

# RESPONSE ACTIONS AT THE EAST HELENA, MONTANA, NATIONAL SUPERFUND SITE: APPLICATIONS OF INNOVATIVE METHODS FOR CHARACTERIZATION, TREATMENT AND REUSE OF METALS-CONTAMINATED LANDS<sup>1</sup>

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**Abstract.** The East Helena National Superfund Site is located three miles from Montana's Capitol. Approximately 3,600 people reside within a radius of two miles from a smelter complex that operated for 114 years. The smelter and ancillary facilities emitted particles and gases enriched with heavy metals, arsenic and sulfur oxides. Virtually all of the nearby residential areas and several thousands of acres of surrounding agricultural lands were impacted.

Characterization studies confirmed that fallout from emissions, despite significant emissions reductions beginning in the 1960's and 1970's, had caused children's lead-in-blood ratios and metals levels in crops and garden vegetables, fish and wildlife, and livestock to be significantly greater than national statistics.

The emphasis of Superfund efforts here has been on soils--both residential and agricultural. Metals and arsenic concentrations were first characterized over large areas by means of representative sampling, followed by statistical kriging of the data. Additional, iterative sampling led to a statistics-based sector analysis, thereby forming a basis for establishing limits on those areas likely to require a response. But, a high degree of variability and unpredictability compelled EPA and Lewis and Clark County health professionals to devise a unique, multi-faceted "trigger" for response actions.

Both traditional and innovative strategies are incorporated into the overall cleanup. Roughly 85 percent of the contaminated residential areas slated for a response under current protocols have been completed. This aspect of the cleanup and a highly effective county-administered education program have contributed importantly to reduced lead-in-blood ratios of East Helena's children. Agricultural lands have received less attention; however, success has been achieved in reducing wind-borne migration of contaminants and improving range conditions. Innovative cleanup approaches include in-place treatment by means of deep tillage and amendments, land application of contaminated spoils, and best agricultural management practices.

**Additional Key Words:** Superfund remedial investigations, heavy metals & arsenic in soils, acidic soils, contaminant sources & pathways, receptors and bioavailability, children's lead-in-blood ratios, response actions, in-place treatment, land redevelopment and reuse, best management practices.

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## **Introduction**

In April 2001, one of the last few remaining North American lead smelters, located three miles east of Montana's Capitol, shut down operations. The East Helena lead smelter operated for 114 years. The American Smelting and Refining Company, now Asarco, owned and operated the lead smelter for all but about seven years of that span. As the lead smelter prospered, so did the town of East Helena and its residents.

Two ancillary industrial plants, a Zn fuming plant owned by the Anaconda Minerals Company (1927 – 1972) and a Zn- and Cu-based products manufacturing and packaging plant owned by American Chemet Corporation (1947 – present), although lesser known, are also “players” in the overall picture of East Helena's economic and environmental health.

East Helena has experienced a complex and difficult transformation in recent years. Residents and community leaders believe that the negative aspects of being designated a national Superfund site outweigh the positive, by a wide margin. From a proud blue-collar community to a community considered by many outsiders to be an unsafe place to live; from a community supported for a century by a prosperous--and generous--publicly-owned corporation to a community faced with the loss of 40 percent of its tax revenues, East Helena is struggling to redefine its future. Its ability to expand is severely limited by being surrounded by agricultural lands that are both unfit for residential development and unavailable due to Asarco's bankruptcy proceedings.

To date, Asarco has expended an estimated \$80 million to \$90 million at East Helena in response to cleanup requirements under Superfund authorities. Remaining Superfund cleanup requirements and additional corrective action requirements, under separate state and federal Resource Conservation and Recovery Act (RCRA) authorities, will add an estimated \$40 million to \$50 million to overall site cleanup costs.

Our presentation highlights 20 years of study and cleanup actions taken at the East Helena Superfund Site. We consider the questions: Where did all the money go and is there measurable benefit? We offer solutions to some of the more perplexing problems, which have frustrated past efforts to render the community and its surrounding environment safe. Both traditional and innovative strategies were put to the test. The innovations are not without controversy.

## **Discussion**

The East Helena Superfund Site is a lead site. It became a national priority because of concerns over children's exposures to lead. Some 18 to 20 other elements were deposited over the landscape during the lifetime of the smelter and its ancillary operations, including Cd, Cu, Hg, Zn, and As. Moreover, uncontrolled S emissions worsened the mobility and bio-availability of most metals by acidification of downwind soils. Thus, the environment also suffered significant impact.

Although Pb is the contaminant of principal concern here, remedies aimed at reducing children's exposures to Pb have reduced risks associated with the other heavy metals and As. Whereas a young child's exposure to lead in East Helena might have resulted in unacceptable levels of risk within just months of exposure, exposures to the other elements would likely require several years or decades—if at all--to raise risk levels above a threshold of concern.

Although concern for ecological risks has taken a back seat to concern for human health risks at East Helena, by reducing and managing human health risks, we have created opportunities for achieving significant benefit for the affected environment and ecological receptors. We plan to discuss efforts—successful as well as unsuccessful efforts—aimed at:

- Understanding the nature and extent of contamination (site characterization);

Early characterization studies were designed to establish liability and effect. Soil metals data were kriged, which was an innovative application for a Superfund site. Subsequent, statistics-based soil characterization studies were conducted to support—or refute—decisions regarding outer limits of contamination requiring action.

- Overcoming variability (variable nature of lead deposition);

The highly variable nature of emissions deposition and redistribution necessitated uncommon solutions. For protection of human health, biases in sampling approach were developed. For reclamation of impacted lands, nontraditional methods were explored, often to the early dismay of “traditionalists.”

- Undertaking early cleanup actions.

- Lowering children’s exposures to lead.

- Establishing an effective lead education and abatement program.

These three aspects go hand-in-hand with one another. Our efforts toward meeting these three vital objectives developed together. Children’s blood-lead levels—our measure of success—dropped significantly. But, disagreements over what constitutes a final, protective lead cleanup action level, and whether or not arsenic in soils is a lingering concern here, hamper efforts to “finish up” and declare East Helena residential areas safe for families.

- Land-applying residential cleanup spoils and simultaneously reclaiming severely contaminated agricultural lands;

Several hundreds of acres of barren landscape were reclaimed by deep-tillage and incorporation of lime, followed by land application of spoils from the yard cleanup. This practice continues and the results are impressive, albeit quite controversial.

- Developing other innovative, cost-effective methods of reclaiming and revitalizing impacted lands.

Examples will be presented, including a proposal for near-future reclamation of approximately 300 acres of contaminated agricultural land that, if the proposal goes forward, would enable East Helena to expand into new residential and commercial developments.