



## Application Instructions

MicroZVI™ is an amendment designed for in-situ chemical reduction of chlorinated contaminants. MicroZVI contains zero valent iron (ZVI) particles that are < 5µm in size and are suspended in a liquid carrier. These materials are strong reductants and should never be combined with acids or oxidizers (see Health & Safety section).

### MicroZVI

40% Colloidal ZVI  
45% Food grade glycerol  
15% Water-based carrier

### Physical Characteristics:

Appearance: Dark grey viscous liquid  
Viscosity: 3,000-4,000 cp (temperature dependent)  
MicroZVI Density: 8.73 kg/L  
pH: 9  
ORP: -400 mV  
Conductivity: 2.36 mS/cm

## Do's and Don'ts

Do	Don't
<p>Use diaphragm pump to transfer MicroZVI from totes or drums</p>	<p>Use dose pumps, drum pumps, etc. to transfer MicroZVI</p>
<p>Use a bucket or graduated vessel to measure MicroZVI for the mix tank from IBC's/drums</p>	<p>Use buckets that contained RegenOx, PersulfOx, HRC, HRC Primer</p>
<p>Rinse each mix tank to prevent excess buildup of solids from the MicroZVI on the tank bottom</p>	<p>Leave solutions containing MicroZVI sitting in the tank overnight or for an excess period of time (4-5 hours)</p>
<p>Use tap water for rinsing and cleaning</p>	<p>Ever add acid or oxidizers to MicroZVI</p>
<p>Inject the equivalent of a 7-borehole volume of clear water into injection wells and any affected monitoring well upon completion of the injection program</p>	<p>Use sodium bisulfite or other oxygen scavengers - They are unnecessary with MicroZVI product</p>
<p>BDI Plus and MicroZVI are compatible. Apply BDI Plus as typical</p>	<p>Use partial buckets of MicroZVI that were opened for a previous site</p>
<p>Use buckets of MicroZVI 2-3 days after opening the bucket</p>	<p>Do not fill batch buckets with more than 25kg of MicroZVI</p>
<p>Use standard PPE when using MicroZVI. This includes safety glasses, face shield, and gloves</p>	

## Best Practices

**Material Handling:** MicroZVI is packaged in 200kg drums. A double diaphragm pump equipped with a stinger/snorkel should be used to transfer MicroZVI material from drums into the mixing tank. Drum pumps, dose pumps, etc. are not likely to work due to the high viscosity of the materials. Because of the low mass of MicroZVI typically required, a bucket or similar container should be used to batch the MicroZVI material by weigh or volume.



**Mixing:** The MicroZVI as shipped material should be pre-mixed in its packaging before adding it into the mix tank. Drums of MicroZVI should be mixed to a homogeneous consistency at the start of each application day using a paddle-mixer attachment. As with all remedial reagents, it is a best practice to make sure to mix the entire drum well before transfer into the mix tank. Care should always be taken to ensure material that may have settled to the bottom of a drum or the bottom and corners of the tote are homogenized in the container prior to use.

**Mixing Order:** Whenever MicroZVI is co-applied with other remedial reagents (3DMicroemulsion®, pH modifiers, etc.), the order of addition should be as follows:

- 1) Water
- 2) Other amendments (3DME, pH modifiers, etc.)
- 3) MicroZVI

Care should be taken to gently mix MicroZVI solution in the mix tank during the injection. The objective of gently mixing MicroZVI is to keep the MicroZVI suspended with minimal or no aeration.

**Cleaning:** Always thoroughly rinse all MicroZVI containers before disposal. Rinse water from this step should be placed into the mix tank for application.

Inspect tank for any residue of reagents that were recently used in the tank. If there is any evidence, rinse tank thoroughly.

A thorough cleaning step should be performed at the end of each work day. This should be performed by flushing the entire injection system with tap water.

## Health & Safety

MicroZVI should only be used by remediation practitioners who may be considered competent and experienced. Prior to use, the remediation practitioner should always complete their own risk assessment of the proposed application, transport and storage activities.

**Risk Potential: Hydrogen Sulfide:** The MicroZVI product will give off hydrogen sulfide gas ( $H_2S$ ) when exposed to acid. For this reason, it is imperative that low pH (acid) solutions NOT come into contact with solutions containing MicroZVI.

In the interest of safety, a hydrogen sulfide detector should be part of every MicroZVI application program.

Hydrogen sulfide is toxic, corrosive, and flammable. The threshold of odor detection for hydrogen sulfide is approximately 0.0005 ppm; however, at higher concentrations, hydrogen sulfide will suppress the olfactory senses. For this reason, one's sense of smell is not a reliable method of detection, and failure to rely on a hydrogen sulfide detector can lead to overexposure and potentially death. The OSHA Permissible Exposure Limit for an 8-hour timeweighted average is 10 ppm, and hydrogen sulfide is classified as Immediately Dangerous to Life and Health at 100 ppm. With proper handling, no detectable hydrogen sulfide will be produced by MicroZVI.

**Do not mix MicroZVI with acid, this includes HRC or HRC Primer.**

- Adding acid to MicroZVI can cause hydrogen sulfide to be produced for many hours. If hydrogen sulfide is being produced, work must stop, the area ventilated and personnel moved away from the work area.

**Do not combine MicroZVI with any oxidizing agent (PersulfOx<sup>®</sup>, RegenOx<sup>®</sup>, etc.)**

- MicroZVI is a strong reductant. Combining it with oxidizers will cause a vigorous exothermic reaction and has the potential to create Hydrogen Sulfide.

**Preferred Storage Conditions:** MicroZVI should be stored in cool, dry places if possible. Indoor storage is preferred – if this is not available, seek a covered or shaded spot outdoors.

**Shelf life\*\*:** MicroZVI should be used within 4 weeks of arrival onsite.

\*\*Shelf life may decrease with extreme temperatures. For situations where prolonged temperatures may exceed 32°C we advise to use the product as soon as possible. Small amounts of hydrogen gas may evolve from the material during storage. For this reason, the drums are vented.

**Handling Practices:** Standard PPE should be used when handling MicroZVI. This includes eye protection, gloves, and face shield when mixing.

There are some specific characteristics to keep in mind for these materials:

**Density** – A half-full container may be heavier than it appears. Use care when lifting.

**Cleanliness** – This material will stain clothes.

**Slip concerns** – MicroZVI can be very slick if spilled. In the event of a spill, use caution as the floor may be very slippery.