

Introduction

EHC™ is the only *in situ* chemical reduction (ISCR) substrate available for removing persistent organic and/or inorganic contaminants from the subsurface environment. EHC has been employed for source area treatment, plume treatment or plume management using permeable reactive barrier (PRBs). EHC slurry (10 to 45% solids) has been added to numerous aquifers using a variety of injection methods, including hydraulic fracturing, pneumatic fracturing and direct injection. Liquid formulations of EHC, EHC-A, have been added to existing well screens. And solid EHC substrate has been directly mixed into the soil using deep soil mixing equipment or placed into an open excavation or trench.

The choice of installation method will depend on your site-specific conditions, including treatment depth and geology. To date, the most commonly practiced *in situ* application method has been direct slurry injection. This document provides guidelines for preparation of the EHC slurry and using direct injection technology for subsurface application.

EHC™ Slurry Preparation

EHC is delivered as a dry powder in 50-lb bags or 2,000 lb Supersacks. EHC consists of solid organic carbon and zero-valent iron and will be mixed with water on site into a slurry containing an estimated 30% solids (i.e., mass of dry EHC divided by total mass of slurry including EHC and water). This results in a final wet density of the slurry of approximately 1.15 g/cm³.



EHC slurry →



Adventus recommends preparing the EHC slurries on site in a mixing tank with a paddle-mixer at the bottom. The slurry is then transferred to a feed tank connected to the injection pump; that way the slurry can be prepared continuously while the injections are performed. For example, the ChemGrout mixing system with two mixing bins (www.chemgrout.com/500hp.htm) has been utilized. The EHC slurry mixes quickly in these types of systems (about a minute) and the injections can proceed without interruption.

← 2-bin mixing system

The EHC slurry has also been prepared in a variety of other ways; everything from in-line automated mixing systems to manual mixing using a hand-held drill with a mixing attachment. However, particularly for larger projects, Adventus recommends having a mechanical mixing system available on site.

EHC™ Injection Approach

The preferred approach for the injections is often in the top-down direction using an injection tip that directs the slurry horizontally, for example Geoprobe's pressure activated tip has been successfully utilized (http://www.geoprobe.com/products/geoprobe_accessories/injprobedesc.htm). For each injection point, the rods are initially advanced to the top of the targeted depth interval and a specified volume of slurry is injected before proceeding down to the next depth. The injections are to be evenly distributed over the targeted depth interval, using a vertical injection spacing of approximately 2-4 ft. We recommend injecting a small volume of water (15 USG) to clear the injection tip between batches and at the end of the injection.



Test of pressure activated tip with 4 horizontal openings.

Pump Requirements

Adventus recommends using an injection pump that is capable of generating at least 500 psi of pressure at a flow rate of 5 gpm. The pump needs to be able to handle solids. For example piston pumps, grout pumps and progressing cavity pumps have worked well in the past, with a preference towards the piston and grout pumps. EHC would typically be injected at pressures of 100 to 200 psi, however, higher pressures are sometimes required to initiate the injection. It would be ideal to have a higher pressure pump available on site that can generate over 500 psi and as high a flow rate as possible. Deeper installations may require higher injection pressures.

Other

We recommend having sufficient rod length and injection tips on site to allow 3 to 5 injection points to be capped overnight to prevent backflow if need be (more for shallow depths and less for deep installations).

Health and Safety

EHC is completely non-hazardous and safe to handle. The EHC MSDS is posted on our web site at www.adventusgroup.com/library/msds.shtml. When working with EHC, it is recommended to use standard personal protective equipment, including safety glasses, steel toe boots, nitrile gloves, hearing protection (when Geoprobe is operated) and hard hat. Dust mask may be required when in close contact with EHC under certain conditions.

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