



STATE OF MICHIGAN

DEPARTMENT OF COMMUNITY HEALTH

LANSING

JENNIFER M. GRANHOLM
GOVERNOR

JANET OLSZEWSKI
DIRECTOR

December 14, 2004

Dear Lyon Township resident:

On September 28, 2004, the Department of Community Health (DCH) posted information to its website regarding evaluating aluminum exposure. The information had been compiled by DCH in response to inquiries from a pediatric clinic that tested serum aluminum levels in two pre-teen children from Lyon Township. The children's parent, concerned that her children might be exposed to excess amounts of aluminum, had her children's pediatrician test for serum aluminum levels. The results of the tests indicated that the serum aluminum levels from the children were higher than the reference range provided by the analyzing laboratory. The parent and the clinic requested information from DCH regarding the implications to health from these serum aluminum levels and how to proceed. The purpose of this letter is to update that information and provide recommendations.

Since the release of that information, DCH has continued to confer with the federal Agency for Toxic Substances and Disease Registry (Atlanta and Chicago offices), the Michigan Poison Control Center (out of the Detroit Medical Center), and the Pediatric Environmental Health Specialty Unit (regionally based in Chicago). Our discussions have centered on:

- determining the necessity for medical testing, in regards to township residents' concerns;
- determining an appropriate reference range, if possible;
- what patients and doctors should be aware of before conducting medical testing;
- and interpreting analytical results.

The updated information sheet, "Evaluating Aluminum Exposure: Information for the Public" is attached. The DCH prepared a similar information sheet for healthcare providers. The key points are below:

1. **Testing is rarely, if at all, necessary in persons with proper kidney function.** Aluminum is commonplace in the soil and in the products we use or eat. There are two tables in the attachment showing concentrations of aluminum found in various foods and over-the-counter drugs. The information in the tables shows how common aluminum is and that we are regularly exposed to it in food and medicine. Although aluminum has no known nutritional function, we do store a small amount in our bones. Our kidneys are used to handling and getting rid of excess aluminum. Therefore, unless you have problems with your kidneys requiring dialysis, **you should not be at risk of having toxic amounts of aluminum in your body.**



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2. **There is no consensus among analytical laboratories on serum (or plasma or urine) reference ranges.** “Reference ranges” are just that: they are a reference, usually specific to the analyzing laboratory. They are similar to “screening levels” used by regulatory or health agencies: a value within the range warrants no concern whereas a value higher than the range warrants further evaluation. The concentration of aluminum in your body is fluctuating continuously. Recent exposures, such as having a baked good with an acidic juice (the acid in the juice will increase absorption) or taking an aluminum-containing antacid, will cause the amount of aluminum in your body to increase rapidly, until the kidneys eliminate it, at which point it will decrease to a steady state. Depending on when you took in that baked good or antacid compared to when your blood is drawn, your serum aluminum level could be above a testing laboratory’s reference range or it could be at the low end of that range.
3. Although DCH does not recommend having your serum tested for aluminum, you might choose to have it tested anyway. As discussed in points 1 and 2, **recent exposure can affect your test results.** If you choose to be tested, you should discuss with your doctor all potential sources of aluminum (food, medicine, water, high-aluminum soils, other sources) ahead of time or when discussing the results.
4. **If you choose to be tested and your results are above the laboratory’s reference range, you should be re-tested as verification.** Again, as discussed in the previous points, exposure to aluminum is, for all practical purposes, unavoidable. If the first test results suggest a re-test, you and your doctor should first consult with the Michigan Poison Control Center, or with DCH, to discuss potential aluminum sources and to ensure that all proper steps are followed during the re-test.

If you need further assistance, please do not hesitate to contact me.

Sincerely,

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Attachments

Evaluating Aluminum Exposure: Information for the Public

Aluminum - Key Points:

- One of the most common elements; found in food, water, drugs, cookware
- Persons with normal kidney function are not considered at risk of reaching toxic levels (the body normally stores a small amount of aluminum in bone)
- Persons with compromised kidney function may not be able to excrete aluminum, among other compounds, efficiently
- Normal urine or blood levels – see Reference Ranges section

General Information:

Aluminum is the third most common element and the most common metal in the earth's crust. Daily exposure to aluminum is inevitable due to its abundance in nature and its diverse use by man.

Sources of Exposure (see attached tables for examples):

General population -

Processed foods
Infant formula
Drinking water
Antiperspirants
Cosmetics
Analgesics
Anti-ulceratives
Antidiarrheals
Antacids
Airborne dust particulates

Worker population -

Primary aluminum smelters
(processing ore)
Secondary aluminum smelters
(recycling)
Production/use of compounds
containing aluminum
Aluminum welding

Populations who may have higher exposures:

Persons living near industrial emission sources or uncontrolled hazardous waste sites
Persons with chronic kidney failure requiring long-term dialysis or treatment with phosphate binders
Infants, especially premature infants, fed soy-based formula containing high levels of aluminum
Individuals consuming large quantities of antacids, anti-ulcerative medications, buffered aspirin, antidiarrheal medications, or vitamins and food supplements containing aluminum

What happens after exposure?

The majority of ingested aluminum passes right through the body and is excreted in the feces. The remaining amount is absorbed by the body, then

excreted in the urine. Certain foods, such as fruit juices, can increase absorption. Some inhaled aluminum may remain in the lung and be absorbed, then excreted in the urine.

Laboratory Testing:

Testing is rarely, if at all, necessary in persons with proper kidney function. If testing is conducted, serum (blood) tests are preferred.

Urine testing may be conducted. It is recommended that a 24-hour collection be used rather than a one-time specimen. The results might be difficult to interpret, since a person might consume aluminum-containing food or medicine before or during the 24 hours.

If the initial sample results appear to be high, a follow-up sample can be taken to verify results. The sample should be collected in a container that is certified free of trace metals.

Testing of hair is not recommended.

Reference Ranges:

Laboratories provide “reference ranges” based on historical results seen in their practice or information from various health studies. Because analytical procedures vary between labs, reference ranges for aluminum vary as well. Some labs report serum aluminum for healthy individuals to be less than 10 µg/L (micrograms per liter), whereas other labs report less than 40 µg/L for healthy individuals. Refer to the “Evaluating Aluminum Exposure: Information for Healthcare Providers” factsheet (<http://www.michigan.gov/mdch-toxics>, click on “Health Assessments and Related Documents,” click on Continental Aluminum) for a table showing several laboratories’ reported reference ranges. You may also find this information on the Internet by searching under “reference range aluminum.”

The majority of health studies on aluminum in which blood values were determined used patients undergoing dialysis treatment or other patients with compromised kidney function. The central nervous system and bone effects discussed below pertain to these patients and have not been seen in otherwise healthy individuals. (Lung effects are generally seen in persons who work in the aluminum industry.)

The body’s aluminum content is in a constant state of flux. It is easily affected when a person consumes food or medicine containing aluminum, especially if the item consumed is accompanied by fruit juice or another citrate-containing beverage (which causes more aluminum to be absorbed). If a person is tested for

aluminum levels and the results are above the reference range specified by the laboratory, the person should be re-tested. (See Suggested Treatments below.)

Potential Health Effects:

Simply because a person's serum or urine aluminum level might be higher than the reference range 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. If you are concerned about your or your children's aluminum levels, you should first consult with your physician.

Central Nervous System (seen only in patients with compromised kidney/excretory function - at blood aluminum levels >50 µg/L) -

Stuttering, stumbling, jerks/twitches, seizures

Bone (seen only in patients with compromised kidney/excretory function - at blood aluminum levels > 100 µg/L) -

Painful spontaneous fractures, not enough calcium in bone

Lung (typically in aluminum workers) -

Cough, wheeze

Suggested Treatments:

Persons with aluminum levels greater than the laboratory-provided reference range -

Evaluate potential recent exposures - it is possible you recently ate food or took medicine that contained aluminum and this caused a brief elevation in your blood or urine.

Retest after consulting with your physician and Poison Control Center (1-800-222-1222) regarding test method - some glassware contains aluminum; it is important to eliminate potential sources of sample contamination.

Persons with aluminum levels > 50 µg/L -

Evaluate potential exposures

Test kidney function

Discuss with your physician and Poison Control Center

Aluminum-containing Non-prescription Drugs

Antacids (e.g., Gaviscon, Maalox, Mylanta, Riopan, Roloids)	
Aluminum salt used	Al content/dose (mg)
Aluminum hydroxide	35 - 208
Dihydroxyaluminum acetate	45 - 72
Aluminum carbonate	(not available)
Aluminum oxide	41
Bismuth aluminate	55
Magaldrate	51 - 61
Dihydroxyaluminum aminoacetate	100
Dihydroxyaluminum sodium carbonate	63
Analgesics (e.g., Arthritis Pain Formula, Bufferin, Vanquish)	
Aluminum salt used	Al content/dose (mg)
Aluminum hydroxide	9 - 52
Aluminum glycinate	35,717
Antidiarrheals (e.g., Kaopectate)	
Aluminum salt used	Al content/dose (mg)
Kaolin	120 - 1,450
Aluminum magnesium silicate	36
Attapulgate	500 - 600
Anti-ulcerative (e.g., Carafate)	
Aluminum salt used	Al content/dose (mg)
Aluminum sucrose sulfate	207