UK Remediation Ltd

ETF Stabilisation-Solidification Process Description

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1. INTRODUCTION

This document provides a detailed description of the process of soil stabilisation-solidification (S-S) to be undertaken at the Exeter Fixed Soil Treatment Facility, hereby referred to as the 'site'. The site accepts a wide range of contaminants within soils and will utilise various methods of treatment specific to the contaminants. This document covers soil stabilisation and solidification only. All other treatments procedures are covered in separate documents.

The purpose of S-S is firstly to serve as a drying /matrix modifying agent to improve the structure and handling properties of soft/wet material (solidification). Solidification reduces the porosity and permeability of the matrix; thereby reducing water ingress and leachate potential by physically excluding free water. Secondly, S-S reduces the contaminant mobility through modification to the physical and chemical matrix properties (stabilisation). This significantly reduces the availability and mobility of contaminants, reducing the hazardous properties of the material. This involves the use of binders, to produce an 'immobilised' waste product whereby the contaminants are adsorbed onto the reagent or bound within the waste, leading to a product that is resistant to biological, chemical and physical degradation processes that could lead to the release of contaminants.

Stabilisation and solidification have the effect of significantly reducing the availability of contaminants to the metabolisms of living organisms while reducing the possibility for making contact with organisms by evaporation in air or dissolving in water. The end point of soil stabilisation and solidification is therefore not to break down contaminants, but to effectively isolate them from potential receptors and in so doing, make them much less toxic and hazardous over the long term, so enabling the risk-assessed reuse of soils and CDM materials.

The proposed use of S-S is to treat the fines soil fraction (fine aggregate material) that had undergone processing through the soil wash plant. S-S is also proposed to treat high moisture or poor structure soil to improve handling and recovery potential.

2. EQUIPMENT

The below table describes the onsite equipment that will be used to undertake S-S onsite.

Table 1: Equipment list

Equipment	Activity
9t forward tipping dump trucks and 30t rear tipping dump trucks	• Movement of material into treatment vessels • Movement of material to storage areas following successful treatment.
20 tonne 360° excavator, fitted with riddle bucket or camshaft (ALLU) mixing bucket	• Construction of stockpiles within quarantined areas and treatment vessels. • Loading of material following successful treatment. • Industry renowned durability and reliability, with efficient engine and hydraulics, supported by peak load discharge capacitor minimises energy use and maintenance needs.
Mobile Dust Suppression Units (Corgin)	• To be used for dust suppression when undertaking stabilisation/solidification.
McLanahan Ultra Scrub 3625, Attrition Cell AC17-1 Lites-Out FBC-6, UltraSand 3 Eco Cycle HRT-8, EcoCycle Filter Press	• Soil washing bulk material. • Fractionate soil into gravel, sand, and fines. • Fines fraction to be stabilised, as required.

3. PRE-ACCEPTANCE PROCEDURE

Please refer to document E7555UK.MAP.01 for more detail of general site pre-acceptance procedures.

The pre-acceptance phase includes screening the chemical analysis to establish the presence and concentration of any compounds that might hinder the treatment process. If the analysis identifies such inclusions then an assessment is made as to whether these materials can be effectively treated and if this assessment is negative, materials will be rejected.

The S-S pre-acceptance procedure for fines processed through the wash plant for S-S is described in E7555UK.MAP.01.

For the stand-alone S-S treatment material pre-acceptance, laboratory scale testing is carried out for each waste source, or combination of waste sources once general suitability for S-S treatment has been established. This confirms the suitability of the proposed waste for treatment and recovery by S-S. The analysis generates a leachable fraction for comparison with site reuse criteria and generic environmental quality standards. These data establish the most effective formula/mix of additives to be added during the full scale treatment. This strategy achieves the most effective outcome in terms of the chemical and physical performance of the material.

Composite samples representative of the waste source, or sources are obtained by a qualified UKRL Engineer prior to import into site. The materials obtained are used to undertake bench scale trials, whereby various mixes and quantities of additives are used to produce a series of monoliths. These monoliths undergo leachability testing consisting of tank tests in general accordance with the requirements of CL:AIRE Bulletin GB01 technical guidance, which follows the Environment Agency R&D Technical Report 'Stabilisation/Solidification (S/S) for the Treatment of Contaminated Soils'. Compressive strength tests are also undertaken to confirm suitability for the defined end use. Final trial batch leachate analyses are undertaken at a UKAS accredited laboratory.

The results of the tank trials and geotechnical tests are used to establish the optimum formula to produce an immobilised waste product that is resistant to natural biological, chemical and physical degradation processes and of suitable geophysical characteristics to enable reuse. These indicate a residence time within the reaction vessel to allow the waste to 'cure' or 'set' into the final immobilised product. The in-house testing undertaken by qualified UKRL staff

are confirmed by tests undertaken by UKAS-accredited laboratories. Results will be retained for a minimum of three years.

Detailed records of the above tests are maintained throughout the site works. These records demonstrate:

- which waste streams have been confirmed to be suitable for stabilisation and solidification,
- which waste streams have been rejected as unsuitable,
- which treatment formulation was selected,
- the modelled results to be expected in the leachable fraction following treatment.

4. ACCEPTANCE PROCEDURES

The general acceptance procedures for the site are described in further detail in document E7555UK.MAP.02. These are applied to materials accepted for stabilisation and solidification treatment.

Confirmatory sampling is undertaken and the chemical analysis is compared against the previously received chemical results from the origin site to confirm suitability. Furthermore, in accordance with BAT requirements, sampling includes leachability testing to confirm that the leachate characteristics of the material conforms with the analysis received at the pre-acceptance phase. This leachability testing will be undertaken at a minimum frequency of one per source batch of material.

The results will be reviewed to confirm that the chemical analysis from the confirmatory samples are consistent with the analysis provided to UKRL at the pre-acceptance phase. If not consistent, the material may be rejected for treatment and transported back to the donor site by UKRL, with the recovery costs covered by the producer of the waste.

Once confirmed suitable for treatment, the material is transported into a designated treatment area on the concrete slab where it will undergo the treatment phases as described below.

5. PRE-TREATMENT OF MATERIAL

For S-S treatment on washed fines, material is subjected to pre-treatment through the mechanical wash plant. The material is particle separated into gravel sand and fines fractions. The fines are processed into a fine aggregate materail following pre-treatment.

Further details of the pre-treatment processes are described in document E7555UK.SWP.01, 'Soil Wash Plant Process Description' .

For S-S treatment on high moisture or poor structure soil pre-treatment will be assessed based on the soils geochemical and geotechnical characteristics, and the intended end-use.

Throughout the pre-treatment process appropriate environmental control measures will be in place to mitigate dust, odour, and noise emissions, as described in the following documents:

- Odour Management Plan, ref; E7555UK.OMP.01.R01
- Dust Emissions Management Plan, ref; E7555UK.DEMP.01.R02

6. MIXING OF ADDITIVES

Upon completion of the pre-treatment phase, the material will be subjected to treatment as described below.

6.1 Application of Additives

A pre-defined optimum formula of additives will be established during the pre-acceptance phase to be used for each treatment batch, specific to the composition of the waste to be treated, as described in section 3.0. The additives to be used as detailed in Table 2 below.

Table 2: Additives for stabilisation and solidification

Material	Activity
Stabilisation Products	
Calcium Oxide (lime)	• Drying agent and immobilisation of organic and inorganic contaminants.
"Cenin" (branded product)	• Drying agent and immobilisation of organic and inorganic contaminants.
Cement (Portland mix and related products)	• Immobilisation or organic and inorganic contaminants.
Ground Granulated Bottom Slag (GGBS) (to BS8500)	• Immobilisation or organic and inorganic contaminants.
Pulverised Fly Ash (PFA) (to BS EN 450)	• Immobilisation or organic and inorganic contaminants.
Cement Kiln Bypass Dust (CKBD) (Cemex Product)	• Immobilisation or organic and inorganic contaminants.
Sodium/calcium bentonite	• Immobilisation or organic and inorganic contaminants.
Hydrated Ferric Oxide (HFO) (Cold Authority product)	• Immobilisation or organic and inorganic contaminants.
Incinerator Bottom Ash (IBA)	• Immobilisation or organic and inorganic contaminants.

Metafix (Evonik branded product)	• Immobilisation or organic and inorganic contaminants.

Treatment is undertaken within enclosed, roofed bays. The untreated material is placed in layers. The additives are transported to the treatment area using the loading shovel, the additions are weighed using the loading shovel weigh cell or weigh bridge. Subsequently the layers are mixed within the ALLU bucket. A mobile dust suppression unit will be in operation to damp down any potential dust emissions. The operative is required to wear a dust mask and disposable coveralls to prevent inhalation or dermal contact with the additive. The cowl air extraction system is deployed to control dust.

Once the bucket is loaded, the mechanical mixing is undertaken in the enclosed compartment of the bucket. Once mixed by the unit, the treated material will exit the bucket. The resulting material will be stockpiled in a suitable location to await transfer to the reuse/restoration location.

6.2 Emissions Control and Abatement System

The mixing will be undertaken in enclosed roofed bays, in an enclosed ALLU bucket, preventing dust emissions. During addition and mixing of additives, potential emissions will be controlled using the corgin dust suppression units. A vacuum air extraction system is deployed above the doors of the mixing vessel to contain and treat potential dust, odour and vapour emissions. Once the waste has been treated, the risk of emissions will be low; however mitigation measures will be implemented as described in the below documents:

- Odour Management Plan, ref; E7555UK.OMP.01.R01
- Dust Emissions Plan, ref; E7555UK.DEMP.01.R02

6.3 Post Treatment Quality Control Procedures

Every treatment batch is subjected to stringent quality control procedures to ensure the product is suitable for its pre-designated purpose.

Composite samples of the treated material are obtained from a UKRL Engineer for use in post treatment testing. Testing of the material includes leach tests as previously described in Section 3.0, and compressive strength testing to confirm suitability against intended reuse.

Samples of the treated material are suitably stored onsite for a minimum of 6 months following completion of the treatment, should additional testing be required. Following validation confirmation receipt of the test results showing the material to be suitable for the proposed use, the material will be exported to the appropriate licensed facility.

7. CONCLUSION

Material imported into site is subjected to an extensive pre-acceptance procedure prior to treatment and quarantined until confirmatory testing is received in line with Best Available Techniques (BAT) guidance for the treatment of hazardous and non-hazardous wastes.

Stabilisation and solidification is undertaken on fines, following processing through the wash plant, in a fully enclosed unit with in-built and site-deployed abatement systems to ensure emissions are appropriately controlled in accordance with Best Available Techniques (BAT) guidance. The process of stabilisation and solidification reduces the volume of hazardous waste going to hazardous landfill.