



## INFORMATION ON ARSENIC IN FOOD

Recent reports have described arsenic levels in a variety of foods including: (1) rice products such as brown or white rice, rice cakes, and rice milk, (2) foods sweetened with organic brown rice syrup such as cereal and energy bars, and (3) non-rice products such as apple juice. This document can help you understand what is known about this issue.

### What is arsenic?

Arsenic is a naturally occurring element, found widely in the environment. It is present in some types of rock and soil. It is used in a number of industrial processes. It is found in measurable amounts in most seafood and in many grains and vegetables.

### What types of arsenic exist?

Arsenic-containing compounds can be classified into two groups: “organic” and “inorganic”. Organic arsenic compounds are usually produced by an animal that has metabolized the inorganic arsenic into a less toxic form and vary in toxicity. The organic arsenic compounds found in seafood are thought to be nontoxic.

### Where is arsenic often found?

Arsenic may be found in drinking water, especially water from wells that draw from groundwater flowing through bedrock containing arsenic. US municipal water supplies should meet the EPA guideline for inorganic arsenic of less than 10 ppb (10 micrograms per kg of water, which is equal to 0.010 milligram per liter of water). Arsenic in some US well water exceeds the EPA recommendation, but rarely rises to very high levels. In parts of Taiwan, Bangladesh and India, extremely high arsenic levels have been found in drinking water.

Arsenic may also be found in many soils. It occurs naturally in soil in many parts of the US and around the world. It may also be present in soils as a result of the use of arsenic-containing pesticides or the application of fertilizers containing poultry waste contaminated with arsenic, due to the addition of arsenic-containing compounds to some poultry feed to prevent disease and promote growth. Recent reports have targeted rice, rice products and apple juice, because rice fields and apple orchards are sited on fields where for decades arsenic-containing pesticides were used (either on cotton fields where rice is now grown, or in orchards which remain in use).

Seafood, both farm-raised and seafood caught in the wild, often has the highest total arsenic levels of all foods. However, arsenic in seafood is present almost entirely in the nontoxic organic arsenic forms, unless the fish is caught in waters polluted by industrial chemicals.

Among foods tested by the US Food and Drug Administration, some vegetables and rice have the highest levels of inorganic arsenic, although these levels are still relatively low.

### **What are the health effects of arsenic?**

What we know about health effects from arsenic is based on long term exposure to very high exposures, such as in populations exposed to contaminated water in Taiwan, India and Bangladesh or from those occupationally exposed at smelters and agricultural sites. Short term health effects after high level exposure generally include symptoms such as nausea, vomiting, abdominal pain and diarrhea, but are extremely unlikely to occur at the levels observed in studies of typical US foods. The long-term problem with arsenic includes its association with a variety of cancers (skin cancer, lung cancer, and bladder cancer) as well as its contribution to skin changes, heart disease, lung disease, neurologic disease, kidney disease, and Type II diabetes. Generally, these diseases are seen with high levels of arsenic exposure, above what is found in drinking water in the United States.

The health effects of very low-level arsenic in foods, as described in these recent reports, are less clear. Several studies of populations outside of the United States raise concerns about a possible cumulative effect of long-term low-level exposure to arsenic (possibly at levels higher than anticipated from ingesting normal amounts of these food products) on learning and neuromotor function.

Currently, there is no level of inorganic arsenic exposure that has been shown to be completely safe, but most experts believe that ingestion of these small amounts of arsenic pose minimal risk when eaten as part of a balanced diet. There have been no long-term follow-up studies of populations exposed through food at the very low levels experienced in the US that have attempted to answer this question, although we can take some direction from guidance developed for drinking water.

While different policy experts have reached different conclusions about the maximum amount that can be eaten safely, in general, the less arsenic the better.

### **Is there medical testing for arsenic?**

Although it is not usually necessary, laboratory testing is available for use and is done by measuring arsenic in the urine. The urine arsenic test can measure arsenic consumed over the

last few days. Before obtaining such a test, consult with your physician or an expert in toxicology to be sure that the urine is collected under conditions most likely to give an accurate result. Both inorganic and organic arsenic will be combined together into one value unless their separate analysis is specifically ordered. While the test can determine if the recent exposure was above average, it cannot determine the likelihood of specific health effects.

### **What regulatory levels are currently available for arsenic in food and drinking water?**

Various public health authorities provide recommendations developed in different ways. Each recommendation provides different levels balancing safety against cost, feasibility, and other factors.

#### Drinking water:

\*The US EPA has set a maximum permissible level in drinking water of 10 ppb

\*The State of New Jersey has set a maximum permissible level in drinking water of 5 ppb

#### Food:

The US has no regulations for inorganic arsenic in food, only in water. Other public health recommendations include those of:

- China: 150 ppb
- United Kingdom: 1,000 ppb and recommends that children less than 54 months of age avoid rice-based drinks

### **What foods have been found to have high concentrations of inorganic arsenic?**

Seafood has been found to contain the highest concentration of arsenic; however, except in very rare circumstances, the vast majority of arsenic in seafood is in a nontoxic organic form of arsenic. Among other foods tested by the US Food and Drug Administration, vegetables and rice have the highest levels of the toxic inorganic form of arsenic. Other foods and fruits, including apples and grapes, also contribute small amounts of arsenic to the human diet.

### **What about arsenic in the typical US diet?**

The risk of arsenic from all sources is estimated based on a lifetime exposure. The risk from eating foods with more arsenic on some days may be balanced by eating other foods with less arsenic on other days. Daily drinking and cooking with water at 10 ppb, the highest level permitted by US EPA regulations, in a typical amount would contribute as much as ½ a serving of average rice cereal.

Since infants eat a more limited diet, their exposure to arsenic may be higher than in people who are eating a more varied diet.

### **What about the recent findings on arsenic in rice?**

The recent reports of arsenic content in rice are consistent with previous studies done by the United States Food and Drug Administration (FDA). The recent findings by Consumer Reports (November 2012) and the FDA (September 2012) suggest that some rice products have higher inorganic arsenic than others and often depends on where the rice is grown. Additional studies are under way by the FDA.

Based on these early studies, it has been calculated that eating regular amounts of these products over a lifetime could increase the risk of some cancers by a very small amount. The effects on a developing child's brain at similar levels are less clear.

Clear recommendations do not exist regarding balancing the potential hazard associated with arsenic exposure with the benefits of a balanced diet that includes dietary products that are known to contain small amounts of arsenic. If choosing substitutes for rice, consider carefully the health benefits of the alternatives and remember to eat a diverse diet with an emphasis on whole, unprocessed foods.

### **What about the practice of introducing rice cereal as the first solid food in an infant's diet?**

The American Academy of Pediatrics notes that single grain cereals like rice cereal are commonly the first solid foods introduced into an infant's diet. However, the specific order in which solid foods are started in an infant's diet has not been shown to be important. Each new food should be started one at a time, and additional foods can be added every three days.

### **What can I do if I am concerned about arsenic exposure?**

Until we know more, concerned families can:

1. Choose rice products lower in arsenic.
2. Rinse rice before cooking.
3. Limit the serving size and frequency of foods noted to be higher in their inorganic arsenic content. See Consumer Reports' November 2012 article for their recommendations.
4. Avoid the frequent use of rice milk in children less than 54 months of age.
5. Limit the use of foods with large amounts of brown rice syrup.
6. Make sure your water has been tested. If your water exceeds EPA recommendations, consider using bottled water low in arsenic for drinking and cooking.

- a. If your drinking water comes from a well that is not a public or community water supply, arrange to have it tested specifically for its arsenic content.
  - b. If your drinking water comes from a public water supply, contact your water provider to find out how much arsenic is in your water.
7. Avoid smoking; arsenic is a component of cigarette smoke.
  8. Avoid sawing, burning, or sanding “pressure-treated” lumber containing copper chromate arsenate (CCA).
  9. Avoid use of pesticides containing arsenic.
  10. Do not allow your children to play in areas potentially contaminated by arsenic in soil (such as former industrial sites that have not had their hazardous materials removed, and sites where arsenic pesticides might have been used). If they are inadvertently exposed to soil in such a site, wash their hands with soap and water. Use of hand sanitizers is unlikely to remove the arsenic on the hands.
  11. Do not grow vegetables in planters made of pressure-treated lumber containing copper chromate arsenate (CCA).
  12. If your children play on wooden structures built with pressure-treated lumber containing copper chromate arsenate (CCA), wash their hands with soap and water. Use of hand sanitizers is unlikely to remove the arsenic on the hands.

### **Who should I contact if I still have concerns about arsenic in food?**

Families with concerns about the relationship between the environment and children’s health should contact their health care provider or the Pediatric Environmental Health Specialty Unit serving their area. Health care providers with similar concerns are also encouraged to contact the Pediatric Environmental Health Specialty Unit serving their area. <http://www.pehsu.net>

---

### **Sources:**

“Arsenic in your food.” Consumer Reports, November 2012, pages 22-27.  
<http://www.consumerreports.org/cro/magazine/2012/11/arsenic-in-your-food/index.htm>

“FDA releases preliminary data on arsenic levels in rice and rice products.” September 19, 2012.  
<http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm319972.htm>

“Arsenic in drinking water.” World Health Organization, 2011.  
[http://www.who.int/water\\_sanitation\\_health/dwg/chemicals/arsenic.pdf](http://www.who.int/water_sanitation_health/dwg/chemicals/arsenic.pdf)

“Arsenic in Rice and Rice Products”. American Academy of Pediatrics. September 2012.

<http://www.aap.org/en-us/about-the-aap/aap-press-room/Pages/Arsenic-in-Food-Products.aspx>

and

<http://www.healthychildren.org/English/News/pages/Arsenic-in-Rice.aspx>

“ATSDR Toxicological Profile on Arsenic.” <http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=22&tid=3>

“Report on Carcinogens, 12<sup>th</sup> ed.” National Toxicology Program.(2011)

<https://docs.google.com/viewer?url=http://ntp.niehs.nih.gov/ntp/roc/twelfth/profiles/Arsenic.pdf&pli=1>

“Total and inorganic arsenic in Mid-Atlantic marine fish and shellfish and implications for fish advisories.” Greene R, Crecelius E. Integrated Environmental Assessment & Management. 2006; 2(4):344-54.

“Arsenic, organic foods, and brown rice syrup.” Jackson BP, Taylor VF, Karagas MR, Punshon T, Cottingham KL. Environ Health Perspect. 2012 May;120(5):623-6.

Dartmouth University. “Arsenic in Food Frequently Asked Questions.”

<http://www.dartmouth.edu/~toxmetal/assets/pdf/arsenicinfoodfaq.pdf>

*Last revised October 1, 2012*

*Lead author: Robert J. Geller, MD, Southeast Pediatric Environmental Health Specialty Unit, Emory University Department of Pediatrics, Atlanta GA*

*Acknowledgements: Thanks to many colleagues, including Ada Otter DNP, Matt Karwowski, MD, Perry Sheffield MD, Larry Lowry PhD, Susan Buchanan MD, Jerry Paulson MD, Jennifer Lowry MD, Mark Miller MD, Rose Goldman, MD, Alan Woolf, MD, Maida Galvez MD, Catherine Karr MD, PhD, Joel Forman MD, Irena Buka MD, Chethan Sarabu, Juliette Merchant, and Nicole Makris, for their helpful comments and contributions to this document.*

---

This document was developed by the Association of Occupational and Environmental Clinics (AOEC) and funded under the cooperative agreement award number 1U61TS000118-04 from the Agency for Toxic Substances and Disease Registry (ATSDR).

Acknowledgement: The U.S. Environmental Protection Agency (EPA) supports the PEHSU by providing funds to ATSDR under Inter-Agency Agreement number DW-75-92301301-0. Neither EPA nor ATSDR endorse the purchase of any commercial products or services mentioned in PEHSU publications.