Hello, this is Kevin O'Donovan, and I'd like to welcome you to the National Institute of Environmental Health Sciences Superfund Research Program monthly Research Brief podcast.

This month, we're discussing arsenic uptake in homegrown vegetables from mining-affected soils.

The Research Brief, Number 219, was released on March 6, 2013, and was written by SRP contractor Sara Mishamandani in conjunction with SRP-supported researchers Monica Ramirez-Andreotta and Raina M. Maier.

Arsenic uptake from soil into the edible portion of some plants presents a potential health hazard that may affect home gardeners near contaminated sites. By testing vegetables grown by local residents, as well as those from a controlled greenhouse environment, Monica Ramirez-Andreotta, Ph.D., at the University of Arizona Superfund Research Program found that the amount of arsenic accumulated in the edible portion of the plant in certain vegetable families is associated with the arsenic soil concentration.

Arsenic is a semi-metal element that is naturally found in the earth's soils and rocks. It is further released from industrial activities. Acute exposure to arsenic can lead to nausea, diarrhea, and numbness in hands and feet. Chronic low-level arsenic exposure has been linked to diabetes, hypopigmentation/hyperkeratosis, and a probable role in promoting cancer of the bladder, lung, skin, and prostate.

The Iron King Mine and Humboldt Smelter Superfund site, a previously operated mine and smelter in Arizona, contains large amounts of uncontrolled mine waste, called tailings, with elevated arsenic concentrations. Older mine tailings are prone to wind dispersion and water erosion, potentially elevating heavy metal concentrations in the soil in neighboring communities.

Ramirez-Andreotta, under the guidance of University of Arizona Superfund Research Center Director Raina Maier, Ph.D., and Research Translation Director Mark Brusseau, Ph.D., recruited home gardeners in a community near the site to submit their soil, water, and vegetable samples for analysis of arsenic concentrations. She also conducted a controlled greenhouse study to characterize the uptake of arsenic by different types of vegetables.

All vegetables accumulated arsenic, ranging from 0.01 to 23.0 mg/kg dry weight. When combining the greenhouse and the home garden study, Ramirez-Andreotta observed a significant linear correlation between the amount of arsenic accumulated in the edible portion of the plant and the arsenic soil concentration for the following families: Asteraceae (or lettuce), Brassicaceae (radish, broccoli, kale, and cabbage), Amaranthaceae (beets, spinach, swiss chard), and Fabaceae (bean).

The Asteraceae and Brassicaceae families were the top accumulators, concentrating more arsenic in their edible tissues than other families. Certain members of the Asteraceae and Brassicaceae

families have been previously identified as hyperaccumulator plants, meaning they may have a genetic and physiological capacity to accumulate high amounts of metals.

The study recommends that home gardeners near smelter or mining operations that have high levels of metals in waste materials test their soils prior to gardening to determine existing soil arsenic concentrations. Gardeners should also be made aware that arsenic can accumulate considerably in certain vegetables.

“Particularly, it may be prudent for home gardeners who neighbor smelter or mining operations with high arsenic levels or who are in an arsenic endemic area to limit the use of vegetables from the Asteraceae and Brassicaceae families to reduce their dietary exposure to arsenic,” said Ramirez-Andreotta.

If you’d like to learn more about this research, visit the Superfund Research Program website at www.niehs.nih.gov/srp. From there, click on “Who We Fund” and follow the links to the University of Arizona research summary. If you have any questions or comments about this month’s podcast or if you have ideas for future podcasts, contact Maureen Avakian at avakian@niehs.nih.gov.

Join us next month as we discuss more exciting research and technology developments from the Superfund Research Program.