



STATE OF MICHIGAN

DEPARTMENT OF COMMUNITY HEALTH
LANSING

JENNIFER M. GRANHOLM
GOVERNOR

JANET OLSZEWSKI
DIRECTOR

December 17, 2004

Marlene Marlatt
Thunder Bay Community Health Services
610 Caring Street
Hillman, MI 49746

Dear Ms. Marlatt:

On December 10, 2004, you spoke with Erik Janus, a toxicologist in the Michigan Department of Community Health (MDCH) Toxicology and Response Section, regarding exposure-testing services requested from local residents relative to the Hillman Elementary School/Hillman Power Plant. Mr. Janus and Christina Bush, another toxicologist in our section, have reviewed biomarker-testing information on arsenic, the chemical in question, referring primarily to the Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Arsenic, and have condensed that information into a factsheet for healthcare providers (attached). Please feel free to share the factsheet with patients seeking exposure-testing services. As well, we are including the ATSDR ToxFAQ (Frequently Asked Questions) sheet for arsenic, which you may want to share with patients.

1. **Necessity of testing:** The first point we want to make clear is that we do *not* feel that biomarker testing for arsenic is necessary for people concerned that they have been exposed, in outdoor or indoor air or in the soil, to emissions from the Hillman Power Company. Three toxicologists in our office, including myself, have reviewed the environmental data collected around the power company, including data taken on the Hillman Elementary School property, and conclude that concentrations of chemicals tested for, which includes arsenic, are well-below health-based screening levels. We do not believe that residents of Hillman or children attending Hillman Elementary School would have elevated arsenic levels or suffer any adverse health effects following dermal contact with the soil or breathing the air in or around the school.
2. **Appropriate sample:** Although we do not recommend that arsenic testing be done, patients may insist upon it and healthcare providers may choose to conduct it. Biological indicators of exposure to arsenic can be measured in blood, hair, nails, and urine. Blood levels of arsenic, however, are not reliable indicators of recent exposure because the concentrations clear within a few hours. The metal accumulates in hair and nails, providing an indication of past exposure. However, exogenous arsenic (arsenic that is not within the body) may adhere to the cuticle of the hair or may be present in hair-care products and be absorbed into the hair follicle, or may be present in dirt on the nails, skewing analytical results. Therefore, although easier to collect, hair and nail samples are not reliable biomarkers. According to the ATSDR Toxicological Profile for Arsenic, *urinary arsenic levels are accepted as the most reliable indicator of recent arsenic exposure via ingestion or inhalation.*
3. **Consider all sources:** When testing for environmental exposures, one should *consider all potential sources of the chemical of interest.* For arsenic, this would include food, medicine, drinking water, CCA-treated lumber (which is no longer marketed but people might have used it for building decks or other outdoor structures), as well as industrial sources. The more sources a patient is exposed to, the greater the likelihood that arsenic will be detectable in the urine.



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4. **“Fish arsenic:”** It should be noted that an arsenic test is usually not speciated (inorganic versus organic forms of arsenic), but reports the total amount of the metal. The organic form is of much less concern than the inorganic form. The organic form can be found in various fish and shellfish species. Therefore, *a patient should not consume fish or shellfish for several days before being tested for arsenic exposure.* That will lessen the likelihood of “fish arsenic” causing an elevation in total arsenic.
5. **Interpreting results:** The University of Utah’s ARUP Laboratories are frequently used to provide laboratory testing information to various states’ Poison Control Centers. ARUP’s website (<http://www.aruplab.com/index.jsp>) reports the following *reference ranges for urinary arsenic: < 53 µg/L for a random (“spot”) sample, < 64 µg/day for a 24-hour sample, and < 35 µg/g creatinine.* If a patient’s urinary arsenic level is greater than the reference range (a screening level) provided by the analyzing laboratory, it is recommended that the sample be speciated. An exposure assessment may be indicated, dependent on results.
6. **Arsenic toxicosis symptoms:** As we stated earlier in this letter, we do not expect adverse health effects to occur as a result of exposure to the low concentrations of arsenic found in the environmental samples from the Hillman area. The single most common characteristic of long-term ingestion exposure to inorganic arsenic is a darkening of the skin and the appearance of small “warts” on the palms, soles and torso. Other symptoms that may appear over time can include gastrointestinal irritation, cardiovascular effects, and peripheral neuropathy. Arsenic is a human carcinogen and is regulated in public drinking water supplies (this does not include private residential wells). There is typically a latency period of at least 10 years, and more often 20-30 years, between an exposure to a carcinogen and the manifestation of the cancer. Cancers related to arsenic exposure would not be expected in elementary school-age children.

We hope this information is useful to you and your patients. If we can be of further assistance, do not hesitate to contact the Toxicology and Response Section at 1-800-648-6942. Thank you.

Sincerely,

Linda D. Dykema, Ph.D.
Toxicologist, Section Manager
Michigan Department of Community Health
Division of Environmental and Occupational Epidemiology
Toxicology and Response Section

Attachments

Evaluating Arsenic Exposure

Arsenic – Key Points:

- Occurs naturally in the soil; can be released to the environment from some industries
- Occurs naturally in fish and shellfish and other foods
- Numerous exposure sources (see below)
- Urine testing is best method to test for recent exposure
- Do not eat fish for several days before and during (if a 24-hour test) sampling

General Information:

Arsenic occurs naturally in soil and minerals. It can also be released into the air from primary (purifying the ore) metal smelters, coal-fired power plants, incinerators, and oil/wood combustion facilities. Organic arsenic compounds have been used in pesticides and occur naturally in fish and shellfish. Inorganic arsenic compounds have been used in preserving wood (CCA-treated lumber, which is no longer marketed). The inorganic form of arsenic is more toxic than the organic form.

Sources of Exposure:

- ▶ Wellwater (inorganic arsenic)
- ▶ Food (primarily organic arsenic): fish, shellfish, rice, grains, mushrooms, other foods
- ▶ Some medicines and herbal remedies (especially from other countries)
- ▶ “Wolmanized” (CCA-treated) lumber (no longer marketed however)
- ▶ Soil containing naturally-elevated concentrations or contaminated by human activity
- ▶ Air: airborne arsenic-containing soil or dust, tobacco smoke, emissions from industrial sources, burning CCA-treated wood
- ▶ Job-to-home: employees exposed at work to arsenic dusts might bring the dusts home with them on their clothing. Other family members can then be exposed.

Laboratory Testing:

Blood levels of arsenic are not reliable indicators of recent exposure because the concentrations clear within a few hours.

Arsenic accumulates in hair and nails. However, exogenous arsenic (arsenic that is not within the body) may adhere to the cuticle of the hair or may be present in hair-care products and be absorbed into the hair follicle, or may be present in dirt on the nails, skewing analytical results. Therefore, although easier to collect, *hair and nail samples are not reliable biomarkers.*

According to the ATSDR Toxicological Profile for Arsenic, **urinary** arsenic levels are accepted as the **most reliable indicator** of recent arsenic exposure via ingestion or inhalation. Either a 24-hour (preferred) or a random (“spot”) sample is acceptable. It is advisable that the patient not consume any fish or shellfish for several days before and during the test, as the organic arsenic in the fish will elevate the results.

Reference Ranges:

The laboratory that analyzes the sample should provide a reference range to which analytical results are compared. A “reference range” is essentially a screening level, below which the arsenic concentration is of no concern. If the arsenic concentration is greater than the reference range, this indicates that speciation of the arsenic in the sample is necessary. An exposure assessment may be indicated, dependent on results.

Potential Health Effects:

Simply because a person’s urinary arsenic level might be higher than the reference range provided by the testing laboratory *does not mean* that adverse health effects will occur. Similarly, exposure to a chemical *does not mean* a person will have a reaction to that chemical. There are many factors that determine one’s reaction to an exposure, including how long, by what route (eating, inhaling, skin contact), and the amount to which the person was exposed, as well as the general state of health of that person.

- Skin effects - The single *most common characteristic* of long-term ingestion exposure to inorganic arsenic is a darkening of the skin and the appearance of small “warts” on the palms, soles and torso. Direct skin contact with arsenic may cause dermal irritation, but this generally occurs at high concentrations.
- Gastrointestinal effects - Eating or drinking low levels of inorganic arsenic may lead to irritation of the stomach and intestines, which could cause stomachache, nausea, vomiting, and diarrhea. Severity of symptoms would increase with increasing dose.
- Cardiovascular effects - Eating or drinking low levels of inorganic arsenic may lead to decreased production of red and white blood cells, possibly leading to fatigue or anemia; abnormal heart rhythm; or blood-vessel damage, possibly leading to bruising.
- Nerve function effects - Eating or drinking low levels of inorganic arsenic may lead to impaired nerve function, possibly leading to a “pins and needles” sensation in hands and feet.
- Cancer - Long-term exposure to inorganic arsenic can increase a patient’s risk of developing several types of cancer.

Additional Information:

The federal Agency for Toxic Substances and Disease Registry has produced the Toxicological Profile for Arsenic and a condensed factsheet on arsenic (“ToxFAQs”). Both documents can be accessed at <http://www.atsdr.cdc.gov/toxprofiles/tp2.html>.

Staff from the Michigan Department of Community Health (1-800-648-6942) or the Michigan Poison Control Center (1-800-222-1222) can help interpret arsenic tests and provide further guidance.