Overview

Useful For
Detecting arsenic, cadmium, mercury, and lead exposure and toxicity using 24-hour urine specimens

Profile Information

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Reporting Name</th>
<th>Available Separately</th>
<th>Always Performed</th>
</tr>
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<tbody>
<tr>
<td>ASHU</td>
<td>Arsenic, 24 Hr, U</td>
<td>Yes, (order ASU24)</td>
<td>Yes</td>
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<tr>
<td>CDHMU</td>
<td>Cadmium, 24 Hr, U</td>
<td>Yes, (order CDU)</td>
<td>Yes</td>
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<tr>
<td>HGHU</td>
<td>Mercury, 24 Hr, U</td>
<td>Yes, (order HGU)</td>
<td>Yes</td>
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<tr>
<td>PBHU</td>
<td>Lead, 24 Hr, U</td>
<td>Yes, (order PBU)</td>
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Reflex Tests

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<th>Reporting Name</th>
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<tr>
<td>ASFR</td>
<td>Arsenic Fractionation, 24 Hr, U</td>
<td>Yes</td>
<td>No</td>
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</table>

Testing Algorithm
If arsenic concentration is greater than or equal to 35 mcg/L, then fractionation will be performed at an additional charge.

Special Instructions
- Urine Preservatives-Collection and Transportation for 24-Hour Urine Specimens
- Trace Metals Analysis Specimen Collection and Transport

Method Name
Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)

NY State Available
Yes

Specimen

Specimen Type
Urine

Specimen Required

Patient Preparation:
1. High concentrations of gadolinium and iodine are known to interfere with most metals tests. If either gadolinium- or iodine-containing contrast media has been administered, a specimen should not be collected for 96 hours.
2. Patient should not eat seafood for a 48-hour period prior to start of, or during, collection.

**Supplies:** Urine Tubes, 10 mL (T068)

**Collection Container/Tube:** Clean, plastic aliquot container with no metal cap or glued insert

**Submission Container/Tube:** Plastic, 10-mL urine tube

**Specimen Volume:** 10 mL

**Collection Instructions:**

1. Collect urine for 24 hours.

2. Refrigerate specimen within 4 hours of completion of 24-hour collection.

3. See [Trace Metals Analysis Specimen Collection and Transport](#) in Special Instructions for complete instructions.

**Additional Information:** See [Urine Preservatives-Collection and Transportation for 24-Hour Urine Specimens](#) in Special Instructions for multiple collections.

**Urine Preservative Collection Options**

**Note:** The addition of preservative or application of temperature controls **must occur within 4 hours of completion** of the collection.

<table>
<thead>
<tr>
<th>Preservative</th>
<th>Requirement</th>
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<tbody>
<tr>
<td>Ambient</td>
<td>No</td>
</tr>
<tr>
<td>Refrigerate</td>
<td>Preferred</td>
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<tr>
<td>Frozen</td>
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</tr>
<tr>
<td>50% Acetic Acid</td>
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<tr>
<td>Boric Acid</td>
<td>No</td>
</tr>
<tr>
<td>Diazolidinyl Urea</td>
<td>No</td>
</tr>
<tr>
<td>6M Hydrochloric Acid</td>
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</tr>
<tr>
<td>6M Nitric Acid</td>
<td>No</td>
</tr>
<tr>
<td>Sodium Carbonate</td>
<td>No</td>
</tr>
<tr>
<td>Thymol</td>
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<tr>
<td>Toluene</td>
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**Specimen Minimum Volume**

3 mL

**Reject Due To**

All specimens will be evaluated at Mayo Clinic Laboratories for test suitability.

**Specimen Stability Information**
Clinical and Interpretive

Clinical Information

Arsenic:

Arsenic is a naturally occurring element that is usually found in the environment combined with other elements such as oxygen, chlorine, and sulfur. Arsenic combined with these elements is called inorganic arsenic. Arsenic combined with carbon and hydrogen is referred to as organic arsenic. The organic forms (eg, arsenobetaine and arsenocholine) are relatively nontoxic, while the inorganic forms are toxic. The toxic inorganic forms are arsenite (As[3+]/As[III]) and arsenate (As[5+]/As[V]). Inorganic As(V) is readily reduced to inorganic As(III) which is then primarily broken down to less toxic methylated metabolites monomethylarsinic acid (MMA) and subsequently dimethylarsinic acid (DMA).

People are exposed to arsenic by eating food, drinking water, or breathing air. Of these, food is usually the largest source of arsenic. The predominant dietary source of arsenic is seafood, followed by rice/rice cereal, mushrooms, and poultry. While seafood contains the greatest amounts of arsenic, for fish and shellfish, this is mostly in an organic form of arsenic called arsenobetaine, which is much less harmful. Some seaweed may contain arsenic in the inorganic form, which is more toxic. In the United States, some areas also contain high natural levels of arsenic in rock, which can lead to elevated levels in the soil and drinking water. Occupational (eg, copper or lead smelting, wood treating, or pesticide application) exposure is another source where people may be introduced to elevated levels of arsenic. Lastly, hazardous waste sites may contain large quantities of arsenic and if not disposed of properly may get into the surrounding water, air, or soil.

A wide range of signs and symptoms may be seen in acute arsenic poisoning including headache, nausea, vomiting, diarrhea, abdominal pain, hypotension, fever, hemolysis, seizures, and mental status changes. Symptoms of chronic poisoning, also called arseniasis, are mostly insidious and nonspecific. The gastrointestinal tract, skin, and central nervous system are usually involved. Nausea, epigastric pain, colic abdominal pain, diarrhea, and paresthesias of the hands and feet can also occur.

Since arsenic is excreted predominantly by glomerular filtration, measurement of arsenic in urine is the most reliable means of detecting arsenic exposures within the last several days.

Cadmium:

The toxicity of cadmium resembles the other heavy metals (arsenic, mercury, and lead) in that it attacks the kidney; renal dysfunction with proteinuria with slow onset (over a period of years) is the typical presentation. Measurable changes in proximal tubule function, such as decreased clearance of para-aminohippuric acid also occur over a period of years, and precede overt renal failure.

Breathing the fumes of cadmium vapors leads to nasal epithelial deterioration and pulmonary congestion resembling chronic emphysema.

The most common source of chronic exposure comes from spray painting of organic-based paints without use of a
protective breathing apparatus; auto repair mechanics represent a susceptible group for cadmium toxicity. Another common source of cadmium exposure is tobacco smoke, which has been implicated as the primary source of the metal leading to reproductive toxicity in both males and females.

The concentration of cadmium in the kidneys and in the urine is elevated in some patients exposed to cadmium.

Mercury:

The correlation between the levels of mercury (Hg) excreted in the urine and clinical symptoms, is considered poor. However, urinary Hg is the most reliable way to assess exposure to inorganic Hg.

Lead:

Increased urine lead excretion rate indicates significant lead exposure. Measurement of urine lead excretion rate before and after chelation therapy has been used as an indicator of lead exposure. An increase in lead excretion rate in the post chelation specimen of up to 6 times the rate in the prechelation specimen is normal. Blood lead is the best clinical correlate of toxicity.

**Reference Values**

**ARSENIC:**

0-17 years: not established

> or =18 years: <18 mcg/24 hour

**CADMIUM:**

0-17 years: not established

> or =18 years: <0.6 mcg/24 hour

**MERCURY:**

0-17 years: not established

> or =18 years: <2 mcg/24 hour

Toxic concentration: >50 mcg/24 hour

The concentration at which toxicity is expressed is widely variable between patients. 50 mcg/24 hour is the lowest concentration at which toxicity is usually apparent.

**LEAD:**

0-17 years: not established

> or =18 years: <1 mcg/24 hour

**Interpretation**

Arsenic:

Mayo Clinic uses the American Conference of Governmental Industrial Hygienists (ACGIH) biological exposure index
Test Definition: HMU24
Heavy Metal Scrn w/Reflex, 24 Hr, U

(BEI) as the reference value. The BEI is the sum of all the toxic species (inorganic arsenic plus methylated arsenic metabolites).

Physiologically, arsenic exists in a number of toxic and nontoxic forms. The total arsenic concentration reflects all the arsenic present in the sample regardless of species (e.g., inorganic vs. methylated vs. organic arsenic). The measurement of urinary total arsenic levels is generally accepted as the most reliable indicator of recent arsenic exposure. However, if the total urine arsenic concentration is elevated, arsenic speciation must be performed to identify if it is the toxic forms (e.g., inorganic and methylated arsenic forms) or the relatively non-toxic organic forms (e.g., arsenobetaine and arsенохолин).

The inorganic toxic forms of arsenic (e.g., As[III] and As[V]) are found in the urine shortly after ingestion, whereas the less toxic methylated forms (MMA and DMA) are the species that predominate longer than 24 hours after ingestion. In general, urinary As[III] and As[V] concentrations peak in the urine at approximately 10 hours and return to normal 20 to 30 hours after ingestion. Urinary MMA and DMA concentrations normally peak at approximately 40 to 60 hours and return to baseline 6 to 20 days after ingestion.

After a seafood meal (seafood generally contains the nontoxic, organic form of arsenic (e.g. arsenobetaine)), the urine output of arsenic may increase to over 300 mcg/24 hr specimen, after which it will decline.

This test can determine if you have been exposed to above-average levels of arsenic. It cannot predict whether the arsenic levels in your body will affect your health.

Cadmium:

In chronic cadmium exposure, the kidneys are the primary target organ. Urine concentrations of cadmium can be useful to assess long-term exposure and determine cadmium body burden. Collection of urine over 24 hours minimizes fluctuations of observed cadmium concentrations in random urine samples.

Mercury:

Daily urine excretion of mercury above 50 mcg/24 hr indicates significant exposure (per World Health Organization standard).

Lead:

Urinary lead excretion of less than 125 mcg/24 hr is not associated with any significant lead exposure.

Urinary lead excretion of more than 125 mcg/24 hours is usually associated with pallor, anemia, and other evidence of lead toxicity.

Cautions

Consumption of seafood before collection of a urine specimen for arsenic testing is likely to result in a report of an elevated concentration of arsenic found in the urine, which can be clinically misleading.

Collection of urine specimens through a catheter frequently results in elevated values because rubber contains trace amounts of cadmium that are extracted as urine passes through the catheter.

To avoid contamination by dust, specimen should be collected away from the site of suspected exposure.

Clinical Reference


**Performance**

**Method Description**

Arsenic (As), cadmium (Cd), mercury (Hg), and lead (Pb) in urine are analyzed by inductively coupled plasma-mass spectrometry (ICP-MS) in kinetic energy discrimination (KED) mode using gallium (Ga), rhodium (Rh), and iridium (Ir) as internal standards and a 5% nitric acid salt matrix calibration.(Unpublished Mayo method)

**PDF Report**

No

**Day(s) and Time(s) Test Performed**

Monday through Saturday; 7 p.m.

**Analytic Time**

1 day

**Maximum Laboratory Time**

4 days

**Specimen Retention Time**

Document generated September 8, 2020 at 3:57am CDT
Test Definition: HMU24
Heavy Metal Scrn w/Reflex, 24 Hr, U

14 days

Performing Laboratory Location
Rochester

Fees and Codes

Fees
- Authorized users can sign in to Test Prices for detailed fee information.
- Clients without access to Test Prices can contact Customer Service 24 hours a day, seven days a week.
- Prospective clients should contact their Regional Manager. For assistance, contact Customer Service.

Test Classification
This test was developed and its performance characteristics determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the U.S. Food and Drug Administration.

CPT Code Information
82175
82300
83825
83655

LOINC® Information

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