IMPLEMENTATION OF THE CALIFORNIA ENVIRONMENTAL CONTAMINANT BIOMONITORING PROGRAM

Appendix E of
Report to the California Legislature

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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Appendix E: Results of Public Participation Activities on What Chemicals Should be Biomonitored in California

(Appendices referenced in this report may be found at: http://www.oehha.ca.gov/multimedia/biomon/reports.html)

Preface

This report presents the results of public participation activities conducted to engage the public in the California Environmental Contaminant Biomonitoring Program ("the Program"). The Program is a new initiative that will measure levels of environmental chemicals in California residents by systematically collecting biological specimens, such as blood and urine, and analyzing them in the laboratory. The goals of the Program are to:

- Determine levels of environmental chemicals in a representative sample of Californians.
- Establish trends in the levels of these chemicals over time.
- Assess the effectiveness of public health efforts and regulatory programs to reduce exposures of Californians to specific chemicals.
- Provide opportunities for meaningful public participation through activities and materials that are understandable and sensitive to the diverse needs of Californians.

The Program was authorized by the State Legislature and signed into law by Governor Schwarzenegger in 2006 (Senate Bill 1379, Perata, 2006), and program funding was received in July 2007. The Program is being implemented by three departments in state government: the California Department of Public Health (CDPH), the Office of Environmental Health Hazard Assessment (OEHHA), and the Department of Toxic Substances Control (DTSC). The external Scientific Guidance Panel ("the Panel") provides expert technical advice. The Program actively engages the public in program design and implementation through workshops, meetings, surveys and other approaches.

The activities described in this report were conducted during March to May 2008 to encourage early public participation and advice on an important element of the Program – the selection of chemicals for biomonitoring. A variety of individuals participated, including those from non-governmental and community-based organizations, state and local government agencies, universities, and businesses, as well as interested residents. We would like to acknowledge and thank all the individuals who participated for taking the time and making the effort to become involved in the Program's development.

Since the completion of the activities discussed in this report, chemical selection has been a topic of discussion at other public meetings: a technical workshop (open to the public) held on June 9 and the Panel meeting on June 10, 2008, both held in Oakland; the Panel meeting on December 4 and 5, 2008, which was held in Sacramento and

webcast. Some results of the public participation activities described in this report were presented at the June 10, 2008 Panel meeting. Members of the public made comments on chemical selection in person at these meetings and also via email during the December 2008 meeting. The Panel recommended additions to the list of designated chemicals at the December 2008 meeting. Recommendations for further additions to the list, and for the identification of priority chemicals for biomonitoring, will occur at future meetings.

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1. Introduction

This report presents results from a series of activities conducted to gather ideas and advice from the public on selecting chemicals for biomonitoring by the California Environmental Contaminant Biomonitoring Program ("the Program"). The report will inform the decision-making process of the Program and its technical external advisory body, the Scientific Guidance Panel ("the Panel"). During the first Panel meeting, held in December 2007, the Program made a commitment to gather information from interested stakeholders on possible chemicals and priorities for biomonitoring. Following this meeting, the Program planned and carried out a series of public workshops and teleconferences and a web-based survey, each focusing on issues of chemical selection.

Program staff had three objectives as they planned these public participation activities:

1. To involve stakeholders in the process of selecting chemicals for the California Biomonitoring Program.
2. To disseminate general information about the Biomonitoring Program.
3. To build community capacity on biomonitoring, that is, to increase understanding of biomonitoring by public participants and thereby enable them to be more effectively involved in the Program's design and implementation.

A variety of individuals chose to participate, including those from non-governmental and community-based organizations, state and local government agencies, universities, and businesses, as well as interested residents. The findings from these public activities do not represent the opinions of a random or representative sample of Californians. Rather, they reflect the opinions of motivated and interested individuals who provided their ideas, concerns, and advice about chemicals of interest and priorities for biomonitoring.

The current report focuses on public participation on the selection of chemicals for biomonitoring. During the public participation activities (workshops, teleconferences, survey), as well as in comments sent to the program by email, participants offered valuable ideas and suggestions, some addressing concerns other than chemical selection. For example, at the public workshops, members of the public commented on special studies and on the overall Program framework, following presentations on Program elements. Information beyond the scope of the current report will be considered by staff in other aspects of implementing the Program, but are not presented in detail here.

Process for Chemical Selection in Legislation

The process for chemical selection is explained below to orient the reader. Selection of chemicals for biomonitoring by the Program involves a multi-step process. The process is laid out in the legislation that established the Program (California Health and Safety Code (H&SC) Sections 105440 et seq.). Key passages on chemical selection in the legislation are quoted in Appendix 2.

Step 1: Designated Chemicals

In the first stage of the selection process, chemicals of concern are considered for inclusion in a list of "designated chemicals". Only a "designated" chemical can be biomonitored. Designated chemicals are defined in the legislation as:

1. "Those substances including chemical families or metabolites that are included in the federal Centers for Disease Control and Prevention (CDC) studies that are known collectively as the National Reports on Human Exposure to Environmental Chemicals program," and
2. Those that have been adopted by the Program as "designated" according to the process laid out in the legislation.

Appendix 1 lists chemicals, including families and metabolites, studied by the CDC. The Panel may recommend additional designated chemicals not included in the CDC program using the following criteria:

1. Exposure or potential exposure to the public or to specific subgroups.
2. Known or suspected health effects based on peer-reviewed studies.
3. The need to assess the efficacy of existing public health actions to reduce exposure to a chemical.
4. The availability of an analytical method for biomonitoring with adequate accuracy, precision, sensitivity, specificity, and speed.
5. The availability of adequate biomonitoring samples.
6. The incremental analytical cost to perform the biomonitoring analysis for the chemical.

At the time these public participation activities were conducted, the Panel had not recommended and the Program had not adopted additional designated chemicals. The public participation activities described in the current report were in part designed to elicit ideas on additional chemicals that should be "designated" within the meaning of the legislation.

Step 2: Priority Chemicals

There are more designated chemicals than can be biomonitored by the Program during its initial activities. The legislation sets out a process of picking "priority chemicals" for biomonitoring from those that have been designated. While the Program retains final decision-making authority, the Panel may recommend priority chemicals based on:

1. The degree of potential exposure to the public or specific subgroups, including, but not limited to, occupational subgroups.
2. The likelihood of a chemical being a carcinogen or toxicant based on peer-reviewed health data, the chemical structure, or the toxicology of chemically related compounds.

3. The limits of laboratory detection for the chemical, including the ability to detect the chemical at low enough levels that could be expected in the general population.
4. Other criteria that the panel may agree to.

The public participation activities described in the current report were also designed to elicit ideas on additional criteria for the Panel to consider in making recommendations for priority chemicals for biomonitoring.

2. Methods and Materials

This section describes the methods and materials used in the public participation activities:

- a series of in-person workshops and teleconferences
- a web-based survey in English and Spanish
- public comment via mail and email submission

A. Workshops and Teleconferences

Staff developed a series of three four-hour workshops and three two-hour teleconferences. The workshops were designed to provide opportunities for the public to suggest environmental chemicals to be considered for biomonitoring, and to present information about biomonitoring and the Program, answer questions and hear public concerns.

Program staff opened each workshop by introducing general information about biomonitoring and the Program. Participants then asked questions and commented on what they had heard. Next Program laboratory staff presented on and discussed laboratory considerations with workshop participants. The rest of the workshop addressed the chemical selection process, focusing both on chemicals of interest for biomonitoring and criteria for selecting priority chemicals. Over half of each event was dedicated to hearing questions and comments from participants. The outline for the workshops and teleconferences follows. The agendas can be found in Appendix 3.

Part I. Program Overview:
California Environmental Contaminant Biomonitoring Program
- Introduction to biomonitoring
- Legislative background on the Program
- Program organization
- Possible program components
- Provisional timelines/milestones

Part II. Why Chemical Selection is Important for the Laboratories
(Segment presented at workshops but not teleconferences)
- Building laboratory capacity
- Starting small and building

- Steps in developing chemical testing methods

Part III. Selecting Chemicals for the California Biomonitoring Program

- Selecting chemicals according to the legislation
- Designated chemicals
- Examples of chemicals
- Selection criteria for choosing priority chemicals

All workshops and teleconferences were open to the public; pre-registration was requested but not required. Program staff publicized the meetings via listserv announcements, posting on the Program's[1] website, and emails to stakeholder organizations. Staff prepared handouts on the Program and chemical selection, and made these and slide presentations available on the Program's website.

B. Public Comments Submitted via Email

In addition to the workshops and teleconferences, the Program also offered an option of submitting comments via the Program's email address, biomonitoring@oehha.ca.gov. This avenue was described during the first Panel meeting and was mentioned at each of the public participation sessions, in the online Chemical Selection Survey, in notes sent by the biomonitoring listserv, and in other materials distributed to the public. Visitors to the Program's website were also informed of the email address where they could send their comments.

C. Survey

Survey Design

The chemical selection survey originated with a review of surveys cited in the California Biomonitoring Needs Assessment, published in October 2002 by the California Department of Health Services[2]. Program staff drafted the chemical selection survey with input from colleagues in the CDPH Occupational Health Branch. The draft underwent multiple revisions, and was reviewed by the Panel Chair and two other members of the Panel.

The resulting qualitative survey was designed to gather opinions and comments on specific chemicals and high-priority chemical categories for biomonitoring, as well as on criteria for selecting priority chemicals. The survey consisted of both multiple-choice and open-ended questions; the web-based interface was created using the online tool, SurveyMonkey. The survey was written in English, translated into Spanish and posted online in both languages. A mechanism for receiving and submitting paper copies of the

[1] Program Website hosted by the Office of Environmental Health Hazard Assessment (OEHHA) at www.oehha.org/multimedia/biomon/index.html

[2] Within CDHS, the Environmental Health Investigations Branch and the Environmental Health Laboratory Branch were responsible for developing the document. Those Branches are now part of the California Department of Public Health.

survey was also offered. The hard-copy adaptations of the survey in English and Spanish are provided in Appendix 4A and 4B. They differ in appearance from the online version, but are the same in all other respects.

The survey consisted of an introduction to the biomonitoring program and a brief explanation of the chemical selection process, and of the criteria set out in the legislation for selecting priority chemicals. This background information was followed by a series of questions. The first section asked respondents to indicate four criteria they believed most important from a list of ten possible additional approaches the Program and Panel could consider using to select priority chemicals. These criteria are listed in Table 1. Respondents were asked to select their top four criteria from the list, and to rank those four in terms of their importance, from most to less. The survey also provided space for respondents to suggest other issues by asking: “Should the program consider other issues in selecting priority chemicals?”

Table 1. Survey Query on Possible Additional Criteria for Selecting Priority Chemicals for Biomonitoring

“The program should give priority to: (1=most important, 4=less important)[1]

1. Measuring chemicals that are widely used throughout California.
2. Measuring chemicals that will help government decide whether environmental laws are working.
3. Measuring new, emerging chemicals, or other chemicals, that are now becoming widely used.
4. Measuring chemicals that Californians come into contact with at work.
5. Measuring chemicals that are studied nationally so that we can compare California with the rest of the country.
6. Measuring chemicals that are not studied nationally so that we can find out about chemical exposures that the federal government is not investigating.
7. Measuring chemicals expected to be higher in Californians because of specific activities or regulations in the state - for example, gold mining, oil refining, farming, or strict flammability standards for furniture.
8. Measuring chemicals to which pregnant women, fetuses and young children are likely to be especially sensitive.
9. Measuring chemicals that persist in the environment and can accumulate in people's bodies over time.
10. Measuring chemicals in communities where people may come into contact with more pollutants than the general population – for example, near factories, ports, oil refineries or farms.

[1] Respondents were asked to choose their four top criteria, ranking the four from most to less important.

The second section asked, “Which chemicals should the Biomonitoring Program measure in Californians?” for 13 different classes or categories of chemicals. These categories are shown in Table 2. Respondents were asked to rate these classes or categories on a scale of “Important – Somewhat important – Not important – Don’t know.” Respondents were also invited to list or describe specific chemicals or products

in each category that should be measured if they rated the overall category as "Important" or "Somewhat Important." Respondents were also offered the opportunity to list or describe other chemicals they thought the program should measure. Finally, the survey asked respondents to rank their top four of the 13 chemical categories listed in Table 2.

The last section gave respondents an opportunity to list examples of highly exposed communities, groups of workers exposed to chemicals on the job, and any additional comments they might have. At the end of the survey there was an optional section requesting respondents' names, affiliations (organization or company) and contact information.

Table 2. Categories of Chemicals Included in the Survey

"Which chemicals should the Biomonitoring Program measure in Californians…

1. Metals, such as those sometimes found in food, toys and drinking water
2. Pesticides or other chemicals used in farming to control weeds, insects, rodents and fungi that affect crops.
3. Pesticides used in or around homes or schools.
4. Chemicals found in plastics, such as those in packaging and consumer products, including water bottles and children's toys.
5. Flame or fire retardants, such as those found in furniture and electronics
6. Chemicals found in personal care products
7. Chemicals found in cleaning supplies
8. Chemicals found in workplaces
9. Chemicals that result from burning trash, plastic, tires and other discarded materials
10. Chemicals that result from burning oil, gasoline, diesel or coal
11. Chemicals from industrial plants or hazardous waste sites
12. Chemicals that may contaminate drinking water
13. Chemicals found in food

Survey Data Collection

Program staff used a web-based survey because it was easy to disseminate broadly and economical to create. The SurveyMonkey tool generates a web link that directs respondents to the survey. The survey was open to any member of the public able to access the link.

The survey link was posted on the Program's website (hosted by OEHHA). The members of the biomonitoring listserv, as well as workshop and teleconference participants, were notified of the survey and the deadline for completing it. In addition, a number of government agencies, private-sector, non-profit and community organizations were informed of the survey and asked to share the survey link with their members and constituents. For individuals without access to the internet, staff provided a paper copy of the questionnaire upon request. Paper copies of the survey were also

available in English and Spanish. The survey was available online from April 8, 2008 through May 7, 2008.

Survey Analysis

The survey data were exported as an Excel file and analyzed using SAS and Excel. Responses to the open ended questions and comments were manually tabulated and grouped. Each individual survey response was read to ascertain specific suggestions for chemicals and criteria.

3. Extent of Participation

A. Participation in Workshops/Teleconferences

The three workshops were conducted in Los Angeles (March 24), Oakland (April 3) and Fresno (April 23), while the three teleconferences were accessed using a toll-free call-in number on April 8, 17, and 28, 2008.

Persons attended as private citizens, though many also listed affiliations with a variety of organizations, including non-governmental organizations, universities, businesses, consulting firms, and state and local government. The numbers of participants at the workshops and teleconferences are listed below.

- Number of workshop participants:
    - Los Angeles – 11
    - Oakland - 40
    - Fresno - 20

- For the teleconferences, a total of 32 telephone lines were open. Some lines had multiple participants.
    - April 8 - 19 lines
    - April 17 - 9 lines
    - April 28 - 4 lines

Comments and questions received during the workshops and teleconferences covered a range of issues about the biomonitoring program. These include some comments and questions that did not address chemical selection issues. These comments on topics other than chemical selection are summarized in Appendix 7. Questions and comments regarding the Program's general approach and framework that are beyond the scope of this report will be considered in subsequent Program implementation.

B. Participation via Email

Eighteen public comments providing suggestions on chemical selection via the Program's email address were received from January 7 through May 7, 2008. In addition, one individual provided comments in hard copy at one of the workshops. Another individual submitted written material in conjunction with oral comments made

during a workshop; both oral and written suggestions from that individual are summarized together with the workshop comments.

The submissions ranged from short email messages to email notes with multiple attachments of 50 to 100 pages in length. These attachments generally provide information supporting the inclusion of a particular chemical or chemicals. One submission focused on criteria to be used in identifying Program priorities, and another provided background material to support consideration of a particular community for a special study. The materials related to community studies will be considered in subsequent Program development and implementation. Suggestions received via email regarding communities of interest and chemicals for biomonitoring are summarized in Appendices 7 and 8, respectively.

C. Participation in the Biomonitoring Survey

In total, 319 people took the survey. 318 started the English-language version of the survey and answered at least one question; one person took the Spanish-language version.

258 (81%) respondents chose the option of giving information about themselves, including organizational affiliations. Figure 1 gives the corresponding percentages, and Table 3 gives further information on these respondents.

Figure 1. Affiliation of Survey Respondents

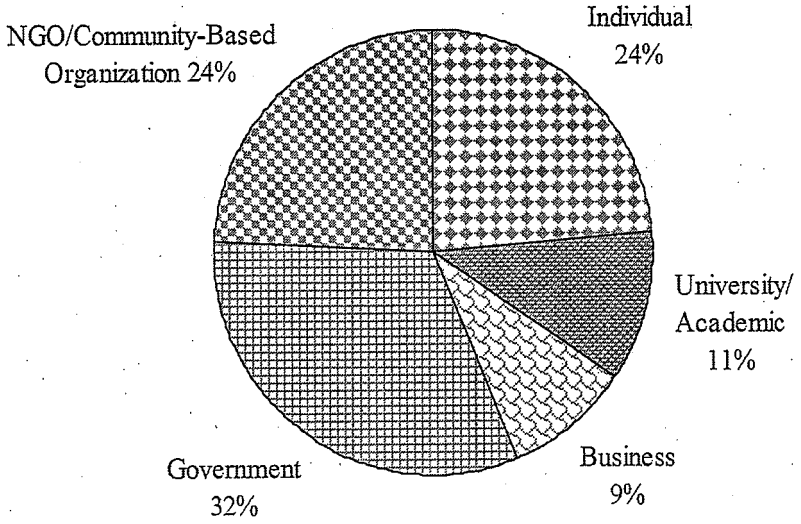


Table 3. Affiliation of Survey Respondents (Who Provided Optional Identifying Information)

Business	24 respondents: Nine (38%) worked for an international business or industry, three (13%) for a national business or industry, seven (29%) were part of a small business, and five people did not specify.
Government	83 respondents: 39 (47%) worked for local government, 33 (40%) for state government, six (7%) for the federal government, and four (5%) for a regional government organization. One additional person identified as a retired government employee.
NGOs or community-based organizations	62 respondents: Some selected “Other” type of organization, 15 (24%) worked for organizations specializing in health outcomes, such as cancer or asthma, 14 (23%) were with environmental organizations, nine (15%) were with environmental justice organizations, 4 (6%) worked for worker health and safety organizations, and 20 (32%) fit into other categories.
Individuals	61 respondents, including one person identified as a member of a Native American tribe.
Academic/ University	28 respondents.

An important caveat to keep in mind in reviewing the results of the online survey is that they do not represent the opinions of a random sample of Californians or a representative sample of people who heard about the new California Biomonitoring Program. Everyone who had expressed an interest in the program, including people from out of state, were invited to take the survey, and people were also encouraged to invite colleagues in state government, universities, nonprofit organizations and the business community to participate. The answers reflect this mix. They are the opinions of individuals but they may also express the point of view of an organization or an employer.

4. Chemicals Suggested for Inclusion in the Program

The public participation activities generated a large number of questions and suggestions regarding chemical categories and specific chemicals and products of concern. Specific findings are detailed in the following sections.

A. Chemicals Recommended in Workshops and Teleconferences

During the workshops and teleconferences, the subject of which chemicals to include in the Program generated 85 comments or questions. In total, 57 chemicals or chemical groups were included among them: 33 discrete recommendations for chemicals to consider for the statewide program, and 24 chemicals related to sites of concern to three workshop participants. Issues related to the laboratory were also raised (28 questions and comments), such as which specimens to collect (e.g., blood, cord blood, hair, breast milk), how many people would be sampled, and what methods would be used.

Discrete Chemicals
Table 4 lists the discrete chemicals raised as concerns or recommended for biomonitoring during the workshops and teleconferences.

Table 4. Chemicals or Chemical Groups Suggested during Teleconferences and Workshops

Chemicals or Chemical groups	No. of supporting comments
1. Metals	8
2. Pesticides	9
3. Radioisotopes	3
4. Phthalates	3
5. Perchlorate	2
6. Other (components of diesel fuel, chemicals in vaccines, decaBDE, triclosan, pharmaceuticals, and personal care products)	8
Total	**33**

Two chemical groups, metals and pesticides, dominated discussions during the public sessions. Specific metals mentioned by name included arsenic, hexavalent chromium, lead, manganese, nickel, and cadmium. Lead and other heavy metals were mentioned twice specifically with relationship to their adverse effects on children, and legacy

contamination from past activities such as mining, shooting ranges, and battery recycling.
Nine participants identified pesticides as a chemical group of concern. Those mentioned specifically by name included organophosphates (three times), chlorpyrifos, DEET, the metam sodium-metabolite MITC, organochlorines, and any pesticides or products sprayed over communities to fight infestations such as fruitflies or the light brown apple moth. Two individuals were interested in the Program measuring cholinesterase levels among biomonitoring program participants with elevated exposure to organophosphates

Also suggested for inclusion were radioisotopes, phthalates, endocrine disruptors, perchlorate, components of diesel fuel, chemicals in vaccines, decabromodiphenylether (decaBDE), triclosan, pharmaceuticals, and personal care products.

Two participants mentioned that chemicals from illegal dumping of waste fertilizers and products from methamphetamine labs should be considered.

Site-specific Chemicals
A participant in Los Angeles submitted multiple documents about three issues of concern in the San Fernando Valley in Southern California. Included are chemicals found at the former Rocketdyne site, chemicals in water being reinjected into the San Fernando Valley Aquifer, and Chatsworth Park, the location of a former shooting range. In addition to radioisotopes, chemicals included in submitted documents include metals (antimony, arsenic, barium, beryllium, cadmium, hexavalent chromium, copper, cyanide, iron, lead, mercury, manganese, molybdenum, nickel, thallium, selenium, silver, vanadium, and zinc), as well as chlorine, tetrachlorodibenzo-p-dioxin (TCDD), tetrachlorophenol (TCP), and pentachlorophenol (PCP).

Laboratory Related Questions
The public workshops served as an opportunity for stakeholders to build knowledge about laboratory procedures for chemicals of interest. Thirteen attendees sought general information about particular chemicals and whether they could be detected in the laboratory on PBDEs, perchlorate, endocrine disruptors, methane, and caffeic and giberellic acids.

Interest was demonstrated in laboratory start-up and specimens to be collected as well during the public sessions. Inquiries were made about laboratory capacity, instrumentation, and collections methods. In terms of biological samples, questions were fielded about testing chemicals in breast milk, cord blood, hair, liver biopsies, nails, saliva, serum, and urine.

One workshop participant expressed concern that samples would be archived in only one laboratory located in an earthquake zone. He recommended that the program consider archiving samples in both northern and southern California locations.

B. Chemicals Recommended via Email

Specific chemicals or products of interest identified in public comments submitted via email are summarized in Table 5. In general they are the same as those identified via the workshops and survey. Some chemical suggestions were accompanied by data and other details to support their inclusion in the Program. Substantial information accompanied comments on two chemicals that are not currently measured by the CDC biomonitoring program, decamethylcyclopentasiloxane (D5) and triclocarban.

Table 5. Chemicals of Interest Identified in Email Submissions

Summary of Submissions	Chemicals or Products Suggested (number of separate submissions noting this chemical)
Six individuals or organizations submitted comments via email or hard copy	Bisphenol A* (twice) Caffeic acid Chemicals present in dryer sheets and fabric softeners Chemicals used in the dry cleaning industry* Decamethylcyclopentasiloxane (D5)* Depleted uranium Fire retardants Formaldehyde Lead Mercury* (twice) Pesticides Phthalates Radionuclides* Solvents Triclocarban* Triclosan*

* Lengthy attachment(s) provided with comment

C. Chemicals Recommended in the Survey

<u>Chemical categories of interest for inclusion in the Program</u>
To get an idea of the types of chemicals the public would like to see biomonitored, survey respondents were asked to rank each of the 13 chemical categories by level of importance. For each category they were asked to answer the question, “Which chemicals should the Biomonitoring Program measure in Californians…” by indicating whether the category was:

- Important
- Somewhat Important
- Not Important
- Don’t Know

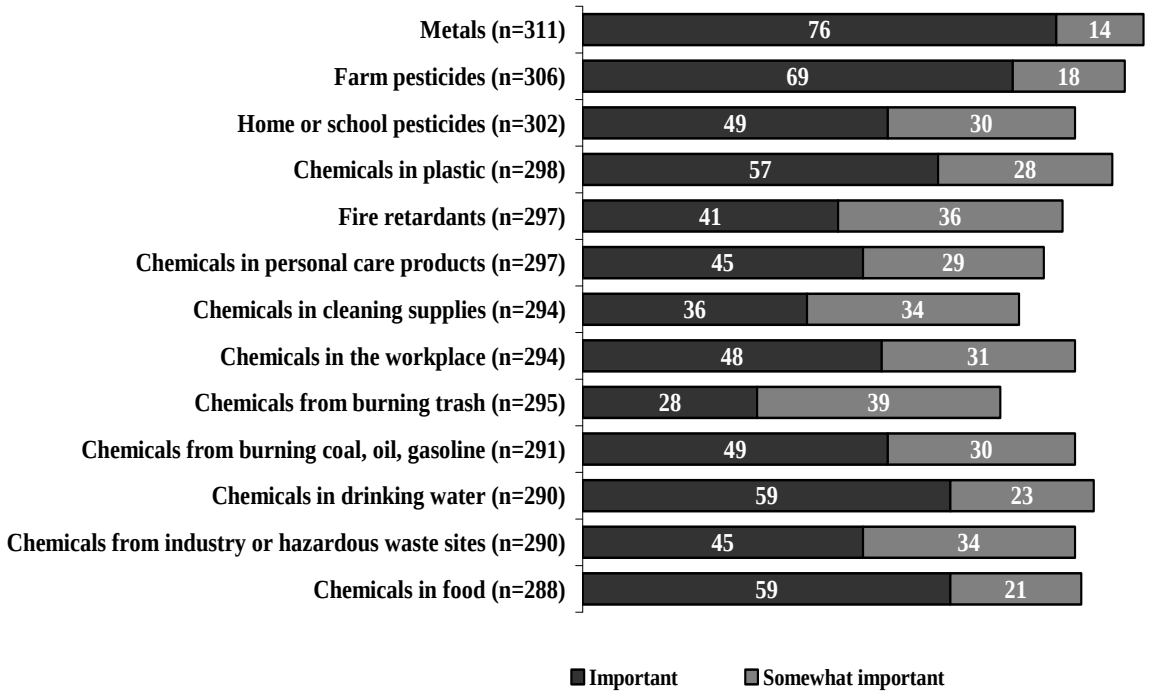
The verbatim wording of the categories in the survey is given in Table 6.

Table 6. Categories for the Survey Question "Which chemicals should the Biomonitoring Program measure in Californians…"

1. Metals, such as those sometimes found in food, toys and drinking water – For example: mercury, lead, chromium, arsenic.
2. Pesticides or other chemicals used in farming to control weeds, insects, rodents or fungi that affect crops, including fruits, grains, vegetables or cotton.
3. Pesticides used in or around homes or schools - for example, to control fleas, ticks, weeds or insects in the home or yard.
4. Chemicals found in plastics, such as those in packaging and consumer products, including water bottles and children's toys.
5. Flame or fire retardants, such as those found in furniture and electronics.
6. Chemicals found in personal care products - for example, cosmetics, nail polish and shampoo.
7. Chemicals found in cleaning supplies - for example, window, floor, and bathroom cleaners.
8. Chemicals found in workplaces. There are many thousands of chemicals used in workplaces; a few examples include chemicals used to manufacture household appliances and electronics, solvents (such as metalworking fluids, paint thinner or nail polish remover), or gases that can be irritating to breathe.
9. Chemicals that result from burning trash, plastic, tires and other discarded materials.
10. Chemicals that result from burning oil, gasoline, diesel or coal - for example, from power plants, ships at port, cars, buses or trucks.
11. Chemicals from industrial plants or hazardous waste sites.
12. Chemicals that may contaminate drinking water - for example, prescription drugs, petroleum products, and chlorine disinfection byproducts.
13. Chemicals found in food - for example, pesticide residues, fungal toxins, byproducts formed during cooking, or chemicals in packaging that migrate into food.
14. Are there other chemicals that you think the program should measure? If so, please list or describe them below.

Nearly all of the 319 survey respondents answered this question. As Figure 2 shows, over two-thirds of the respondents found each chemical category to be either important or somewhat important for biomonitoring. The largest percentage of "most important" votes was for metals, followed by agricultural pesticides, chemicals in plastics, drinking water and food. The extent of response followed the order of placement of the question in the survey: 311 responded to the question for the first category (metals), with numbers generally dropping by a few individuals to the final category (chemicals in food), with 287 respondents.

Figure 2. Present Respondents Rating Each Category as Important or Somewhat Important



Respondents selecting the options “most important” or “somewhat important” for a category were then offered the option of suggesting specific chemicals that the program should measure. For example, after responding to Question 7 (see Table 6) the following option was offered:

> “If you answered Important or Somewhat Important, you may list or describe below any specific chemicals found in cleaning supplies that you think the program should measure.”

Respondents provided a large number of suggestions for chemicals to biomonitor in response to this option for the set of 14 categories presented. They named over 300 different chemicals or chemical types. Responses are tabulated in Appendix 5. In many cases, the same chemical was named by multiple people, with lead, mercury, phthalates and bisphenol A named by one-third or more of those completing the survey. Table 6 gives the chemicals and chemical types most frequently written in by respondents. A number of these are being tested in the CDC’s program. These are shown in italics in Table 7.

Table 7. Chemicals Most Frequently Suggested for Biomonitoring in Survey Responses[1]

Individual Chemicals	Chemical Classes	Chemical Types
• *Lead* • *Mercury* • *Bisphenol A* • *Arsenic* • *Dioxin* • *Cadmium* • Chromium • Glyphosate • *Formaldehyde* • *Perchlorate* • *Chlorpyrifos* • *Benzene* • Deca-BDE • *Perfluorooctanoic acid*	• *Phthalates* • *Polybrominated* • *Diphenyl Ethers* • *Polychlorinated biphenyls* • *Pyrethroids* • Parabens • Heavy *Metals* • *Organophosphates* • *Polyaromatic hydrocarbons*	• Pesticides • Pharmaceuticals • Endocrine Disruptors • Solvents • Fragrances • Bioaccumulative or persistent • Diesel exhaust • Fluorinated Polymers • Volatile Organic Compounds • Hormones • Particulate Matter • Hazardous air pollutants

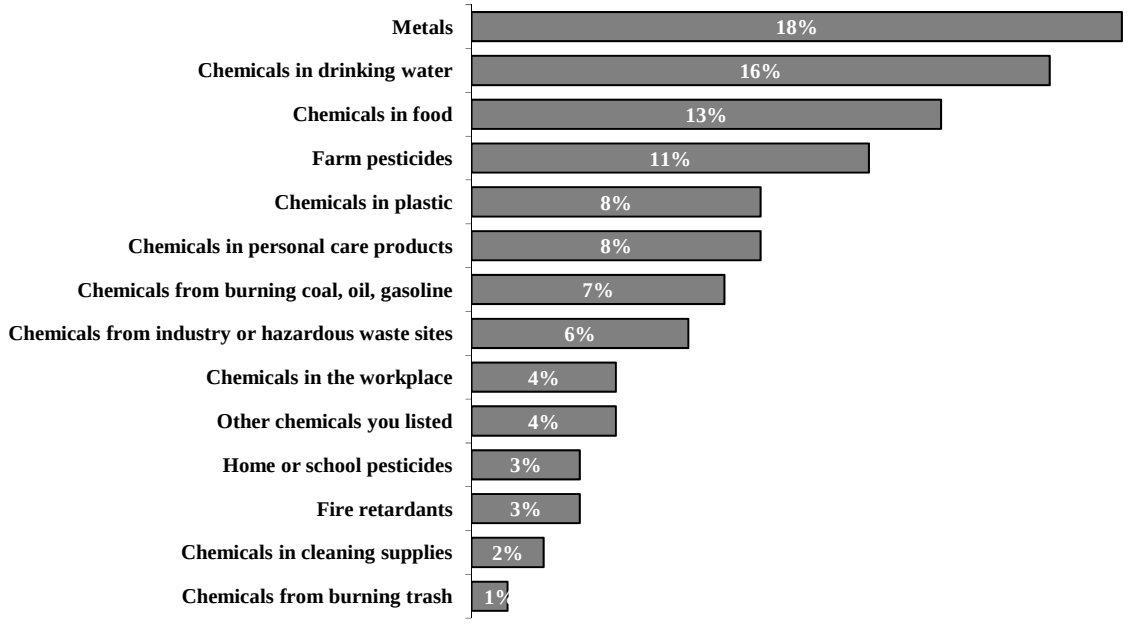
[1] Chemicals or chemical classes being biomonitored in the national CDC program are *italicized*.

In response to the final category, respondents could suggest other types of chemicals not covered by earlier categories. Generally suggestions included chemicals that fit into the previous categories. Those that did not include tobacco smoke indicators (e.g., cotinine), crystalline silica, the perchloroethylene substitute D5, aflatoxin, nanotubes, and indicators of effect such as inflammatory markers of cardiovascular disease.

Oftentimes the same chemical was mentioned in different categories by different people. For example, endocrine disruptors, lead, mercury, and phthalates were raised in nine of the 14 categories, and dioxins were raised in ten. Various respondents indicated the desire for the program to give priority to chemicals that cause specific types of health outcomes – cancer, asthma, mutations, reproductive effects and endocrine disruption. The wide range of specific suggestions for biomonitoring in response to the open-ended questions on chemical selection are grouped by type in Appendix 5, and specific chemicals or classes under study by the CDC are noted.

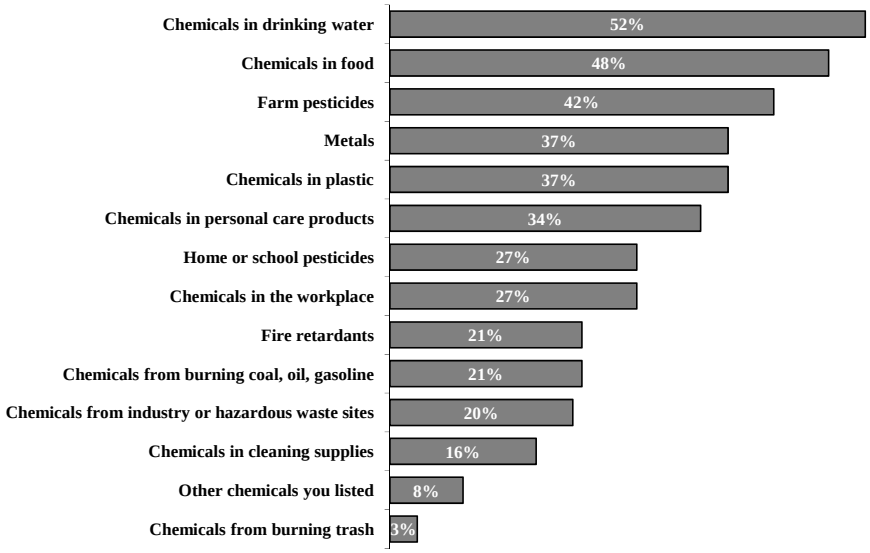
Finally, people were asked to indicate the “four most important categories of chemicals that the program should measure.” Metals were ranked first followed by chemicals in drinking water, chemicals in food, and farm pesticides.

Figure 3. Percent Respondents Choosing a Specific Chemical Category as Their Highest Priority (262 Respondents)



If instead of considering only the category chosen as the highest priority as is shown in Figure 3, we consider the four categories that were top priorities of respondents, a somewhat different ordering emerges. However, in this analysis, the same categories are of greatest interest, as shown in Figure 4. The chemicals in drinking water category (52%) is the one chosen most frequently by respondents as one of their top four. This is followed by chemicals in food (47%) and farm pesticides (41%); the metals category is tied with chemicals in plastics (both with 37%).

Figure 4. Percent Respondents Selecting a Specific Chemical Category as One of Their Top Four (262 Respondents)



5. Criteria Suggested for Selecting Chemicals

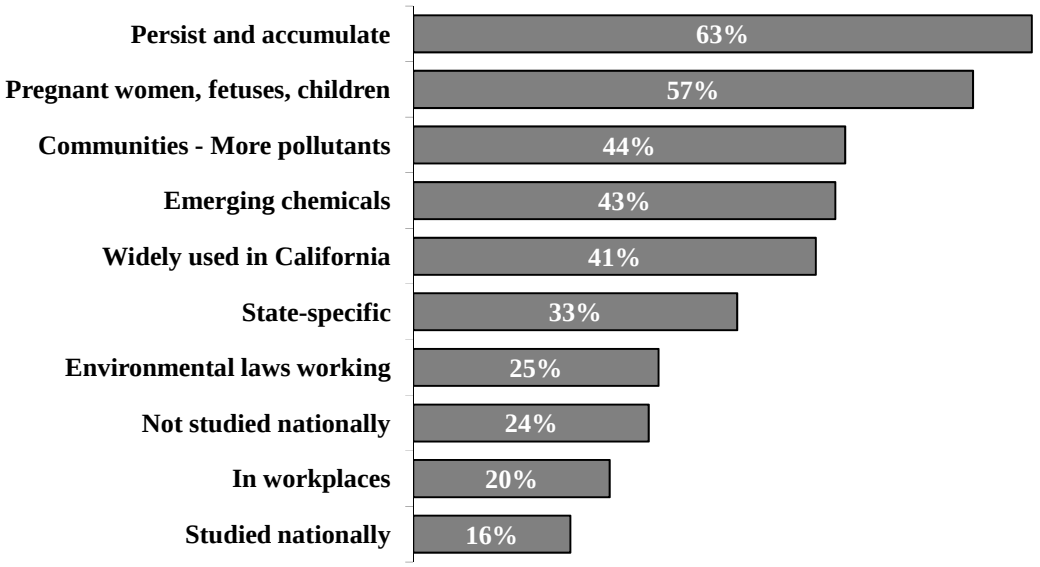
Ten possible criteria that might be used for selecting priority chemicals were discussed at public workshops and teleconferences, and were presented in the survey. As discussed above, these would be additional criteria beyond the three criteria specified in legislation. Suggestions for other issues that should be considered in selecting priority chemicals were also solicited. This section describes which criteria the public found most important and other considerations they suggested for choosing priority chemicals.

A. Comments Received on Possible Criteria Suggested for Selecting Priority Chemicals

Survey respondents were asked to rank the criteria listed in Table 1 above (see page 9) by indicating the four they believed were most important for the Panel and the Program to consider, and to rank them from most important to less important. During the public participation sessions, staff introduced these same criteria and then solicited input from participants by asking: "What issues do you think should be considered as part of the decision-making?" The criterion listed as number 10 in Table 1, *Communities where people come into contact with more pollutants*, was included in the survey but was inadvertently omitted from the public participation session presentations. A total of 290 survey respondents provided their top four criteria, and during the workshops and teleconferences, participants made 24 comments about these criteria.

Figure 6 shows the criteria ranked in the top four by the survey respondents. The one that was ranked most often in the top four (63.1%) was measuring chemicals that persist in the environment and can accumulate. Several public workshop participants expressed interest that banned chemicals be biomonitored, and these tend to be those that persist and can accumulate, so these discussions suggested a similar concern. The other criterion ranked in the top four by a majority of survey respondents (56.6%) was measuring chemicals that impact pregnant women, fetuses and children. This criterion was the one mentioned most often by participants in the public participation sessions. One of the public comments submitted via email suggested the Program focus on chemicals which affect children.

Figure 5. Choice by Survey Respondents of Possible Criteria for Selecting Priority Chemicals as Among Their Top Four



Three other criteria were chosen by a large number of survey respondents, with rankings in the top four by more than 40 percent of respondents (Figure 6). Among these, the criterion related to chemicals that are found in communities where people may come into contact with more pollutants than the general population was the ranked in the top four by 44 percent of respondents. Although public participation session participants were not presented with this criterion, several participants expressed a concern that exposures in such communities be addressed by the Program. Two public email comments suggested that the Program study specific communities where people are thought to come into contact with more pollutants than the general population.

The other highly ranked criteria included measuring chemicals that are widespread in California (41%), and measuring new or emerging chemicals that are now becoming widely used (43%). Participants in the public sessions also mentioned multiple times the criterion of measuring new, emerging chemicals and those that are widespread in California. A single public comment submitted via email suggested the Program focus on chemicals that have widespread potential exposure.

B. Comments on Other Criteria that Should Be Considered in Selecting Priority Chemicals

Suggestions about other criteria to consider in selecting priority chemicals, beyond those ten criteria offered for evaluation and ranking, were received from 13 workshop and teleconference participants, four submitting comments via email, and 148 (roughly half) of the survey respondents. The suggestions made are summarized below and listed in Appendix 6. This Appendix also tabulates, where available, the organizational affiliation of the person making the suggestion, and whether it was received through the

survey, public participation sessions, or email submission. Some respondents provided multiple suggestions.

Table 8. Criteria Suggested for Selecting Priority Chemicals

General criteria	Criteria Subcategory
1. Toxicity	A. Severity of the effect B. Type of harm caused by the chemical C. Potential for cumulative effects of chemicals D. Toxicity and exposure considered together in some form of hazard evaluation
2. Exposure	A. Extent of exposure B. Persistence C. Specific locations or sources of exposure D. Population at risk – those with a chronic illness or condition E. Population at risk – due to intrinsic characteristics, such as age or genetic factors (e.g., race) F. Population at risk – due to location or particular exposures faced, such as communities of people of color exposed to high levels of toxic chemicals, or exposed workers
3. Laboratory	A. Type of biomarkers available, such as biomarkers of effect B. Type of media sampled, such as blood and urine C. Method availability, accuracy and sensitivity D. Cost
4. Other	A. Results allow for intervention or to assess effectiveness B. Chemicals that have safe alternatives C. Emerging chemicals D. Measured by national program (CDC list) E. Risk communication issues F. Other issues – economics, public concern, delisting

To make it easier to understand the general areas, the suggestions received have been grouped into four major categories, which correspond to the three criteria specified in the legislation (toxicity, exposure, and laboratory considerations) and an additional category of “other”. Within each category, there are subsets of criteria suggested. These are described below, with examples, and are summarized in Table 8. Some of the suggestions overlap with the possible criteria presented by the Program, and also with criteria in legislation.

Toxicity-related Criteria

A substantial portion of the suggestions the Program received on criteria related to considerations of toxicity. Suggestions made regarding selecting priority chemicals based on toxicity generally were one of four types.

First was the suggestion to consider the severity of toxicity in selecting chemicals for the program. An example of this type of suggestion is “The more toxic the chemicals, the higher the priority should be.” A second type of suggestion was to take into account the type of harm caused by the chemical. Many different types of harm were suggested by survey respondents as deserving of priority, including: chemicals that cause cancer, endocrine disruption, neurotoxicity, reproductive toxicity, and ecotoxicity. A third type of toxicity-related suggestion was consideration of the potential for cumulative (e.g., additive, synergistic) effects of chemical exposures.

The fourth type of suggestion grouped in this category concerned both toxicity and exposure. A number of survey respondents suggested as a possible approach consideration of toxicity and exposure together in some form of hazard evaluation. For instance, “Chemicals already known to have health consequences and widely distributed should be measured.”

Exposure-related Criteria

The greatest number of suggestions made addressed issues related to exposure. There were six types of exposure-related criteria described. The first three were the extent of exposure, persistence, and specific locations or sources of exposure. The suggestions to consider the extent of exposure generally pointed to giving priority based on the number of people exposed to commonly encountered chemicals. Persistence was somewhat less frequently suggested, but had also been provided as a possible criterion in the survey and at public participation sessions. As discussed above, persistence was selected as among the top four choices of the ten criteria presented for ranking by the greatest number of survey respondents. Suggestions regarding particular sources of exposure or media were especially frequent, and included indoor air, food, consumer products, vaccines, drinking water, outdoor air pollution and others.

Three other categories of exposure-related criteria suggested relate to considerations of populations at risk. One population at risk mentioned by survey respondents comprised those with a chronic illness or condition, such as people with compromised immune systems or who have severe chemical sensitivity. A second category included populations who are vulnerable due to intrinsic characteristics, such as race or other genetic factors, or age (the elderly, infants and children). This is in accord with the criterion ranked second highest by survey respondents, “measuring chemicals to which pregnant women, fetuses and children are especially sensitive” (See Figure 5). A third category of populations at risk referred to the location or exposures faced by a given population, frequently suggesting that low-income communities, or communities of people of color exposed to high levels of toxic chemicals be given high priority. These suggestions accord with the third ranked survey criterion referencing high-exposure communities (i.e., “Measuring chemicals in communities where people may come into contact with more pollutants than the general population – for example, near factories,

ports, oil refineries or farms”). Other examples include specific populations exposed at the workplace.

Laboratory-related Criteria

Suggestions related to laboratory considerations were made less frequently than those in other categories. One comment referred to chemicals that have particular types of biomarkers available (“Consider chemicals for which there are known markers, i.e., cholinesterases for pesticides, carboxyhemoglobin for methylene chloride”), while another suggested examining biomarkers that might serve as a surrogate for a class of compounds. A different type of suggestion referred to the tissue or fluid to be sampled, with multiple suggestions made to use umbilical cord blood. Other comments related to the availability of methods to analyze the chemical, measurement accuracy, and cost considerations.

Other Criteria

Suggestions of criteria that did not fit into the sets described above generally concerned policy considerations. The majority of these focused on chemicals for which the results could lead to public health interventions or allow for the evaluation of regulatory effectiveness. Multiple respondents suggested focusing on chemicals for which there are effective and safe alternatives. Others suggested that new or emerging chemicals should be emphasized. Some respondents focused on the national program and how the Program’s selection of chemicals should be similar or from CDC’s selection. Others noted that how results would be communicated should influence the choice of chemicals. Still others indicated the need to consider economic factors, such as risk/benefit evaluations, or the level of public concern. One person suggested the development of criteria to remove chemicals from the Program’s list.

6. Summary and Concluding Remarks

This report presents the results of public participation activities conducted in Spring 2008 by the California Environmental Contaminant Biomonitoring Program. A series of public workshops and teleconferences and a web-based survey were conducted and the public's advice via email submission was solicited. These activities were designed to gather ideas and suggestions from the public early in the Program's design phase, on selecting chemicals for biomonitoring in California. In addition, these activities were used to disseminate general information about the Biomonitoring Program, and also to increase the understanding of biomonitoring by public participants to enable more effective involvement in the Program's design and implementation.

The public participation activities were designed to support the multi-step implementation process for chemical selection laid out in the legislation that established the Program. Ideas were solicited on chemicals to biomonitor and criteria to use in choosing from the many possible chemicals worthy of study.

The participation in these activities was reasonably diverse and a good start for a new program. Seventy-one people participated in workshops and teleconferences, 18 commented by email and 319 people took the survey. There was representation from various sectors, including business, NGOs and community-based groups, government and academia, as well as the general public.

A large volume of suggestions for chemical selection were received. Specific chemical classes and types of chemicals suggested most frequently in the survey are as follows:

Individual chemicals

- Lead
- Mercury
- Bisphenol A
- Arsenic
- Dioxin
- Cadmium
- Chromium
- Glyphosate
- Formaldehyde
- Perchlorate
- Chlorpyrifos
- Benzene
- Deca-BDE
- Perfluorooctanoic Acid

Chemical classes

- Phthalates
- Polybrominated Diphenyl Ethers
- Polychlorinated biphenyls
- Pyrethroids
- Parabens
- Heavy Metals
- Organophosphates
- Polyaromatic hydrocarbons

Chemical types

- Pesticides
- Pharmaceuticals
- Endocrine Disruptors
- Solvents
- Fragrances
- Bioaccumulative or Persistent
- Diesel Exhaust
- Fluorinated Polymers
- Volatile Organic Compounds
- Hormones
- Particulate Matter
- Hazardous Air Pollutants

With few exceptions, the comments at the workshops and conferences were consistent with the chemicals named above.

Respondents felt a wide number of sources leading to chemical exposures were worthy of biomonitoring. In response to queries on 13 varied categories of chemical exposures from occupational and environmental sources, two-thirds or more of survey respondents found each category to be either important or somewhat important for biomonitoring. Categories considered to be of most importance were metals, chemicals in drinking water, chemicals in food, and pesticides used in farming. This was seen in the survey and was also reflected in discussions at the workshops and teleconferences.

As for criteria to supplement the three specific ones in the legislation for choosing priority chemicals to biomonitor, the one that was ranked most often in the top four was measuring chemicals that persist in the environment and can accumulate. Several public workshop participants expressed interest that banned chemicals be biomonitored, and these tend to be those that persist and can accumulate, so those discussions suggested a similar concern. The other criterion ranked in the top four by the majority of survey respondents was measuring chemicals that impact pregnant women, fetuses and children. This criterion was also the one mentioned most often by participants in the public participation sessions. The public shared their own specific ideas for criteria, beyond those identified as possibilities by Program staff. In general they indicated the importance of considering different aspects of toxicity, exposure, laboratory capacity, and policy in selecting priority chemicals for biomonitoring in California. Specific advice and ideas are captured in this report and its Appendices are proving to be quite useful as the Program proceeds with planning and design activities.