



A Division of  
IMPACT Services, Inc.

## **HAZARDOUS WASTE SOLIDIFICATION/STABILIZATION PRODUCTS**

- o What They Can Do
  - o What They Are
    - o How They Are Applied
      - o How They Perform

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### **WHAT THEY CAN DO**

Fluid Tech products can solidify almost any waste – liquids, sludges, soils, dry solids, or suspensions. At the same time, they can chemically stabilize heavy metals and many organic compounds in the waste to meet EPA Land Disposal Restrictions (LDR's, 40 CFR 268).

They offer, to the user, four principal advantages over traditional cement/pozzolan methods:

#### 1. Low Volume/ Weight Expansion

Solidification of wastes which are to be land-disposed, or stored after treatment, expands both the volume and the weight of the waste. The degree of expansion will have a direct effect on the dollar cost of final disposal, as well as on the cost of transportation to the disposal site.

For any given degree of stabilization, as measured by the EPA's TCLP, our product technologies will result in much lower expansion than those processes which are primarily based on cement and/or pozzolans. Typical volume expansion coefficients with our stabilizers will run between 1.05 and 1.35. For cement/pozzolan stabilizers, the coefficients will run between 1.50 and 2.50.

A recent example is a barium-contaminated sludge which, if treated with Portland cement, required 1.5 tons of Portland cement per ton of sludge to drop its barium TCLP leachability from 1600 mg/l to 30 mg/l. This would have produced a volume expansion factor of 2.50, or an addition of 150% in volume.

Treatment with our product was accomplished by the addition of only 0.2 tons of stabilizer per ton of sludge, and resulted in a barium TCLP reading of only 0.36 mg/l, and an expansion factor of only 1.2. This sludge was in two ponds, and was treated in-situ with Fluid Tech products.

2. Simultaneous Stabilization of Both Inorganic (Heavy Metal) and Organic Toxins

Wastes (soils in particular) often contain both heavy metals and toxic organic compounds. Cement-based stabilization can capture the heavy metals, but will not stabilize organic toxins. A separate operation would thus be required (such as thermal treatment) to deal with the organics.

With Fluid Tech products, both the metals and the organics often can simultaneously be stabilized in a single treatment. The accompanying data sheets show some examples.

3. Low Temperature Rise in Mixing

Cement and pozzolan reactions are strongly exothermic, and can cause the volatile and semi-volatile organic components of a waste to be “cooked-out” into the atmosphere during the mixing process. Fluid Tech product reactions are, in contrast, almost totally non-exothermic.

A recent test run by Dr. Neville Kingham of Kiber Associates in Atlanta on a typical PC/Pozzolan mix with soil showed a net temperature rise of about 26°C (start of 22°C, finish at 48°C). In this test, Dr. Kingham was particularly looking into VOC release, and found that the measured VOC discharge was substantial.

Using the same waste, (a badly contaminated soil), and the same mixing procedures, but with a Fluid Tech blend of stabilizers, the temperature rise was less than 3°C. VOC kickout was correspondingly reduced.

**WHAT THEY ARE**

The several Fluid Tech products are each based upon one of more carefully selected and purified clays. Certain of these clays are chemically modified for specific tasks, and may also be premixed with other components to achieve specific goals. Most applications can be completed with one of these products. In some cases, two or more Fluid Tech products may be either premixed or applied in sequence.

Most Fluid Tech products are dry powders which are to be mixed with the waste being treated. Two are granular, and when used with clear, aqueous waste, do not require mixing.

**PRODUCT DESCRIPTIONS**

LIQUI-SET®  
CHEM-BOND®  
CHEM-BOND® II

LIQUI-BOND®  
LIQUI-BOND® II  
PETRO-LOCK®

They are slightly alkaline, non-flammable, non-reactive and non-corrosive, and are not biodegradable.

These reagents immobilize wastes (liquid, sludge, or solid) through the action of complex bonding mechanisms and ion exchange reactions. The end result is a homogeneous solid with excellent leach resistance

## **LIQUI-SET**

Liqui-Set is a water-activated, granular solidification/stabilization agent used for treatment of aqueous liquids containing small amounts of dissolved and suspended solids, detergents, chelating agents, resins, and up to 5% oils. Liqui-Set does not require stirring, and is utilized by simple addition to the aqueous liquid waste. Typically, 100 to 150 pounds of Liqui-Set are required to solidify 45 to 48 gallons of liquid waste in a 55-gallon drum.

## **LIQUI-BOND, LIQUI-BOND II**

Liqui-Bond is chemically similar to granular Liqui-Set, but instead is a finely-divided powder. Its application requires power mixing, either with an impeller (drum mixing) or a ribbon-blender or pugmill (continuous or bulk mixing). It thus can be used to treat wastes with high solids content, including heavy sludges. With the addition of water, dry solid wastes can be successfully treated to meet TCLP leach-resistance standards.

## **CHEM-BOND, CHEM-BOND II**

Chem-Bond is a powdered solidification/stabilization agent used either alone or in combination with Liqui-Bond or Petro-Lock. Chem-Bond finds its greatest utility in the solidification/stabilization of aqueous solutions very high in dissolved solids, such as neutralized acids and bases, and those organic liquids that are water soluble or miscible. Examples of organic liquids in this category include alcohols, glycols and low molecular weight ketones. Mixtures of Chem-Bond and Petro-Lock are ideal when the above liquids are present in combination with oils and/or greases. Use of Chem-Bond requires power mixing equipment. Chem-Bond can also be used to treat sludges and soils contaminated with metals and/or water soluble or miscible organics, since it can stabilize heavy metals.

## **PETRO-LOCK**

Petro-Lock is a finely ground solidification/stabilization agent for organic compounds. It is used in the treatment of wastes some or all of whose liquid components are not water-miscible (such as oils). Treatment of wastes which have both water-miscible and water immiscible components is accomplished through the use of a combination of Petro-Lock with Liqui-Bond, or Petro-Lock with Chem-Bond.

Petro-Lock, used alone, will not solidify nor chemically stabilize the aqueous phases of waste. With the addition of Chem-Bond or Liqui-Bond as described above, heavy metal contaminants in the aqueous phase of a two-phase waste will be chemically stabilized simultaneously with the organic components. Power mixing is required.

## **CURING**

With two exceptions (Liqui-Bond II and Chem-Bond II) Fluid Tech solidifiers/stabilizers cure to a stiff putty-like consistency during mixing, depending upon the nature of the raw waste and its matrix, and the loading rate used.

Liqui-Bond II and Chem-Bond II are chemically equivalent to their respective namesakes. They differ in that they cure more slowly (48 to 96 hours), and result in a hard end product. Again depending on the makeup of the raw waste, and the reagent loading rate, typical 28-day Penetrometer readings will be well over 3.6 tons per square foot (50 PSI).

## **MIXING**

With the exception of Liqui-Set, which is a granular product designed for use on predominantly clear liquid wastes with negligible solids, all of the Fluid Tech products are finely-divided powders (200 mesh). Good dispersion of the stabilizer material within the waste matrix is essential to ensure that there are no "islands" of untreated waste. Since these materials begin to "catch" or clot the waste rather quickly, good shear action is desirable to break down over-treated clots, and to achieve good dispersion.

In drums, a simple four-blade impeller, slightly smaller in OD than the ID of the drum, works well. Means should be provided to raise and lower the impeller during mixing. Bulk mixing can be done in a ribbon blender, pugmill, or similar apparatus.

In-situ treatment of soils and sludges can be accomplished with backhoes, rotary tillers, augers, or other equipment.

## **SUMMARY**

These brief product descriptions are presented as general guidelines in the use of Fluid Tech stabilization media. Because of nearly endless waste varieties, determination of a waste-specific media recipe is essential to achieve optimum balance of efficiency and economy. The amount of solidifiers required for a given waste will vary with the type and concentration of contaminants present, as well as the character of the matrix.

## TYPICAL HAZARDOUS WASTE APPLICATIONS

### FLUID TECH PRODUCTS

Waste Matrix	Contaminants	Fluid Tech Stabilizers	Nominal Loading Rate	Notes
Soil, sludge, or solids	Water-soluble inorganics, heavy metals, etc.	Liqui-Bond or Liqui-Bond II	See Notes	Added water may be needed to facilitate mixing and reagent dispersion. Nominal stabilizer loading rate is 35% (by weight) of total water in the soil or sludge.
Soil or sludge, or solids	Above, plus water-miscible organics	Chem-Bond or Chem-Bond II	See Notes	Same as above
Soil or sludge, oil plus water	Petroleum, plus other organics, plus heavy metals in aqueous phase	Petro-Lock, plus Liqui-Bond or Chem-Bond	See Notes	Same as above, plus Petro-Lock at 25% (by weight) of total oil in sample.
Aqueous Liquid	Inorganics; total dissolved solids < 5%	Liqui-Bond or Liqui-Bond II	3 to 5 #/g	---
Aqueous Liquid	Total dissolved solids > 5%; water-miscible organics and inorganics	Chem-Bond or Chem-Bond II	3 to 6 #/g	---
Oils, solvents	Organics	Petro-Lock	2 to 3 #/g	---
Oil/Water Mixtures	Heavy metals, organics, inorganics	Petro-Lock plus Chem-Bond or Liqui-Bond	See Notes	Use 2 to 3 lbs of Petro-Lock per gallon of oil in mixture, plus 3 to 4 lbs. of either Liqui-Bond or Chem-Bond per gallon of water in mixture.

## PARTIAL LIST OF CUSTOMERS

Aeroject Compton Laboratory	LLNL Los Alamos National
Aeroject Heavy Metals	Layne Environmental
Aerojet Nevada	Lab Safety Supply
Aeroject Ordnance TN	Mason & Hanger, Silas Mason Co.
Allied Technology Group	Mid-American Aerospace
American Bank of Commerce	Nebraska Public Power
Arizona Nuclear Power	Nuclear Fuel Services
Arkansas Power Company	Pacific Nuclear
Atomic Energy of Canada, Ltd.	Portland General Electric
AWC Nuclear Services	Quadrex Corp, Oak Ridge, TN
Babcock & Wilcox Co.	Reynolds Electric/Engineering Co.
Baltimore Gas & Electric Co.	Rockwell International
BHP-Utah International, Ltd.	Salem Nuclear Power Station
Calcomp Graphics Division	Sandia Laboratories
Calloway Nuclear Plant	Scripps Clinic
Ciba Corning Diagnostics	Spears Manufacturing
Clinton Power Station	Southwest Hazmat Control
Combustion Engineering	SynerGen
Commonwealth Edison – Dresden Power Plant	3M Corporation
CyanoKem	TVA
Duane Arnold Energy Center	Teollisuude Voima OY-Finland
EG&G Idaho	Thomas Gray Associates
EG&G Rocky Flats	Three Mile Island Power Co.
EG&G Nevada	Trinity Chemical Company
Engineering Sciences, Inc.	USPCI
Environmental Waste Enterprises	U.S. Army – Fort Irwin, CA NTC
Ethyl Corporation	U.S. Bureau of Reclamation
Ford Motor Company	U.S. Bureau of Ecology, Inc.
General Electric – Space Systems Division	University of Arizona
Great Lakes Chemical Corporation	University of California
Ground Exploration	University of Kansas
ICN Biomedicals	University of Oregon
INEL Idaho National Engineering Laboratory	Ventura Petroleum Services
Iowa Electric Light & Power	Washington Public Power System
J.A. Jones Construction Co.	WasteMaster, Inc.
Koppers Company	Wolf Creek Nuclear Station
LANL Lawrence Livermore National Laboratory	