A Review of Chemical Treatment Methods for Soil and Groundwater containing Arsenic and Chromium

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Background/Objectives.
Treatment of soil and groundwater contaminated with a mixture of heavy metals can be challenging because the mechanisms operative in adsorption, precipitation, and coprecipitation of these target compounds are complex and vary widely. For example, an alkaline reduction treatment that effectively removes soluble chromium may simultaneously increase the solubility of arsenic. The mechanisms involved in treatment of heavy metals using reagents based on (a) alkalinity, (b) sulfide, and (c) iron will be reviewed from the perspective of metals present and site conditions. Performance data from both bench-scale testing and field-scale treatment using these three approaches will be presented and discussed. The objective is to review, compare, and contrast various treatment approaches for specific site conditions using both target compound geochemistry and data from published field-scale applications.

Approach/Activities.
The mechanisms involved in conversion of common heavy metals from their soluble forms to insoluble forms during treatment with alkaline, sulfide, and iron based reagents will be reviewed with emphasis on the solubility, pH range stability, mineralogy, and other characteristics of the products formed (i.e., heavy metal hydroxides, sulfides, iron sulfides, iron oxyhydroxides, carbonates). The findings of both academic and applied research will be discussed from an environmental remediation perspective. The influence of soil/groundwater variables such as native concentrations of iron and sulfate as well as pH and redox status. Regulatory issues and the potential impact of future land use will also be considered.

Results/Lessons Learned.
Treatment approaches for heavy metals should be selected on the basis of several factors including the chemistry of the metals to be treated, the geochemistry and biochemistry of the environment in which the metals reside, the regulatory framework that must be satisfied, and potential changes in land use.