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# Encapco Emulsified Treated Base Product

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## ENCAPCO EMULSIFIED TREATED BASE PRODUCT

### THE NEED

One remediation option for metal contaminated soil is to consider the use of waste containing soils to serve as aggregate for construction purposes. The resulting product should pass the requisite RPA regulatory leaching test (TCLP: Toxicity Characteristic Leaching Procedure) and be less available to receptors for environmental reasons and have suitable physical properties for construction purposes such as road base, covers, berms, and fill. The incorporation of petroleum contaminated soils into asphalt for reuse is becoming more common. The incorporation of metal contaminated soil is less common, possibly due to the fact that early process development did not use chemical stabilizers for the reduction of metal(s) leachability, relying strictly on encapsulation.

### THE TECHNOLOGY

Asphalt emulsions consist of intimate mixtures of asphalt, water and an emulsifying agent or surfactant. The physical and chemical properties of the emulsion depend on the emulsifying agent's chemical type and molecular structure. When the surfactant is mixed with asphalt and water, its molecules align with those of the asphalt and water forming an emulsion with a negative (anionic) or positive (cationic) surface charge. The presence of charged oil droplets in emulsions improves the adhesion of asphalt to aggregates compared to what occurs in asphalt concrete. The surfaces of aggregate particles carry a charge and if this charge is opposite to that of the droplets in the emulsion, a strong bond can take place.

An important objective is to make an emulsion stable enough for pumping, prolonged storage, transportation and mixing. During mixing with the contaminated soil, the emulsion coalesces and encapsulates the soil particles. Any hydrocarbons in the soil preferentially adsorb onto the asphalt surface and diffuse into the asphalt. The result is a blending of contaminant with the asphalt into an integral, stable part of the mixture that is chemically bonded. Upon curing, the emplaced product should retain the adhesive, durability and water-resistant properties of the asphalt cement from which it was produced, provided the emulsion mix was properly designed.

Encapco's organic-based asphalt emulsion is used to immobilize lead in contaminated soil. Unlike other fixation or stabilization technologies, which physically bind contaminants in the soil matrix, Encapco's emulsion is capable of chemically fixing





lead. The Encapco process employs a chemical binding reaction in addition to encapsulation to meet regulatory leaching tests. The Encapco process has been evaluated on a number of contaminated materials ranging from silty sand from a quarry site, contaminated sand from a steel mill, and a foundry sand. Marshall stability tests and leaching test have been evaluated for these contaminated materials. The following table illustrates analytical test results from a few of these sites.

**TABLE 1 ANALYTICAL TEST RESULTS**

		<b>TCLP</b>	<b>TCLP</b>	
<b>Site Location</b>	<b>Metal</b>	<b>mg/l</b>	<b>mg/l</b>	<b>Comments</b>
MacDill AFB, Fl	Pb	600.00	ND	Firing Range
Speakman Foundary, DE	Pb	13,00	ND	Foundary Sand
Vulture Mill, AZ	Pb	90.00	1.0/ND	Mine Tailings
Midvale Slag, UT	Pb	130.00	0.50	Slag Fines
	Cd	92.00	ND	
Emeryville Chemical, CA	Pb	0.96	ND	Contaminated Soil
	As	2.70	ND	
	Zn	44.00	ND	

## THE BENEFITS

Encapco's emulsion can be used to clean up soils that are contaminated primarily with lead, such as soil found at abandoned rifle ranges.

- Can be used as road base, general fill, and for a variety of other construction purposes.
- Avoiding the high cost of disposal of contaminated soil in a hazardous waste landfill.
- Providing a valuable material for use in construction.
- Can be used to clean up soils that are contaminated primarily with lead, such as soil found at abandoned rifle ranges.

## STATUS

Asphalt encapsulation technology is now being evaluated for construction purposes. Waste metal contaminated materials may be recycled as aggregate for construction purposes, if chemical reactions reduce metal mobility and adequate physical properties are developed. An engineering approach to achieve mobility reduction and physical properties is available. The treated soil, which Encapco calls



emulsified treated base, passes the TCLP criterion for lead and can be used as road base, general fill, and for a variety of other construction purposes.

## **BARRIERS**

- WHEN RECYCLING METALS CONTAMINATED SOIL FOR USE AS A STRUCTURAL MATERIAL, THE STRUCTURAL CAPABILITIES OF THE SOILS MUST BE EVALUATED WHILE AT THE SAME TIME TREATING THE METALS CONTAMINATION.
- LARGE CHUNKS OF LEAD SHOULD BE REMOVED FROM THE SOIL PRIOR TO TREATMENT WITH THE EMULSION. THE EMULSIFIED TREATED BASE IS TESTED TO ENSURE COMPLIANCE WITH TCLP LIMITS.
- IN ANY APPLICATION OF ASPHALT TECHNOLOGY A SITE-SPECIFIC ENGINEERING EVALUATION MUST BE UNDERTAKEN.

## **POINT OF CONTACT**

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2. Civil Engineering Research Foundation (CERF), Environmental Technology Evaluation Center (EvTEC), <http://www.cerf.org/evtec/eval/encapco.htm>

## **REVIEWERS**

Peer reviewed as an emerging construction technology

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