Heavy Metal Handbook
A Guide for Healthcare Practitioners

Science Subcommittee of the Heavy Metals Remediation Committee
of the Vashon-Maury Island Community Council, 2003

For further information, please see our website at http://www.vmicc.org/comm_metals.html.

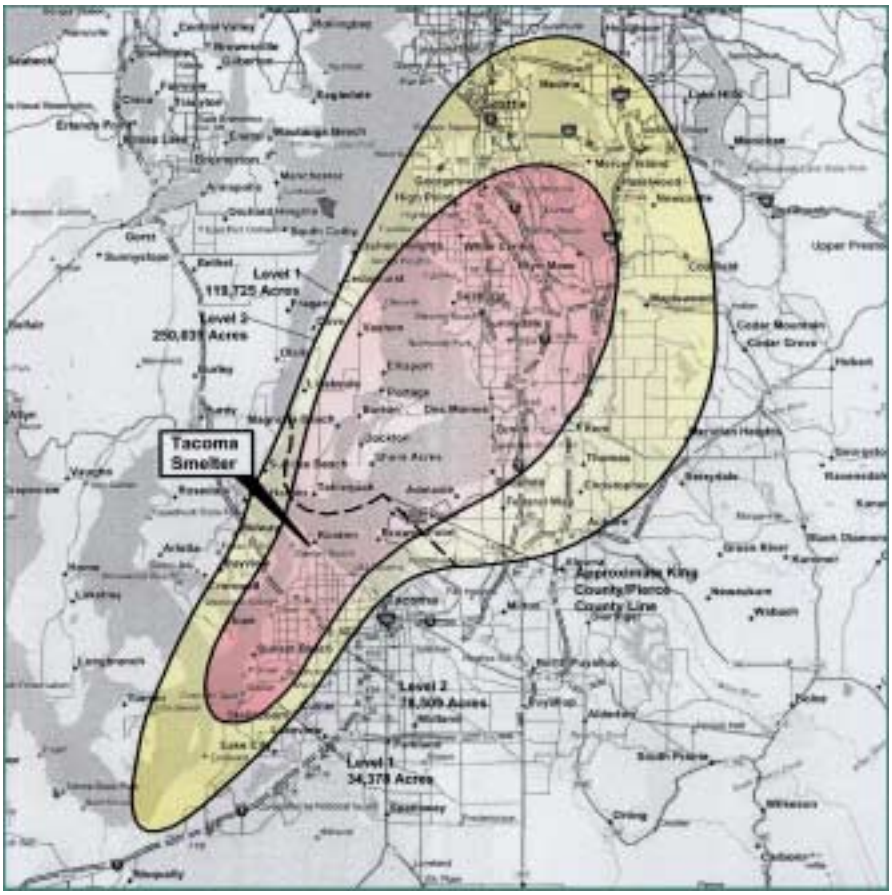

Figure after Washington Area-Wide Soil Contamination Task Force Final Report
Depicting Heavy Metal Plume Due to the Tacoma Smelter

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Disclaimer

Reference in this document to any specific health care provider, commercial product, process, service, manufacturer, or company does not constitute its endorsement or recommendation by the Vashon Maury Island Community Council. It is entirely the reader's responsibility to decide what choices to make.

This document is subject to change.

Executive Summary

Children with pica (who may eat soil) are at highest risk for lead and arsenic exposure.

Cadmium has been found to be high in soils on Vashon-Maury Islands and is taken up by leafy vegetables in amounts that may cause significant toxicity.

Think about heavy metal toxicity in patients of any age with anemia, neuropathy, hypertension, kidney or liver dysfunction, especially if they have two or more of these or also have cancer or other symptoms noted in this manual.

Testing of blood for lead and of urine for cadmium is especially useful.

Arsenic toxicity may show up years after exposure when the metal is no longer in the system.

There is no magic bullet for treatment, but you can make a difference.

- Stopping or minimizing exposure is crucial.
- Supplemental calcium citrate and vitamin D, and avoiding excess protein intake, decrease risk of lead toxicity along with preventing osteoporosis.
- Supplemental iron when needed (e.g. childhood and adolescence, pregnancy) can decrease lead uptake as well as prevent iron deficiency.
- Diets high in fiber and low in fat can decrease heavy metal risks along with their other benefits.
- Diets high in antioxidant plant foods and sulfur compounds may be protective against heavy metal toxicity in addition to other benefits such as decreasing risk of cancer.

Arsenic, Cadmium and Lead Exposure

A large part of the Puget Sound Basin, including Vashon and Maury Islands, contain soils with elevated levels of lead, arsenic and cadmium, much of it as a result of the fallout from the long-running Asarco copper smelter in Ruston, Washington.

People, especially those under the age of six, are exposed primarily through accidental ingestion. Once exposed, toxic effects may be observed indefinitely into the future, even after exposure has stopped.

Please be aware that individuals with clusters of the symptoms described below may be suffering from chronic heavy metal toxicity. Testing may be necessary.

The King County Public Health Department has maps and lists available showing sample levels of soil contamination for many locations on Vashon and Maury Island.

Possible Symptoms of Chronic Heavy Metal Exposure

Heavy metal exposure can have symptoms that are chronic and subtle. Often the symptoms of heavy metal toxicity resemble those of other diseases.

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Arsenic

Symptoms

- Skin and nail changes:
    - hyperkeratosis
    - hyperpigmentation
    - exfoliative dermatitis;
- Sensory and Motor Polyneuritis:
    - headache, drowsiness, confusion
    - stocking- glove distribution of numbness and tingling
    - distal weakness;
- Moderate hemolytic anemia, leukopenia, slight proteinuria, and liver function abnormalities;
- Inflammation of respiratory mucosa;
- Peripheral vascular insufficiency;
- Elevated risk of skin cancer, and cancers of lung, liver, bladder, kidney, colon.

Sources of Arsenic Exposure

- Smoking tobacco;
- Releases into the air and onto soils by smelting industry;
- Natural contamination of some deep water wells;
- Industrial exposure in the glass and microelectrics industry (gallium arsenide);
- Use of wood preserved with Chromated Copper Arsenic (CCA), including sawing, sanding and skin contact with treated wood;
- Burning CCA lumber;
- Pesticides including some herbicides and fungicides;
- Some paints;
- Burning of fossil fuels in which arsenic is a contaminant.

Arsenic has a short half-life in the body (weeks) but its effects can be seen years after exposure has ceased.

Cadmium

Symptoms

- Anemia resistant to iron therapy (hypochromic, microcytic anemia with normal ferritin and iron indices, and normal hemoglobin electrophoresis);
- Yellowing of teeth, excessive dental caries (tooth decay);
- Kidney dysfunction, proteinuria, urinary tract problems;
- Emphysema (not due to smoking or other obvious cause);
- Osteomalacia (softening of the bones so that they become flexible or brittle);
- Hypertension;
- Minor liver function changes;
- Possible prostate cancer;
- Lung cancer (from inhalation exposure);
- Anosmia (loss of the sense of smell).

Sources of Cadmium Exposure

- Cigarette smoking (but not second-hand smoke);
- Releases into the air and onto soils by smelting operations and incineration of municipal waste containing plastics and ni-cad batteries;
- Ingestion of ni-cad batteries;
- Ingestion of foods grown on soils contaminated with smelting emissions, sewage sludge, chemical fertilizers, polluted groundwater, metal-plating industry wastes or cadmium pigments: leafy vegetables are especially noted for cadmium bio-concentration;
- Industrial exposure in the battery, pigment and plastic industries.

Cadmium has a very long half-life in the body (10 to 30 years) and can build up over a long time. Over 80% of the body burden resides in the kidneys.

Lead

Symptoms, All Ages

Low levels of lead in blood have been associated with:

- Increased blood pressure;
- Decreased creatinine clearance;
- Subtle decrements in cognitive performance;
- Iron deficiency anemia.

Symptoms, Children

Selective neurological deficits in the following areas:

- Mental retardation;
- Language;
- Cognitive function;
- Balance;
- Behavior;
- School behavior.

Symptoms, Adults:

Kidney Disease, including:

- Interstitial nephritis;
- Tubular damage (with tubular inclusion bodies);
- Hyperuricemia (increased risk of gout);
- Decline in glomular filtration rate;
- Chronic renal failure.

Sources of Lead Exposure

- Leaded Paints, cans, plumbing fixtures, leaded gasoline, deterioration of leaded paint used in the past;
- Consumption of lead chips or paint dust (which tastes sweet) by children or developmentally delayed adults;
- Soldering, as an occupational or hobby exposure;
- Vehicle exhaust, in soil and house dust;
- Ingesting leafy vegetables grown in lead-contaminated soil;
- Storing acidic foods in improperly-glazed ceramics, lead crystal;
- Industries such as: battery manufacturing, demolition, painting and paint removal, and ceramics pose a significant threat to workers and communities;
- Releases into the air and onto soils by smelting operations.

Lead may accumulate in bone and lie dormant for years, and then pose a threat later in life during events such as pregnancy, lactation, osteoporosis, and hyperthyroidism and hyperparathyroidism, which mobilizes stores of lead in bones.

Goals For Healthcare Practitioners

Appropriate interventions in the case of heavy metal exposure include:

- Limit exposure;
- Decrease absorption;
- Decrease release of stored metals;
- Protect vulnerable tissues;
- Chelation therapy only for acute exposure.

1) In the Puget Sound region, the majority of the exposure to arsenic and cadmium comes from residual exposure to the emissions from the Tacoma smelter. Good practice to limit exposure includes practicing good hygiene. A detailed program can be found at http://www.metrokc.gov/health/tsp/guidelines.htm.

Children with pica behavior (who eat dirt; about 10% of the population of 1-6 year-olds) are a very high risk group. Parents should be advised to ensure their children are not exposed to contaminated soils. Parents may wish to test and remediate the soils their children play in. Methods for doing so can be found at **http://www.iere.org/vashon-metals.html**.

Not smoking is especially valuable for those exposed to cadmium and arsenic.

Leafy vegetables grown in cadmium-contaminated soils may be an important source of cadmium toxicity.

2) A healthy diet can help reduce uptake. Mineral nutrition is especially important, particularly iron and calcium nutrition. Calcium citrate and vitamin D supplementation may be appropriate. Iron supplementation may be needed during periods of high need such as childhood and pregnancy. Excessive protein intake (more than 1.5 grams protein per kilo of lean body mass per day) is not advised except in special circumstances such as pregnancy. Foods high in fiber limit the uptake of heavy metals. A low-fat diet reduces cadmium uptake. Including high-sulfur foods in the diet may limit cadmium effects. See more detail on potentially useful foods below.

3) Release of lead from bones may be reduced by standard methods to reduce the risk of osteoporosis, such as weight-bearing exercise, adequate calcium and vitamin D intake, and other treatment such as hormone therapy. Arsenic does not stay in the body; it is readily excreted within weeks. However, the damage caused by arsenic is permanent and may not be evident for decades.

4) The kidneys are protected through adequate consumption of water. Bones and kidneys are aided through avoiding excess protein intake. Many heavy metals act in part through creation of free radicals in the cellular environment. A diet high in anti-oxidants can mitigate some of these effects.

5) Acute and massive exposure of young children leading to extremely toxic levels of lead or cadmium may require chelation therapy. It is not indicated in other situations and carries serious risks since it removes calcium and iron and other nutrients from the body.

Dietary Suggestions

That May Help Inhibit Uptake of Cadmium, Arsenic and Lead

Dietary factors affect heavy metal uptake. For example, an adequate level of dietary iron reduces uptake of cadmium and lead. Dietary calcium reduces the uptake of cadmium. Good habits that can reduce the intake and uptake of toxic metals include eating a balanced diet that is high in fiber, eating organic foods and avoiding foods grown with pesticides and artificial fertilizers or in contaminated soils.

Including high sulfur foods such as onions, garlic, legumes, and eggs probably assists the body in blocking uptake and decreasing retention of many toxic metals.

Using cast iron cooking vessels especially when cooking acidic foods (such as tomatoes) can add valuable iron to the diet.

Providing children with four to six small meals a day. Children with full stomachs are less likely to absorb lead.

Foods high in sulfur:
Algin (a gelatinous derivative of kelp or other seaweed, is available as a nutritional supplement)
Eggs
Garlic
Legumes (e.g. soy, beans, lentils, peanuts)
Onions
Seaweeds

Foods high in dietary fiber:
Fruits
Legumes
Vegetables
Whole grains

Foods high in iron
Leafy vegetables (avoid those grown in cadmium-contaminated soils)
Legumes
Meat
Iron-fortified cereals
(Note: eating foods high in vitamin C improves iron absorption, except from meats)

Foods high in calcium:
Calcium-fortified fruit juices
Leafy vegetables (avoid those grown in cadmium-contaminated soils)
Milk and milk products (but beware of their protein content since excessive protein intake removes calcium from the body)
Tofu (processed with calcium sulfate)
Shellfish

Foods high in anti-oxidants:

Plants supply most of our dietary anti-oxidants: in general, the fresher the better. Plant pigments such as those found in green yellow and red vegetables tend to be associated with antioxidants. Storage and processing tend to decrease antioxidant concentrations, but fermentation can increase them.

Red bell peppers
Spinach and other leafy vegetables (not grown in cadmium-contaminated soils)
Carrots
Tomatoes
Citrus fruits
Strawberries
Teas, some herbal and green teas especially
Algae
Chocolate
Wine

(Note: This list is roughly ordered from highest to lowest concentrations of anti-oxidants).

Resources For Testing

Medical Testing

Blood lead testing can be performed at many laboratories. For children, results under 5 µg/dL are considered to be acceptable. For adults, under 25 µg/dL is acceptable.

Cadmium testing of the blood indicates recent exposure and of the urine indicates a combination of recent and long-term exposure.

Arsenic testing of the urine can be used only as a rough estimate of recent exposure. It is complicated by the high level of mostly non-toxic forms of arsenic that are found in seafood and rapidly excreted in the urine.

Heavy metal in hair and nails can provide information about the history of exposure when repeated samples are taken.

Measuring heavy metals requires great care: the opportunities for error are many. Choosing the right laboratory is essential for providing accurate results.

Great Smokies Diagnostic Laboratories
(800) 522-4762; 8am-8pm M-F EST
63 Villikoa St, Asheville, NC 28801
www.gsdl.com
offers the following tests for heavy metals:

Hair,1/4 gm (nape of neck close to scalp)	Cash up front: 48.00	Billed to Insurance: 128.00
Blood, 1 ml packed RBC	Cash up front: 140.00	Billed to Insurance: 196.00
Urine	Cash up front: 85.00	Billed to Insurance: 192.00

Doctor's Data Inc.
3755 Illinois Avenue
St. Charles IL, 601741
800-323-2784
1-630-377-8139
FAX: 1-630-587-7860
email: inquiries@doctorsdata.com

Hair, nail, blood and urine measurements

Metametrix Clinical Laboratory
4855 Peachtree Industrial Blvd.
Norcross GA, 30092
Phone. 800.221.4640 Local. 770.446.5483
Fax. 770.221.2247

Hair and urine analyses

Literature from these laboratories indicate that they have extensive experience in measuring heavy metals in human tissues.

For more information, contact Rita Schenck, 206-463-7430

Testing soils

Information about how to sample and where to analyze soils can be found at www.iere.org/vashon-metals.html. How to clean up soils is also described there.

Community Resources

Institute for Environmental Research and Education (IERE) (206) 463-7430
17917 Vashon Hwy. SW
Vashon Island, WA 98070
www.iere.org/vashon-metals.html
Has a wealth of information on the heavy metals problem, including how to test your soil, how to clean up contaminated soil, maps of where the highest concentrations are, health effects, state cleanup levels, specific concerns with child-use areas, etc.

Public Health- Seattle-King County
Bonnie Meyer (206) 205-1150
www.metrokc.gov/health/hazard/hazindex.htm
Has lots of information and free posters available by request for schools and healthcare offices to educate public on mitigation of household/environmental contamination.

Other information available.
King County's comprehensive study of the contamination of Vashon-Maury Island soils is at:
http://www.metrokc.gov/health/hazard/vmfinal.htm

Minglement (206) 463-9672
20316 Vashon Hwy SW
Vashon, WA 98070
Carries foods and supplements referenced in this document. Items can be special ordered from the food buying club.

Thriftway (206) 463-2100
9740 SW Bank Rd.
Vashon, WA 98070
Carries foods and supplements referenced in this document.

The Heavy Metals Remediation Committee (HMRC) is a committee of the Vashon Maury Island Community Council. The HMRC works to educate the public and facilitate solutions for the cleanup of heavy metals on Vashon.

HMRC has developed or acquired a wealth of information on the health effects of heavy metals, soil testing, cleanup, maps of the heavy metal concentration concentrations on island and other information related to this issue. New volunteers are welcome.

Contact May Gerstle (206) 463-0974
Chair, Heavy Metals Remediation Committee.

Shaheeda Laura Pierce, LM, CPM
(206) 463-6246
Health care provider with experience of family member affected by cadmium, successfully treated.

Rita Schenck, Ph.D. Chair of HMRC science sub-committee (206) 463-7430.
Rita maintains the informational pamphlets and other material for the HMRC at her offices at 17917 Vashon Hwy SW

Vashon Library (206) 463-2069
17210 Vashon Hwy SW
Vashon, WA 98070

Has a reference section on area-wide heavy metals contamination, with studies dating back to the 1970s.

Vashon Pharmacy (206) 463-9118
17617 Vashon Hwy. SW
Vashon, WA 98070
Carries supplements referenced in this document.

Health Care Practitioner
Who May be of Assistance in Cases of Acute Heavy Metals Exposure

Dr. Tom Martin
(206)731-3998
Harborview Medical Center
Seattle, WA

References

The Natural Pharmacy, by Skye Lininger, DC, Jonathan Wright, MD, Donald Brown, ND (see antioxidants and free radicals).

Encyclopedia of Natural Medicine, by Michael Murray, ND, and Joseph Pizzorno, ND (see cadmium, lead, learning disabilities, table on heavy metals and learning disability).

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Seidel S, Kreutzer R, Smith D, McNeel S, Gilliss D. Assessment of commercial laboratories performing hair mineral analysis. JAMA. 2001 Jan 3;285(1):67-72.

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Bass DA, Hickock D, Quig D, Urek K. Trace element analysis in hair: factors determining accuracy, precision, and reliability. Altern Med Rev. 2001 Oct;6(5):472-81.

If you would like additional copies of this handbook, please send an email to hmrc@vmicc.org or write to us at:

VMICC / HMRC
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