NEW METHODS OF CLESNING UP HEAVY METALS IN SOILS

A.I. Shapoval, *postgraduate student*

There are several options for treating or cleaning up soils contaminated with heavy metals. This paper discusses three of those methods.

At many sites around the world heavy metals have been mined, smelted, or used in other industrial processes. The waste has sometimes been left behind to pollute surface and ground water. The heavy metals most frequently encountered in this waste. They typically are spread out over former industrial sites and may cover huge territories.

Heavy metal contamination can be carried with soil particles swept away from the initial areas of pollution by wind and rain. Once these soil particles have settled, the heavy metals may spread into the surroundings, polluting new areas. Remediation technologies available for reducing the harmful effects at heavy metal-contaminated sites include: excavation (physical removal of the contaminated material), stabilization of the metals in the soil on site, and the use of growing plants to stop the spread of contamination or to extract the metals from the soil (phytoremediation).

Excavation and physical removal of the soil is perhaps the oldest remediation method for contaminated soil. Advantages of excavation include the complete removal of the contaminants and the relatively rapid cleanup of a contaminated site. Disadvantages include the fact that the contaminants are simply moved to a different place, where they must be monitored; the risk of spreading contaminated soil and dust particles during removal and transport of contaminated soil; and the relatively high cost. (see Table 1) Excavation can be the most expensive option when large amounts of soil must be removed.

Table1. Comparative costs for different types of heavy metal soil remediation.

Type of Remediation	Cost/cubic	Time
Excavation and removal	$100-$400	6-9 months
In situ fixation	$90-$200	6-9 months
Phytoextraction	$15-$40	18-60 months

Heavy metals can be left on site and treated in a way that reduces or eliminates their ability of adversely affect for human health and the environment. This process is sometimes called stabilization. Eliminating

the bioavailability of heavy metals on site has many advantages over excavation. One way of stabilizing heavy metals consists of adding chemicals to the soil that cause the formation of minerals that contain the heavy metals in a form that is not easily absorbed by plants, animals, or people. This method is called in situ (in place) fixation or stabilization. This process does not disrupt the environment or generate hazardous wastes. Instead, the heavy metal combines with the added chemical to create a less toxic compound. The heavy metal remains in the soil, but in a form that is much less harmful. Adding definite fertilizer to soil create insoluble minerals. This means the new minerals cannot dissolve easily in water. This has two beneficial effects. The minerals (and the heavy metals) cannot be easily spread by water to pollute streams, lakes, or other groundwater. Table 1 shows the cost of treating the soil by *in situ* fixation may be about half the cost of excavation and disposal of heavy metal contaminated soil. This method is relatively rapid and takes about the same amount of time as excavation.

Growing plants can help contain or reduce heavy metal pollution. This is often called *phytoremediation.* It has the advantage of relatively low cost and wide public acceptance. It can be less than a quarter of the cost of excavation or *in situ* fixation. Phytoremediation has the disadvantage of taking longer to accomplish than other treatment. The plants are used to reduce wind and water erosion that spread materials containing heavy metals (phytostabilization). Another way plants can be used to clean up heavy-metal contaminated soil is called phytoextraction. The list of plants that may be used for phytoextraction include alfalfa cabbage, tall fescue, juniper, and poplar trees.

Another way plants are used to treat heavy metal contamination is called rhizofiltration. In this method heavy metals are removed directly from water by plant roots. For example, sunflowers were used to remove radioactive metals from sandy soil at Chernobyl.

The expensive process of excavating and disposing contaminated soil has been augmented with new methods that treat the soil in place. In situ fixation is less disruptive to people's lives and to the environment compared to excavating. Phytoremediation uses plants by several methods to contain or clean up heavy metals. Phytoremediation has great benefit of being relatively low-cost, natural solution to an environmental problem.

A.M. Dyadechko, *ELA*