Idaho Bureau of Laboratories

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IDAHO DEPARTMENT OF HEALTH & WELFARE

In this issue:

Biomonitoring Capabilities at IBL

Michael Stevenson, PhD

A *biomonitor* is an organism that is sensitive to and shows measurable responses to changes in the environment, such as changes in pollution levels. In terms of analytical chemistry, *biomonitoring* is the measurement of the body burden of toxic chemical compounds, elements, or their metabolites; these measurements are often done in blood and urine.

IBL's Chemical Threat (CT) Laboratory has the capability to do this!

In 2004, the CT lab was established as part of the Emergency Preparedness Section of Idaho Bureau of Laboratories (IBL). Funded under the Public Health Emergency Preparedness cooperative agreement and monitored by the Centers for Disease Control and Prevention (CDC), the lab is responsible for confirmatory testing of human exposure to a variety of chemical threat agents that may be involved in an all-hazards incident.

While the lab's primary focus is to respond to chemical threat incidents, opportunities for biomonitoring do occur. In early summer 2010, IBL was contacted by a physician for the Boise Fire Department Hazardous Materials (HazMat) personnel. He was interested in determining baseline levels of toxic metals in the HazMat individuals; these levels would be used as a reference in the event of a metals exposure to the team during an incident response. First responders are at an increased risk of chemical exposure, and the ability to quantitate this exposure will benefit in effective therapeutic treatment.

In July of 2010, the CT lab received both the

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Understanding Fluoride Levels in Your Drinking Water

Ernie Bader

Fluorides occur naturally in the environment in several different forms and exist in the earth's crust where they are found in rocks and soil. These natural sources of fluoride are released into water from soil leaching into the groundwater. As a result of the leaching process, drinking water fluoride concentrations vary between water systems. Fluoridation is the adjustment of fluoride compounds into community drinking water to achieve optimal levels (0.7 -1.0mg/L). This level is set by the U.S. Public Health Service for the prevention of tooth decay. Currently, Idaho ranks 45th in the U.S. in the percentage of

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Biomonitoring Capabilities at IBL

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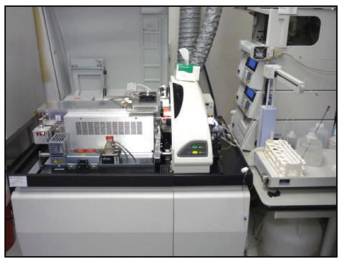
blood and urine samples from over 30 Boise HazMat personnel. From blood, the lab determined baseline levels of cadmium, lead, and mercury. From urine, the lab established baseline levels of antimony, arsenic, barium, beryllium, cadmium, cesium, cobalt, lead, molybdenum, platinum, selenium, thallium, tungsten, and uranium. Metal concentrations were determined using an inductively coupled plasma-mass spectrometer (ICP-MS); metals can be detected with this instrument at part per trillion levels—equivalent to one drop of contaminant diluted into 20 Olympic-size swimming pools.

A similar situation arose for the CT lab in October 2010. The lab was requested to test for selenium levels in four children from two Idaho families. The children were experiencing unique symptoms, one of which was that their fingernails were falling off. Selenium was suspected because although it is a trace mineral needed in small amounts for good health, exposure to higher levels can result in neurological effects, brittle hair, and deformed nails. From the children's urine samples the CT lab determined higher than typical selenium levels.



IBL's Chemical Threat lab utilizes the ICP-MS for metals analysis.

As recent as this past October, the CT lab was requested to test a 5 year old child's blood lead levels (BLL) after a one-year-old sibling

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IBL provides support for national study and exercise

Walt DeLong, MS

Recently, the Department of Homeland Security and the Environmental Protection Agency (EPA) conducted a "Bio-operational Testing and Evaluation (BOTE)" study and exercise at the Idaho National Laboratory near Idaho Falls. The study was prompted by a Government Accountability Office (GAO) report that anthrax sampling strategies had not been adequately evaluated. The event was conducted in two phases: a four-week EPA study (Phase 1) last spring followed by a two-week exercise (Phase 2) in September in which EPA, FBI, and CDC conducted an interagency response to an indoor anthrax event.

Phase 1 was designed to determine the most cost-effective technology or strategy for decontamination following an indoor release of anthrax. In Phase 1, EPA staged 3 "release" events, using *Bacillus atrophaeus* subspecies *globigii* (BG) as a surrogate for *B. anthracis.* Each event was followed by a different decontamination procedure. IBL was one of only eight state laboratories in the nation providing laboratory support in Phase 1.

During the study period, IBL's LRN Reference Laboratory processed over 300 environmental specimens, successfully delivering results within 24 hours. IBL, along with the other participating laboratories provided valuable feedback on sampling and best practices, suggesting changes to make testing safer and more efficient. Many of these changes were incorporated in Phase 2.

The scenario in Phase 2 was a covert indoor BG release and was a full-scale exercise designed to address interagency roles and responsibilities for a biological incident response from the initial public health and law enforcement response through environmental response (remediation) in a field setting. In Phase 2, IBL and other participating laboratories successfully demonstrated the ability to disseminate timely laboratory results in support of multiple federal agencies. The exercise also evaluated communications between the laboratories and the teams in the field.

On a local level, the study and exercise afforded the laboratory opportunities to practice its incident command structure for emergency response. Observations and recommendations made by the LRN laboratories participating in both phases will ultimately be used to formulate revised procedures for responding to a biological event.

Understanding Fluoride Levels

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population (31.3%) served by a community water system with optimal fluoride levels[1]. Supplementing fluoride into public water has been a controversial issue since its inception in 1945. Opponents' objections include questioning the safety and effectiveness of ingesting fluoride and civil rights concerns over having government add a supplement to public water systems. Despite polarizing opinions, consumers can empower themselves by learning of fluoride benefits, fluoride health concerns, and naturally occurring fluoride levels in their area.

The Centers for Disease Control and Prevention (CDC) lists community fluoridation as one of the 10 great public health achievements of the 20th century[2]. The past 5 Surgeons General have supported community water fluoridation and have encouraged communities to fluoridate their water[3]. Tooth decay is caused by specific bacteria in the mouth. When a person eats sugar and other refined carbohydrates, these bacteria produce acid that removes minerals from the surface of the tooth. Fluoride helps to remineralize tooth surfaces and prevents cavities from continuing to form. In addition to water, fluoride is available in toothpaste, mouth rinses, professionally applied fluoride treatments, and prescription fluoride supplements. However, these fluoride sources are more costly than supplementing through community water systems and may not reach lower income households. In Idaho, students in low-income schools have significantly higher rates of untreated tooth decay compared to students in high-income schools[4]. The correlation between social economic status and fluoride benefits is difficult to summarize because individuals in low income households face additional oral health issues including poor nutrition and inadequate dental care[5].

Physiologically, when fluoride is consumed, about half of the fluoride is excreted in urine within 24 hours. The remaining fluoride stays in the body and is stored in bones or teeth. Elevated fluoride levels during enamel maturation may result in dental fluorosis, which is characterized by hypomineralization of subsurface layers of enamel. In the mildest forms of dental fluorosis, the tooth is fully functional but has cosmetic alterations of almost invisible opaque white spots. In more severely fluorosed teeth, the enamel is pitted and discolored and is prone to fracture and wear. Several studies have found significant increases in the number of decayed, missing, or filled tooth surfaces in children with severe dental fluorosis[6]. The Environmental Protection Agency (EPA) has set a secondary drinking water contamination level of 2.0 mg/L to minimize the likelihood of dental fluorosis. Secondary standards are non-enforceable guidelines regulating contaminants that may cause cosmetic or aesthetic effects (such as taste, odor, and color) in drinking water[7].

Elevated fluoride levels over a lifetime can lead to a serious health effect, skeletal fluorosis. Fluoride increases bone density and negatively affects the growth of osteophytes in the bone and joints, which leads to joint pain and limited movement. Denser bones are often more fragile than normal bones and are at an increased risk of breaking. The Health and Human Services toxicological profile of fluoride states that skeletal fluorosis is extremely rare in the United States. EPA has set a national primary standard maximum contamination level of 4.0 mg/L in drinking water to limit the lifetime exposure levels and minimize the likelihood of skeletal fluorosis. National

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Correction

In the Fall issue of the Clinical Forum, an article on the new TB NAAT test offered at IBL contained an error. The TB NAAT being performed at IBL does not differentiate non-tubercular *Mycobacterium* species. Our test will detect *Mycobacterium tuberculosis* complex DNA in clinical samples. Our test has been validated for respiratory samples only. Results are usually available within 24 hours of sample receipt. Please contact the TB lab at IBL if you have any questions regarding the TB NAAT at (208)334-2235 ext. 253.

Environmental Word Find

answers on page 6

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PHOSPHORUS
PHTHALATES
POLYCHLORINATED BIPHENYLS
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Biomonitoring Capabilities at IBL

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tested with a BLL of 39 µg/dL. Because lead exposure adversely affects the cognitive development and behavior of young children, the CDC has defined an elevated BLL for children less than 6 years of age as ≥ 10 micrograms per deciliter (µg/dL); evidence also suggests that there are subtle effects at lower levels. According to the Idaho Reportable Diseases Rules, BLL ≥ 10 µg/dL in children and adults are to be reported to the Office of Epidemiology, Food Protection, and Immunizations. The 5 year old child's BLL was determined by the CT lab to be 10.4 µg/dL. Further testing of a 10 year old sibling and the children's mother gave 7.4 and 21.0 µg/dL BLL, respectively. Currently, no sources to explain the elevated BLL have been identified.

IBL's Chemical Threat lab hopes to participate in additional biomonitoring studies in the future. This could include testing urine samples from people living in Idaho regions that have higher than normal arsenic levels. This metal is a naturally occurring element widely distributed in the earth's crust and can be ingested by humans primarily through drinking water. Chronic exposure to arsenic can cause skin lesions and cancer. Biomonitoring for arsenic and other compounds could not only improve human health through targeted mitigation strategies but also help establish a precedent for monitoring additional toxic chemical compounds in the human body to better understand the relationship between environmental and clinical health.

Understanding Fluoride Levels

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Primary Drinking Water Regulations (NPDWRs or primary standards) are legally enforceable standards that apply to public water systems. Primary standards protect public health by limiting the levels of contaminants in drinking water[8].

Idaho is low on the list of fluoridated community water supplies; however, there are areas within the state that have high naturally occurring fluoride levels in ground water. Water tested by the Idaho Bureau of Laboratories (IBL) from Adams, Canyon, Custer, Gem, Owyhee, and Washington counties have been found to contain fluoride levels above both primary and secondary levels. To identify fluoride levels in community water systems, go to CDC's website, My Water's Fluoride[9] to locate your water system. Community or public water systems serve a minimum of 25 people or have at least 15 service connections for more than 60 days per year. Private wells are not regulated by EPA, and those drinking from private wells can have their water tested for fluoride concentrations through a lab that tests for drinking water standards. To find a lab that performs drinking water analyses, go to IBL's Drinking Water Certification page.

Below are links for additional information from the CDC and Idaho Department of Environmental Quality (DEQ) that may be beneficial when considering what level of fluoride is best for your health. Since almost all drinking water sources in Idaho contain fluoride, once you know your level, you can discuss your options with a health care provider and/or dentist. Fluoride is a compound that is beneficial when taken appropriately yet may lead to negative health effects if consumed at increased levels over extended periods of time. Knowing your drinking water consumption level first and then considering additional exposure sources will assist you in determining what is best for you and your family.

References

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[2]MMWR Weekly. (1999). *Top ten great public health achievements—United States, 1900-1999*. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/00056796.htm

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[5]National Institute of Dental and Craniofacial Research. (2011). *Oral health in America: Report of the Surgeon General (executive summary).* Retrieved from http://www.nidcr.nih.gov/datastatistics/surgeongeneral/report/executivesummary.htm

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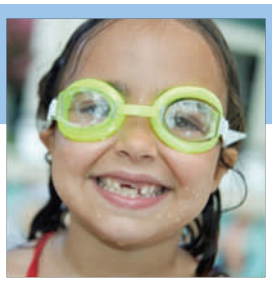
[7]Environmental Protection Agency. (2011). *Secondary drinking water regulations: Guidance for nuisance chemicals*. Retrieved from http://water.epa.gov/drink/contaminants/secondarystandards.cfm

[8]Environmental Protection Agency. (2011). *Drinking water contaminants*. Retrieved from http://water.epa.gov/drink/contaminants/index.cfm#Primary



More Information

- Centers for Disease Control and Prevention - Community Water Fluoridation
- Dietary Fluoride Supplements: Evidence-based clinical recommendations
- Idaho Department of Environmental Quality - Fluoride in Drinking Water

A Job Well Done

Walt DeLong announces retirement after 35 years with the state of Idaho.

IBL's Biological Threat (BT) Coordinator, Walt DeLong, recently announced his retirement effective January 20, 2012. Walt has been with the state of Idaho for 35 years. His career with the state began at the University of Idaho in animal disease research and diagnosis. After 24 years there, Walt was hired as Microbiology Section Manager at the Idaho Bureau of Laboratories. Then in 2005, Walt assumed full responsibility over Idaho's Biological Threat Program and became IBL's second BT coordinator.

Throughout Walt's tenure with the state, he has taken part in numerous projects. His most notable professional accomplishments include his involvement with the LRN program since its inception, participating in the early planning and design of the Biosafety Level 3 Laboratory at the Idaho Bureau of Laboratories, and publishing around 40 scientific publications.

Walt's favorite part of his job as BT coordinator has been collaborating with colleagues across the country through his involvement with the Laboratory Response Network (LRN). Consequently, the thing that Walt will miss most when he retires will be his relationships with professionals both in and out of the laboratory. Walt is looking forward to spending more time with his wife of 31 years, 3 children, and 7 (soon to be 8) grandchildren. He is also looking forward to traveling and pursuing his hobby of building and repairing musical instruments.

Walt, you will surely be remembered for the things you did here at IBL. Thanks for your years of hard work and dedication. Congratulations on your retirement!

Solution to Word Find

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BIOACCUMULATION(8,29,E)
COPPER(10,6,NW)
CYANIDE(7,5,SE)
EPA(17,19,E)
FLUORIDE(16,13,NE)
GIARDIA(15,17,S)
LEAD(6,7,NE)
MERCURY(25,2,SW)
NITRATE(18,20,W)
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POLYCHLORINATED BIPHENYLS(26,10,W)
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TOTAL COLIFORM(1,13,SE)
TURBIDITY(26,9,N)
WASTEWATER(19,28,NW)

Training Opportunities

APHL/NLTN Packaging and Shipping Division 6.2 Materials Online Course for Recertification

Cost: Free (from now until December 31, 2011)
Register and more information: www.nltn.org/302-11.htm

"Ready? Set? Test!" CDC Online Laboratory Training

Purpose: to promote good laboratory practices and assure the quality of patient testing, especially in physician office laboratories and other sites that perform waived tests

Cost: Free

Register and more information: http://wwwn.cdc.gov/dls/waivedtests/