including the agenda, presentations and transcript, are available here:

<http://www.oehha.ca.gov/multimedia/biomon/sqp092110.html>.

Program and Laboratory Updates

Program staff gave an update on progress toward meeting the objectives of the Cooperative Agreement with the Centers for Disease Control and Prevention (CDC). This included updates on the Maternal and Infant Environmental Exposure Project (MIEEP) and the Firefighter Occupational Exposures (FOX) Project. The Program's efforts to establish a collaboration with the Kaiser Research Program on Genes, Environment, and Health were also briefly introduced. Other items of interest were the new Biomonitoring California logo, the completion of a draft brochure on Biomonitoring California in English and Spanish, and participation of Program staff in an effort spearheaded by the Association of Public Health Laboratories to develop national biomonitoring guidelines.

A Panel member recommended carrying out a power calculation for MIEEP to see if the size of the Project is sufficient to answer the question, "Is this population of women systematically different in their exposures compared to the national NHANES survey population?" The availability of adequate funding was discussed. A Panel member commended the Program's progress on the smaller projects being conducted in the absence of funding for a statewide survey.

Laboratory staff gave an update on activities since the last SGP meeting and a preview of upcoming work. The California Department of Public Health Environmental Health Laboratory is expanding existing methods (such as increasing the number of phthalates that can be analyzed), continuing work on methods in progress (such as environmental phenols), and increasing laboratory capacity. The Department of Toxic Substances Control Environmental Chemistry Laboratory reviewed already validated methods and results obtained using these methods, reported on methods under development (new or alternative brominated flame retardants, such as polybrominated ethylbenzene) and previewed future work (such as developing methods for phenolic compounds). The Panel commended the laboratories for the continued progress.

Designated Chemical

The Panel voted unanimously to recommend adding manganese to the designated chemical list. Panel members noted that before considering manganese as a potential priority chemical, the Program should research the pharmacokinetics and laboratory methods for manganese.

Draft Public Involvement Plan

Program staff presented the key elements of the draft Public Involvement Plan that has been released for public comment, the approaches being undertaken to solicit comments, and the timeline for finalizing the Plan. The Panel discussed the Plan and provided input. Individual Panel members suggested that the Program:

- Consider developing a media strategy or other method to amplify the message.
- Partner with community organizations to reach people we would otherwise miss by our use of online tools.
- Do outreach to various groups (e.g., labor groups, professional associations, medical providers) to involve them in the Program.
- Keep a focus on the statewide survey in designing public involvement efforts.
- Convey to the public the importance of biomonitoring by making a connection to green chemistry.
- Seek wide input on the subject of biomonitoring reference levels from a variety of groups and individuals with relevant interests, such as those in the role of talking to patients and others about biomonitoring results.

Introductory Discussion of Biomonitoring Reference Levels

Program staff gave a presentation introducing the concept of "biomonitoring reference levels" - concentrations in biological media (e.g., blood or urine) that would be useful to compare with biomonitoring results. The Program is using the term broadly to include things like measured levels in relevant populations (e.g., NHANES) and levels used to derive guidance values or standards (e.g., blood lead level used to derive drinking water standard). The Program sought the Panel's perspectives on the use of biomonitoring reference levels and their suggestions for the March workshop on this topic. Individual Panel members (not necessarily the entire Panel) expressed their opinions and recommended that the Program:

- Consult with experts on nutrient loadings, radioactivity, and pharmaceuticals as part of researching biomonitoring reference levels.
- Be aware of the large uncertainties in attempting to develop reference levels. Don't assume that simple translations between biological levels and health effects will exist in all cases. Reference levels for a single chemical may differ between groups of people because of genetic variation, for example.

- Recognize that there will not be information on health-based levels of concern for many of the chemicals of great interest to the Program, because the Panel has focused on "staying ahead of the curve" and recommending that emerging chemicals be biomonitoring.
- Be very cautious in taking a poor toxicity data set and attempting to extrapolate to obtain a biological equivalent. Consider carefully if we should attempt to include chemicals with sparse or no data on health effects or pharmacokinetics. Distinguish between a screening level assessment and a full risk assessment.
- Be aware that developing biomonitoring reference levels could subject the Program to controversy or even derail the Program.
- There is a need to provide a health context for biomonitoring results, particularly when returning results to individuals. People will ask questions about the meaning of their results in terms of their health and we have a responsibility to respond.
- Provide proper guidance on how any levels developed by the Program should be viewed (i.e., not as a standard or a regulatory level).
- Discuss a probability or risk-based interpretation for noncancer health effects versus the reference dose approach.
- Look at mixed exposures particularly for chemicals that have similar mechanisms. Even if chemicals do not act in the same way, cumulative exposures to multiple chemicals should be considered and evaluated.
- Be clear about the difference between exposure assessment and health risk assessment. Biomonitoring is a measure of exposure. CDC has reported results and avoided health-based interpretations. The Program has been on a path of identifying the presence of chemicals in the body; developing reference levels goes down a different path of attempting to determine how much harm is acceptable.
- Do not attempt to say that a particular level of a chemical in the body is okay. The uncertainties are too great to make those kinds of conclusions.
- Recognize that developing reference levels sets the Program on a very different path than simply identifying the presence of chemicals in blood or urine. Others have chosen not to go down this path. For example, the Royal Commission on Environmental Pollution took the position that rather than embarking on a risk assessment strategy around chemicals identified in people, they simply stated that steps should be taken to reduce the use of substances that appear in humans and in higher mammals. The European REACH regulation classifies substances that are very persistent and very bioaccumulative as chemicals of a high concern, regardless of questions of risk.
- Understand that there is value in a simple translation between a blood level and an intake level, without considering health risks.

- Make the focus of the workshop broader than just reference levels. Frame the workshop as a discussion of ways to provide context for biomonitoring results, with biomonitoring reference levels as one way to do that. Consider how to interpret biomonitoring results for individuals and groups. For example, the Program might consider providing context by using measured levels in relevant populations (e.g., NHANES), calculating levels for certain chemicals, or declining to provide context in some cases and figuring out a good way to explain to people why no context is given.

Chemical Selection Planning

Program staff gave an overview of selected chemicals and groups of chemical that are being tracked as possible candidates for consideration as potential designated chemicals, including: plasticizers, a non-halogenated flame retardant (triphenyl phosphate), emerging disinfection byproducts, two organotins (tributyltin and dibutyltin), nonylphenols and nonylphenol ethoxylates, and pesticides. Panel members expressed particular interest in triphenyl phosphate and non-halogenated flame retardants in general. Other categories of interest were pesticides, emerging disinfection byproducts and organotins,.

The Panel recommended that the Program briefly summarize the following information when reviewing possible candidates for designation: the extent and type of use, indicators of environmental persistence and/or bioaccumulation, existing data from biomonitoring studies or studies of dust levels, and evidence of toxicity. A further recommendation was to consider looking at the hazard traits that OEHHA recently defined as part of their green chemistry work.

One technical listing proposal was also considered: Should the Program automatically add to the priority list chemicals that are newly being measured by CDC and are part of a group that the Panel already recommended as priority? For example, the Panel moved the entire group of phthalates that were already designated to the priority list. CDC has recently begun measuring isodecyl phthalate. Under the proposed approach, this new phthalate would be automatically added to the priority list under phthalates, instead of being brought to the Panel for approval. The Panel unanimously agreed to the proposal.

Firefighter Occupational Exposures (FOX) Project

Dr. Leslie Israel of the University of California Irvine gave an update on the FOX Project. As of November 1, 18 participants had been recruited, with a goal of 100 participants. The Program does not anticipate any difficulties in reaching that goal. The Panel inquired about other aspects of the project, including the questionnaire, the firefighters' chemical exposures, the results return process and approaches being considered to provide context for the results. For the complete discussion, refer to the full transcript available here:

<http://www.oehha.ca.gov/multimedia/biomon/sgp092110.html>.

March 16, 2011 Meeting of the Scientific Guidance Panel for Biomonitoring California

Summary of Panel Recommendations

The Scientific Guidance Panel (SGP) for the California Environmental Contaminant Biomonitoring Program (also known as Biomonitoring California) met on March 16, 2011 in Oakland. The SGP's recommendations and suggestions on various topics are summarized below. Meeting materials, including the agenda, presentations and the full transcript, are available here:

<http://www.oehha.ca.gov/multimedia/biomon/sqp031611.html>.

Program Update

Program staff gave an update on funding status and staffing changes. A timeline highlighting Program accomplishments since its inception was presented. Various possible strategies for approximating a statewide representative sample were also reviewed. Updates were given on the Program's ongoing projects: the Maternal and Infant Environmental Exposure Project (MIEEP), the Firefighter Occupational Exposures Project (FOX) and the Biomonitoring Exposures Study (BEST). Public involvement activities were briefly described. The release of the Program brochure in English and Spanish was also announced, with hard copies of the brochure distributed at the meeting.

Panel member Dr. Julia Quint suggested developing a formal dissemination plan for the brochure. A public commenter, Carl D. Ruiz, a research fellow at Henkel Consumer Goods, asked that a disclaimer used by the Centers for Disease Control and Prevention be added to the brochure to clarify that biomonitoring measurements are an indication of exposure, not of health effect.

A public commenter, Davis Baltz from Commonweal, commended the program on its considerable achievements to date and reminded the audience that his organization was one of the sponsors of the enabling legislation. He stated that the requests the program is receiving from other parties to analyze samples, marked a significant achievement.

A public commenter, Tony Stefani of the San Francisco Firefighters Cancer Prevention Foundation, expressed interest in the Program broadening the FOX project to include other firefighters from other areas in the state, such as San Francisco. Panel members seconded that suggestion.

Laboratory Update

Laboratory staff gave an update on activities since the last SGP meeting, including staffing changes and newly acquired equipment. Progress in sample analyses and the

development and validation of new methods was also outlined. The California Department of Public Health (CDPH) Environmental Health Laboratory (EHL) described its preliminary success in the challenging analysis of dried blood spots and low-volume specimens for persistent organic chemicals (e.g., polybrominated diphenyl ethers or PBDEs). The Department of Toxic Substances Control (DTSC) Environmental Chemistry Laboratory (ECL) discussed methods development for newer brominated flame retardants (BFRs). ECL also described the testing of different types of tubes for collecting blood samples.

In the discussion with laboratory staff, Panel members:

- Commended the laboratories on their progress.

The critical support of the CDC in helping develop the laboratory capability, including training Biomonitoring California laboratory staff, was also acknowledged. The fact that outside researchers are requesting that Biomonitoring California laboratories conduct analyses for them was noted as an indication of the importance and success of the Program.

- Supported the Program's intention to develop criteria for which outside projects to accept, to ensure that new projects fit into the overall Program goals.

These criteria will be important to avoid the laboratories being used simply as service laboratories. Panel members also emphasized the importance of ensuring that the Program has access to the data generated through outside collaborations.

- Suggested that the quality of the filter paper used to collect the newborn dried blood spots might be improved to help reduce background contamination.
- Recommended that the laboratories present summary information on quality assurance/quality control (QA/QC) as part of their presentations.
- Reiterated an earlier recommendation that the Program consider developing methods to screen for unknown chemicals.

The usefulness of such a method in elucidating complex exposures, such as those experienced by firefighters from a mixture of combustion products, was noted. The increasing number of substitutes for phthalates and plasticizers for which we have very little information on level of use, exposure or toxicity was highlighted as further support for screening unknowns. Having a state reporting system for chemical ingredients in products and the volumes of those chemicals would be another resource for identifying emerging chemicals.

A public commenter, Dr. Dale Hattis of Clark University, suggested the Program also consider analyzing for DNA adducts, for example, as a way of detecting DNA reactive chemicals that have not been previously identified.

Chemical Selection Planning

Program staff presented a proposed screening approach for possible candidate chemicals for designation, based on recommendations by the Panel from the November 2010 SGP meeting. The purpose of doing this screening would be to allow the Panel to weigh in early on chemicals that might be brought forward as potential designated chemicals. The screening approach included elements highlighted by the Panel previously: extent and type of use, indicators of environmental persistence, bioaccumulation and toxicity, and information from past environmental sampling and biomonitoring studies. The approach was illustrated using the example of nonhalogenated organophosphate flame retardants.

Panel members gave a number of comments on the proposed screening approach and suggestions for refining and expanding the approach:

- The screen is useful for gathering information on multiple chemicals in a readable format for easy comparison.
- Production volume alone can be misleading: Some low volume chemicals have significant toxicity concerns or concerns for persistence or bioaccumulation. Production volumes can change rapidly once a chemical gets on to the market. A chemical that starts off at a low volume may dramatically increase shortly after being introduced.
- Include information about whether the chemical is a substitute for an existing designated chemical or other chemical of concern.
- Include information on the types and numbers of products in which the chemical is found.
- Indicate some indication of the potential for exposure and likely routes of exposure (e.g., via inhalation, food).
- Overall persistence is a good indicator of exposure potential for a broad range of chemicals.
- Expand the toxicity screen to include some indication of the toxicity concern and extent of information. For example, toxicity concerns could be based on results from many conducted studies, minimal toxicity information or structure activity information. A toxicity concern could also exist because there is absolutely no information. An in-depth evaluation of data quality is not needed, but some indication of what is available would be useful.
- Consider adding reference doses (RfDs), if available.
- It would be helpful to know what chemicals are used in California and in products sold in California.
- Consider adding a notation for very persistent, very bioaccumulative chemicals, which can be a concern regardless of toxicity.
- Using laboratory-based identification of unknowns as a possible screening tool will likely generate long lists of chemicals on each participant studied. Use informatics to identify chemicals that show up most frequently and at the highest concentrations, which could help narrow down the list.
- Add more physical chemical properties to the screen, such as vapor pressure.

- Do not exclude chemicals that are not persistent. We are exposed to many nonpersistent compounds on a regular basis, and even with short half-lives in the body, exposure is still substantial: think about exposure potential.

A public commenter, Dale Hattis of Clark University, recommended the Program consider looking at intake fraction, which better describes exposure potential than volume of use. Intake fraction varies over orders of magnitude, in the same way that persistence varies over orders of magnitude, making it a good screening tool.

The Panel also recommended that the Program prepare a document on aromatic non-halogenated organophosphate flame retardants as potential designated chemicals.

"Biomonitoring Literacy:" Developing Report-Back Materials with Input from Study Participants

Dr. Rachel Morello-Frosch and Holly Brown-Williams of UC Berkeley's School of Public Health presented the work they did on developing a report-back template for the Maternal and Infant Environmental Exposure Project (MIEEP, or Chemicals in Our Bodies Project). Their findings from usability testing with some MIEEP participants were summarized and the improvements to the report back template based on the testing were explained. The primary aim of the report back materials is to address in a readable and accessible way the major questions that participants typically ask: "What did you find? How much? Is it high? Is it safe? Where does it come from? And what should I do?"

Panel member Dr. Dwight Culver inquired about how the "level of health concern" would be chosen and noted the importance of determining appropriate follow up action if high levels are found. Program staff responded that the Program will be deciding on whether a level of health concern has been established and noted that a follow up protocol is already determined for lead and is being developed for certain other chemicals such as mercury.

The Panel commended the extensive work that was done in developing a clear template. They also noted issues that should be considered in using the template and further refining it:

- Providing more information and more resources for participants who want it.
- Looking at ways to indicate that some chemicals vary considerably from measurement to measurement and that a single measurement may not be representative, particularly for non-persistent chemicals.
- Conveying the meaning of finding a metabolite, which could indicate exposure to the parent compound or to pre-formed metabolites.
- Developing information for health care providers on how to interpret the results.

There were three public commenters on this agenda item. Davis Baltz of Commonweal,

noted that in many cases we will need to be prepared to say that we do not know whether a chemical level is high or whether it is safe. He also emphasized that he does not think it's the role of Biomonitoring California to try to decide what is safe. He noted that the main goal of the Program, established in the legislation, is to regularly provide information on chemicals in Californians, both to establish a baseline and to look at trends over time, and that this should remain the focus.

Dr. Lesa Aylward of Summit Toxicology recommended that the Program include information on breast-feeding when returning results to mothers and also consider providing reference values from NHANES beyond just the average, such as the 95th percentile. Levels can vary widely and this would not be illustrated by the average only.

Caroline Silveira, of Government Affairs at DuPont, suggested clarifying which chemicals have established levels of health concern and where those levels come from.

Kaiser Permanente Collaboration: Biomonitoring Exposures Study (BEST)

Program staff gave an overview of the Program's newest collaboration with Kaiser Permanente Northern California, Division of Research, Research Program on Genes, Environment, and Health (RPGEH). The Biomonitoring Exposures Study (BEST) is a pilot biomonitoring project in the Central Valley, with a recruitment goal of 100 English-speaking male and female adults. Collaborating with Kaiser offers an opportunity to approximate a representative sample, because of the very similar demographics of the Kaiser membership compared to the overall demographics of California. This initial pilot in the Central Valley also expands the Program's projects into a new geographic area.

Panel members' comments and recommendations included:

- Give the Panel the opportunity to comment on the exposure questionnaire to be used in BEST.
- Consider doing some pilot samples to test the integrity of the samples during the overnight shipping.
- Consider collecting blood samples at a patient's regular blood draw, rather than a home visit, to save resources.
- In addition to sending a phlebotomist to the home, consider also conducting a home environmental assessment to look for potential sources of chemicals.

Looking Forward for Biomonitoring California - Program Planning

The Program posed a series of discussion questions (full set of questions are here: <http://www.oehha.ca.gov/multimedia/biomon/pdf/032011Discussion.pdf>) to the Panel to assist with Program planning, focusing on:

- Identifying populations for community studies;
- Approaches for approximating a statewide representative sample;

- Approaches for investigating environmental exposure sources; and
- Additional input on Program planning.

The Panel's suggestions and recommendations are summarized below, organized by topic area.

Identifying populations for community studies

- Pay attention to children, particularly from birth to kindergarten age. The lowest age in NHANES is age 6.
- Focus initially on building on the two existing successful collaborations - mothers and infants; firefighters - and consider new projects as resources allow.
- Consider populations that might be particularly impacted by toxic exposures, which could pose environmental justice concerns. These could be urban or rural populations.
- Publicize the availability of our laboratory capability and see if external researchers might have resources to collaborate with the Program.
- Conduct outreach to additional occupational groups.
- Consider veterans returning from Iraq and Afghanistan as a population with potentially unique exposures.
- Some Panel members liked the idea of testing incoming medical students, while others raised some concerns. Incoming medical students are not likely to be a vulnerable population and may be less representative of California. However testing this population would offer an excellent opportunity to educate future physicians about environmental health.
- With regard to health care workers as a possible group, it was recommended that this group be broadly defined to include all types of health care workers (e.g., janitorial staff in addition to doctors, nurses, etc.). It was noted that a key exposure for health care workers, particularly nurses, is antineoplastic agents and other drugs. These drugs are not on the designated or priority lists, but if this group were studied, these exposures should be considered.
- Consider major ethnic groups in California not adequately represented in NHANES- such as Asian Americans.

Approaches for approximating a statewide representative sample

- Kaiser is the most promising collaboration for this purpose.
- Consider expanding to the Kaiser population in Southern California.
- Consider adding partnerships with community-based hospitals or clinics that could help fill in the lower income, uninsured portion of the population that would be missed in Kaiser.

- Consider collaborating with the California centers of the National Children's Study. The centers are distributed across the state in rural and urban counties and would capture children as a key group. Some challenges in this possible collaboration were that field work will not start until 2012 or 2013 and there may be difficulties in adding a collaboration with Biomonitoring California to the protocol.

Approaches for investigating environmental exposure sources

- If this is undertaken, the Program should use both environmental sampling and modeling together. The sampling results can help constrain the modeling.
- Measuring environmental samples is not the focus of the legislation, so the funding would need to come from an outside source.
- Community studies could offer good opportunities to identify environmental exposure sources but that effort should not distract from biomonitoring as the main purpose of the studies.
- Look at existing environmental sampling already being done by other researchers (e.g., the National Children's Study) and the state (e.g., the Air Resources Board).

Additional input on Program planning

- Two Panel members, Dr. Gina Solomon and Dr. Tom McKone, talked about the importance of considering how Biomonitoring California should respond in emergency situations that could arise in California, similar to the Gulf oil spill and the Japanese nuclear accident that followed the recent tsunami. The Program could play a role in developing scientifically accurate information in those situations and be a resource for the public. The Program could help address fears and counter misleading information that might be spread during emergencies like these. This would require having plans in place to get out in the field quickly.

The Acting Director of OEHHA, Dr. George Alexeeff, noted that the state has fairly well developed emergency procedures and suggested that staff involved with these emergency programs could give a presentation to the Panel. This could be a first step in developing a "biomonitoring emergency response plan."

There were three public commenters on the Looking Forward agenda item. Rachel Washburn from Loyola Marymount University in Los Angeles suggested considering nail salon workers as a group to study. This group tends to be Asian urban women of reproductive age, another population which has not been studied well.

Davis Baltz of Commonwealth seconded the comment on nail salon workers, pointing to the California Healthy Nail Salon Collaborative as a good point of contact for this group of workers. Mr. Baltz also suggested that the Program consider people who work with cleaning chemicals and agricultural workers. He also agreed with the concept of building on and expanding the mother and infant and firefighter projects as a first step, considering the Program's limited resources. He raised the idea of trying to monitor cord blood on a regular basis. He named a number of fence-line communities who may be appropriate to study: West Oakland and Richmond in northern California, and in Southern California, the cities of Vernon, Commerce,

and areas around the Port of Los Angeles. Mr. Baltz thought some environmental sampling would be useful, such as taking samples of couches since dust that is coming off older sofas is going to be more laden with flame retardants. However, he also emphasized the importance of focusing on biomonitoring. He noted that Camp Lejeune in North Carolina had a spike of breast cancer cases among men, so military bases might be of interest as a follow-on to the idea of looking at returning veterans. Mr. Baltz thought it would be worth offering to biomonitor County Health Officers or the Legislature, as a way to raise the profile of the Program. He also noted an example where the CDC did an emergency biomonitoring study when a pesticide was illegally applied in Mississippi, which helped identify those who were actually exposed and needed to be evacuated versus homes that were not contaminated. So Biomonitoring California could play an important role in emergency response, though there is no funding for that.

Sharyle Patton of the Commonwealth Biomonitoring Resource Center brought up the idea of having a way for communities to apply to be biomonitored, instead of taking only a top down approach in choosing them.