

Biomonitoring: An Integral Component

OF PUBLIC HEALTH PRACTICE

Three decades of biomonitoring studies demonstrate its usefulness in assessing population exposure to environmental chemicals.^{1,2,3,4}

Despite being firmly established in national surveillance programs and despite growth in laboratory capabilities at the state and local level, biomonitoring is not yet considered an essential public health service used by state and local public health programs. This document reviews uses of biomonitoring by state health departments and indicates how biomonitoring can become an integral part of environmental and public health practice.

BACKGROUND

Human exposure to chemicals can occur from multiple sources, such as food, air, water and consumer product usage. By measuring internal dose, biomonitoring data integrates exposure across all environmental sources,⁵ therefore, it can provide a more accurate picture of exposure than estimates based solely on environmental measurements.

By using biomonitoring, environmental and public health practitioners can identify unusually high exposures as compared to the rest of the US population (listed in CDC's [National Report of Human Exposure to Environmental Chemicals](#)),^a

Biomonitoring data also helps identify potential linkages between environmental exposures and health effects (such as through Environmental Public Health Tracking or EPHT⁶ programs).

APHL defines biomonitoring as the assessment of individual or population exposure to environmental contaminants, by measuring the concentration of chemicals or their metabolites in human specimens, such as blood or urine.

APPLICATIONS OF BIOMONITORING IN PUBLIC HEALTH

There are many reasons to include biomonitoring in routine public health practice:

- Assists **targeted public health investigations** of potential community exposures - conducted in response to health concerns or the discovery of environmental contamination.
 - Serves as a **public health surveillance** tool to detect and measure spatial and temporal differences in population exposures to provide baseline information unique for the state or local jurisdiction.
 - Provides a way to **evaluate the efficacy of public health policies** aimed at reducing exposures to environmental chemicals.
- Contributes to **disease diagnosis or rapid response efforts**, by supporting diagnosis of poisoning and informing treatment plans.
- Can **inform individual and consumer choice**.

BIOMONITORING IN ACTION

In the fall of 2010, elemental mercury spilled on the wooden floors of the century-old Grafton Street Elementary School in Massachusetts. It spread throughout the day as hundreds of students shuffled to and from classes. Meanwhile, school officials were unaware of the spill until the next day, and cleaning crews swept and mopped the contaminated floors. Students and teachers possibly even brought mercury home.

Once air sampling confirmed the presence of mercury vapor at 2000-44,000 mg/m³ (far exceeding exposure guidelines for occupancy), students were sent home along with their belongings.

At this point, the Massachusetts Department of Public Health (MDPH) stepped in to address whether individuals had been exposed by offering urine mercury testing to students and staff at the school. The Bureau of Environmental Health Assessment worked with the Hinton State Laboratory to collect and analyze the appropriate specimens. Working around the clock, using skills refined during exercises conducted by the Laboratory Response Network for Chemical Threats,⁷ the laboratory rapidly completed the testing on 188 urine specimens and reported the results. Fortunately, despite alarmingly high air mercury concentrations, none of the students or staff members tested had elevated urine mercury levels.

This story illustrates how biomonitoring can be used to calm citizens' concerns. For more examples on how biomonitoring works within the public health system, please see the accompanying examples in [Examples of Biomonitoring in Public Health](#).^b

MOVING FORWARD

For decades federal agencies, state health departments, environmental advocacy groups and others have called for increased use of biomonitoring in environmental risk assessments, health impact assessments, health consultations, toxic chemical reform and other areas. This shift is happening, but only very slowly, despite the growth in capabilities available in most state public health laboratories.⁸

Consider the environmental concerns in your communities; some can be addressed through biomonitoring in conjunction with, or instead of, environmental testing. **To explore the biomonitoring capabilities available in your state**, speak to your public health laboratory director or chemical terrorism coordinator.⁹ Talk with them about barriers to implement biomonitoring and how they might be overcome: for example, partnering with local universities or neighboring states. Find additional resources by visiting the [APHL Biomonitoring Toolkit](#)^c and the [Biomonitoring Capabilities List](#),^d which houses information about the testing capabilities of various public health laboratories.

POINT OF CONTACT

Regional Services Available:

FOOTNOTES

1. Centers for Disease Control and Prevention. "Fourth Report on Human Exposure to Environmental Chemicals," 2009. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. <http://www.cdc.gov/exposurereport/>.
2. Arendt, M. (2008). Communicating human biomonitoring results to ensure policy coherence with public health recommendations: analyzing breastmilk whilst protecting, promoting and supporting breastfeeding. *Environmental Health, Suppl 1(S6)*, 11-13.
3. Sexton, K., Needham, L., & Pirkle, J. (2004). Human Biomonitoring of Environmental Chemicals. *American Scientist*, 92(January-February), 38-45.
4. The National Academies Press. "Human Biomonitoring for Environmental Chemicals." (2006) Print. http://www.nap.edu/openbook.php?record_id=11700.
5. Data on sources of exposure may need to be collected concurrently with biomonitoring to inform public health interventions or environmental decisions.
6. The National Public Health Tracking Network provides a system of integrated health, exposure and hazard information and data state, local and federal sources. <http://ephtracking.cdc.gov/showHome.action>.
7. The Laboratory Response Network for Chemical Threats provides emergency response capabilities for their local areas, the nation or both. <http://www.bt.cdc.gov/lrn/chemical.asp>
8. Many public health laboratories maintain biomonitoring capability using infrastructure built through public health preparedness funding. CDC funds a few laboratories (CA, NY, WA) to work on biomonitoring. Some states, such as MN, even have legislation that requires them to perform biomonitoring studies. See "Biomonitoring: Building a Network of Success" in the *Journal of Environmental Health*: <http://www.neha.org/JEH/>.
9. Many state biomonitoring programs share equipment with their chemical emergency preparedness programs.

RESOURCE LINKS

- a. CDC's National Report on Human Exposure to Environmental Chemicals
<http://www.cdc.gov/exposurereport/>
- b. APHL's Examples of Biomonitoring in Public Health
http://www.aphl.org/AboutAPHL/publications/Documents/EH_2013October_Examples-of-Biomonitoring-in-PH.pdf
- c. APHL's Biomonitoring Toolkit
https://www.aphlweb.org/aphl_departments/Environmental_Health/Environmental_Health_Program/biomon/toolbox/default.aspx
- d. APHL's Biomonitoring Capabilities List
<http://www.aphl.org/aphlprograms/environmental-health/biomonitoring-capabilities-list/Pages/Biomonitoring-Capabilities-List.aspx>
- e. CSTE's Biomonitoring in Public Health: Epidemiologic Guidance for State, Local, and Tribal Public Health Agencies
<http://www.cste2.org/webpdfs/BioMonISFINAL.pdf>
- f. APHL's Guidance for Laboratory Biomonitoring Programs
http://www.aphl.org/AboutAPHL/publications/Documents/EH_2012_Guidance-for-Laboratory-Biomonitoring-Programs.pdf
- g. NCSL's Biomonitoring: A Best Practices Report for State Legislatures
http://www.aphl.org/aphlprograms/environmental-health/pollution-in-people/Documents/EH_May2010_NCSL-Biomonitoring-Report.pdf
- h. APHL's Moving Forward: Biomonitoring Stories From the States
http://www.aphl.org/AboutAPHL/publications/Documents/EH_2009Oct_Moving-Forward-Biomonitoring-Stories-from-the-States.pdf
- i. ASTHO's Biomonitoring: Perspectives from State Health Agencies
http://www.aphl.org/aphlprograms/environmental-health/pollution-in-people/Documents/ASTHO_Biomonitoring_Report_093010.pdf

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