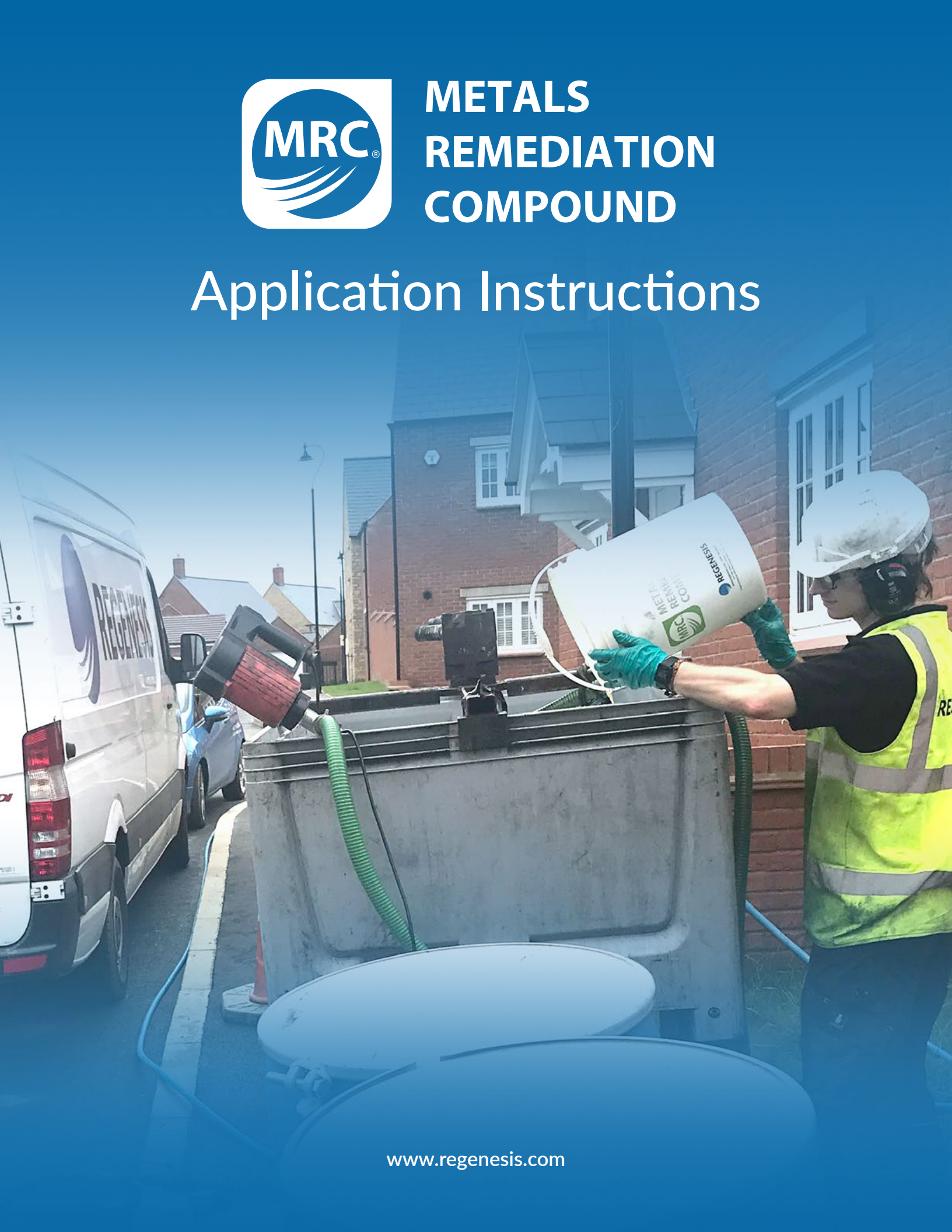
METALS REMEDIATION COMPOUND

Application Instructions



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MRC® Quick Reference Table

The following table is a quick reference guidance providing only the most relevant information.
Please review the entire document carefully, plus the product Safety Data Sheet prior to any application.
Please contact REGENESIS Technical Support if you need any further assistance.

Viable application methods	Direct push In wells
Typical dilution factor	To be applied pure (no dilution with water) Dilution with an equivalent amount of water interferes with longevity of release Small amounts of water possible for containers cleaning and equipment flushing
Mixing activities	Heat the product in sealed containers to 35-40 °C Homogenize concentrated product before transferring Transfer concentrated product to application hopper
Mixing activities – co-application with other amendments	In case of co-application with other high volume amendments (such as 3-D Microemulsion), apply separately, and apply MRC after other amendments
Recommended injection pump	Positive displacement pump (progressive cavity or piston pump)
Recommended injection pressure	Low to average pressure injection. Typically 2-8 bar Adjust pressure using pressure regulator Take note of pressure and flow rate for each step
Direct push injection	Use a pressure activated tip or a retractable screen tip Typical injection steps every 30 cm
In well application	Pressure injection; **DO NOT** gravity feed Use double packer (single packer only for wells with short screened interval) Flush well with small amounts of clean warm water after application
Other recommendations	Always wash and flush equipment with small amounts of warm clean water Seal injection direct push points after injection Do not operate P&T or other activities likely to disturb groundwater in surrounding area during and after injection
Recommended monitoring	Typically, monthly to quarterly monitoring. Monitoring period typically 9 months to 2/3 years Parameters: contaminants of concern. Supporting evidence: O_2, redox, pH, electrical conductivity, Fe, Mn, nitrates, sulphates (Fe & Mn need to be filtered and acidified in the field)

Metals Remediation Compound

Metals Remediation Compound (MRC®) is a slow release metals remediation product that simultaneously removes dissolved metals from groundwater via in situ immobilization and provides a substrate for biodegradation of chlorinated compounds. The use of MRC for groundwater remediation offers a comparatively simple and cost effective remediation alternative for sites that would otherwise require unacceptably long periods of time for natural attenuation or the high levels of capital investment and operating expense associated with active remediation technologies.

Safety Data Sheets will be supplied with all delivered products. These should be read carefully prior to product handling. It is assumed that the user is appropriately trained and competent and will have completed a comprehensive site-specific health, safety & environmental risk assessment for the works they intend to carry out.

Pre-Application Guidance

MRC is shipped in **13.6kg buckets**. The buckets are generally delivered to site on pallets via a heavy goods vehicle. Please discuss any site access restrictions with REGENESIS, so an appropriately sized delivery vehicle is used.

The viscosity of the MRC is approximately **20,000 centipoise at 21°C**. This means that it is too thick to pour at ambient outside temperatures in most regions and requires heating. The most convenient method of heating MRC is to place it in a warm water bath with a variable temperature setting. The unopened buckets should be placed in the bath, then water added to just below the top of the bucket. The **water temperature** should be set to between **50 °C and 60 °C** with an aim to heat the **MRC to an approximate temperature of 35 °C**. Please note this may take several hours.

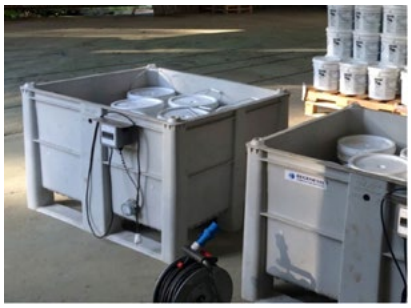

Fig 1. MRC tubs in heating bath

Water will need to be added as buckets are removed to maintain sufficient volume in the tank. Some residue will be left in the bucket after adding product to the mixing tank. This can be removed by adding a small amount of warm water and agitating using a battery powered drill with a mixing attachment or a hand-held paddle/scraper.

Injection Equipment

Due to the high viscosity of MRC, standard injection equipment used to inject high volume products is generally not suitable.

A limited number of pumps are capable of transferring high viscosity products. REGENESIS recommends that a positive displacement pump, such as progressive cavity or piston pump is used for injection of MRC; a diaphragm pump will generally not be suitable for application of the product. The pump should have a graduated hopper (ideally, situated directly above the pump intake) to which the product can be added, allowing the product to move directly into the pump chamber via gravity. Graduations within the hopper give an indication of the volume of product applied.

A small quantity (1-2L) of warm water per bucket of MRC can be added to the hopper to thin the mixture slightly if necessary. The water used to remove residue from the bucket can be used for this purpose. The mixture should be recirculated in the hopper for a few minutes prior to injection to thoroughly mix the product. **Please note that adding greater quantities of water to the MRC may reduce product longevity in the subsurface**.

Direct Push Application

The most suitable application method to deliver MRC into the subsurface is via Direct Push injection, as this allows the most uniform distribution throughout the aquifer. REGENESIS recommends using a **300mm or 600mm** retractable injection tip for application of MRC, as this provides good distribution of low volume products.

Once the requisite volume of MRC has been applied to the injection location, warm water (from the heating bath) should be used to flush the pump and injection equipment. Flushing with significant amounts of water should not be carried out in between injection intervals as this could lead to dilution of the MRC.

Injection Well Application

Where possible, direct push should be used for application of MRC. However, where application method is limited by the geology or target depth for example, injection wells can be used.

REGENESIS recommends using a double packer to isolate a discrete injection depth when injecting MRC via injection wells, ensuring adequate distribution across the target zone. Use of a double packer should be considered during well design prior to well installation. REGENESIS can provide guidance on well design as required.

If multiple products are to be applied into the same well, MRC should be injected after other high-volume products.

Once the requisite volume of MRC has been applied to the injection location, warm water should be used to flush the pump and injection equipment. Warm water flushing should not be carried out in between injection intervals as this could lead to dilution of the MRC.