

OVERVIEW

Provect-IR® *In Situ* Chemical Reduction (ISCR) reagent is designed to treat persistent organic and/or inorganic contaminants present in the subsurface environment. As developers of the conventional ISCR amendments, scientists now at Provectus know that Provect-IR is a more efficient, and safer amendment. It is unique in its composition:

- ◆ Zero Valent Iron: Up to 85% (weight basis), site-specific particle sizes
- ◆ Integrated Vitamins, minerals, and nutrients (yeast extract) specially selected for anaerobes
- ◆ Chemical oxygen scavenger to maintain reduced condition
- ◆ Multiple, Complex, Hydrophilic, Timed-Release organic carbon sources (plant materials, Kelp, Calcium Propionate) @ 390 g H donor / lb product
- ◆ Natural, food-grade methane inhibitors to increase safety and efficiency

MATERIAL PACKAGING, HANDLING AND STORAGE



Provect-IR can be specially formulated to meet site-specific needs. The standard formulation contains 40% ZVI and is packaged as a dry powder in 50-lb easy-open (no sharps), polyethylene-lined, recycled paper bags or, upon request, in 2,000 lb supersacks. Typical shipments entail multiple units of 4x4 wooden pallets containing 40 bags x 50 lbs/ bag = 2,000 lbs reagent per pallet. Each pallet is neatly wrapped in water-resistant plastic, but direct exposure to rain should be avoided.

GENERAL HEALTH AND SAFETY GUIDELINES

Provect-IR is non-hazardous and safe to handle. The use of standard personal protective equipment is always recommended, including safety glasses, steel-toe boots, gloves, hearing protection (in the proximity of loud machinery) and hard hats. Dust mask may be desired when working with the material under certain conditions. The SDS is posted on our web site.

SLURRY PREPARATION

Provect-IR is mixed with clean water on site to yield an aqueous slurry (see **Table 1** for field mixing guidelines). Experienced injection contractors can manage (mix, transport/pump, and inject) slurry containing between 20% and 30% solids (defined as the mass of dry Provect-IR divided by the total mass of slurry, including the water). For situations where more volume is desired, slurry density can be decreased (e.g., using a thinner slurry). Conversely, for situations where less volume is required (for example to minimize surfacing issues), thicker slurry with higher

solids can be applied. A slurry containing ca. 30% solids will have the following general characteristics:

- ◆ Wet Density = 0.9 to 1.1 g/cm³
- ◆ Dry Density = 0.3 to 0.4 g/cm³
- ◆ Viscosity = 500 to 1,500 cP

TABLE 1. FIELD GUIDE FOR MAKING SLURRY			
per 50 pound bag		per 25 kg bag	
Target weight %	USG water required	Target weight %	Liters water required
15	34	15	142
20	24	20	100
22	21	22	89
24	19	24	79
26	17	26	71
28	15	28	64
30	14	30	58
32	13	32	53
34	12	34	49
36	11	36	44

APPLICATION TECHNIQUES

Provect-IR has been employed for source area treatment, plume treatment and/or plume management using permeable reactive barrier (PRBs). The choice of installation method will depend on the site-specific conditions, including treatment depth and geology. The most practiced *in situ* application method has been direct injection of aqueous slurry.

Provect-IR® slurry containing 10 to 35% solids has been added to numerous aquifers using a variety of injection methods, including hydraulic fracturing, pneumatic fracturing, and direct

injection. It can also be added via direct soil mixing using a wide range of equipment, or it can be placed directly into an open excavation or trench.

GENERAL GUIDELINES FOR DIRECT PUSH INJECTION OF AQUEOUS SLURRY

Mixing Equipment: Reagent slurry has been prepared in various ways, ranging from in-line automated mixing systems, to manual mixing using a hand-held drill with a mixing attachment, to more creative processes. Particularly for larger projects, experienced drillers will have some form of mechanical mixing system on site that includes a tank with a paddle-type mixer at the bottom. The slurry is then transferred to a feed tank connected to an injection pump so that slurry can be prepared continuously while injections are being performed (see example, ChemGrout mixing system). Slurry mixes quickly in these systems (<1 minute), and injections can proceed without interruption.



Pumps: Experienced drillers will have a variety of pumping equipment on site. For injecting slurries, an injection pump capable of generating at least 300 psi of pressure at a flow rate of >5 gpm is desired. Obviously, the pump needs to be able to handle solids, such as piston pumps, grout pumps, and progressing cavity pumps - with a preference towards the piston and grout pumps. Slurry is typically injected at pressures of 100 to 200 psi; however, higher pressures are sometimes required to initiate the injection. It is recommended to have a higher pressure pump available on site that can generate over 500 psi and ca. >10 gpm, as deeper installations often require higher injection pressures.



Tooling. Experienced drillers will have sufficient rod length on site to allow 3 to 5 injection points to be capped overnight to allow pressure to dissipate. This can help prevent backflow and surfacing of slurry as the injection rods are retracted. Likewise, experienced drillers will have on hand a variety of injection tips, some that direct the slurry horizontally (see for example GeoProbe's pressure activated tip).

In a “top-down” injection approach, the rods are initially advanced to the top of the targeted depth interval, and a specified volume of slurry is injected while recording flow rate, injection pressure, and slurry volume delivered. The injection rods are then further advanced a distance ranging 2 to 4 feet and the process is repeated to help ensure even distribution of slurry over the targeted depth interval. At the end of each injection point, a small volume of water (15 USG) is often used to clear the rods and the injection tip of any slurry.

CONTACT US FOR A SITE EVALUATION

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