1. DISEASE REPORTING

1.1 Purpose of Reporting and Surveillance
   1. To identify persons with elevated urine cadmium levels.
   2. To identify risk factors for high cadmium levels, including proximity to industrial sources of cadmium.
   3. To identify specific occupational exposures for follow-up with Oregon Occupational Safety and Health Division.

1.2 Laboratory and Physician Reporting Requirements
   Laboratories and providers must report any finding of cadmium in urine to Local Health Department (LHD) within one working day.

1.3 Local Health Department Reporting and Follow-Up Responsibilities
   1. Report all urine cadmium results, including reports of nondetectable results received, to the Oregon Public Health Division (OPHD) by the end of the calendar week.
   2. Investigate detectable urine cadmium reports using Orpheus module.

2. THE DISEASE AND ITS EPIDEMIOLOGY

2.1 Etiologic Agent and Sources
   Cadmium is an element found naturally in the environment, typically as a component of zinc ore deposits in the Earth’s crust. On the periodic table of elements, it is a “transitional metal,” and is commonly referred to as a “heavy metal.”

   In modern times, cadmium has been widely dispersed into the environment through mining and smelting, as well as through use in certain fertilizers, presence in sewage sludge, and various industrial uses. Occupational exposure to airborne cadmium can occur among persons who work with metals containing cadmium. Cigarettes also contain cadmium, and smoking is an important source of exposure. The primary source of cadmium in non-smokers is dietary; environmental deposition of airborne cadmium enters the food chain after being absorbed by plants, particularly leafy greens, root crops, cereals and grains. It can also be ingested through meats such as liver and kidney.
Cadmium Toxicity

Cadmium has no biologic function in humans. There is also no effective method of elimination, so cadmium’s biologic half-life may be up to 38 years, and it accumulates in the liver and kidneys over time. A very small amount is excreted in the urine.

2.2 Description of Illness
Cadmium creates reactive compounds inside cells that can damage DNA. The organs most affected by cadmium are the lungs, kidneys, and the skeletal system.

Acute toxicity can occur following exposure to very high levels of cadmium in a short period of time. Symptoms depend upon the route of exposure. If via inhalation, inflammation of the respiratory tree ensues, manifesting as bronchitis, pneumonitis, and pulmonary edema; pulmonary toxicity — which is seen primarily in occupational exposures — is often fatal. Ingestion of high doses of cadmium causes inflammation of the intestines, with symptoms of nausea, vomiting, abdominal pain, and diarrhea. Most persons recover from ingestion without complications.

Chronic exposure to high levels of cadmium has been associated with a variety of conditions. Renal tubular dysfunction is the most established consequence of chronic exposure. The latency period between exposure and renal dysfunction may be >10 years. Skeletal complications, including osteoporosis and fractures, may result from abnormal calcium loss in the renal tubules. Among cancers, the association with lung cancer is the strongest.

2.3 Treatment
No treatment exists for cadmium toxicity. Chelation is not recommended, as there is little circulating cadmium to be removed, and the chelation itself may be harmful. Management involves stopping exposure to cadmium. Patients should be advised to stop smoking, practice good occupational hygiene, and — because iron deficiency enhances cadmium absorption in the GI tract — ensure adequate dietary iron intake.

Persons with end-organ damage from cadmium should be under the care of a medical provider.

3. CASE DEFINITIONS, DIAGNOSIS AND LABORATORY SERVICES

***See algorithm at end of Investigative Guidelines***

3.1 Confirmed Case
A person with detectable urine cadmium ≥2.0 µg per gram of creatinine on repeat testing at the Washington State Public Health Laboratory and renal dysfunction, evidenced by proteinuria, Fanconi’s syndrome, recurrent kidney stones, or reduced glomerular filtration rate (GFR), without another underlying condition that explains the renal dysfunction.
Presumptive Case
A person with detectable urine cadmium ≥2.0 µg/g creatinine on repeat testing at the Washington State Public Health Laboratory and renal dysfunction, evidenced by proteinuria, Fanconi’s syndrome, recurrent kidney stones, or reduced glomerular filtration rate (GFR) — but with an underlying condition that may explain the renal dysfunction;

OR
A person with detectable urine cadmium ≥2.0 µg/g creatinine on repeat testing at the Washington State Public Health Laboratory and no renal dysfunction;

OR
A person with detectable urine cadmium greater than the NHANES 95th percentile for age but <2.0 µg/g creatinine on repeat testing at the Washington State Public Health Laboratory.

Suspect Case
A person with detectable urine cadmium greater than the NHANES 95th percentile for age, without repeat testing at the Washington State Public Health Laboratory.

No Case
A person with a urine cadmium test with no detected cadmium (i.e., the lab result was undetectable or below the laboratory’s threshold for detection);

OR
A person with detectable urine cadmium below the NHANES 95th percentile, either on initial testing or on repeat testing at the Washington State Public Health Laboratory.

3.2 Laboratory Testing for Cadmium
Urine, blood, and hair can be tested for cadmium. However, only urine accurately reflects the total body burden of cadmium. Free cadmium is rapidly bound in the blood, and levels are useful only in the context of acute toxicity (see above). Testing of hair or nails is not clinically useful and is not currently recommended by CDC.

3.3 Services Available at the Oregon State Public Health Laboratories
OSPHL does not perform urine cadmium testing.

To submit a sample to the Washington State Public Health Laboratory, complete the requisition form and facilitate specimen collection with approved container. Ship on dry ice to Public Health Laboratories, Office of Environmental Health Laboratory Sciences, 1610 NE 150th St, Shoreline, WA 98155; telephone 206-418-5400.
3.4 Commercial/reference laboratory urinary cadmium testing

Specimens should be collected in an acid-washed and metal-free, trace-element-free plastic container. Specimens should be refrigerated. All specimens must be properly packaged in double containers with absorbent material around them.

Ideally, patients should be instructed to collect their first urine of the day, which is usually the most concentrated.

See Condensed Packaging and Shipping Information (pdf) and WSPHL Specimen Shipping Form (pdf)

4. ROUTINE CASE INVESTIGATION

Routine case investigation should ascertain case demographics, clinical and laboratory data, location and duration of residence, occupational history, smoking history, and other potential exposures, as outlined in the Orpheus module.

5. CONTROLLING FURTHER SPREAD

5.1 Education

Provide basic education about cadmium, as outlined above. Advise all individuals to stop smoking. If concerned about occupational exposure (including among hobbyists), advise the person to practice good occupational hygiene, including not eating in the workspace, ensuring proper ventilation, and where indicated, using appropriate personal protective equipment.

Additional resources are available from

- OHA’s Environmental Health Assessment Program (www.healthoregon.org/ehap)
- National Institute for Occupational Safety and Health (CDC): Cadmium NIOSH Resources: http://www.cdc.gov/niosh/topics/cadmium/

5.2 Case Follow-up

Generally not indicated. Individuals with an elevated urine cadmium value should be referred to a physician or other medical provider. Repeat testing in the presence of an elevated level should be considered as part of the clinical work-up, to ensure test is a true positive.

5.3 Environmental Measures

If putative occupational sources are identified, notify the Oregon Occupational Safety and Health Division: 503-378-3272. Advise OHA’s Environmental Health
Cadmium Toxicity

Tracking Program (971-673-0977) if a particular neighborhood seems to be implicated; they can help assess whether environmental sampling is indicated.

REFERENCES


CASE DEFINITION ALGORITHM
Table. NHANES 95th percentiles

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<th>Age (years)</th>
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UPDATE LOG

May 2016 – Updated case definitions and added algorithm (Hines).
February 2016 – created (Hines).