

SOLUCORP

INDUSTRIES

MBS® **(MOLECULAR BONDING SYSTEM)** **PROCESS DESCRIPTION**

MBS® is an EPA "SITE" (Superfund Innovative Technology Evaluation) Program accepted technology. It has been designed to stabilize a variety of media contaminated with heavy metals in a superior and cost effective manner. The process employs a proprietary mixture of non-hazardous chemicals which convert the heavy metal contaminants from their existing reactive and leachable form (usually oxides) into an insoluble, stable, non-hazardous metallic sulfide compound that will achieve TCLP levels far below regulatory limits. In addition to the TCLP test, MBS has passed other regulatory testing methods such as SPLP, SWEP, CAL WET and MEP.

MBS operations may be completed either in-situ or ex-situ using standardized mixing equipment. MBS mixing systems can easily be installed in a manufacturing line to stabilize a hazardous heavy metal waste and have it reclassified as non-hazardous. This means a safer facility with lower insurance, compliance, training and disposal costs.

Unlike competitive heavy metal technologies, MBS is not pH dependent. This insures the solubility of the treated metal(s) is not significantly altered by the addition of acids or caustics to the media. MBS has been designed (and proven successful in commercial-scale applications) for wastes classified as D004 through D011, as well as K-listed wastes. Furthermore, its ability to chemically transform the hazardous contaminants into a non-hazardous compound provides a unique, cost effective and permanent solution to the treatment of heavy metals. MBS treated material has been subjected to the Multiple Extraction Procedure (MEP) test that is designed to measure the long term stability of a treated waste. In every instance, MBS passed this test, which according to EPA protocol, proves MBS treated material will not leach for 1,000 years.

As depicted in the attached process flow diagram, the MBS treatment process is completely mobile and easily transportable to allow for on-site treatment. Processing rates range from 25 tons per hour to in excess of 500 tons per hour. Waste material is screened and crushed to reduce particle size to an average 2" diameter. The waste media is then mixed with MBS powdered reagents in a closed hopper pugmill system (the reagent mixture is established through treatability studies for the site specific conditions). Water is then added to catalyze the reaction and to ensure homogeneous mixing. The treated media is then conveyed to a stockpile.

Volume change is usually only 2% - 3% with volume reduction also possible. Unlike other heavy metal treatment processes, there is no curing time or change in the physical characteristics of a treated waste. Solucorp's fully enclosed pugmill is provided with a negative pressure system which pulls the exhaust vapors through a regenerable wet scrubber prior to discharge to the atmosphere. The treated media can then be either returned to the original site or disposed in a Subtitle D landfill. MBS has also been approved for beneficial reuse in a landfill as cover, fill or contouring material.

PROCESS RESULTS

The MBS process underwent extensive bench and pilot scale testing prior to its successful full-scale commercialization, where the same dramatic reductions in the TCLP levels of hazardous contaminants achieved in the laboratory were achieved in the field. Table 1-1 outlines results obtained from several recent commercial projects.

Table 1-1 Commercial Project Summary

LOCATION	CONNECTICUT	NEW YORK	CANADA	MASS	SCOTLAND	MISSOURI
WASTE TYPE	Lead & Cadmium Contaminated Soil With Elevated Levels Of Zinc And Copper	Lead Contaminated Soil	Lead, Cadmium And Zinc Contaminated Soil	Lead Contaminated Soil	Chromium Contaminated Soil	Lead Contaminated Slag
SOURCE OF POLLUTION	Brass Manufacturer	Lead Paint Chips	Steel Production	Skeet Shooting Range	Metal Plating	Lead Smelting
PRE-TCLP	Lead 33 mg/l Cadmium 6 mg/l	Lead 66 mg/l	Lead 188 mg/l Cadmium 3.78 mg/l Zinc 1300 mg/l	Lead 34 mg/l	Tri Chrome 111 mg/l Hex Chrome 100 mg/l	Lead 5 mg/l - 600 mg/l
POST TCLP ⁽¹⁾	Lead 0.10 mg/l Cadmium <0.01 mg/l	Lead 0.34 mg/l	Lead 0.9 mg/l Cadmium 0.29 mg/l Zinc 128 mg/l	Lead <0.1 mg/l	Tri Chrome <0.03 mg/l Hex Chrome <0.02 mg/l	Lead <0.50 mg/l
REGULATORY LIMIT	Lead 5.0 mg/l Cadmium 1 mg/l	Lead 5.0 mg/l	Lead 5.0 mg/l Cadmium 1.0 mg/l Zinc 500 mg/l	Lead 5.0 mg/l	Tri Chrome 5.0 mg/l Hex Chrome 5.0 mg/l	Lead 5.0 mg/l
VOLUME ADDITION	1.6%	1.85%	3.4%	1.75%	7.5% (Including Reduction)	2.8%

(1) Analysis conducted daily by independent, state certified laboratories.

COMPARISON WITH OTHER TREATMENT TECHNOLOGIES

The *MBS* process is the most effective system to chemically alter the form of heavy metal contaminants into a non-hazardous, stable compound. Conventional solidification or stabilization methods require the addition of large volumes of reagents (e.g. cement, CKD, lime or silicate-based additives) to the treated waste which significantly increases off-site transportation and disposal costs. If increases in compressive strength or reductions in permeability are desired, *MBS* is completely compatible with cement or bentonite.

In summary, due to the inherent process simplicity of *MBS* combined with its modular/ transportable design and fully enclosed operational system (preventing the release of contaminants or secondary wastes), one will obtain lower operating costs, enhanced safety and reduced emissions/secondary wastes. Table 1-2 provides a comparison of various remediation technologies to the *MBS* process. As demonstrated, *MBS* is far superior to other remediation technologies in every category including long term stability. Its inherent ability to transform hazardous contaminants into a non-hazardous, insoluble compound can facilitate on-site disposal as well as reduce the owner's future liability.

When off-site disposal is called for, *MBS* results in much lower T&D costs since the treatment process does not require the addition of large volumes of reagents. Table 1-3 demonstrates a comparison of the costs advantages of using *MBS* versus landfill disposal

Table 1-2 Remediation Technology Comparison Matrix

VARIABLE	MBS PROCESS	LIME/PORTLAND CEMENT/CKD
CHEMISTRY	Chemical reagents are combined with metals to form an insoluble metallic sulfide compound which prevents leaching in the TCLP test and in the natural environment.	Chemical additives neutralize the acid in the TCLP test (or in an acidic disposal environment) to produce a final pH that is near the minimum solubility for the metal concerned.
CHEMICAL COST	Chemical expense is usually lower due to low chemical dose.	Chemical expense usually high due to high dosage requirements.
VOLUME/BULKING	<2% volume change.	Typically 15% - 30% or more increase in bulk.
MATERIALS HANDLING	No physical change in soil characteristics; low volume addition improves production thus shortening project duration. No curing time.	High bulking factor increases material handling which decreases production rate resulting in a longer project duration. Curing time necessary.
TRANSPORTATION AND DISPOSAL	Lower transportation and disposal cost due to less material to be transported and disposed.	High transportation and disposal cost due to significant increase in treated material.
TOTAL COST	Saving of up to 50% or more are feasible.	Higher costs due to chemicals, material handling, volume increases, transportation and disposal expenses.

Table 1-3 Comparison of MBS versus Hazardous Landfill

ELEMENT	MBS	HAZARDOUS LANDFILL	VARIANCE
Stabilization Cost 10,000 Tons Processing @ \$35/Ton	\$350,000	-0-	[\$350,000]
Transportation and Disposal			
Total Product Weight	10,200	10,000	[200 Tons]
Transportation and Disposal	\$45/Ton	\$150/Ton	\$105/Ton
Total T & D Cost	\$459,000	\$1,500,000	\$1,041,000
Total Stabilization and T&D Cost	\$809,000	\$1,500,000	\$691,000 46.1%

MBS® REMEDIATION PROCESS

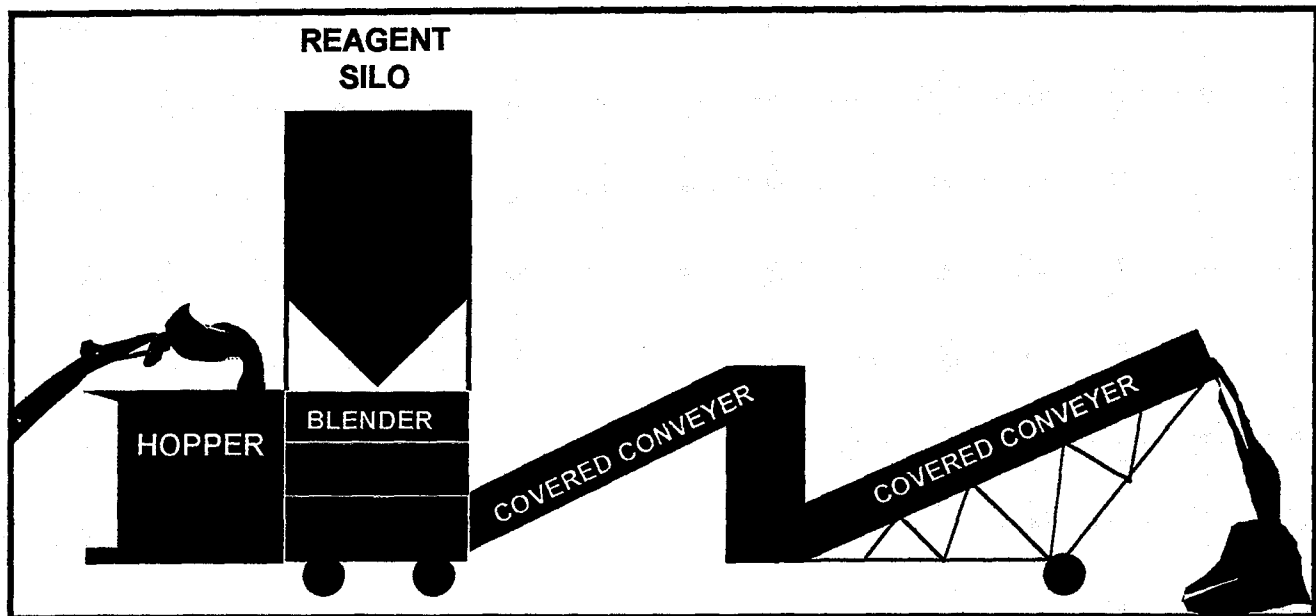


Illustration 1. MBS® On-Site Flow Chart

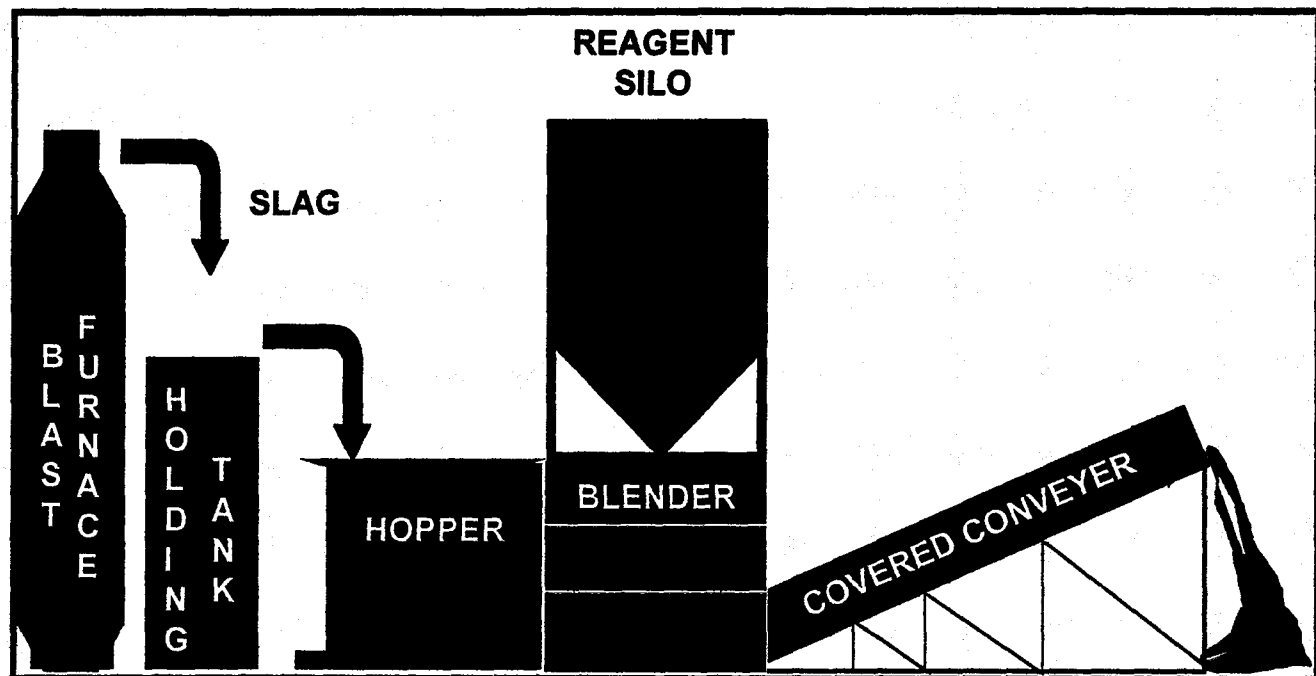


Illustration 2. MBS® In-Line Flow Chart