



**Scientific Guidance Panel Meeting
November 18, 2015**

State Biomonitoring Program Profiles included in this packet:

- [Biomonitoring California](#)
- [Florida](#)
- [Four Corners States Biomonitoring Consortium](#)
- [Indiana](#)
- [Massachusetts](#)
- [Michigan](#)
- [Minnesota](#)
- [Nebraska](#)
- [New Hampshire](#)
- [New Jersey](#)
- [Texas](#)
- [Texas - City of El Paso](#)
- [Virginia](#)
- [Washington](#)

STATE PROGRAM: Biomonitoring CaliforniaProgram website: www.biomonitoring.ca.govProgram email: biomonitoring@oehha.ca.govContact person: Robin Christensen; 510-620-3687; Robin.Christensen@cdph.ca.gov**BACKGROUND**

The California Environmental Contaminant Biomonitoring Program (also called Biomonitoring California) was established via legislation in 2006 (Senate Bill 1379, Perata and Ortiz). The Program is a collaborative effort of the California Department of Public Health (CDPH) as lead, the Office of Environmental Health Hazard Assessment (OEHHA), and the Department of Toxic Substances Control (DTSC). The legislation mandated the creation of the Scientific Guidance Panel (SGP), which provides input on the design and implementation of the Program. Biomonitoring California receives state funds and was awarded CDC grants in 2009 and 2014. Since the Program's inception, we have developed the capacity to measure over 160 distinct chemicals or their breakdown products in urine, serum, and whole blood; obtained specimens from over 7,000 Californians; conducted over 18,500 biomonitoring analyses; and provided specially designed packets describing individual biomonitoring results to over 600 participants.

ORGANIZATION/STRUCTURE

Refer to the attached table.

KEY MANDATES/PRIORITIES

- Measuring chemicals in a statewide representative sample and tracking trends over time
- Conducting community-based studies in impacted and/or vulnerable populations, including intervention studies
- Helping assess the effectiveness of regulatory and public health efforts to reduce exposures to specific chemicals and acting as an early warning system for emerging chemical exposures
- Returning biomonitoring results to all participants who request them
- Integrating environmental justice principles into our studies

CHEMICALS MEASURED (*matrix*)

Environmental phenols (*urine*), including bisphenol A (BPA), some BPA analogs (such as BPS), benzophenone-3, parabens, and triclosan
 Herbicides (*urine*), such as 2,4-D
 Metals (*whole blood, serum, plasma, and urine*)
 Organochlorine pesticides (*serum*)
 Organophosphate flame retardants (*urine*)
 Organophosphate pesticides (*urine*)

Perchlorate (*urine*)
 Perfluorinated chemicals (*serum*)
 Polybrominated diphenyl ethers (PBDEs) (*serum*)
 Polychlorinated biphenyls (PCBs) (*serum*)
 Pyrethroid pesticides (*urine*)
 Herbicides, such as 2,4-D (*urine*)
 Phthalates (*urine*)
 Polycyclic aromatic hydrocarbons (PAHs) (*urine*)

CURRENT/UPCOMING PROJECTS (*visit website for [complete list of projects](#)*)

Biomonitoring Exposures Study (BEST; [Pilot](#) and [Expanded](#)): Study of chemical exposures in adults in the Central Valley
Measuring Analytes in Maternal Archived Samples (MAMAS): Analysis of metals and persistent chemicals in blood collected from pregnant women during prenatal screening
Foam Replacement Environmental Exposure Study (FREES): Pilot intervention study to measure the effects of foam removal on levels of flame retardants in blood and urine (**new project in 2015**)

RECENT PUBLICATIONS (*visit website for complete list of [publications](#), [scientific documents](#), and [reports](#)*)

Dobraca D, Israel L, McNeel S, et al. (2015). Biomonitoring in California firefighters: Metals and perfluorinated chemicals. *J Occup Environ Med*. 57(1): 88–97. [Free full text article](#)
 Park J-S, Voss RW, McNeel S, et al. (2015). High exposure of California firefighters to polybrominated diphenyl ethers. *Environ Sci Technol*, 3; 49(5):2948-58. doi: 10.1021/es5055918. [Link to abstract on PubMed](#)

ADDITIONAL INFORMATION

We provide Spanish language translations of results return materials to participants, if requested, and post selected materials in [Spanish on our website](#). The Program is required to file a [report to the California Legislature](#) every two years. We collaborate with other innovative programs in California, including the [Safer Consumer Products](#) program and [CalEnviroScreen](#).

BIOMONITORING CALIFORNIA

DTSC	CDPH (Program Lead)		OEHHA
<p><i>Environmental Chemistry Laboratory</i></p> <p>Laboratory analyses of blood samples for biologically persistent chemicals, and urine samples for organophosphate flame retardants</p> <p>Quality assurance and interpretation of laboratory data</p> <p>Semi-targeted screening for emerging contaminants</p>	<p><i>Environmental Health Laboratory</i></p> <p>Laboratory analyses of blood samples for metals, and urine samples for metals and non-persistent chemicals</p> <p>Quality assurance and interpretation of laboratory data</p> <p>Processing and storage of blood and urine samples</p> <p>Semi-targeted screening for emerging contaminants</p> <p>Management of analytical results and sample information using LIMS*</p>	<p><i>Environmental Health Investigations Branch</i></p> <p>Overall coordination of Program components and partners</p> <p>Liaison/Principal Investigator on CDC Cooperative Agreement</p> <p>Design of statewide and community surveys</p> <p>Participant recruitment and sample collection</p> <p>Results communication to participants</p> <p>Management and analysis of epidemiologic data</p> <p>Generation of reports to the Legislature</p> <p>Dissemination of information to the public</p>	<p><i>Reproductive and Cancer Hazard Assessment Branch</i></p> <p>Scientific and administrative support of the SGP</p> <p>Evaluation of scientific information for chemical selection, choice of biomarkers, and interpretation of results</p> <p>Development of chemical fact sheets and protocols for evaluating elevated levels</p> <p>Outreach to the public, including updates and improvements to the Program website</p>

*LIMS = Laboratory Information Management System

STATE PROGRAM: Florida Biomonitoring Program

Contact person: Victor Asirvatham, Florida Department of Health, Bureau of Public Health Laboratories, 1217 N. Pearl Street, Jacksonville, FL 32202 Phone 904 791 1792; Email: Victor.Asirvatham@flhealth.gov

BACKGROUND

In 2003 the Center for Environmental/Occupational Risk Analysis and Management, College of Public Health, University of South Florida released the State of Florida Biomonitoring Plan as an assessment for biomonitoring program in Florida to monitor the citizens and visitors of Florida for environmental chemicals exposure. As a result the Florida Department of Health's Bureau of Public Health Laboratories and Bureau of Epidemiology have initiated the Florida Biomonitoring Program.

ORGANIZATION/STRUCTURE

State of Florida, Florida Department of Health, Bureau of Public Health Laboratories, Florida Biomonitoring Program

KEY PRIORITIES

- Identify the prevalence of elevated levels of toxic substances in high risk populations (e.g. the prevalence of elevated blood lead levels among children living in older housing);
- Determine body and tissue levels of pollutants in populations that may be at increased risk of exposure to environmental chemicals;
- Characterize body and tissue levels of pollutants to examine the relationship between exposure to toxic substances and adverse health effects;
- Determine whether levels of toxic substances are higher in vulnerable populations, such as children, the elderly, or women of childbearing age, compared to the general population;
- Characterize trends in the body and tissue levels of select pollutants among vulnerable populations (e.g. levels of mercury in populations that consume fish as a major portion of their diet);
- Verify the efficacy of public health programs to reduce exposure of specific populations to toxic substances.

CHEMICALS MEASURED (*matrix*)

Mercury in hair, arsenic in urine, lead, cadmium and mercury in blood, nicotine in hair and saliva, etc.

CURRENT/UPCOMING PROJECTS**RECENT PUBLICATIONS****ADDITIONAL INFORMATION** (*optional*)

STATE PROGRAM: Four Corners States Biomonitoring Consortium (4CSBC)

Program website: www.4csbc.org

Contact person(s): Sanwat Chaudhuri; 801-965-2470; schaudhu@utah.gov

Sam LeFevre; 801-538-6191; slefevre@utah.gov

BACKGROUND

In 2014, the state public health agencies of Arizona, Colorado, New Mexico, and Utah formed a regional biomonitoring consortium. In addition to sharing a common boundary these states have much in common in geology, environment, economy and demographic makeup. The goal of the Four Corners States Biomonitoring Consortium is to address environmental health concerns that are common to the four states. The program is a collaborative effort of the public health laboratories and environmental epidemiology programs of the four states, with the Utah Department of Health as the lead agency. The 4CSBC is leveraging experience gained through the consortium states' participation in a previous Rocky Mountain Biomonitoring Consortium (RMBC) that functioned between 2003 and 2008, and ongoing collaboration that continued after the RMBC. The 4CSBC was awarded a grant from CDC in 2014 to conduct biomonitoring in this region.

ORGANIZATION/STRUCTURE

See attached Table

KEY MANDATES/PRIORITIES

- Measuring chemicals in urine samples from the residents of the four corners states to estimate exposure to these chemicals
- Conducting community-based studies in affected and/or vulnerable populations and developing interventions
- Reporting individual biomonitoring results back to all participants who request them
- Utilizing existing Chemical Threat (CT) equipment and resources as much as possible
- Developing tools, templates, and experiences that can be shared as an Environmental Epidemiology Toolbox for biomonitoring to states that want to start biomonitoring activities
- Demonstrating the feasibility of multistate collaborative efforts for biomonitoring

CHEMICALS MEASURED (*matrix*)

Metals (*urine*)
Phthalate metabolites (*urine*)
Pyrethroid (insecticide) metabolites (*urine*)
2,4-DCP, a metabolite of herbicide 2,4-D (*urine*)
2,5-DCP, a metabolite of pesticide p-DCB (*urine*)

CURRENT/UPCOMING PROJECTS

AZ: Study of chemicals statewide in the population who are 6 years and older
CO: Study of chemical exposures in 3 to 13 year old children in the San Luis Valley
NM: Study of chemicals statewide in the population who are 18 years and older
UT: Study of chemicals statewide in the population who are 3 years and older

RECENT PUBLICATIONS**ADDITIONAL INFORMATION (*optional*)**

Hopes to collaborate with First Nations/Native American reservations within the 4 states once the procedures and processes have been fully developed and implemented

The 4CSBC is including both English-speaking and non-English speaking participants.



AZ Department of Health Services		CO Department of Public Health and Environment		NM Department of Health		UT Department of Health (consortium Biomonitoring Program Lead)	
<u>Office of Environmental and Analytical Services</u>	<u>Environmental Health</u>	<u>Chemistry Program, Laboratory Services Division</u>	<u>University of CO, School of Medicine</u>	<u>Scientific Laboratory Division</u>	<u>Epidemiology Public Health Division</u>	<u>Chemical and Environmental Services Program, Bureau of Laboratory</u>	<u>Environmental Epidemiology Program, Bureau of Epidemiology</u>
Training and technology transfer	Design and/or adapt 4CSBC surveys for statewide and community studies	Training and technology transfer	Design and/or adapt 4CSBC surveys for community studies	Training and technology transfer	Design and/or adapt 4CSBC surveys for statewide and community studies	Training and technology transfer	Design and/or adapt 4CSBC surveys for statewide and community studies
Laboratory analyses of urine samples for metals and phthalates	Participant recruitment and sample collection	Laboratory analyses of urine samples for metals and 2,4-DCP; 2,5-DCP	Participant recruitment and sample collection	Laboratory analyses of urine samples for metals and pyrethroids	Participant recruitment and sample collection	Laboratory analyses of urine samples for metals and pyrethroids	Participant recruitment and sample collection
Quality assurance and interpretation of laboratory data	Management of participant and sample information	Quality Assurance and interpretation of laboratory data.	Management of participant and sample information	Quality Assurance and interpretation of laboratory data	Management of participant and sample information	Quality assurance and interpretation of laboratory data	Management of participant and sample information
Management of analytical results and sample information	Result communication to participants	Result communication to participants	Result communication to participants	Management of analytical results and sample information	Result communication to participants	Result communication to participants	Result communication to participants
	Management and analysis of epi data	Management of analytical results and sample information	Management and analysis of epi data		Management and analysis of epi data	Management of analytical results and sample information	Management and analysis of epi data
	Generate reports for policymakers		Generate reports for policymakers		Generate reports for policymakers		Generate reports for policymakers
	Disseminate report to public		Disseminate report to public		Disseminate report to public	*Coordinate lab and epi activities with all four states	Disseminate report to public
							*Generate Region-wide report

STATE PROGRAM: Indiana Lead and Healthy Homes Program - Indiana State Department of Health

Program website: <https://secure.in.gov/isdh/19124.htm>

Contact person: Mike Mettler; 317-233-7183; mmettler@isdh.in.gov

Laboratories: Mary Hagerman; 317-921-5553; mhagerma@isdh.in.gov

BACKGROUND

Indiana's Lead and Healthy Homes Program oversees Blood Lead testing for children at risk of Lead Poisoning in Indiana.

ORGANIZATION/STRUCTURE

Indiana Lead and Healthy Homes involves the Environmental Public Health Division of ISDH. The ISDH Laboratories analyzes some of the Blood Lead specimens and all of the environmental investigation samples.

KEY MANDATES/PRIORITIES

- Maintain database of all children tested for Blood Lead in the state
- Educational/Medical follow-up of children with over 5 ug/dL of Lead
- Educate and encourage testing for all eligible children
- Investigate the source of Lead Poisoning of affected children

CHEMICALS MEASURED (*matrix*)

Blood Lead in Dried Blood Spots and Venous Specimens

CURRENT/UPCOMING PROJECTS

None

RECENT PUBLICATIONS

None

ADDITIONAL INFORMATION (*optional*)

STATE PROGRAM: State-Based Biomonitoring in MassachusettsProgram email: DPHBiomonitoring@state.ma.usContact person: Environmental Health: Marc A. Nascarella, Ph.D. (marc.nascarella@state.ma.us)Laboratory Sciences: Jamshid Eshraghi, Ph.D. (jamshid.eshraghi@state.ma.us)**BACKGROUND**

Massachusetts Department of Public Health (MDPH) has established a State-Based Biomonitoring Program to increase the capability and capacity to conduct population-based surveillance to assess human exposure to environmental chemicals. Within MDPH, the Bureau of Laboratory Science (BLS) and the Bureau of Environmental Health (BEH) are the primary collaborators on this effort. The biomonitoring project is expected to increase the capacity of MDPH to perform high quality analytical determinations of biological exposure to environmental toxicants to inform health risk based interpretations and possible interventions to reduce exposure to harmful levels of chemicals. Through this study MDPH seeks to (1) better understand the magnitude of exposure to select environmental chemicals in high-risk communities; (2) establish a statewide baseline level of exposure to select environmental chemicals and (3) increase BLS capacity and capability to conduct rapid biomonitoring assessment following episodic chemical exposure events or acute chemical emergencies.

ORGANIZATION/STRUCTURE (refer to the attached table)**KEY MANDATES/PRIORITIES**

- Use funding to improve the State Laboratory's (MSPHL/BLS) capability and capacity to perform biomonitoring via acquisition of state-of-the-art instrumentation and dedicated staffing
- Provide a database of state-specific background levels of high priority pollutants in a representative sample of adult Massachusetts residents
- Determine levels of select chemicals in targeted, at-risk populations, living in communities with a high risk of potential exposure to metals such as lead, mercury, cadmium and manganese.
- Enhance capacity and capability to respond to episodic/acute chemical exposure events using rapid biomonitoring assessment
- Provide training with academic partners to enhance national capability and capacity to develop biomonitoring studies, conduct chemical analyses, and interpret results

CHEMICALS MEASURED (matrix)

Polychlorinated Biphenyls, PCBs, 39 congeners (<i>serum</i>)	Cesium (<i>urine</i>)
Antimony (<i>urine</i>), Total Arsenic (<i>urine</i>)	Cobalt (<i>urine</i>)
Arsenobetaine (<i>urine</i>), Arsenocholine (<i>urine</i>)	Lead (<i>whole blood and urine</i>)
Trimethylarsine oxide (<i>urine</i>)	Manganese (<i>whole blood and urine</i>)
Monomethylarsonic acid (<i>urine</i>)	Total mercury (<i>whole blood and urine</i>)
Dimethylarsinic acid (<i>urine</i>), Arsenous (III) acid (<i>urine</i>)	Inorganic mercury (<i>whole blood</i>)
Arsenic (V) acid (<i>urine</i>)	Methyl mercury (<i>whole blood</i>)
Barium (<i>urine</i>), Cadmium (<i>whole blood and urine</i>)	Ethyl mercury (<i>whole blood</i>)
	Molybdenum (<i>urine</i>)
	Thallium (<i>urine</i>)
	Tungsten (<i>urine</i>)
	Uranium (<i>urine</i>)

CURRENT/UPCOMING PROJECTS

- 1) Determine levels of PCBs and 13 metals (i.e., antimony, arsenic, barium, cadmium, cesium, cobalt, lead, manganese, mercury, molybdenum, thallium, tungsten, uranium) in a representative sample of adult Massachusetts residents.
- 2) Assess levels of select metals (lead, mercury, cadmium and manganese) in communities with a high risk of potential exposure. This effort is focused on children (ages 5-12) and women of childbearing age to determine the prevalence of individuals with levels above a toxicity threshold.
- 3) Enhance MDPH capability and capacity by conducting rapid biomonitoring assessment following episodic chemical exposure events or acute chemical emergencies.

Massachusetts Department of Public Health	
<i>Bureau of Laboratory Sciences</i>	<i>Bureau of Environmental Health</i>
<ul style="list-style-type: none"> • <i>Environmental Chemistry</i> • <i>Childhood Blood Lead Screening</i> • <i>Develop, verify, and validate methods for all the biomonitoring studies</i> • <i>Implement methods, protocols, and Standard Operating Procedures (SOPs) for biomonitoring project</i> • <i>Process, prepare, store Biomonitoring samples</i> • <i>Analyze clinical samples for PCBs in serum and heavy metals in urine and blood</i> • <i>Screening samples for contaminants</i> • <i>Quality assurance system and interpretation of laboratory data</i> • <i>Management of analytical results and sample information using Laboratory Information Management System (LIMS)</i> 	<ul style="list-style-type: none"> • <i>Development and implementation of methods to identify sample populations from entire state, high risk communities, and episodic/acute exposure events</i> • <i>Development and implementation of technical resources for health-based interpretation of biomonitoring results</i> • <i>Development and implementation of culturally appropriate outreach material for participants and collaborators</i> • <i>Design and implementation of participant questionnaire and outreach tools</i> • <i>Participant recruitment and sample collection</i> • <i>Management and analysis of individual and aggregate data</i> • <i>Results communication to participants</i> • <i>Dissemination of aggregate population data to the public</i> • <i>Coordination of advisory panel to advise on study planning, implementation and outcomes</i>

STATE PROGRAM: MichiganProgram website: http://www.michigan.gov/mdhhs/0,5885,7-339-71551_2945_5103---,00.htmContact person: Matthew Geiger; 517-335-8344; geigerm@michigan.gov**BACKGROUND**

The Michigan Department of Health and Human Services (MDHHS) Analytical Chemistry Section (AC) and Bureau of Epidemiology (BE) have a rich 55 year history of biomonitoring mainly focused on fish and people who eat them, i.e., fish-eaters. Since 1960, AC and BE have been involved in biomonitoring and have served as one of the Community Study Laboratories under the FDA and the US EPA for the development of pesticide exposure by gas/liquid chromatography. In the 1970's, Michigan animal feed was accidentally contaminated with polybrominated biphenyl (PBB), a flame retardant, which exposed Michiganders to the persistent organic pollutant and necessitated the sacrifice of an abundance of farm animals. From this event, AC and BE together with CDC created a cohort of nearly 5,000 individuals (case and control) which provided for multi-generational monitoring of individuals; currently, the cohort monitoring is being managed by Emory University. In the 1980's, AC and BE together with US EPA created another cohort of 1,500 individuals and assessed the levels of PCBs and organochlorine (OC) pesticides in both Great Lakes fish and fish-eaters. This birthed the production of the annual fish consumption advisory which advises residents which fish are safe for consumption and in what quantity based on age, sex, pregnancy status, type of fish and the location the fish was caught. This large cohort of individuals being monitored for persistent organic pollutants has been used as part of many different researches studies since the 1980s. During the 1990's AC and BE worked with researchers from universities around the county to elucidate the effects of human exposure to POP and other environmental. Most recently AC and BE worked with ATSDR creating a new cohort of individuals that consumed fish as a primary source of food for the Detroit River and Saginaw Bay Water shed to study the effect of human exposure to PCBs, OC pesticides, dioxins and furans.

ORGANIZATION/STRUCTURE

See attached table

KEY MANDATES/PRIORITIES

- Measuring exposure levels of PCBs, OC pesticides, and metals in fish-eaters and fish tissue.
- With CDC, measure exposures in response to a major domestic chemical event (natural or intentional).
- Microcystins
- Measuring lead exposure in children and their environment as an extension of the HUD/Healthy Homes program

CHEMICALS MEASURED (matrix)

Metals (*whole blood, serum, plasma and urine*)
Organochlorine pesticides (*serum, adipose, tissue, breast milk*)
Organophosphate pesticides (*urine*)
Perfluorinated Compounds (*tissue, serum*)
Polybrominated diphenyl ethers (PBDEs) (*serum, tissue*)
Polychlorinated biphenyls (PCBs) (*serum, adipose, tissue, breast milk*)
Polybrominated biphenyls (PBBs) (*serum, adipose, tissue, breast milk*)
Polycyclic aromatic hydrocarbons (PAHs) (*serum, urine, tissue*)
Volatile organic compounds (VOCs) (*serum, whole blood*)
Cyanide (*whole blood*)

CURRENT/UPCOMING PROJECTS

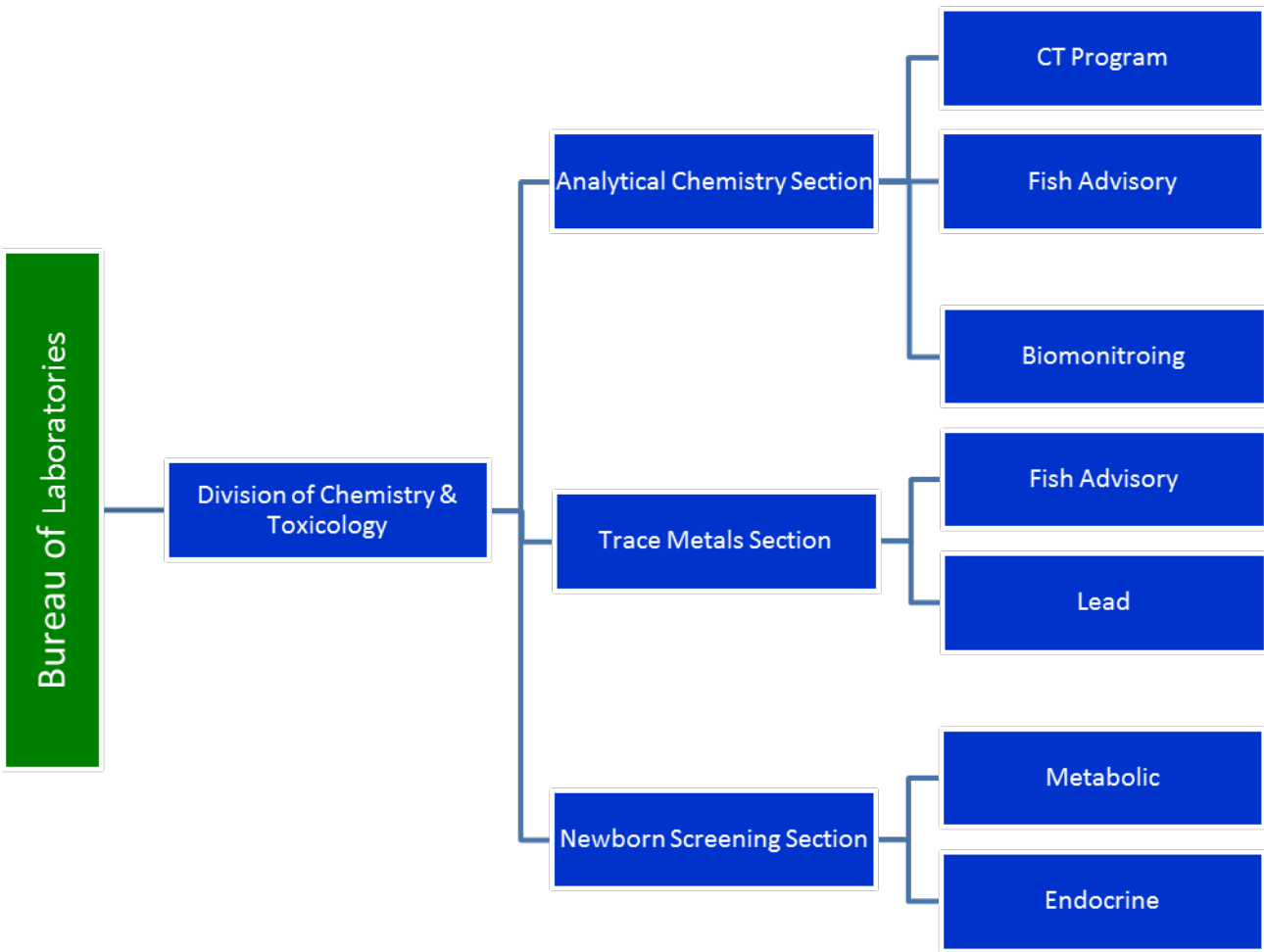
1. Epidemiologic Research of Autism in Jamaican (ERAJ) children through service contract with the University of Texas, Health Science Center at Houston.
2. Public Health Emergency Preparedness Cooperative Agreement with CDC
3. Cotinine Levels in Newborns in relation to ADHA.
4. Autism Research in India in children through exposure from PAHs and metals, though a service contract with the University of Texas Health Science Center at Houston.

RECENT PUBLICATIONS

Hus, W.W.; Osuch, J.R.; Todem, D.; Taffe, B; O'Keefe, M.; Adera, S.; Karmaus, W.; **DDE and PCB serum concentration in maternal blood and their adult female offspring**; Environ Res (2014) 132:384-390.

Warner, J.; Osuch, J.R.; Karmaus, W.; Landgraf, J.; Taffe, B.; O'Keefe, M.; Mikucki, D.; Haan, P.; **Common Clasification Schemes for PCB Congeners and the Gene Expression of CYP 17, CYP19, ESR1 and ESR2 (2012)** Sci Total Environ; Jan1; 414:81-89

ADDITIONAL INFORMATION (optional)



STATE PROGRAM: Minnesota (MN) Biomonitoring

Program website: <http://www.health.state.mn.us/biomonitoring> &
<http://www.health.state.mn.us/divs/eh/risk/studies/biomonitoring.html>

Contact person: Carin Huset, 651-201-5329, carin.huset@state.mn.us, Jessica Nelson, 651-201-3610
Jessica.nelson@state.mn.us or Deanna Scher, 651-201-4922 deanna.scher@state.mn.us

BACKGROUND

MN Biomonitoring was established in 2007 when the Minnesota Legislature passed *Environmental Health Tracking and Biomonitoring* legislation (MN Law 144.995-144.998) which directed Minnesota Department of Health (MDH) to collect and share with the public data on environmental hazards, biomonitoring, and chronic diseases in Minnesota. The law also established an external Advisory Panel of experts in public health and environmental science to provide guidance and recommendations for program priorities and projects. The initial program established 4 pilot projects which have since initiated subsequent follow-up studies as well as new projects. In addition to the biomonitoring studies spurred by the legislation, Minnesota has also sought and received funding to do biomonitoring in the Great Lakes. Through the Great Lakes National Program Office (GLNPO), we have obtained support for 3 additional studies of Minnesota and Lake Superior populations.

ORGANIZATION/STRUCTURE

Minnesota Department of Health

Biomonitoring and Emerging Contaminants Laboratory

- Assist with sample collection training and kit preparation
- Storage and submitting samples to partner or subcontract labs
- Laboratory analyses of blood and urine samples for chemical biomarkers
- Data upload to LIMS and data review

Environmental Epidemiology

- Coordination of program and partners
- Recruit participants and plan sample collection
- Design and administer questionnaires
- Analyze results and write reports
- Communicate results with participants and communities
- Report findings to Scientific Advisory Panel and use recommendations for planning future studies

Environmental Health

- Coordination of program and partners
- Recruit participants and plan sample collection
- Design and administer questionnaires
- Analyze results and write reports
- Communicate results with participants and communities

KEY MANDATES/PRIORITIES

- Plan and implement a biomonitoring program to measure communities' exposure to chemicals in Minnesota's diverse communities.
- Collect, analyze and share data to track how people in Minnesota are exposed to hazards in the environment and related chronic diseases or health outcomes.
- Protect participant personal information and specimens in compliance with the project guidelines and IRB requirements.
- Communicate results of studies with participants and communities.
- Develop analytical methods to detect chemical compounds/metabolites for chemicals of concern
- Maintain a robust quality assurance program to ensure that the data used in biomonitoring studies is of the highest quality

CHEMICALS MEASURED (*matrix*)

- | | |
|--|---|
| ● Perfluorinated chemicals (<i>serum</i>)
(PFBA, PFPeA, PFHxA, PFOA, PFNA, PFBS, PFHxS, PFOS) | ● Metals (<i>whole blood and urine</i>) |
| ● Arsenic speciation (<i>urine</i>) | ● Mercury (<i>dried bloodspots</i>) |
| ● Bisphenol A & Triclosan (<i>urine</i>) | ● Fatty acids (<i>plasma</i>) |
| ● Volatile Organic Compounds (<i>serum</i>) | ● Hydroxypyrene (<i>urine</i>) |
| | ● Cyanide (<i>whole blood</i>) |

CURRENT/UPCOMING PROJECTS (*visit website for more information about current projects*)

Fond du Lac GLRI Biomonitoring Study: Collaboration between MDH and Fond du Lac Band of Lake Superior Chippewa to study exposure to environmental chemicals in this community (chemicals include legacy POPs, PFCs and metals as well as fatty acids, which are not a contaminant)

PFC3: A third round of longitudinal biomonitoring for a population with PFC exposure through contaminated drinking

water; this is the third round of study and also includes a group of residents who are new to the community.

Fish are Important for Superior Health (FISH): Study to measure mercury exposure in women of childbearing age and implementation of follow up education about risks and benefits of eating fish.

Minnesota Family Environmental Exposure Tracking (MN FEET): Study of lead, mercury and cadmium in a diverse population of Minnesota women and their babies.

Children's Health Exposure Analysis Resource (CHEAR): Partnering with University of Minnesota for university led Exposure Assessment Laboratory Hub for biomarker analysis for NIEHS children's health research.

RECENT PUBLICATIONS

Landsteiner A, Huset C, Johnson J, Williams A. (2014). Biomonitoring for perfluorochemicals in a Minnesota community with known drinking water contamination. J Environ Health, 77(5), 14-9.

ADDITIONAL INFORMATION *(optional)*

STATE PROGRAM: Nebraska Lead Poisoning Prevention Plan

Program website: <http://dhhs.ne.gov/publichealth/Pages/LeadIndex.aspx>

Program email: DHHS.HealthHazardsIndoorAir@nebraska.gov

Contact person: Doug Gillespie, Doug.Gillespie@nebraska.gov

BACKGROUND

Nebraska has a state program to screen for lead. It is aimed mainly at children but any age can be tested. Testing is done through Nebraska Medicine and the Nebraska Public Health Laboratory located at the University of Nebraska Medical Center. Lead testing at certain ages is required for all children participating in Medicaid or WIC programs.

ORGANIZATION/STRUCTURE

Established by the state with NEB. REV. STAT. §71-2518 in July of 2012.

KEY MANDATES/PRIORITIES

- Develop a statewide assessment and blood lead testing plan
- Develop and disseminate educational materials for health care providers, child care providers, parent, owners and tenants of residential dwellings
- Receive results for all lead testing in the state, regardless of result
- Contact local public health department and physician when children have elevated blood lead levels
- Report annual findings to state legislature

CHEMICALS MEASURED (*matrix*)

Lead in whole blood – either venous blood or filter paper blood spot

CURRENT/UPCOMING PROJECTS**RECENT PUBLICATIONS****ADDITIONAL INFORMATION** (*optional*)

EPA superfund site located in Omaha, NE. The Nebraska Public Health Lab is working with several organizations to expand upon testing and to possibly institute testing for different exposure types.

STATE PROGRAM: New Hampshire

Contact person: Julianne Nassif; 603.271.3233; julianne.nassif@dhhs.state.nh.us

BACKGROUND

New Hampshire is one of six states awarded a CDC Cooperative Agreement in 2014, to enhance the capability and capacity of state public health laboratories to conduct high quality biomonitoring studies and programs. The New Hampshire program is in the developmental stage; refining the study design and survey instrument, recruiting staff and securing Institutional Review Board approval. The NH Public Health Laboratories are building upon the technical expertise and experience acquired through participation in the Laboratory Response Network – Chemical (LRN-C), previous biomonitoring planning and implementation grants and response to community environmental health concerns.

ORGANIZATION/STRUCTURE

The New Hampshire Public Health Laboratories provide the administrative and technical direction for New Hampshire Biomonitoring Program with regular guidance from environmental, academic, community and public health partners at the local, state and federal levels. Significant financial and technical support is provided by the Division of Laboratory Sciences, National Center for Environmental Health at the US Centers for Disease Control and Prevention.

KEY MANDATES/PRIORITIES

- Measure chemicals of concern in biological specimens from individuals from high-risk areas
- Ensure target group is inclusive of vulnerable and under-served populations
- Identify potential sources of exposure and implement interventions as appropriate
- Evaluate the efficacy of exposure reduction, regulatory actions and medical interventions to specific chemicals
- Establish a state-wide surveillance system to determine jurisdiction specific background levels and identify trends
- Provide aggregate data to communities in multiple and understandable ways
- Return individual biomonitoring results to participants at the conclusion of the study
- Use biomonitoring data to establish environmental health priorities and refine resource allocation

CHEMICALS MEASURED (*matrix*)

Arsenic (*urine*)
Speciated arsenic (*urine*)
Metals (*urine, whole blood*)
Creatinine (*urine*)
Pyrethroid pesticide metabolites (*urine*)
Organophosphate pesticide metabolites (*urine*)
Cotinine (*serum*)
Perfluorinated chemicals (*serum*)

CURRENT/UPCOMING PROJECTS

- Southern New Hampshire Targeted Study – residents reliant on private wells for drinking water; total arsenic, uranium and speciated arsenic.
- State-wide Surveillance (2016) – metals, pesticides, cotinine, PFCs and nutritional biomarkers

RECENT PUBLICATIONS

None

ADDITIONAL INFORMATION (*optional*)

STATE PROGRAM: New Jersey Biomonitoring

Contact person: Dr. Bahman Parsa, Director; 609-530-2820; bahman.parsa@doh.state.nj.us

BACKGROUND

New Jersey has a disproportionate level of chemical contamination compared to the rest of the US given a variety of sources of pollution. The state is home to the highest number and density of Superfund/National Priorities List sites in the country and manages over 15,000 contaminated sites throughout the state. Available data indicates that perfluorinated compounds (PFCs), polychlorinated biphenyls (PCBs), and heavy metals are widespread throughout New Jersey, some of which are more prevalent in the state than they are nationally. New Jersey does not have biomonitoring data to assess the exposure and health of the population.

The state of New Jersey was awarded its first ever CDC biomonitoring grant in 2014. Since then we have established and enhanced our laboratory capacity and have developed three core projects that will help us reach our project objectives as efficiently as possible. We expect to obtain a minimum of 2000 whole blood samples and 1000 urine samples for metals analysis, at least 500 serum samples for PFC analysis, and over 1000 serum samples for PCB analysis.

ORGANIZATION/STRUCTURE

Please see attached table.

KEY MANDATES/PRIORITIES

- Develop and demonstrate laboratory capability and capacity to conduct biomonitoring in New Jersey for environmental pollutants, and to develop the infrastructure to respond to acute exposure incidents.
- Determine levels of select environmental contaminants in blood and urine among New Jersey residents using remnant clinical laboratory and blood bank specimens based on gender, age, geographic location and, if available, race/ethnicity to screen for disparities across the study population in NJ. Heavy metals in blood/urine, and PFCs and PCBs in serum are selected for study based on the distribution of these chemicals in NJ and their persistence both in nature and in humans.
- Compare the blood and urine levels of the target analytes in the study population in New Jersey to national levels reported by NHANES.
- Identify effectiveness of drinking water intervention in reducing PFC body burden in response to contaminated drinking water supplies.
- Encouraging intervention in pregnant women exposed to environmental contaminants and assessing the outcomes.
- Increasing public awareness of the New Jersey Biomonitoring Program and of the value of biomonitoring in general.

CHEMICALS MEASURED (*matrix*)

Metals, PCBs, and PFCs. Specific analytes are presented in the "Target Analytes" table.

CURRENT/UPCOMING PROJECTS

Project 1: Environmental Contaminant Levels in Blood and Urine Specimens from New Jersey Clinical Laboratories and Blood Banks

Project 2: Assessing PFNA Body Burdens following Drinking Water Intervention

Project 3 (to be developed): Assessing Environmental Exposure of Pregnant Women to Toxic Metals and PCBs

RECENT PUBLICATIONS**ADDITIONAL INFORMATION** (*optional*)

ORGANIZATION/STRUCTURE:

<u>NJDOH</u>		EOHSI-Rutgers University	NJDEP	DRBC	DRN
PHEL- ECLS	CEOHS				
Study design	Study design	Study design	Study design	Study design	Community outreach and subject recruitment
IRB application	Data interpretation	IRB application	Data interpretation	Data interpretation	
Recruitment of subjects or blood/urine sample providers	Final report	Recruitment of subjects			
Sample collection		Sample collection			
Sample analysis		Statistical data analysis			
Data interpretation		Exposure modeling			
Final report		Data interpretation			
		Final report			

NJDOH: New Jersey Department of Health

PHEL: Public Health Environmental Laboratories

ECLS: Environmental Chemical Laboratory Services

CEOHS: Consumer, Environmental and Occupational Health Service

EOHSI: Environmental and Occupational Health Sciences Institute

NJDEP: New Jersey Department of Environmental Protection

DRBC: Delaware River Basin Commission

DRN: Delaware Riverkeeper Network

TARGET ANALYTES:

Matrix	Analytes
Serum	<p><i>Polychlorinated Biphenyls:</i> PCB 18, PCB 28, PCB 44, PCB 49, PCB 52, PCB 66, PCB 74, PCB 87, PCB 99, PCB 101, PCB 105, PCB 110, PCB 118, PCB 128, PCB 138, PCB 146, PCB 149, PCB 151, PCB 153, PCB 156, PCB 157, PCB 167, PCB 170, PCB 172, PCB 177, PCB178, PCB 180, PCB 183, PCB 187, PCB 189, PCB 194, PCB 195, PCB 196, PCB 199, PCB 206, PCB 209</p> <p><i>Perflourinated Compounds:</i> PFHpA, PFOA, PFNA, PFDeA, PFUA, PFDoA, PFOSA, Me-PFOSA-AcOH, Et-PFOSA-AcOH, PFBuS, PFHxS, PFOS</p>
Whole Blood	<p><i>Heavy Metals:</i> cadmium, lead, mercury, other metals</p>
Urine	<p><i>Heavy Metals:</i> arsenic, barium, beryllium, cadmium, lead, thallium, uranium, other metals</p>

STATE PROGRAM: Texas Emergency Preparedness Branch Chemical Threat Response LaboratoryProgram website: <http://www.dshs.state.tx.us/lab/epr.shtm>Program email: LabEmergencyPrepared@dshs.state.tx.usContact person: Jocelyn Jeansonne, 512-776-3486, Jocelyn.hover-jeansonne@dshs.state.tx.us**BACKGROUND**

The Texas Department of State Health Services (DSHS) is a state agency created by House Bill 2292 of the 78th Texas Legislature in 2003 and is a merger of 4 different agencies (Texas Department of Mental Health and Mental Retardation, Texas Health Care Information Council, and Texas Commission on Alcohol and Drug Abuse). The agency provides an array of public health services and oversight across the state via 8 Regional Offices. The Laboratory Services Section of the Texas Department of State Health Services performs public health testing and is nestled in the Division for Disease Control and Prevention Services. By State mandate, Texas newborns are screened for 26 heritable disorders and hypothyroidism. Through the Texas Health Steps program our laboratory screens for Blood Pb, Total Hemoglobin, syphilis, diabetes and hyperlipidemia. Drinking water, consumer products, candy/food, and various other sample matrices are screened for organic chemicals, heavy metals and radionuclides within our environmental section. We boast a vibrant microbiological section at our laboratory facility. Testing conducted is varied and includes rabies, viral isolations, STD/HIV, diagnostic serology, TB, medical parasitology, consumer microbiology and clinical bacteriology. Within the Laboratory there is the Emergency Preparedness Branch which includes the Biological Threat Response and Chemical Threat Response Groups. Each is capable of performing rapid testing for clinical and environmental samples for various agents of concern. Both groups are part of the Laboratory Response Network and actively participate in the education of exposure recognition with various first responders and medical personnel across the State of Texas.

ORGANIZATION/STRUCTURE

Refer to the attached table.

KEY MANDATES/PRIORITIES

- Prevent and Prepare for Health Threats
- Build Capacity for Improving Community Health
- Promote Recovery for Persons with Infectious Disease and Mental illness
- Protect Consumers
- Develop and Expand Integrated Services
- Streamline Administrative Systems
- Maintain and Enhance DSHS Assets
- Expand the Effective Use of Health Information
- Build and Sustain Effective Partnerships

CHEMICALS MEASURED (*matrix*)

Multiple Toxic Elements (Hg, Pb, Cd) {*blood*}

Multiple Toxic Elements (Be, Ba, Cd, Tl, Pb, U, As) {*urine*}

Nerve Agents (*urine and serum*)

VOCs (*urine*)

Ricinine/Abrine (*urine*)

CURRENT/UPCOMING PROJECTS

Method exploration of Pesticides (urine), PBDEs (serum), PCBs (serum), PAHs (urine), Organophosphate flame retardants (urine) to add to our emergency response capabilities. Additionally we are in the validation process of the following Toxic Elements: Mn, Se (blood); Mo, Co, Sb, Cs, W, Pt, Sr, Mn (urine) Sn is a possibility (urine) however it is proving difficult at the moment. Additionally, in the future we would like to look at the speciation of As and Hg; this is of great interest to our Toxicological Epidemiologists.

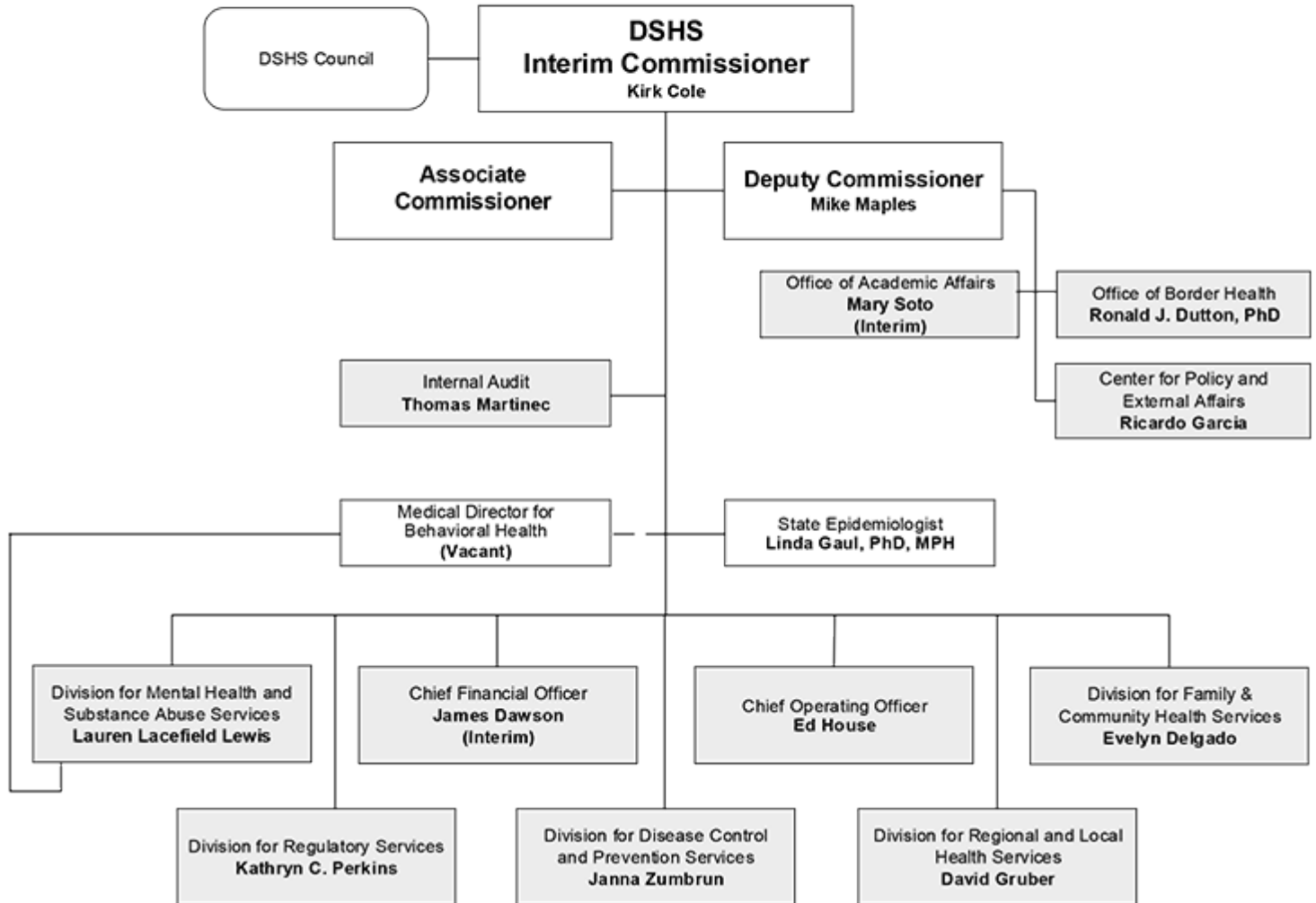
RECENT PUBLICATIONS

NA

ADDITIONAL INFORMATION (*optional*)

NA

Department of State Health Services
Organizational Chart
September 10, 2015



STATE PROGRAM: El Paso Department of Public Health

Program website: <http://www.elpasotexas.gov/public-health/programs/laboratory>

Contact person: Robert Resendes, 915-212-6500, resendesr@elpasotexas.gov

BACKGROUND

Our laboratory is split physically - occupying 2 separate facilities, miles apart in El Paso, Texas. One facility serves as a core Public Health Laboratory providing water, dairy, STD, mycology, Quantiferon and rabies testing. The other facility is an LRN laboratory with a BSL 3 handling food testing, air quality, PCR testing, "white powder" testing, etc.

We are in the process of merging the two labs into one and also creating a stat lab within our clinic/nursing area.

The laboratories employ 12 FTEs performing about 50,000 tests/year.

ORGANIZATION/STRUCTURE

The City of El Paso Department of Public Health is made up of 12 divisions, e.g., WIC, STD, Epidemiology, Immunizations, Food Safety, etc., of which the Laboratory is one. The entire department's budget is about \$20,000 with about 300 employees.

Currently, the laboratory is staffed solely with biologists and microbiologists none of which are ASCP registrants. We are in the process of downsizing personnel while requiring ASCP registration for all new hires.

KEY MANDATES/PRIORITIES

- Consolidation of 2 laboratories into one
- Creation of a new STAT laboratory in our clinical care area
- CAP accreditation
- Exploration of new testing opportunities to better serve the community
- Hiring of a new laboratory manager for the consolidated laboratories

CHEMICALS MEASURED (*matrix*)

N/A

CURRENT/UPCOMING PROJECTS

- Creation of a new stat lab
- Field collection of mobile food vendor water samples
- Exploring becoming a contractor for the state's Environmental Quality department for air quality sample collection and testing.
- Across the board cross-training of all staff who have become silo'd through the years

RECENT PUBLICATIONS

N/A

ADDITIONAL INFORMATION (*optional*)

-Operations are currently in flux with physical moves pending, new responsibilities being assigned, new testing being explored and a new lab manager being recruited.

-El Paso, in West Texas is an island of sort, being geographically isolated from the rest of Texas' large cities. We are the only county in Texas to be in a separate time zone. We are closer to 4 other state capitals than our own. We are closer to San Diego than we are to Houston.

-Our isolation requires us to be somewhat self-sufficient in our testing

-Our dairy samples originate in Mexico

-El Paso hosts the 2nd largest border community in the United States, second only to San Diego. We experience a daily influx of 20,000 border crossings.

STATE PROGRAM: The Virginia Biomonitoring Program

Program email: Biomonitoring@dgs.virginia.gov

Contact person: Christopher Retarides; 804-382-3480; Christopher.Retarides@dgs.virginia.gov

Shane Wyatt; 804-641-7069; Shane.Wyatt@dgs.virginia.gov

BACKGROUND

The Virginia Biomonitoring Program was established in 2014 through funding and support from the Centers for Disease Control and Prevention (CDC). The program is administered by the Division of Consolidated Laboratory Services (DCLS) in partnership with the Virginia Department of Health (VDH). The goal of the program is to safeguard public health within the Commonwealth by proactively monitoring the exposure of residents to select chemicals of concern. Specimens will be collected from volunteers throughout Virginia and analyzed to determine background levels of selected chemicals and to pinpoint areas of concern. Results may be used to investigate sources of exposure to hazardous chemicals and to develop strategies to reduce the risk associated with these exposures.

ORGANIZATION/STRUCTURE

See Attached

KEY MANDATES/PRIORITIES

- Proactively monitor Virginia residents for chemical burden based on exposure to chemicals of concern.
- Conduct targeted studies to assess chemical exposures to potentially high risk populations.
- Develop the infrastructure and expertise to respond to community needs regarding chemical exposure assessment.

CHEMICALS MEASURED (matrix)

- PAH Metabolites (*urine*)
- Creatinine (*urine*)
- Perchlorate (*urine*)
- Cadmium (*urine*)
- Lead (*urine*)
- Uranium (*urine*)
- Barium (*urine*)
- Beryllium (*urine*)
- Thallium (*urine*)
- Hydrogen Cyanide (*blood*)

CURRENT/UPCOMING PROJECTS

Toxic Metals and Perchlorate: Study of toxic metals and perchlorate exposures in the general population of Virginia.
Toxic Combustion Products in Firefighters: Study to determine firefighter exposure to polycyclic aromatic hydrocarbons and hydrogen cyanide during firefighting activities.

RECENT PUBLICATIONS

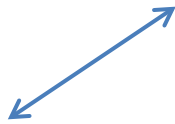
Wyatt, S et al. *Journal of Exposure Science and Environmental Epidemiology* 2007:1-17

ADDITIONAL INFORMATION

An advisory committee will be established during the first quarter 2016 to provide input and guidance to the program coordinators. The committee will consist of six to ten members with diverse backgrounds and experience from throughout Virginia. The advisory committee will meet three to four times a year to offer advice on subjects including data interpretation, sampling strategies and the direction of current and future studies.

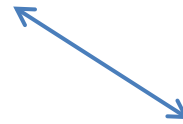
DCLS

- Program administration
- Study design
- Storage of samples
- Sample analysis
- Analytical data interpretation and integration with epidemiological data.
- Data integrity and quality assurance
- Confidentiality of subjects and data



VDH

- Epidemiological analysis
- Questionnaire design
- Results interpretation and communication with local health departments and epidemiologists



Advisory Committee

- Provide input for study design
- Assist with data interpretation

STATE PROGRAM: WEBS (Washington Environmental Biomonitoring Survey)

Program website: <http://www.doh.wa.gov/DataandStatisticalReports/EnvironmentalHealth/Biomonitoring>

Contact person: Blaine N. Rhodes; (206) 418-5520; blaine.rhodes@doh.wa.gov

BACKGROUND

In 2009, the Washington State Department of Health (WS-DOH) received a grant from the U.S. Centers for Disease Control and Prevention (CDC) to collect biomonitoring data in Washington State. This funding created the Washington Environmental Biomonitoring Survey (WEBS) program. The grant provided funding for five years ending in 2014. The purpose of this Cooperative Agreement between WS-DOH and the CDC was to increase the capability and capacity of the state public health laboratories to assess human chemical exposures within Washington State through biomonitoring. The goal of collecting biomonitoring data is to monitor the levels of environmental exposures by the direct measurement of environmental chemicals in people's blood, urine, or other body tissues. The expected outcome of activities conducted under this cooperative agreement was to improve our monitoring of environmental exposures to selected environmental chemicals among Washington State residents. We use data collected under this agreement to compare to national exposure data and to help target follow-up activities to reduce exposures. WEBS collected 1422 urine samples from 666 households for the general population (background), 175 urine samples from 82 households for the High Arsenic study, 551 urine samples from 56 participants in the Pyrethroid Exposure Survey and Testing (PEST) study, and 1170 urine samples from 585 participants in the Low Income housing Survey and Testing (LIST) study. We also collected 502 tap water samples from 498 households in the general population study and 84 tap water samples from the High Arsenic study.

ORGANIZATION/STRUCTURE

Lab work performed at the WS-DOH Public Health laboratories and epidemiology analysis performed at the WS-DOH headquarters.

KEY MANDATES/PRIORITIES

- Establishing a statewide background for specific environmental contaminants and comparing these results to the National Health and Nutritional Examination Survey (NHANES).
- Perform special studies for exposure incidents and high risk groups and compare these results with the general population background as well as NHANES.
- Report back results of established toxicants to participants as indicated per study.
- Compare questionnaire responses to analytical results monitoring trends and establishing cause vs effect scenarios.
- Use the data collected to reduce exposures.

CHEMICALS MEASURED (*matrix*)

See attachment: "Washington State Biomonitoring Project Accomplishments" for a full description of the chemicals and matrices WEBS analyzed and reported on.

CURRENT/UPCOMING PROJECTS

With funding streams for the project discontinued as of July, 2015, we plan to maintain basic capabilities in biomonitoring methods, including participation in CDC Proficiency Testing (PT) programs for Pyrethroid pesticides and Bisphenol compounds and the College of American Pathologists PT program for Creatinine in Urine, Cd in Urine, and Cd in Blood until more funding can be secured to expand back into a full biomonitoring program.

RECENT PUBLICATIONS

- West, C.E. and Rhodes, B.N. Determination of Urinary Creatinine in Washington State Residents via Liquid Chromatography/Tandem Mass Spectrometry. International Journal of Analytical Chemistry, Volume 2014 (2014), Article ID 247316, 6 pages; <http://dx.doi.org/10.1155/2014/247316>. Accepted December 11th, 2014.
- Three other articles on population results are in the publication process.

ADDITIONAL INFORMATION (*optional*)

We had our materials translated into 8 languages and employed multi-lingual field staff. We also collaborated with Dr. Thomas Schettgen with RWTH Aachen University Institute of Occupational and Social Medicine in Aachen, Germany and sent samples for Bifenthrin analysis. They also measured 3-PBA, 4-F-3-PBA, DBCA, trans DCCA, and cis DCCA so we were able to compare results between the two methods and laboratories for a selected subset of samples.

Washington State Biomonitoring Project Accomplishments

Washington Environmental Biomonitoring Survey (WEBS), 2009 – 2014

Study (biospecimens are urine specimens only)	Result
General Population study of metals: Antimony, Barium, Beryllium, Cadmium, Cesium, Cobalt, Lead, Molybdenum, Platinum, Thallium, Tungsten, Uranium	Established baseline for Washington residents with 95% confidence.
General Population study of metals in tap water: Arsenic, Cadmium, Lead, Manganese, Thallium, Uranium	Side study performed for the Washington Tracking Network. Correlated to the urine levels of the participants.
General Population studies of arsenic compounds: Total Arsenic, Arsenous acid (As III), Arsenic acid (As V), Monomethyl Arsenic acid, Dimethyl Arsenic acid, Arsenobetaine, Arsenocholine	Established baseline for Washington residents with 95% confidence. Washington is significantly higher in Total Arsenic than the National Average, NHANES.
Study of households with high arsenic in the drinking water source	Work by local health jurisdiction to help private well owners lower their arsenic exposure.
General Population study of a single organophosphate pesticide indicator: 3,5,6-trichloro-2-pyridinol (TCPy)	Established baseline for Washington residents with 95% confidence. Levels matched the declining levels of NHANES.
General Population study of five pyrethroid pesticide metabolites: 3-phenoxybenzoic acid (3-PBA), 4-fluoro-3-phenoxy-benzoic acid (4-F-3-PBA), cis-dichlorovinyl-dimethylcyclopropane carboxylic acid (cis-DCCA), trans-dichlorovinyl-dimethylcyclopropane carboxylic acid (trans-DCCA), and cis-dibromovinyl-dimethylcyclopropane carboxylic acid (DBCA)	Established baseline for Washington residents with 95% confidence. Levels were slightly higher than the increasing levels of NHANES.
Pyrethroid Exposure Survey and Testing (PEST) study of pesticide applicators: 3-PBA, 4-F-3-PBA, cis-DCCA, trans-DCCA, and DBCA	Levels for applicators were higher than the general population for the most used pesticides. The results were used to design an applicator safety course by Washington State University.
Analysis of medical case of possible pyrethroid overexposure	Results used for symptom correlation study.
General Population study of Bisphenol A (BPA)	Established baseline for Washington residents with 95% confidence. Levels matched NHANES levels.
Special out-of-state population study of BPA	Generated special population levels for comparison with NHANES.
General Population study of 9 phthalate metabolites: mono-ethyl phthalate (MEP), mono-butyl phthalate (MBP), mono-benzyl phthalate (MBzP), mono (2-ethylhexyl) phthalate (MEHP), mono (2-ethyl-5-hydroxyhexyl) phthalate (MEHHP), mono-isobutyl phthalate (MiBP), mono (2-ethyl-5-oxohexyl) phthalate (MEOHP), mono (carboxynonyl) phthalate (MCNP), and mono (carboxyoctyl) phthalate (MCOP)	Established baseline for Washington residents with 95% confidence.
Low Income Housing Survey and Testing (LIST) study of Pyrethroid pesticide and Phthalate metabolites.	Compared results of participants from low income housing with those of the general population. The metabolite monoethyl phthalate (MEP) was significantly higher for low income participants. The other eight were within experimental error.
Subset Population study for BPA, Bisphenol F (BPF), and Bisphenol S (BPS)	Goal to establish the degree of substitution of BPF and BPS for BPA in consumer products or other contributable sources.