



*Omnia subiecta sunt naturae.*

### **Hazardous waste fixation and solidification EnviroMix®**

Solidification offered by Ecotech Poland is an internationally recognized technology which delivers outstanding performance for the chemical fixation and stabilization of hazardous wastes.

The technology has been applied to the treatment of a range of inorganic, organic and mixed wastes as either dry materials or sludges. These wastes have come from a number of sources, such as industrial or mining wastes, or soils and sludges resulting from the remediation of contaminated sites.

Chemical fixation and solidification (CFS) technologies are a well-established method for the stabilization of hazardous wastes. To date, an array of CFS technologies have been utilized for the immobilization of a variety of organic and inorganic compounds. Solidification process offers a highly effective solution to a broad range of hazardous waste problems, through individual optimization for specific waste materials, the technology is widely applicable to both inorganic and organic contaminants, and particularly to complex hazardous wastes containing multiple and different contaminant types.

CFS technology offered by Ecotech Poland immobilize with high efficiency pollution generated by heavy metals, TPH, PAH.

#### **Process stages**

Stage 1. Identification and evaluation of contamination type and level at given site. Part of this stage are physical and chemical analysis of waste to be treated. Analytical part and reporting will be committed to certified laboratory.

Stage 2. Analysis of data collected from the lab. Establishment of the most efficient way of waste treatment. Cost estimation and technical issues solving.

Stage 3. Reception of wastes from the site. If necessary - after prior preliminary works.

Stage 4. Waste logistics based on ADR vehicles from the site to the treatment plant.

Stage 5. Temporary storage of waste in the treatment plant. Storage includes selection of waste depending on type of waste and level of contamination.

Stage 6. Waste treatment realized via mixing of waste and binding substances in controlled environment. Process is operated automatically by computer. Description of equipment used for this process is presented later in this document.

Stage 7. Temporary storage of treated waste. At this stage waste has to be exposed on contact with atmospheric air in order to let fixation and stabilization processes occur fully. At this stage stabilized waste is evaluated in terms of possibilities for further application of stable waste as a product. Analytical work and reporting is performed by certified laboratory.

Stage 8. Transportation of stabilized waste to receiver, or to the inert waste landfill according to results of waste evaluation from stage 7.

### **CFS equipment description**

The process of solid waste treatment will be performed by Ecotech Poland. Company has both knowledge, experience and equipment for efficient and safe waste stabilization.

#### **Stationary installation**

The mixing of solid waste with binding materials and activating agents is a strictly physical unit operation, which has the aim of homogenizing the composition of a mixture consisting of two or more solids. Apart from solid fraction, water is also added to the process, hence stabilization and solidification occurs in wet environment. In case of river bed sludge amount of added water can be significantly reduced, what improves economical efficiency of the process.

Mixing is brought about by three different mechanisms due to:

- Diffusive phenomena;
- Convective phenomena;
- Cutting forces.

The equipment used for this unitary operation is classified as fixed casing mixers. For wastes, which tend to show high degree of cohesion or form agglomerates, as well as wastes subjected to segregation, the equipment adopted must be capable of high cutting and convection actions, like a fixed casing mixer.

In a fixed casing mixer, mixing is brought about by using internal moving tools.

The mixing quality is mainly affected by:

- the average speed of the mass,
- the characteristic dimension of mixing chamber,
- the length and shape of tools,
- density, dynamic viscosity, granulometry and adhesiveness of the ingredients.

A rotary blade mixer is used in solid waste stabilization and fixation. It consists of a fixed cylinder inside where rotating horizontal shaft is present, which is fitted with ploughshare or arc-shaped blades; the rotation of the blades allows the material to be lifted from the drum walls and moved vigorously. If necessary, the mixer is provided with devices capable of breaking the lumps present.

This type of equipment has a very simple construction. It is durable and reliable despite minimal maintenance that has to be provided during operating. Mixers operated by Ecotech Poland are resistant against dust, aggressive chemicals and rust. Very low level of noise generated by working unit will be in case of river bed sludge even lower due to low friction of wet material.

Inlet – waste + binding material + water

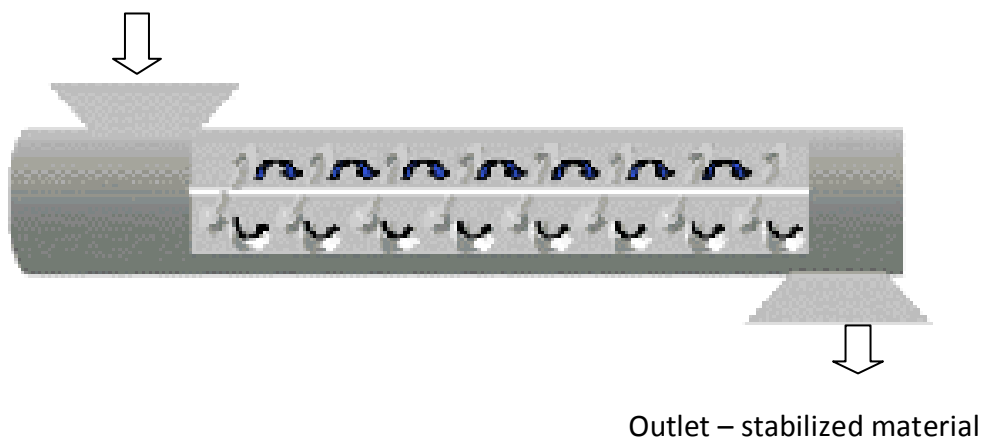


Fig 1. Principle of stationary mixing in waste fixation and solidification process

As it was stated previously it is necessary to add precisely controlled quantities of water into the waste and binding material to be distributed uniformly throughout the mass. The liquid is injected together with air. This improves nebulization of the ingredient and fluidisation of the mass.

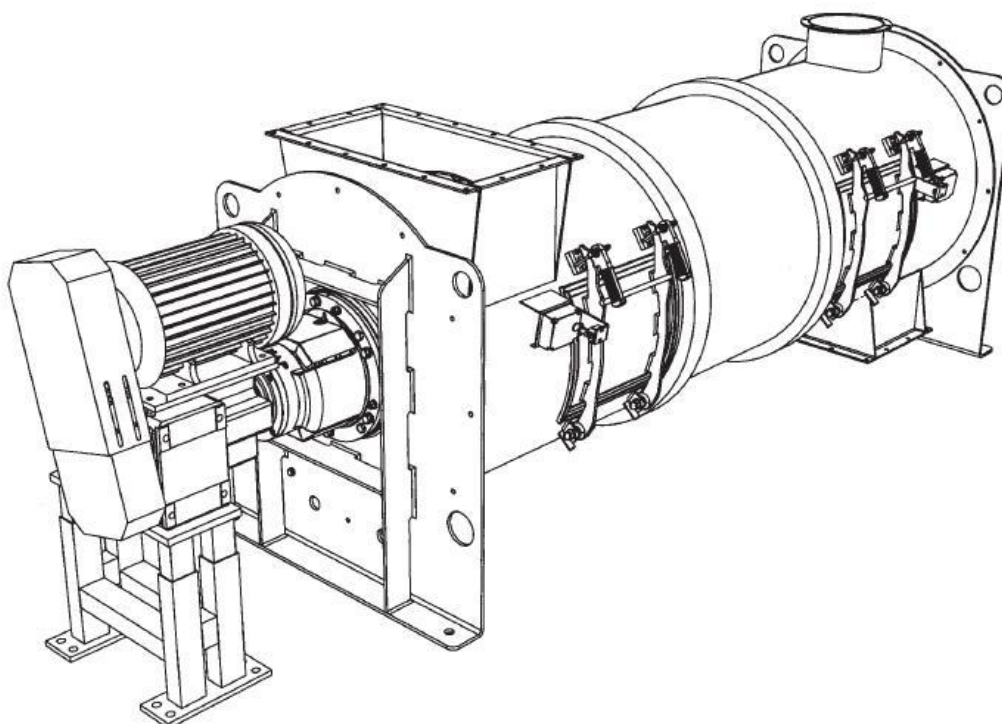


Fig 2. Mixer for stationary fixation and solidification process

Stationary mixer operate on the principle of a mechanically generated fluid bed. Ploughshare or shovel-shaped mixing tools rotate close to the horizontal, cylindrical drum casing lifting the components to be

mixed from the product bed into the open mixing area. This type of construction secures efficient treatment of all the waste mass. The quality of the mixture, which result in efficient stabilization and fixation is achieved before the product reaches the mixer outlet. Continuous mixers are suitable for all types of waste regardless moisture content.

*Performance & Technical Features (depending on desired efficiency):*

- ✓ Range: from 75 to 15,000 liters
- ✓ Drives: from 4.0 to 200 kW
- ✓ Capacity: from 2 to 450m<sup>3</sup>/h (depending on recipe and configuration of the mixer)
- ✓ Mixing time: from 25 to 60 seconds
- ✓ Maximum mixing homogeneity
- ✓ Gentle product treatment (if desired)
- ✓ Reproducible mixes
- ✓ High uptime
- ✓ Minimum wear – low maintenance



Fig 3. Stationary mixer for solidification waste treatment

Type	Length (mm)	Width (mm)	Height (mm)	Residence time 50% dm <sup>3</sup> /h		Weight (kg)
				60 s	180 s	
WAH 15000	6090	2110	2465	411,9	137,3	8200
Type of engine	Electric					
Engine power	70 kW					

Mixer is equipped in automatic dosing equipment and electrical conveyers for automatic waste and binders transportation to the mixer. Automatic conveyers will be used also for transportation of stabilized waste from the mixer to the temporary storage place. The whole unit will be operated by experienced and trained stuff of Ecotech Poland.

For waste treatment work trained and experienced stuff will be deployed. This refers both to analytical and technical work as well as to supervision over the whole process. Every crew member is properly trained for his job, what is proven with licenses, permission and certificates depending on type of job.

**Test results to demonstrate the effectiveness of EnviroMix® technology (examples).**

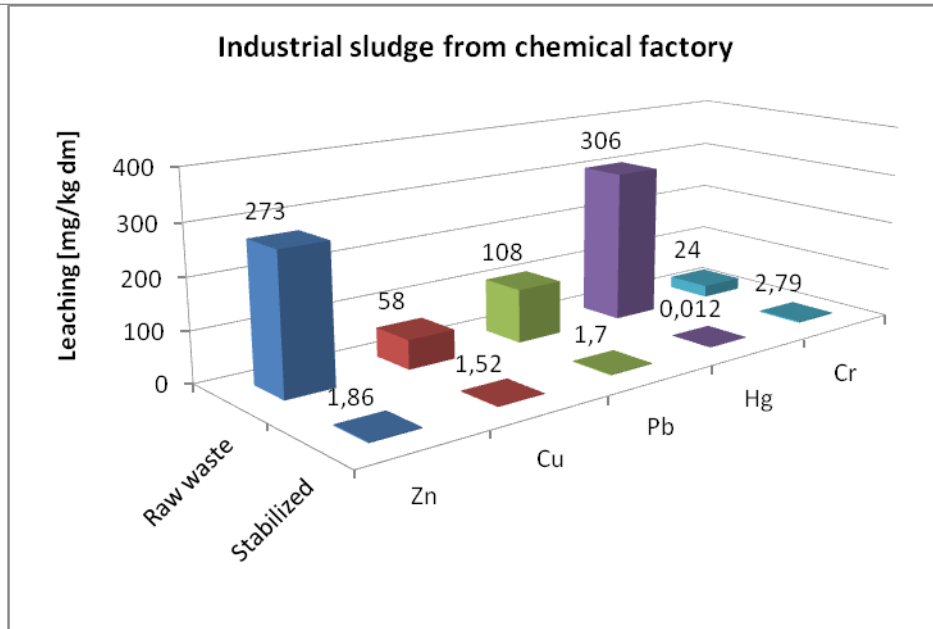
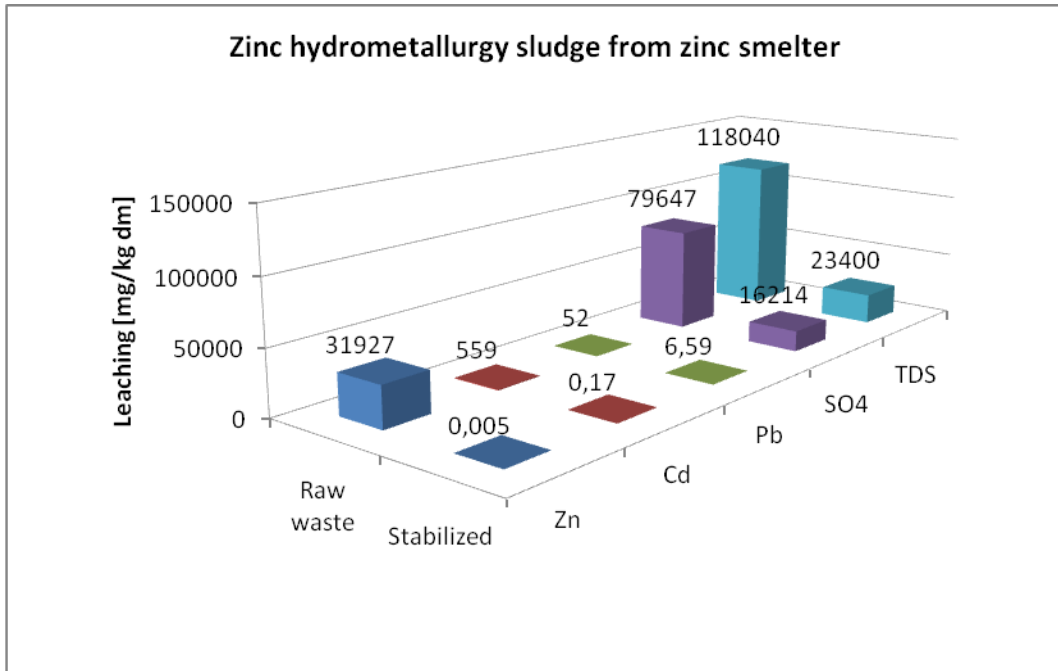
Substance/example	Initial concentration before stabilization	TCLP results before stabilization	TCLP results after stabilization
Arsenic wastes	47% arsenic(liquid) 72% arsenic (solid)	-	1,6 mg/l arsenic (liquid sample) 2,3 mg/l arsenic (solid sample)
Cattle dip site	585 mg/kg arsenic	-	<0,1 mg/l arsenic
Arsenic wastes	1,405% arsenic	-	<0,1 mg/l arsenic
Organo nickel liquid	28 000 mg/l nickel	liquid	3,0 mg/l
Organo chromium liquid	360 mg/l chromium	liquid	<0,1 mg/l
Radioactive monazite	-	22,5 µg/l uranium	<0,05 µg/l uranium
Radioactive monazite	-	58 µg/l thorium	0,25 µg/l thorium

**Organochlorine and organophosphate pesticides**

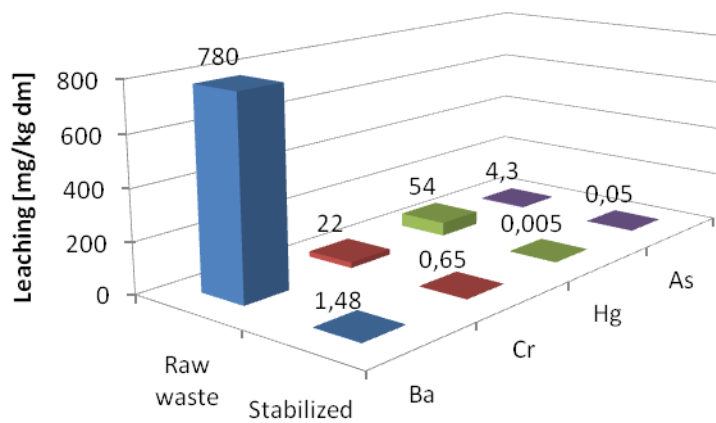
Contaminant	Concentration in waste. Totally (>99%) water soluble before stabilization		TCLP concentration after stabilization
	µg/kg	%	µg/l
Heptachlor	10 000 000	1,0	<0,05
Chlordane (total)	24 000 000	2,4	8,7
Aldrin	1 400 000	0,14	<0,05
Dieldrin	54 000 000	5,4	56,0
Endrin (total)	1 500 000	0,15	9,5
Lindane	<50	< 50 µg/kg	2,8
DDTs (total)	140 000 000	14,0	106
Total OCP	230 000 000	23,0	190
Bromophosethyl	510 000	0,051	0,74
Total OPP	510 000	0,051	<1

**TCLP** Toxicity characteristic leaching procedure is sample extraction method for chemical analysis employed as an analytical method to simulate leaching through a landfill. The extract is analysed for substances appropriate to the protocol.

The Resource Conservation and Recovery Act (RCRA) established US federal laws for the disposal of wastes. RCRA requires that industrial waste streams and other wastes must be characterized following protocols laid out in SW-846. TCLP is one of these tests.



### Rubble polluted with mercury



### Filter and boiler ash from incineration

