



# Iron King Mine / Humboldt Smelter Superfund Site

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## EPA Sampling Results for Arsenic and Lead in Soils in Residential Yards

This fact sheet discusses the results of the U.S. Environmental Protection Agency's (EPA) sampling of soils for arsenic and lead in residential yards in Dewey-Humboldt, Arizona. EPA's sampling of yards is part of a larger environmental investigation related to the historical mine and smelter operations 75 to 110 years ago.

EPA is currently evaluating the possible health risks posed by contamination in residential yards, at the former mine and smelter properties, and in contaminated gulches and storm water pathways in Dewey-Humboldt. EPA is also exploring potential cleanup options for this contamination. EPA will continue to update and seek input from community members before a cleanup action is selected for the Iron King Mine / Humboldt Smelter Site.

EPA has now screened or sampled soils in 580 residential yards and collected and analyzed more than 6,253 samples during its investigation. Of these, 396 yards were evaluated in higher detail with 10 to 20 samples per yard. Residents and owners of these yards have been sent individual letters with their soil results.

### Where the Contamination Came From and Why EPA Sampled Residential Yards

The old mining and smelting operations in Dewey-Humboldt produced waste called *tailings* that have high levels of arsenic and lead. The companies who ran the mine and smelter dumped fine-grained tailings in piles — such as the four-million cubic-yard tailings pile on Highway 69 — and in ponds held back by dikes or dams. Over time, piles collapsed and dikes failed. This allowed tailings to move into storm drainages and gulches where they are found today, mixed in with other soils. While in operation, the smelter also released contaminated particles into the air through its smoke stack.

Over decades, some of the mine and smelter tailings also reached residential yards. Tailings or particles may have blown in the wind, been used as fill material, or been left in areas that later became yards. If levels of arsenic and lead in residential soils are high enough, they can pose health risks to persons exposed to the soils. For this reason, EPA investigated where residential soils would potentially have higher levels of arsenic or lead because of the mine and smelter, and whether these elevated levels may pose a health risk to residents. EPA's investigation has found that some residential yards have soil that has been impacted by the mine or smelter, though most yards have not been affected.

### Information at a Glance

- » EPA has finished sampling and studies in both residential and non-residential areas of the Iron King Mine/Humboldt Smelter Superfund Site.
- » EPA has sampled arsenic and lead levels in soils for 580 residential yards in Dewey-Humboldt.
- » The majority of yards sampled do not have arsenic and lead levels that would pose an elevated health risk, even to someone exposed over years or decades.
- » EPA is still in the process of deciding which yards will need cleanup action.
- » Next, EPA will finish the investigation reports and risk assessment and begin evaluating cleanup options.

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## Understanding Background Metals and the Area of Potential Site Impact

Arsenic and lead are metals that occur naturally in soils at varying levels. Levels of naturally-occurring “background” arsenic or lead can be higher in Arizona mining country as a result of weathering of natural rock formations containing arsenic. Also, lead levels can be elevated in residential soils due to man-made factors, such as old household lead-based paint or leaded gasoline. The Superfund law only allows EPA to consider cleanup of lead and arsenic that are related to the mine and smelter.

To help us evaluate the background levels of arsenic and lead in the Dewey-Humboldt area, EPA collected hundreds of soil samples from undisturbed areas outside of town within a three-mile radius of the mine and smelter. We used these results to calculate what are called **background threshold values** (BTV) for arsenic and lead in soils. When we see levels above the BTV, we can be confident that some of the arsenic or lead in the soil is from sources other than natural or background factors. For Dewey-Humboldt, the arsenic BTV is 112 mg/kg (milligrams per kilogram), and the lead BTV is 35 mg/kg.

EPA also needed to determine how far from the mine and smelter residential yards could have been impacted by contamination. This physical area that might be affected by arsenic or lead from the mine or smelter is called the **Area of Potential Site Impact**, or APSI. To identify the APSI, we examined soil levels of copper and zinc as indicators that soils have been impacted by the mine and smelter. These two metals are associated with the ores processed at the mine and smelter, but do not occur naturally at high levels in soils. We also used statistics to compare the levels of metals in undisturbed soils at the surface to soils one foot deep because mine and smelter activities affected surface soils and deeper soils differently.

## The Residential Soils Investigation Areas

EPA conducted sampling at residential yards within the APSI to determine whether there are levels of arsenic or lead that might pose a health risk to residents. After sampling investigations in both 2009 and 2014, EPA has now sampled, screened, or otherwise evaluated 580 residential yards, including a great majority of the yards in downtown Humboldt and near the mine or smelter. See Figure 1.

EPA investigated yards in two groups. First, 184 yards on the outskirts of the area potentially affected by the mine and smelter were separated into **screening areas**. These are labeled A – H in Figure 1. In these areas, EPA strategically collected more than 250 samples on a broad scale throughout each area. Based on the sampling results showing low levels of arsenic and lead, EPA screened out all of the yards from further investigation. EPA does not plan to consider cleanup actions in these areas.

Second, EPA investigated soils in all other residential yards in the APSI on a yard-by-yard basis. These 396 yards lie closer to the mine and smelter than the screening areas. Every yard received an individual, yard-specific evaluation of arsenic and lead levels and any potential health risks. This was the **yard-specific investigation**.

## How EPA Evaluates Potential Health Risks Posed by Soils in Yards

In the yard-specific investigation, EPA typically collected 10 to 20 samples per yard, with more samples taken in larger yards than in smaller ones. Using the results from these samples, EPA

then calculated a health-protective average for arsenic and lead levels in each yard. This was done using statistics, and is called an **Exposure Point Concentration**, or EPC. An EPC is higher than a plain average and takes into account that EPA

cannot take samples at every single point in a yard. By using an EPC, EPA errs on the side of caution to be protective of health.

When deciding whether cleanup actions are needed in yards, EPA compares the EPC for arsenic and lead in each yard to health-protective levels that would pose a very small health risk even to someone exposed to the soil for many years or decades (see Figure 2). In Figure 2, you will see one scale for arsenic and one scale for lead, each divided into three colors (green, yellow, and orange). The figure notes the relative likelihood of the cleanup level being chosen in any one of these ranges. The number of sampled yards that fall into each color range is also shown on Figure 2. It is likely that EPA will select a cleanup level for residential soils somewhere within these color ranges.

It is important to know that arsenic and lead levels in any of the green, yellow, or orange color ranges on Figure 2 would still pose low health risks even to someone exposed to the soils for many years or decades. Calculations for all of these ranges make very health-protective assumptions.

**Arsenic BTV: 112 mg/kg**  
**Lead BTV: 35 mg/kg**

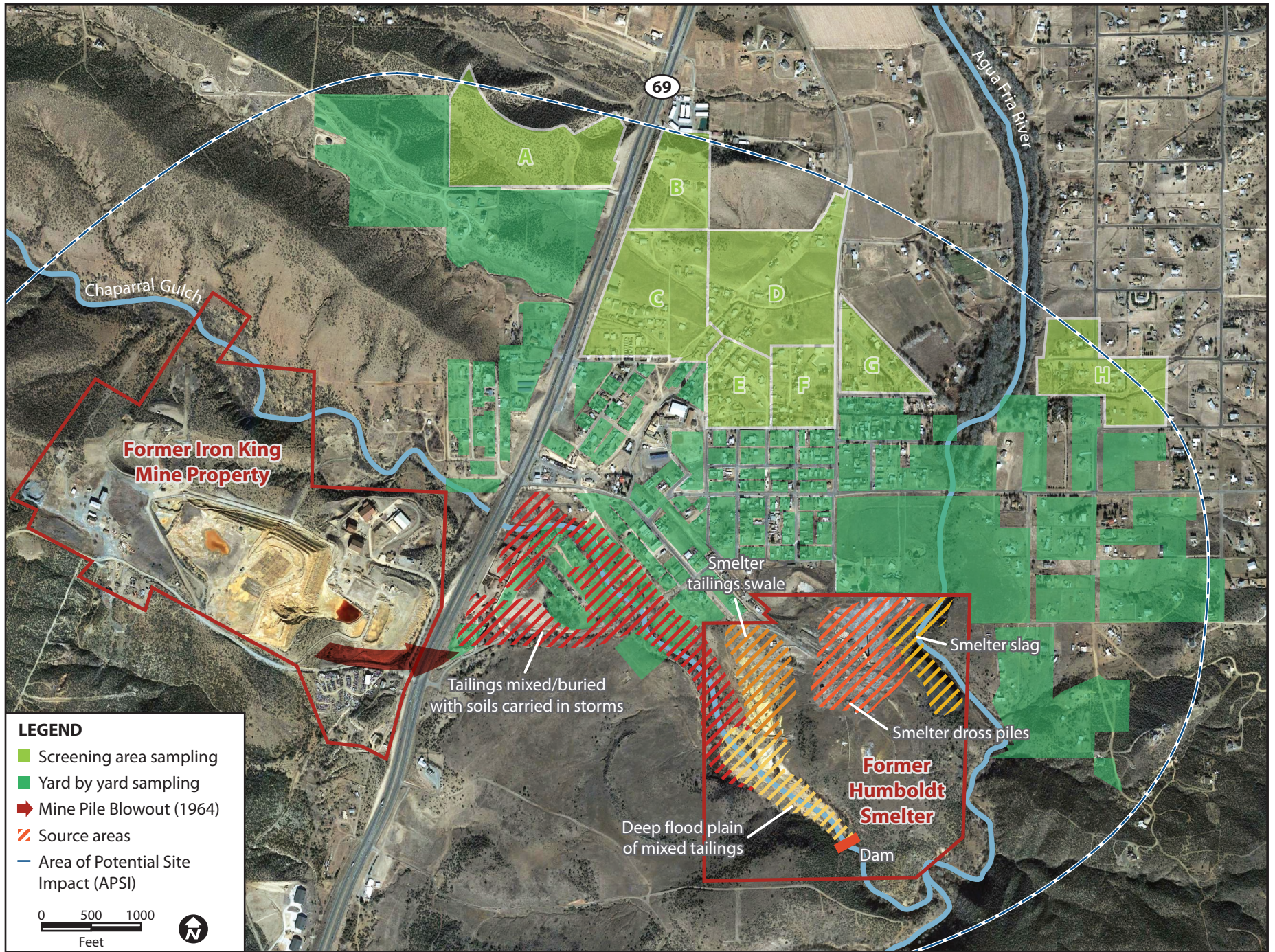


Figure 1: Iron King/Humboldt Smelter Superfund Site Sampling Areas

EPA is now conducting a more detailed **risk assessment**, which allows us to evaluate what health risks may be posed by contamination, how such risks could be avoided or eliminated, and where a cleanup action is needed. Based on the risk assessment, EPA will identify which yards may require cleanup actions.

The risk assessment evaluates many factors, including the toxicity and bioavailability of a chemical (see the box on bioavailability, right); how much of that chemical is in soils; how much of these soils a person might be exposed to; and for how long a person might be exposed. This allows us to evaluate the risks of health effects from exposure over both the short and long term.

## What is Bioavailability?

The bioavailability of a chemical is the percentage of that chemical that remains in the body after it is ingested. The rest of the chemical is excreted. Lower bioavailability means that less of a chemical stays in the body where it is available to cause harm. The bioavailability of metals can vary depending on the type of soil in which they are found.

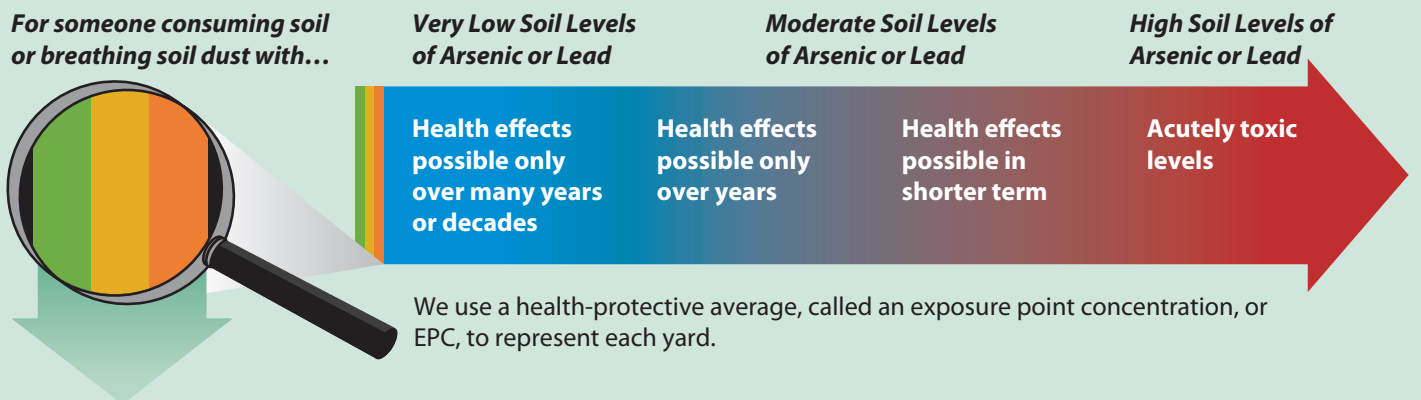
In Dewey-Humboldt, EPA conducted a thorough testing program of both animal and lab studies. There were 69 samples collected to study the bioavailability of arsenic and lead, including 30 samples in actual residential yards. We have found that the bioavailability of these metals is lower than originally expected.

**Bioavailability of Arsenic in soil at the Site: 22%**

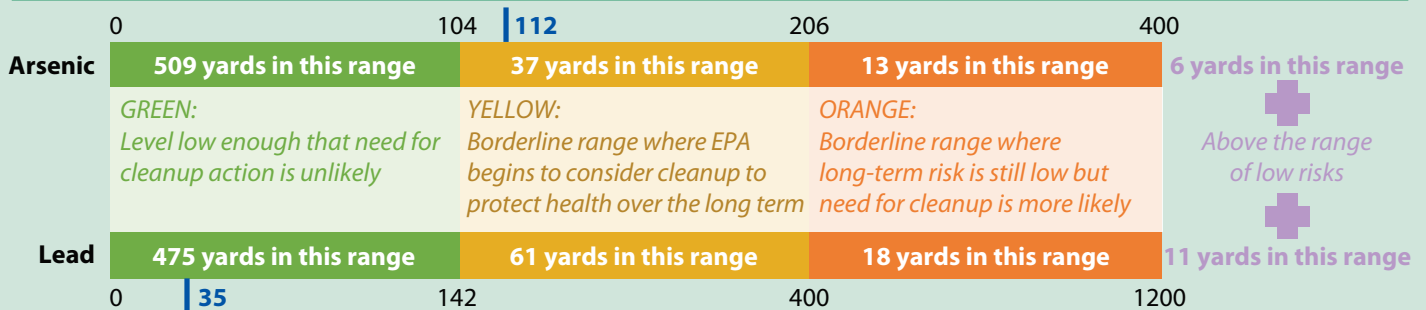
**Bioavailability of Lead in soil at the Site: 60%**

### Putting Yard Results from Dewey Humboldt Soils In Perspective

When considering whether a cleanup action is needed, EPA compares yard results with very low, health-protective levels that would pose a low health risk even for someone exposed to the soil for decades.



### Exposure Point Concentrations EPA Found for Residential Yards



At levels above those indicated in blue, we can be confident that the arsenic or lead is not just background, or naturally-occurring.

**Figure 2:** Putting Yard Results from Dewey Humboldt Soils In Perspective. Residential yards in the green, yellow, and orange color ranges still pose low health risks even to someone exposed to the soils for many years or decades.

## Other Things We Learned from the Residential Soils Investigation

The sample results from the residential investigation show that yards with elevated arsenic or lead occur sporadically across town. They do not form a pattern with levels decreasing with greater distance from the mine or smelter. Yards along the former railroad loading area for the smelter tend to have higher levels of metals, which is likely due to rail-loading activities while the smelter was in operation. Yards that lie *in* the Chaparral Gulch also have higher levels of metals because storm water has carried tailings from the former mine through the Gulch. EPA has also found several individual yards with elevated soils levels of arsenic and/or lead, where tailings were either directly dumped long ago or were deposited more recently as fill material.

The majority of yards, even many that are close to the mine or smelter, do not have levels of arsenic or lead that would pose a health risk to residents.

## What's Next

The next steps in our process for both the residential and non-residential portions of the site are to finish the risk assessment and to publish the Remedial Investigation report on all EPA sampling and investigation. We will also begin to study cleanup alternatives for the site and will reach out to community members to seek your input about proposed cleanup alternatives. After receiving and considering public comments, we will select cleanup alternatives for both the residential and non-residential portions of the site.

## Reduce Your Exposure to Arsenic and Lead

Naturally-occurring arsenic and lead in soils in the Dewey-Humboldt area are higher than in many other parts of the country, and the arsenic and lead levels span a wide range. Some areas also have Superfund site-related contamination. Here is a short list of some actions that you can consider to reduce exposure. *These are practices we recommend to everyone in the Dewey-Humboldt area, regardless of whether you live near the Superfund site.*

- » **Get your tap water tested for arsenic and lead if you have a private well.** In some locations, groundwater in the Dewey-Humboldt area contains arsenic and other contaminants at levels above the drinking water standards. The intake for private wells can lie close to locations of naturally occurring arsenic in rock. The EPA drinking water standard for arsenic is 10 micrograms per liter. To discuss how often to test your well water and for which contaminants, contact the Arizona Department of Health Services (ADHS) at (602) 364-3128. For help finding a water laboratory, contact the ADHS laboratory at (602) 364-0728.
- » **If your private well water has arsenic levels above 10 micrograms per liter, consider installing an in-home water treatment system.** Some filters and systems are much less effective than others. Contact the University of Arizona at (520) 621-3516 for information on effective treatment systems.
- » **Wash your homegrown vegetables and fruit before eating.** This will ensure that you do not consume any loose soils that may be clinging to the food.
- » **Practice smart gardening.** Lettuce, radishes, broccoli, Brussel sprouts, kale, and cabbage accumulate more arsenic from soils than other garden plants. Consider eating a limited amount of these vegetables from local gardens.
- » **Have your children's blood tested for lead.** All children in the United States should have their blood tested for lead at age 1, and again at age 2, at a minimum.
- » **If you are connected to the public drinking water system, note that the water provider is required to meet state and federal drinking water standards.** Residents with questions or concerns should contact Southwestern Utility Management at (520) 623-5172 or Arizona Department of Environmental Quality at (602) 771-4617.
- » **Remove your shoes before entering the house.** Dust from outside can be tracked in on your shoes and lodge in carpets and upholstery in small amounts that add up over time.
- » **Have your house heating/cooling ducts professionally cleaned regularly.** This will minimize soils and dust from the outside that can collect in ducts.
- » **Wash your hands and your children's hands before eating.** This will ensure that soils or dust on your hands do not get on your food or directly into your mouth.

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## EPA Sampling Results for Arsenic and Lead in Soils in Residential Yards

### For More Information

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