



STATE OF MICHIGAN

DEPARTMENT OF COMMUNITY HEALTH

LANSING

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GOVERNOR

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Dear Lyon Township resident:

The attached information sheets were compiled by the Department of Community Health (DCH) as a result of a request from a pediatric clinic that found elevated serum aluminum levels in two pre-teen children. These children live in Lyon Township in Oakland County, Michigan where an aluminum recycling smelter operates. The children have recently attended Dolsen Elementary School in New Hudson, which is about one-half mile in the predominantly downwind direction from the smelter. 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 parent and the clinic have requested information regarding what the implications to health are from these elevated levels and how to proceed. The DCH has prepared a similar information sheet for healthcare providers.

The attached is not a medical opinion but instead a compilation of information, primarily from the Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile on Aluminum (<http://www.atsdr.cdc.gov/toxprofiles/tp22.html>), the American Academy of Pediatrics' policy statement on aluminum toxicity in infants and children (<http://aappolicy.aappublications.org/cgi/reprint/pediatrics;97/3/413.pdf>), and several medical centers' websites (e.g., Beth Israel Deaconess Medical Center, Cleveland Clinic). ATSDR is conducting further review.

Other resources you may consider investigating are:

- Local health department (<http://www.malph.org/page.cfm/18/>)
- Michigan Department of Community Health Toxics Hotline 1-800-648-6942
- Poison Control Centers 1-800-222-1222
- Agency for Toxic Substances and Disease Registry (<http://www.atsdr.cdc.gov/toxfaq.html>)
- Centers for Disease Control and Prevention 1-888-246-2675
- American Academy of Pediatrics (<http://www.aap.org>)
- Pediatric Environmental Health Specialty Units (at <http://www.aoec.org>)

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

Sincerely,

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# Evaluating Aluminum Exposure: Information for the Public

## Aluminum - Key Points:

- One of the most common elements; found in food, drugs, cookware
- Normal serum levels (adult) = 0-40 µg/L (“micrograms per liter”; some references suggest children’s levels may be similar)
- Normal urine levels (adult) = less than 36 µg collected over 24 hours (children’s values may be similar)
- Serum levels greater than 100 µg/L increase risk of aluminum toxicity, as seen in dialysis patients exposed to aluminum-containing solutions
- Target organs: nervous system, bone, lungs
- Persons with normal kidney function can reduce excess in body by limiting exposure (the body normally stores a small amount of aluminum in bone)
- Chelation may be considered for persons with near or greater than 100 µg/L levels

## **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:**

### 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

## Special populations at risk of excess exposure:

Persons living near industrial emission sources or hazardous waste sites  
Persons with chronic kidney failure requiring long-term dialysis or treatment with phosphate binders  
Persons requiring intravenous fluids  
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

**Laboratory Testing:**

Blood tests may be run on plasma or serum, however the reference range is for serum.

Urine testing may be conducted. It is recommended that a 24-hour collection be used rather than a one-time specimen. Persons should not consume chocolate, beer, juices, teas, coffee, and antacids for 24 hours before and during collection as these might affect aluminum levels.

Testing of hair is not recommended.

**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 -

**Not proven** as causing Alzheimer's disease  
Stuttering, stumbling, jerks/twitches, seizures

Bone -

Painful spontaneous fractures, not enough calcium in bone

Lung -

Cough, wheeze

**Suggested Treatments:**Persons with aluminum levels greater than the reference range -

Evaluate potential exposures  
Retest over time

Persons with aluminum levels near or greater than 10 times the maximum reference value -

Evaluate potential exposures  
Discuss chelation (treatment that removes metals from one's body) with your physician

Aluminum Content of Various Foods and Food Products

<b>Beverages</b>	<b>Al conc. (ug/g)</b>	<b>Fruits</b>	<b>Al conc. (ug/g)</b>	<b>Herbs/Spices</b>	<b>Al conc. (ug/g)</b>
Beer	0.07	Apple	0.1	Basil	3,082
Coffee (brewed)	0.235 - 1.163	Banana	0.05	Celery seed	465
Coffee (instant)	0.02 - 0.581	Peach	0.4	Cinnamon	82
Fruit juices	0.043 - 4.130	Raisins	3.1	Oregano	600
Liquor	0.148 - 0.635	Strawberries	2.2	Pepper (black)	143
Milk (all forms)	0.06 - 1.409			Thyme	750
Orange juice (concentrate)	0.06				
Soda	0.1 - 2.084				
Tea (black)	0.424 - 4.3				
Tea (herbal)	0.14 - 1.065				
<b>Animal Products</b>	<b>Al conc. (ug/g)</b>	<b>Grains</b>	<b>Al conc. (ug/g)</b>	<b>Vegetables/Legumes</b>	<b>Al conc. (ug/g)</b>
Beef, cooked	0.2	Biscuits (refrig. Dough)	16.3	Asparagus	4.4
Cheese (brick)	3.83 - 14.10	Bread, pumpernickel	13.2	Beans, green, cooked	3.4
Cheese (processed)	297	Bread, white	0.351 - 3.0	Beans, navy, boiled	2.1
Chicken, cooked (w/skin)	0.7	Bread, whole wheat	5.4	Cabbage, raw	0.1
Cottage cheese	0.2	Cold cereal	0.040 - 29.33	Cauliflower, cooked	0.2
Eggs	0.1 - 2.865	Corn chips	1.2	Corn	0.1
Fish	0.127 - 5.44	Cornbread	400	Cucumber, pared	0.1
Ham	1.2	Muffin, blueberry	128	Lettuce	0.6 - 7.16
Salami	1.1	Oatmeal, cooked	0.7	Peanut butter	5.8 - 6.29
Yogurt, plain low-fat	1.1	Oats	2.21 - 4.18	Peas	1.64 - 1.9
		Rice	1.7 - 1.97	Potato, red	3.63
		Spaghetti, cooked	0.4	Potato, sweet	1.01
				Potatoes, unpeeled, baked	2.4
				Potatoes, unpeeled, boiled	0.1
				Spinach, cooked	25.2
				Tomatoes, cooked	0.1
<b>Other Food Products</b>	<b>Al conc. (ug/g)</b>	<b>Other Food Products</b>	<b>Al conc. (ug/g)</b>		
Baking powder	2,300	Oreo cookie	12.7		
Candy, milk chocolate	6.8	Pickles	0.126 - 39.2		
Cocoa	45	Soup	0.032 - 3.6		
Creamer, powdered	25.7 - 139				

Aluminum-containing Non-prescription Drugs

<b>Antacids (e.g., Gaviscon, Maalox, Mylanta, Riopan, Roloids)</b>	
<b>Aluminum salt used</b>	<b>Al content/dose (mg)</b>
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
<b>Analgesics (e.g., Arthritis Pain Formula, Bufferin, Vanquish)</b>	
<b>Aluminum salt used</b>	<b>Al content/dose (mg)</b>
Aluminum hydroxide	9 - 52
Aluminum glycinate	35,717
<b>Antidiarrheals (e.g., Kaopectate)</b>	
<b>Aluminum salt used</b>	<b>Al content/dose (mg)</b>
Kaolin	120 - 1,450
Aluminum magnesium silicate	36
Attapulgate	500 - 600
<b>Anti-ulcerative (e.g., Carafate)</b>	
<b>Aluminum salt used</b>	<b>Al content/dose (mg)</b>
Aluminum sucrose sulfate	207