Health Consultation

Post-Removal Action

ROSE EXTERMINATOR SITE
NORWOOD, HAMILTON COUNTY, OHIO

EPA FACILITY ID: OHN000510327

Prepared by the
Ohio Department of Health

AUGUST 28, 2009

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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SUMMARY

Introduction

The Ohio Department of Health (ODH) Health Assessment Section (HAS), in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR), seeks to serve the community of Norwood by using the best environmental science, providing accurate health information, and taking public health actions to prevent harmful exposures and disease related to toxic substances.

Conclusions

HAS concludes that skin contact with, breathing, or accidentally eating soil or dust at or near the former Rose Exterminator site will not harm people's health at this time. The reason for this is that arsenic and lead levels in soils at the former Rose Exterminator facility are now below levels of health concern as a result of a U.S. EPA time-critical removal action which was completed on June 8, 2009.

Basis for decision

The U.S. EPA recently removed the arsenic-contaminated building and soils from the former Rose Exterminator site in Norwood, Ohio. Post-excavation sampling results indicate that the arsenic and lead levels in these soils are now significantly below the health-based 20 ppm recommended value for arsenic and the 400 ppm residential standard for lead. In addition, soils in the backyard of a nearby property to the south of the site that were contaminated with arsenic have been removed. Arsenic- and lead-contaminated soils from the Rose Exterminator site no longer pose a public health hazard to area residents.

Next steps

No additional recommendations are made at this time.

For more information

See U.S. EPA Region V's Rose Exterminator Site Profile and Pollution Report, available at: http://www.epaosc.net/roseexterminatorsite for information about the U.S. EPA removal action. ODH chemical fact sheets and public health assessments and consultations are available on-line at: http://www.odh.ohio.gov (go to "H" and "Health Assessment Section"). You may also call ODH at 614-466-1390 for more information on this site.

BACKGROUND AND STATEMENT OF ISSUES

Site Location and Description

The Rose Exterminator site is a former pesticide facility located at 5421 Carthage Avenue adjacent to a residential area in Norwood, Ohio. A 700-square-foot building on the site was once used to produce and package a rodenticide containing arsenic until the 1940s. The building had been unoccupied since 1974 and showed signs of damage, including a collapsed roof. Residential properties are located directly to the east and west of the site (U.S. EPA 2009). The site was not completely fenced off - the building was vacant and posted to keep out trespassers. The commercial building directly north of the site is vacant and the house south of the site is also vacant. All the residences immediately behind the site to the west are occupied (NCHD 2009). Based on census data (2000), 221 people, including 43 under the age of 18, live within the block area that includes this site (defined as Block 5006, Census Tract 252, Hamilton County, Ohio). The site's location within the residential neighborhood is shown in Figure 1.

At the request of the Norwood City Health Department (NCHD), the National Institute for Occupational Safety and Health (NIOSH) investigated the site in 1974 and found it highly contaminated with the rodenticide arsenic trioxide. In 1981, NIOSH found that the site was still contaminated with arsenic. Six dust samples collected from the floor contained 3 to 41 percent by weight arsenic. Walls and ceiling surfaces were also contaminated. NIOSH recommended that the building be decontaminated (NIOSH 1982); however, the site remained contaminated for years, according to NCHD inspections.

The Ohio EPA requested the assistance of the U.S. EPA in conducting a removal site evaluation and potential time-critical removal action at the site due to the historically elevated arsenic and lead levels. The U.S. EPA investigated the site in December 2008 to evaluate residual arsenic in and around the building and documented very high levels of arsenic and lead in soil (U.S. EPA 2009).

HAS/ATSDR Involvement

On January 26, 2009, U.S. EPA requested that the Ohio Department of Health's Health Assessment Section (HAS) provide a health consultation with recommendations in support of a proposed removal action at the Rose Exterminator site. In a Letter Health Consultation dated April 17, 2009, HAS evaluated the data collected by U.S. EPA and concluded that the site posed a public health hazard. In the letter health consultation, HAS listed the following recommendations:

1. Additional soil samples should be collected on-site and from adjacent residences to fully define the extent of the arsenic and lead contamination in the area.

2. Access to the property should be restricted to prevent exposure to the contaminated building and soils.

3. Future exposure to arsenic and lead contamination at the site can be eliminated by removing the arsenic-contaminated building and contaminated soils from the site.

U.S. EPA Removal Action

U.S. EPA initiated the removal action on April 29, 2009 and began building demolition and soil excavation on May 11, 2009. The removal action also included site security and perimeter air monitoring. U.S. EPA's cleanup contractor transported 8 loads (about 160 cubic yards) of hazardous arsenic-contaminated soil and building debris off-site for disposal. Once the concrete building was removed, soil arsenic and lead levels at the base of the excavation area were tested by XRF and verified by laboratory analysis. The average XRF readings and the confirmatory laboratory test results for total arsenic were below 20 parts per million (ppm). Lead concentrations were well below 400 ppm (Table 1 and 2). The site was covered with "clean soil" with low background levels of arsenic and lead.

U.S. EPA also sampled adjacent residences for arsenic contamination. Sampling did not indicate arsenic contamination in lots on the western perimeter of the site behind the former site building. Arsenic contamination was found in a commercial lot which used to be a former automobile repair garage and restaurant to the north of the site. Surface soil was removed at this property, where arsenic levels were recommended not to exceed a commercial value of 80 ppm in soil at this location.

U.S. EPA discovered arsenic at levels up to 137 ppm in the soil in the backyard of a residence south of the site. After discussion and agreement with the owner, all arsenic-contaminated soil from the property was removed, including the removal of a large tree in the backyard and the underlying arsenic-contaminated soil. Soil was removed from 6 to 30 inches below ground surface, or until arsenic levels were all less than 20 ppm at the bottom of all excavation areas.

A total of 19 loads (380 cubic yards) of non-hazardous arsenic-contaminated soil and tree parts were transported for off-site disposal. The site and the residential property south of the site were backfilled with clean topsoil and seeded. The removal action was completed on June 8, 2009.

DISCUSSION

Potential Exposure Pathways

The main exposure routes with regard to arsenic and lead poisoning are by ingestion (eating or drinking) or inhalation (breathing it in). A major route of exposure for very young children is incidental ingestion of arsenic or lead-contaminated soil or dusts from repeated hand-to-mouth activity. The main contaminant of concern at the Rose Exterminator site in Norwood, Ohio was inorganic arsenic and, in particular, arsenic trioxide (As_2O_3), one the most toxic and prevalent forms. Arsenic trioxide is a white or transparent solid in the form of glassy, shapeless lumps or a crystalline powder that resembles sugar. Arsenic trioxide has no odor or taste.

Ingestion is the most important route of acute exposure. Ingested arsenic trioxide is quickly absorbed by the digestive tract and can be extremely hazardous. Arsenic trioxide dust is readily absorbed from the lungs, but inhaled quantities are usually insufficient to cause acute systemic toxicity. Dermal exposure (skin contact) is considered to be a minor route of exposure for either arsenic or lead.

The site was relatively easy to access and there were signs of trespassing, including debris, trash, and toys scattered inside the building. White arsenic contamination was visible on the inside walls. The site was very close to residences to the south and west of the site building. Therefore, a pathway for exposure to arsenic and lead through contact with contaminated soil and dust likely existed over the past 30 years or more. The U.S. EPA removal action eliminated this likely exposure pathway.

Exposure Evaluation

In December 2008, the U.S. EPA collected soil samples and analyzed them via XRF technology (X-ray Fluorescence). Arsenic concentrations up to 73,100 ppm were found in the interior of the structure and up to 2,720 ppm around the exterior of the building. Lead was also detected at levels up to 1,795 ppm inside and 1,637 ppm outside of the building. Additional laboratory samples detected arsenic concentrations as high as 68,800 ppm by weight and a lead concentration of 1,560 ppm, which exceeded the ATSDR-recommended Comparison Value of 20 ppm for arsenic in residential soils and the 400 ppm EPA removal guideline for lead.

After the excavation and removal of contaminated soils at the site, XRF readings ranged from less than the limit of detection (10 ppm) to 24.9 ppm at the base of the excavation area (Table 1). Although one XRF reading was above 20 ppm, the average of five XRF readings was below 20 ppm. In addition, confirmatory laboratory results for two soil samples collected from the base of the excavation were less than 20 ppm for arsenic and less than 400 ppm for lead (Table 2). No arsenic contamination above 20 ppm was found by XRF for the two residential properties to the west of the site. For the property south of the site that had arsenic contamination in the backyard of the home, post excavation results for arsenic were below 20ppm, with excavation depths ranging from 6 to 30 inches below ground surface.

The analysis of the soil sample used as the backfill at the site showed arsenic at 5.8 ppm and lead at 25 ppm, which approach the average levels of arsenic (5.6 ppm) and lead (15 ppm) found in natural background soils in Ohio (Ohio EPA 2008).

Table 1. XRF Results for Base of Excavation of Rose Exterminator Site

Chemical	*Range of Detections (ppm)*	*Average (ppm)*	*Detections/ Samples*	*# Above Comparison Value*	*Comparison Value (ppm)*
Arsenic	<LOD – 24.9	15	4/5	1	20
Lead	<LOD – 33.0	18	4/5	0	400

Source: Sherrard 2009

< LOD – less than Limit of Detection (approx. 10 ppm)
ppm – parts per million

Table 2. Lab Analytical Results for Base of Excavation of Rose Exterminator Site

Chemical	*Sample S-1 Result (ppm)*	*Sample S-2 Result (ppm)*	*Comparison Value (ppm)*
Arsenic	<19.5	<19.0	20
Lead	17.5	<15.1	400

Source: Sherrard 2009

< – less than (laboratory reporting limit)
ppm – parts per million

Health Evaluation

Arsenic

Discussion

Arsenic is a naturally occurring element, widely distributed in the earth's crust. Levels of arsenic in natural soils range from 1 to 40 ppm, with an average level of 5 ppm. In nature, arsenic is mostly found in minerals as opposed to its elemental form. Arsenic, primarily as arsenic trioxide, is a byproduct of smelting of copper, lead, cobalt, and gold ores.

Arsenic is a potent poison that may exist in several valence states and in a number of inorganic and organic forms. The chemical of concern at the Rose Exterminator site was inorganic arsenic in the form of arsenic trioxide (As_2O_3), one the most toxic and prevalent forms. Arsenic trioxide is a white or transparent solid with no odor or taste and was used in the past as a pesticide (rat poison). The use of inorganic arsenic has been phased out. However, arsenic does not break down in the environment and tends to remain in the upper layers of soil indefinitely. The Rose Exterminator site was still highly contaminated with residual arsenic from past production even after many years.

Most cases of arsenic-induced toxicity in humans are due to exposure to inorganic arsenic; differences in potencies of different inorganic chemical forms are usually minor. High oral

exposures to inorganic arsenic (in general) can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet. Ingestion of inorganic arsenic can cause injury to the nervous system, including peripheral neuropathy and intellectual deficits in children. The main effect of dermal exposure to arsenic is local irritation and dermatitis (ATSDR 2007a).

Health Effects of Arsenic

Acute effects

In a letter health consultation provided to U.S. EPA, ODH's Health Assessment Section (HAS) estimated a child's exposure dose from incidental ingestion of soil contaminated with the maximum concentration of arsenic found at the site (HAS 2009) . The estimated dose for this acute (short-term) exposure was well above health guidelines (Table 3).

The time-critical removal action, completed on June 8, 2009, removed the arsenic-contaminated soils at the site. The current level of arsenic in soil is not expected to cause acute health effects.

Chronic effects (Non-cancer)

Before the removal action, ODH estimated an exposure dose from chronic exposure to inorganic arsenic from incidental ingestion of soil contaminated with the average level of arsenic previously found at the site (HAS 2009). The estimated exposure dose was above health guidelines (Table 3).

Long-term (chronic), non-cancer health effects would not be expected now that the site has been backfilled with soil containing 5.8 ppm arsenic, which is near the average background level for arsenic in Ohio and the U.S.

Table 3. Estimated Arsenic Exposure Doses Compared to Health-Based Values

Exposure Situation	***Exposure Concentration***	***Estimated Exposure Dose (mg/kg/day)***		***MRL (mg/kg/day)***	***NOAEL (mg/kg/day)***	***LOAEL (mg/kg/day)***
		Child	***Adult***			
Acute	73,100 ppm	0.91	0.10	0.005	--	0.05
Chronic	610 ppm	0.008	0.0009	0.0003	0.0008	--

Cancer risk

The International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), and the U.S. EPA have all determined that inorganic arsenic is a human carcinogen. Chronic inhalation exposure to arsenic in air increases the risk of lung cancer. Chronic oral exposure is known to increase the risk of skin cancer and cancer in the lungs, bladder, liver, kidney and prostate.

ODH HAS calculated the estimated increase in cancer risk over a 30-year exposure to a mean

concentration of inorganic arsenic previously found at the site and calculated it to be above the health guideline for cancer risk (1 in 10,000 or 1 x 10^{-4}). The levels of arsenic in the soil at the site following the removal action are now near natural background levels and are not expected to produce an increase in cancer risk from exposure to arsenic.

Lead

Discussion

Lead is a heavy, low melting, bluish-gray metal that occurs naturally in the Earth's crust. However, it is rarely found naturally as a metal. It is usually found combined with two or more other elements to form lead compounds. Once lead falls onto soil, it sticks strongly to soil particles and remains in the upper layer of soil. Some lead compounds are changed into other forms of lead by sunlight, air, and water; however, elemental lead cannot be broken down.

Lead-contaminated soil can pose a risk through direct ingestion, uptake in vegetable gardens, or tracking into homes. Uncontaminated soil contains lead concentrations less than 50 ppm but soil lead levels in many urban areas exceed 200 ppm. The EPA's standard for lead in bare soil in play areas is 400 ppm by weight and 1200 ppm for non-play areas. This regulation applies to cleanup projects using federal funds (ATSDR 2007c).

Health Effects of Lead

Acute effects

ODH HAS used EPA's Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) to predict the elevation of a child's blood lead level that could occur from exposure to lead in soil containing the maximum level of lead previously detected at the site. Predicted blood levels were above CDC's blood lead level of concern but were not at dangerous levels and indicated that acute (short-term) health effects would not be expected to occur (HAS 2009). Following the removal action, lead levels in the uncontaminated soil at the site will not raise a child's blood lead level above the level of concern or harm a child's health.

Chronic effects (Non-cancer)

The IEUBK model was used to predict the elevation of a child's blood lead level that could occur from exposure to lead in soil containing the mean lead concentration previously found in soil at the site. The predicted blood levels were below 10 µg/dL. Following the removal action, soil lead levels are not expected to raise a child's blood lead level above the level of concern.

Cancer risk

Inorganic lead compounds are, according to IARC, *probably carcinogenic to humans (Group 2A)* and NTP, *reasonably anticipated to be human carcinogens*. These conclusions were based on studies on laboratory animals and workers exposed to high levels of lead. The exposures in these studies greatly exceed the expected types of exposures to lead that could have potentially occurred at the Rose Exterminator site in Norwood, Ohio. An increased risk of cancer from exposure to lead at this site is not expected either before or after the removal action.

CHILD HEALTH ISSUES

The major pathway of concern, especially with regard to young children, is by incidental ingestion of soil or dust resulting from repeated hand-to-mouth activity. Children have a higher breathing rate than adults, breathing in a greater volume of air per pound. Small children are closer to and spend more time on the ground where they may come into contact with contaminated soil and dust. Children who exhibit pica, a compulsive hand-to-mouth behavior and repeated eating of nonfood items, are at greatest risk. Children exposed to inorganic arsenic may have similar health effects as adults, however, they and are more sensitive to the effects of lead exposure than are adults (HAS 2009).

Current conditions at the site are now near background levels for lead and arsenic in soil and will not harm a child's health if he or she touches or accidentally eats the soil.

CONCLUSIONS

HAS concludes that skin contact with, breathing, or accidentally eating soil or dust at or near the former Rose Exterminator site will not harm people's health at this time. The reason for this is post-removal confirmation sampling of soils at the site demonstrate that arsenic and lead levels are now below levels of health concern as a result of the U.S. EPA time-critical removal action at the site that was completed as of June 8, 2009.

The HAS's recommendation to remove contaminated soil at the Rose Exterminator site to eliminate future exposures to arsenic and lead has been successfully carried out by the U.S. EPA. Post-excavation sampling results indicate that the arsenic and lead levels in these soils are now significantly below the 20 ppm recommended value for arsenic and the 400 ppm standard for lead. In addition, backyard soils of a nearby property to the south of the site identified as being contaminated with arsenic were removed and replaced with clean backfill and topsoil. Arsenic- and lead-contaminated soils on these properties have been removed and no longer pose a public health hazard to area residents.

RECOMMENDATIONS

No further recommendations are made at this time.

PREPARERS OF THE REPORT

John Kollman, MS, CIH, RS
Environmental Specialist/Toxicologist
Health Assessment Section
Ohio Department of Health

Robert Frey, PhD
Section Chief
Health Assessment Section
Ohio Department of Health

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CERTIFICATION

The Rose Exterminator Site Health Consultation was prepared by the Ohio Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun. Editorial review was completed by the Cooperative Agreement Partner.

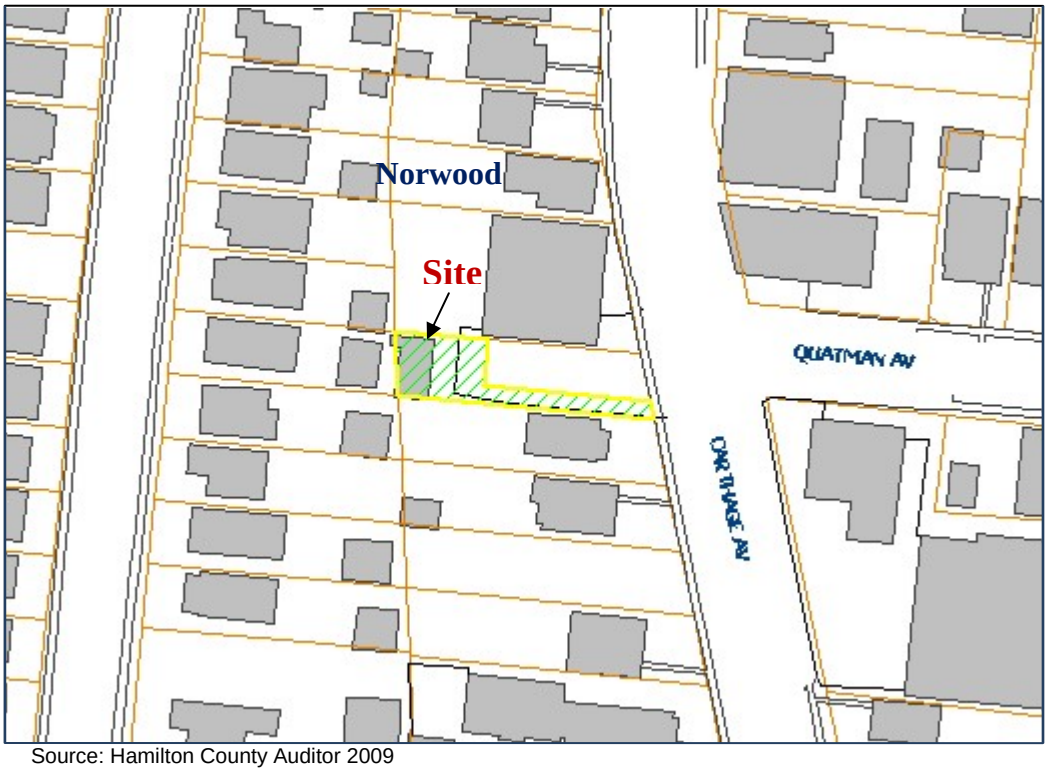
Technical Project Officer, CAT, CAPEB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Team Lead, Cooperative Agreement Team, CAPEB, DHAC, ATSDR

Figure 1. Rose Exterminator Site Location Map

Ohio Department of Health
Health Assessment Section



Source: Hamilton County Auditor 2009

Site Building. Source: U.S. EPA OSC. 2009

Demographic Statistics Norwood, Ohio	
Total Population	21,675
White	20,429
Black or African American	509
Am. Indian & Alaska Native	80
Asian	167
Native Hawaiian & Other Pacific Islander	4
Some other race	190
Two or more races	296
Hispanic or Latino (of any race)	401
Under 5 years	1,304
18 years and over	16,603
65 years and over	2,733
Total Housing Units	10,044

Source: 2000 U.S. Census

Appendix B. Fact Sheets

Bureau of
Environmental Health
Health Assessment Section

"To protect and improve the health of all Ohioans"

Arsenic

Answers to Frequently Asked Health Questions

What is arsenic?

Arsenic is an element found in nature. Arsenic has no smell or taste.

Where is the arsenic found in nature?

Natural arsenic is found in rocks. Ohio's rocks contain low levels of arsenic. We all have a small amount of arsenic in our bodies. Higher levels come from mining, some factories and chemical plants and wood treated products.

How do higher levels of arsenic get in the environment?

- **How does arsenic get in your body?**

1. Arsenic goes into the air when materials that contain arsenic are burned.
   - People then breathe in the smoke and arsenic (inhalation).
2. During the burning, arsenic falls from the air to the ground or into the rivers and lakes.
   - Kids play outside in the dirt (dermal-skin contact).
   - People have gardens or flower beds and have contact with the soil (dermal-skin contact).
   - People eat food that was grown in contaminated soil (ingestion-eating or drinking).
3. On the ground, arsenic will dissolve into the underground drinking water.
   - Humans then drink the water (ingestion-eating or drinking).

Who is more likely to come in contact with higher levels of arsenic?

- Private well users that live in areas with higher levels of natural arsenic in the rock.
- Kids who play outside in dirt with high levels of arsenic.
- People who have gardens or flower beds in soils with higher arsenic levels.
- People who drink water polluted by a nearby chemical plant or waste site.

Can you get sick from arsenic?

Yes, you can get sick from arsenic. But getting sick will depend on the type of arsenic and the contact (exposure) you had with this chemical.

Types of arsenic:

- Organic arsenic: This type can be found in food, especially seafood, and does not cause health problems.
- Inorganic arsenic: This type can be found in the soil, in the drinking water and in the air. This type sometimes causes health problems.

Exposure (contact) with the inorganic arsenic:

- How much you were exposed to (dose).
- How long you were exposed (duration).
- How often you were exposed (frequency).
- General Health, Age, Lifestyle
  Young children, the elderly and people with chronic (on-going) health problems are more at risk to chemical exposures.

Note that both types of arsenic occur naturally. But very high levels of inorganic arsenic in food or water can cause serious, sudden health problems or sometimes death.

How do we measure arsenic?

Arsenic is measured (counted) in parts per billion (ppb). Example: One part per billion (ppb) would be equal to one bean in a pile of one billion beans. A deadly dose of arsenic would be 60,000 parts per billion (ppb) or more. In Ohio drinking water, we normally find natural arsenic levels between 5-15 ppb.

How does arsenic harm your health?

If you were to drink water with arsenic levels of 200 parts per billion every day and over many years, you may experience some of the following:

- Nausea (upset stomach), vomiting, and diarrhea.
- The body will make less red and white blood cells which help fight disease.
- A feeling of "pins and needles" on the hands and feet.
- Long-term contact with inorganic arsenic may cause the skin to darken and the growth of small "corns" or "warts" on the palms of the hand, bottom of the feet (soles), and on the trunk of the body (torso).

Does arsenic cause cancer?

Eating or drinking (ingesting) high levels of inorganic arsenic (300 ppb, daily and over many years) increases the risk of getting skin cancer. It also increases the risk of developing tumors of the bladder, kidney, liver, and lungs. New data show contact with arsenic may cause a greater risk of getting cancer than previously thought. It is for this reason that the United States Environmental Protection Agency (U.S. EPA) lowered the Maximum Contaminant Level (MCL) of arsenic allowed in public water systems from 50 parts per billion (ppb) to 10 parts per billion (ppb).

The new Maximum Contaminant Levels (MCL) of 10 *ppb* is set at this **very** low level to be sure that the risk of getting a cancer from arsenic is very, very small. Many wells in Ohio may have levels of arsenic that go above the new MCL. The U.S. EPA said there is no extreme risk to health by drinking water with arsenic levels between 10 - 50 ppb. People with private wells above 10 ppb may wish to drink bottled water or consider a water treatment system.

Contact the Ohio Department of Health, Residential Water and Sewage Program to learn about treatment systems that remove arsenic, or for a list of registered water treatment dealers call (614) 466-1390 or visit www.odh.state.oh.us

Is there a medical test to show if you have been exposed to arsenic?

Since arsenic stays in the body a short time, you must get the test soon after contact (exposure). These tests only look for high levels of arsenic (over 150 ppb) and are not useful for low level exposures.

Types of tests:

- Urine test. This the most trusted test for arsenic exposure.
- Testing hair or fingernails. This can measure your exposure to high levels of arsenic over the past 6-12 months. It is not good for testing low levels.

Note: These tests will show the amount of arsenic in body but cannot tell you whether you will have harmful health problems. These tests also do not determine where the arsenic came from.

Where can I get more information?

Ohio Department of Health
Bureau of Environmental Health
Health Assessment Section
246 N. High Street
Columbus, Ohio 43215
Phone: (614) 466-1390
Fax: (614) 466-4556

References:

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ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

The Ohio Department of Health is in cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), Public Health Service, U.S. Department of Health and Human Services.

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Bureau of
Environmental Health
Health Assessment Section
"To protect and improve the health of all Ohioans"

Lead

Answers to Frequently Asked Health Questions

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts of the earth's crust. Prior to our current knowledge of the health hazards of lead, it was widely found in many of the products we used every day. Products such as gasoline, paints, batteries, metal products and ammunition just to name a few. Because lead is toxic, its use has been dramatically reduced since the 1980's.

Lead in the environment:

Lead does not break down in the environment. And although lead occurs naturally in the environment, most of the high levels of lead found come from human activities.

Once lead falls on to soil, it usually sticks to the soil particles. If the soil is uncovered and open to the air or becomes disturbed, lead-contaminated dust is created and carried by the wind. This dust is easily breathed in or swallowed. With construction activities, the possibility of lead-contaminated dust is an important concern.

Gardens grown in lead-contaminated soils may contain lead. Produce of fruits, grains and vegetables (especially root vegetables such as beets, carrots, parsnips, radishes, turnips, and rutabagas) absorb some of the lead through their roots. There is also the possibility of lead-contaminated dust falling onto crops.

Inside the house, lead can be found in lead-based paint, lead-contaminated dust, older lead pipes that carry water and some glazed pottery. A child can easily eat lead paint chips, breathe or ingest the dust on their fingers.

How does lead get in your body?

You may be exposed to lead by breathing (inhalation), eating/drinking (ingestion) or by skin contact (dermal contact). However, only very small amounts of lead can get into your body through dermal contact. Inhalation and ingestion of lead-contaminated dust and soil are the main health concerns.

How does lead affect your health?

The harmful effects of lead are the same whether it is breathed or swallowed. The main target for lead toxicity is the nervous system, including the brain. But lead can negatively affect every organ of the body.

Children are most vulnerable to lead poisoning because they play outside, close to the ground or in the dirt. Small children also put their fingers in their mouths. Compared to adults, a bigger proportion of the amount of lead swallowed will enter the blood in children. About 99% of the amount of lead taken into the body of an adult will leave in the waste within a couple of weeks. But only about 32% of the lead taken into the body of a child will leave in the waste.

Lead exposure in the womb, in infancy, or in early childhood may also slow mental development and lower intelligence later in childhood. Lead can cause irritability and aggressive behavior in children. If pregnant women have high levels of lead in their bodies, fetuses exposed to lead in the womb may be born prematurely and have lower weights at birth. In some cases, pregnant women with high levels of exposure to lead may have miscarriages.

Some other harmful health effects of lead include damaged kidneys, damaged male reproductive system, severe "stomachaches," a poor appetite, sleep disorders, and hearing problems. Lead can also decrease reaction time and affect the memory.

Is there a medical test to determine whether I have been exposed to lead?

Yes, there is a test to see if you have been exposed to lead. The primary screening method is the measurement of total lead in the blood. This test can tell if you have been recently exposed to lead.

Also, exposure to lead can be evaluated by measuring the erythrocyte protoporphyrin (EP) in the blood sample. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (µg/dL). For this reason, total lead is the primary method of screening.

Lead can also be measured lead in teeth or bones by X-ray techniques. These tests can tell about long-term exposure but are not widely available..

How can families reduce the risk of exposure to lead?

The most important way a family can lower exposures to lead is to avoid exposure to lead-contaminated soil and dust sources, avoid lead-based paint chips, avoid water from lead-lined pipes and avoid some plastic products made outside the United States.

The swallowing of lead-contaminated soil or dust is a very important exposure pathway for children. This problem can be reduced in many ways. Regular hand and face washing to remove lead dust and soil, especially before meals, can lower the possibility that lead on the skin is accidentally swallowed while eating. Families can lower exposures to lead by regularly cleaning the home of dust and tracked-in soil. Door mats can help lower the amount of soil that is tracked into the home and removing your shoes before you enter the house will also help. Planting grass and shrubs over bare soil areas in the yard can lower contact that children and pets may have with soil and the tracking of soil into the home. Also, wash all produce grown in lead-contaminated soils before eating.

Families whose members are exposed to lead-contaminated soil and dust can minimize the exposure to children by changing and bagging their work clothes before they are brought into the home for cleaning. Also, they should immediately wash their hands or shower.

It is important that children have proper nutrition and eat a balanced diet of foods that supply adequate amounts of vitamins and minerals, especially a diet high in calcium and iron. Good nutrition lowers the amount of swallowed lead that passes to the bloodstream and also may lower some of the toxic effects of lead.

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Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) considers children to have an elevated level of lead if the amount of lead in the blood is at least 10 µg/dL. Medical evaluation and environmental investigation and remediation should be done for all children with blood lead levels equal to or greater than 20 µg/dL. Medical treatment may be necessary in children if the lead concentration in blood is higher than 45 µg/dL.

The Environmental Protection Agency (EPA) requires that the concentration of lead in air that the public breathes be no higher than 1.5 micrograms per cubic meter ($\mu g/m^3$) averaged over 3 months. EPA regulations no longer allow lead in gasoline. The Clean Air Act Amendments (CAAA) of 1990 banned the sale of leaded gasoline as of December 31, 1995.

The EPA regulations also limit lead in drinking water to 0.015 milligrams per liter (mg/L). The 1988 Lead Contamination Control Act requires the Consumer Product Safety Commission (CPSC), EPA, and the states to recall or repair water coolers containing lead. This law also requires new coolers to be lead-free. In addition, drinking water in schools must be tested for lead, and the sources of lead in this water must be removed.

To help protect small children, CPSC requires that the concentration of lead in most paints available through normal consumer channels be not more than 0.06%. The Federal Hazardous Substance Act (FHSA) bans children's products containing hazardous amounts of lead.

The EPA has also developed standards for lead paint hazards, lead in dust, and lead in soil. To educate parents, homeowners, and tenants about lead hazards, lead poisoning prevention in the home, and the lead abatement process, EPA has published several general information pamphlets. Copies of these pamphlets can be obtained from the National Lead Information Center or from various Internet sites, including http://www.epa.gov/opptintr/lead.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological profile for lead. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Where can I get more information?

Ohio Department of Health
Health Assessment Section
246 N. High Street
Columbus, Ohio 43215
Phone: (614) 466-1390
Fax: (614) 466-4556

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