MEASURING BIOLOGICAL EXPOSURE TO ENVIRONMENTAL CHEMICALS

COURSE DESCRIPTION

This course will cover approaches for the measurement of hazardous materials (or their metabolites) in an individual’s body fluids or tissues. These measurements provide valuable information on actual levels of exposure to environmental chemicals from all sources (e.g., air, dust, water, food). This information can be essential when addressing site-related concerns about environmental measurements and the probability of adverse health effects in potentially exposed individuals. This course will include a general overview of biomonitoring as well as specific case studies of when and how it has been used effectively in Massachusetts. The course will describe opportunities to use biomonitoring to better understand the magnitude of exposure at hazardous materials sites in Massachusetts and nationwide. The presentation will also describe how MDPH is conducting a statewide study to identify participants with a high risk of potential exposure to select metals (e.g., lead, mercury, manganese, and cadmium) as well as establishing a statewide baseline level of exposure to these and other analytes including: PCBs, antimony, arsenic, barium, cesium, cobalt, molybdenum, thallium, tungsten, and uranium. Topics covered will include case studies of how biomonitoring was used to understand chronic exposure to naturally-occurring metals; Best practices for measuring and interpreting acute biological exposure to chemicals; Best practices when responding to elemental mercury spills; and best practices for environmental health risk communication.

OUTLINE

1. Overview of Biomonitoring Programs 1:00 – 1:30 PM
2. Biomonitoring Massachusetts Study 1:30 – 2:00 PM
3. Evaluating Chronic Exposure to Naturally Occurring Metals 2:15 – 2:45 PM
4. Factors to Consider When Measuring Acute Exposure 2:45 – 3:15 PM
5. BREAK (Poster Session) 3:15 – 3:30 PM
7. Risk Communication 4:15 – 4:45 PM
8. Questions and Answers 4:45 – 5:00 PM

This work is partially supported by a State-Based Biomonitoring Cooperative Agreement (5 U88 EH 001144) to the Massachusetts Department of Public Health by the U.S. Centers for Disease Control and Prevention. The content of this presentation and views expressed by the speaker do not necessarily reflect the official views of the Centers for Disease Control and Prevention or the official views of the Department of Health and Human Services, or the official views of the Commonwealth of Massachusetts.
SYLLABUS/CONTENT

1. Overview of Biomonitoring:
   This module will explain the National and State system of biological monitoring (or biomonitoring) and how we measure chemicals (or their metabolites) in a person’s body fluids or tissues, such as blood or urine. The module will explain how these measurements provide valuable information on actual levels of exposure to environmental chemicals from all sources (e.g., air, soil, water, dust, and food). This information can be essential when LSPs are addressing concerns related to environmental chemical exposure and the potential for adverse health effects in exposed individuals. The Massachusetts Department of Public Health (MDPH) has established a statewide biomonitoring study through a Cooperative Agreement with the US Centers for Disease Control and Prevention.

2. Biomonitoring Massachusetts Study:
   This module will explain how we use biomonitoring specifically in Massachusetts to better understand the magnitude of exposure to select environmental chemicals in high-risk communities, and to establish a statewide baseline level of exposure to select environmental chemicals. We will explain how MDPH has the capability to measure biological exposure to environmental chemicals following an episodic or acute exposure to these chemicals. Through this work, MDPH has developed best practices for conducting biomonitoring in response to events involving exposure to environmental chemicals.

3. Evaluating Chronic Exposure to Naturally Occurring Metals:
   This module will provide an overview of an arsenic and uranium biomonitoring project conducted in collaboration with USGS and MassDEP. The module will focus on biomonitoring and how it was used as a tool to evaluate exposure and potential health impacts of these analytes. This section will include analysis of environmental exposure to manganese.

4. Factors to Consider When Measuring Acute Exposure to Environmental Chemicals:
   This module will provide LSPs with an understanding of the importance of understanding the kinetics of the chemical of concern when evaluating exposure using biomonitoring results. The section will highlight the importance of exposure durations, and highlight the uncertainties and known inter-individual (susceptibility) differences among demographic groups based on the scientific literature (e.g., vulnerable demographics).

5. Best Practices from Elemental Mercury Spill Events in Massachusetts:
   This module will specifically describe the lessons learned and best practices from several mercury exposure events in Massachusetts. This will be a case-study presentation where we will describe the methods and challenges associated with the effective use of biomonitoring to evaluate exposure, and the potential health impacts during specific mercury spills events. This module will highlight the unique challenges that were overcome (e.g., access agreement, coordination with clean-up contractor...
regarding clean-up level, follow-up with families, need for translation services, and challenges with cross-contamination). This module will be co-taught with an LSP and will address the role of local health departments in biomonitoring incidents; how an LSP’s background and training can be useful in incidents requiring biomonitoring; cases where biomonitoring should be considered by an LSP as part of decision-making.

6. Risk Communication and Reporting Back Biomonitoring Data:
This module will address best practices when communicating the human health risks of exposure to environmental chemicals. The module will address the technical and complicated nature of this task. The purpose of this module is to ensure that when engaging the general public on environmental health issues, it is important to articulate complex technical concepts in a manner that is appropriate for the largest segment of the intended population.

*Poster: Overview of Biomonitoring Massachusetts Poster*

Biological monitoring (or biomonitoring) is the measurement of chemicals (or their metabolites) in a person’s body fluids or tissues, such as blood or urine. These measurements provide valuable information on levels of exposure to chemicals from all environmental sources (e.g., air, soil, water, dust, consumer products, food, etc.). This information can be essential when addressing concerns related to exposure and the potential for adverse health effects. MDPH is conducting a statewide study to better understand the magnitude of exposure to select environmental chemicals in the state of Massachusetts. In one phase of the study, efforts are focused on identifying participants with a high risk of potential exposure to metals such as lead, mercury, manganese, and cadmium. In another phase of the study, efforts are focused on establishing a statewide “baseline” or reference level of exposure to PCBs, antimony, arsenic, barium, cadmium, cesium, cobalt, lead, manganese, mercury, molybdenum, thallium, tungsten, and uranium. In cooperation with CDC, MDPH has established best practices for conducting biomonitoring at the state level in response to both acute and chronic exposure to environmental chemicals.

**INSTRUCTOR BIOGRAPHIES**

Ms. Carol de Groot Bois, M.P.H., LSP, founded Bois Consulting Co., Inc. in Framingham, Massachusetts, in 1998. Ms. Bois has managed hazardous waste site investigation and remediation projects nationally and internationally for over 25 years. Her work includes managing Superfund, RCRA Corrective Actions, Brownfields, and ASTM Phase 1/Phase 2 due diligence projects at industrial, commercial, and residential properties, as well as environmental consulting work for non-profit organizations and municipalities. She is a Massachusetts Licensed Site Professional (LSP) and former President of the Massachusetts LSP Association. Prior to her work as a consultant, Ms. Bois was the Section Chief of the Site Assessment Branch in MassDEP’s Central Regional Office in Worcester, Massachusetts. Ms. Bois has a B.A. in Biology from the University of Rochester and an M.P.H. (Environmental Health) from Boston University School of Medicine. She is currently an active member of the LSP Association and is on the Science Advisory Board for the UMass Conference on Soils, Sediments, Water and Energy.
Ms. Meg Blanchet, Assistant Director of the Environmental Toxicology Program at the Massachusetts Department of Public Health. She is responsible for the day-to-day oversight of the Biomonitoring Massachusetts Study and has managed staff in numerous public health investigations involving exposure to chemical contaminants in a variety of environmental media and in relation to hazardous waste sites. During her 18 year tenure at MDPH, Ms. Blanchet has presented on biomonitoring, public health investigations, and other environmental health topics including assessment of health impacts associated with exposure to arsenic and uranium in private well water, lead in soil, acute mercury spills, and volatile organic compounds in indoor air. Ms. Blanchet is a Registered Environmental Health Specialist (REHS) with a Masters in Environmental Health and a Graduate Certificate in Epidemiology, both from Tufts University. Prior to her time at MDPH, Ms. Blanchet was employed as a risk assessor and cartographer in the private sector, and has also worked as an environmental health specialist at the city/county level.

Ms. Julie Cosio, Senior Environmental Analyst with the Environmental Toxicology Program at the MDPH Bureau of Environmental Health. Ms. Cosio is responsible for evaluating acute and chronic health impacts associated with chemical contaminants that may be present in a variety of environmental media including air, water, soil, fish, and some consumer products. She has experience with exposure investigations and biomonitoring efforts to assess the extent of environmental exposure and to evaluate possible health effects. She has previously presented on topics including human health impacts from environmental contamination at superfund sites in Massachusetts, Biomonitoring and the challenges of human exposure assessment, and Environmental Public Health Tracking. Ms. Cosio has a Masters in Public Health from Boston University and has worked for the Massachusetts Department of Public Health since 2005.

Ms. Rachel Wilson, Senior Environmental Analyst in the Massachusetts Department of Public Health, Bureau of Environmental Health, Environmental Toxicology Program. Rachel serves as the primary toxicologist responsible for the development and implementation of evidenced-based health assessment tools for systematic integration into program activities across the Water, Air and Exposure Units. Rachel has a Bachelor of Science in Allied Health Professions (focused on medical management of cardiopulmonary pathophysiology) from The Ohio State University, as well as a Master's Degree in Environmental Health from Boston University School of Public Health. She is a licensed healthcare practitioner (Registered Respiratory Therapist) and has several years of experience in clinical settings. Rachel has presented on topics related to risk assessment and toxicology of lead, disease education and outcomes, biomonitoring of arsenic, and environmental contaminants in recreational waterbodies. Over the past year, Rachel has worked extensively on regulatory toxicology, exposure assessment, and risk assessment projects to support the programmatic needs of the Environmental Toxicology Program.

Ms. Jill Clemmer, Senior Environmental Analyst in the Environmental Toxicology Program at the MDPH Bureau of Environmental Health. She is responsible for the coordination of program activities, procedures, and grant deliverables conducted in support of the Biomonitoring Massachusetts Study related to participant selection and enrollment, outreach, results reporting, and organization of participant sample collection events in consultation with the State Public Health Laboratory. Ms. Clemmer has 28 years of clinical analytical chemistry experience, 22 of those with direct biomonitoring laboratory experience conducting and supervising the analyses of urine metals and serum PCBs. Her laboratory experience also includes the analyses of foods, beverages and consumer products for toxins; i.e. saxitoxins, biogenic amines, metals and pesticides.
Ms. Andrea DiPerna is an Environmental Analyst in the Massachusetts Department of Public Health, Bureau of Environmental Health, Environmental Toxicology Program. Andrea serves as the primary coordinator of participant enrollment into the Biomonitoring Massachusetts Study and develops risk communication and outreach materials for communities throughout the state. Andrea has a Bachelor of Science in Health Science from Boston University and a Master of Public Health degree in Environmental Health from the Boston University School of Public Health. Andrea has presented on topics related to evaluating exposure to environmental chemicals and biomonitoring study development.

Ms. Jenna Kiridly is an Environmental Analyst in the Massachusetts Department of Public Health, Bureau of Environmental Health, Environmental Toxicology Program. Jenna serves primarily as a data analyst for the Biomonitoring Massachusetts Study, managing and analyzing biomonitoring and exposure data gathered in-field and aiding in generating report back materials to study participants. Jenna also assists with participant enrollment data to generate internal reports which aide in tracking study progress. Jenna has a Bachelor of Arts in Molecular Biology and Genetics from Boston University and a Master of Science in Epidemiology from the University of Massachusetts, Amherst School of Public Health. Jenna has presented on topics such as antidepressant use and risk of colorectal cancer and methods to reduce the incidence of tick-borne diseases through increasing awareness.

Dr. Marc A. Nascarella is the Chief Toxicologist and Director of the Environmental Toxicology Program at the Massachusetts Department of Public Health (MDPH) where he directs a team of scientists responsible for evaluating the safety of contaminants in food, environmental media (e.g., air, water, soil), and consumer products in the Bureau of Environmental Health (BEH). Dr. Nascarella also oversees technical staff supporting regulatory activities associated with the medical use of marijuana, recreational water quality, and the environmental monitoring of radionuclides. He serves as the Principal Investigator on the MDPH “Biomonitoring Massachusetts Study” as well as a PI on federal grants and cooperative agreements related to state-based biomonitoring, water quality surveillance, and climate change assessment. In addition to public service, Dr. Nascarella has previously held positions in the active-duty military, academia, and private sector. He currently serves as an Adjunct Professor at the University of Massachusetts School of Public Health and Health Sciences.