HEAVY METAL STABILIZATION

Heavy metal contamination is one the most common forms of pollution found in and around industrial sites, landfills, abandoned mining operations, and municipal and agricultural outfalls. In addition, heavy metals are used in a variety of industrial processes such as steel production, metal plating and anodizing, automobile and aircraft manufacturing, and general metal fabrication, just to name a few. Ultimately, all heavy metal wastes exceeding strict EPA environmental standards require adequate toxicity reduction and proper disposal.

Custom Designed Treatment

There are thousands of documented contaminated sites throughout the US and over 1.3 millions tons of reportable metal bearing process wastes generated every year. Each situation is unique having different physical and toxic characteristics. As such, there is also no one single treatment process or method (magic bean) to address every waste or site situation. However, with expertise in site remediation and years of chemical treatment experience, SCE, in a teaming arrangements with ADT Environmental, LLC, has created a diverse array of effective treatment methods custom designed to achieve desired results for each unique situation.

For example, this versatility allows a mixed waste stream containing a combination of TCLP metals such as lead, chrome and arsenic to be reduced simultaneously. Customized treatment reagents formulated to address specific metals can be added to generated wastes without impacting existing in house treatment processes.

SCE's heavy metal treatment also provides the highest level of assurance in terms of heavy metal reduction consistency and longevity. SCE does not promote any one specific reagent or treatment method but produces the right combination of reagents demonstrated most effective for each waste.

Whether involving phosphate or sulfate based additives, metal valiance reducing reagents, or simple pozzolonic based materials, SCE's heavy metal treatment capabilities lend for increased flexibility in addressing waste handling and disposal.

Our products closely resemble untreated material in most cases with little volume increase and minimal increase in mass (i.e. <10%). The treated materials may be land filled as a special waste or interred onsite. Since decontamination wastewaters can be used to dilute the proprietary reagent(s), no waste streams are generated. SCE does not form monoliths. Therefore, the technology can be

applied by using ex-situ or in-situ methods.

Benefits of SCE's Heavy Metals Treatment Process:

- Cost-Effective
- Irreversible Mineral Products
- Reacts Immediately
- NO Volume Increase
- Minimal Mass Increase
- Applicable to all Matrix Types
- National and State Regulatory Acceptance
- Conforms with OSHA Requirements and USEPA ARAR's
- Field Proven
- Long-term Product Stability
- Remains Soil-like After Treatment
- Practical Field Application
- Applicable to All RCRA Metals

The SCE process may be used alone or incorporated into a train of processes that treat organics or other metals. Organics contaminants do not interfere with SCE's ability to form complexed mineral and other compounds with heavy metal contaminants. Among the types of material successfully treated by this technology are:

- Paint chips and abrasives
- Sediments
- Sludge's
- Filter and centrifuge cake
- Smelter slag
- Matte/Dross
- Soils-clay, sand, gravel, silt and various mixtures thereof
- Peat
- Battery casings
- Aqueous waste streams
- Glass (coated and impregnated)
- Wire chop and installation fluff
- Shooting/Skeet Range Soils
- Construction debris and other Oversized material

The reagents can be blended both in-situ and ex-situ. Ex-situ treatment can allow for greater control under some conditions. Ex-situ treatment has been successfully applied to wastes amounting to only a few drums up to projects requiring very large volumes of treatment at a production rate of up to 2,000 tons per day. The system may be modified to comply with RCRA regulations on closed/contained and tank treatment systems.

Several in-situ processing techniques are available depending on topography and near surface soil conditions. Projects range from little as 300 yd3 treated to a depth of one foot to very large projects at greater depths. Current capabilities now allow treatment to take place at much greater depths and in some cases under water tables. In-situ treatment at voluntary remediation and RCRA sites have not required a Part B RCRA treatment permit and have allowed clients to

significantly expedite regulator approval for onsite treatment when the alternative was excavation and offsite disposal as hazardous waste.

Cost of SCE's treatment is low to moderate. Cost-effectiveness will depend on a number of site-specific factors. These include:

- Treatability studies and determination of reagent dosage requirements
- Physical handling characteristics of contaminated material
- Treatment system sizing and material variability
- Ease of site access
- Transportation and disposal costs for treated material
- Site support requirements
- Waste quantities (economy of scale)
- Ancillary site tasks additional to treatment

Management Solutions for Heavy Metal Waste Treatment

*The **SCE** product line offers highly effective, proprietary treatment chemistries that render inorganic waste streams non-hazardous by controlling the solubility of the targeted metals across a broad range of disposal environments.*

SCE's chemicals are designed to combine with the targeted metals to produce insoluble compounds that do not leach when subjected to the Toxicity Characteristic Leaching Procedure (TLCP) or other alternative leaching tests, such as the Synthetic Precipitation Leaching Procedure (SPLP), Multiple Extraction Procedure (MEP) or others.

The technology has been proven in both industrial and commercial applications nationwide, including:

- Foundry operations (i.e. iron, steel, aluminum, brass, copper)
- Battery manufacturing and recycling
- Primary and secondary smelting
- Scrap processing and recycling
- Federal and state Superfund sites - soil remediation
- RCRA soil/sludge clean-up actions
- Use in permitted TSDFs (Transport, Storage and Disposal Facilities)
- Treating EPA-listed K061 steel mill waste (electric arc furnace dust)
- Incinerator ash stabilization
- Mine tailings and leachate treatment

How does SCE's treatment methodology compare to conventional stabilization and other methods using chemical additives?

1) SCE's heavy metal treatment technology is not tied to any one treatment product, methodology or means of application and therefore is not restricted to one or two heavy metals or specific site conditions. SCE's technology can be applied in a variety of ways under most site conditions addressing one, or a combination of heavy metal contaminates. Organic or inorganic constituents in soil and other media, including petroleum do not effect SCE's treatment. It also works in a wide range of pH conditions and is permanent.

2) Additives or reagents applied using SCE's technology adds marginal volumes, (1%- 5%), to the final waste volume as opposed to standard means (30%-50%). This reduces on site set up, space requirements and equipment cost, not to mention the significant reduction in off site transportation and disposal fees

3) SCE's technology is safe, simple and regulatory complaint while converting toxic heavy metals into a safer, naturally occurring state. SCE successfully performed field treatment for TCLP arsenic and chrome at one of the most regulatory restrictive sites in the Northwest. SCE's technology has been demonstrated at a number of EPA test sites and has been accepted in the US Navy's BBA program as a viable technology option for military site clean ups.

4) SCE provides substantial cost reduction opportunities saving between 30 and 60 percent over conventional stabilization costs. SCE conducts extensive laboratory testing on every waste stream prior to application in the field to provide reliable results the first time around.

5) SCE's treatment technology can meet or exceed strict EPA land disposal restrictions in the field and can interface with state and federal regulatory agencies to provide a complete, compliance oriented service package to the client.

RESULTS

	Pretreated Totals (ppm)	Treated TCLP (ppm)
Lead	9,200	ND
Cadmium	160	ND
Chrome	1900	0.11
Zinc	120,000	0.10

Process Wastes

K061 is an EPA regulated waste by-product from the primary production of steel in electric furnaces. K061 can contain a variety of heavy metals including lead, cadmium and chrome. Depending on the specific process, waste K061 may also contain elevated levels of zinc, copper, and other metals that can interfere or render pozzolonic or ion specific stabilization methods ineffective. ADT was requested to conduct treatability studies on K061 waste from a steel mill and containing high levels of lead, cadmium, chrome, and zinc. Using treatment formulations that added only 3 percent to the original waste volume, ADT successfully reduced TCLP levels to below RCRA as well as below the more stringent land disposal restrictions for all metals of concern. This on site treatment process allows for off site disposal at considerably less cost.

	Pretreated TCLP (ppm)	Treated TCLP (ppm)
Lead	57	0.15
Arsenic	25.2	<0.1
Zinc	78.9	0.72

Soil Contamination

During the 1990s, heavy metal concentrations have been identified in the Spokane River, which empties Lake Coeur d'Alene and leads to the salmon and trout spawning grounds of the Columbia River system. Following laboratory bench scale tests a stabilization method was identified for on-site confirmation of an in-situ technique that would not damage the River's banks. Specially formulated reagents were applied and testing revealing concentrations below EPA (LDR)

	Pretreated TCLP (ppm)	Treated TCLP (ppm)
Arsenic	27.8	0.13
Chrome	25.2	98.1

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ENVIRONMENTAL GROUP
WASTE IS A TERRIBLE THING TO MIND.

Waste Stockpiles and Sediments

An EPA superfund located northern California is typical of wood treating facilities that employed CCA (Copper-Chromium-Arsenate) formulations to reduce biological degradation and insect damage in structural and decorative timber. Concentrations of leachable arsenic in excess of RCRA clean up standards were identified in several areas of the plant including the upper 2- 3 feet of soil in the "drip-line" area; sediments collected in storm water settling basins and soils around and under the pressure retorts used to force treating solutions into the timber. SCE conducted on site treatment using costumed formulated bulk reagents adding less than 2 % original waste volume. Treated wastes were then permanently deposited in a specially designed cell on site.

List of Treatable Waste Streams

Heavy Metal	Media
Lead	Soils - tills, clays, fine sands, coarse sands, loam, silts, etc. Wastewater Sludge - plumbing fixture mfg., TV tube mfg. Sediments - river & lake bottoms, settling basins Mineral processing waste - tailings, media separator bottoms Battery recycling debris Primary and Secondary smelter slag Steel electromelt furnace dust (K061) Petroleum refinery sludge - K048, K051, K052, tetraethyl lead Mirror mfg. waste Target range backstop soils Automobile recycling "shredder fluff" Foundry sands Paint sandblasting debris Scrap yard soils and storm water runoff basin sediments Municipal waste incinerator ash Abrasive mfg. debris
Cadmium	Wastewater sludge - battery mfg. Wastewater sludge - printed circuit board mfg. Lead & Zinc ore processing waste Automobile "shredder" fluff
Arsenic	Soils & sediments at CCA wood treating plants Veterinary medicine formulation waste. Ash from thermal destruction of chemical weapons. K084 sludge

Zinc	Zinc ore processing waste Galvanizing process rinseate sediments
Chromium	Soil at chromium ore staging site Soil around chrome plating line. Wastewater treatment sediment at bearing mfg. Cooling tower basin sediments
Selenium	Agricultural runoff sediment Ceramic "frit" residue
Antimony	Weapons mfg wastewater sediment