



**OXYGEN
RELEASE
COMPOUND**

Application Instructions





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ORC Advanced (ORC-A) Quick Reference Table

The following table is a quick reference guidance providing only the most relevant information. Review this 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 excavation (ORC Advanced pellets formulation recommended) In wells (ORC Advanced socks or powder).
Typical dilution factor	20% (exact dilution to be discussed with REGENESIS). 1 kg of ORC Advanced powder in 5 litres of water.
Mixing activities	Add ORC-A powder to tank already filled with water. Mix to form a slurry and maintain in agitation until injection. Do not leave standing. Use the slurry within 30 minutes.
Recommended injection pump	Progressive cavity or piston pump. Diaphragm pump not recommended.
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 single or double packer. Flush well with clean water after application. Expect that ORC solid particles will block the well, unless thorough flushing is carried out. Do not use application wells for monitoring. ORC Advanced socks can be applied as an alternative to slurry for in well application.
Excavation application	Use ORC Advanced pellets for excavation application, but powder can also be used. Mix powdered ORC-A with water before application to avoid dust production. Place at the bottom of excavation and/or mix with backfilling material.
Other recommendations	Always wash and flush equipment with 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.
Cleaning activities	Check monitoring wells surrounding the application area for accidental entering of ORC-A. Application wells and monitoring wells which accidentally filled with ORC-A need to be cleaned immediately: ORC-A is a solid powder and will form a cement-like layer with time. Cleaning could be done by pumping, vacuum truck and/or injection of clean water.
Recommended monitoring	Typically, monthly to quarterly monitoring. Monitoring period: typically 6 to 12 months. Parameters: contaminants of concern. Supporting evidence: O ₂ , redox, pH, Fe, Mn, eventual daughter products (Fe & Mn need to be filtered and acidified in the field).



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This document is for guidance only and 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. A Safety Data Sheet (SDS) is provided with each shipment, which should be studied carefully by the user to ensure the ORC Advanced is handled and stored appropriately, including the use of appropriate PPE.

ORC Advanced is a single part, engineered oxygen release compound designed specifically for enhanced, in situ aerobic bioremediation. It is a fine powder, classified as a 5.1 oxidiser, delivered in **18.1kg bags** and as such should be handled with care.

ORC Advanced can be applied via 3 primary methods. Direct push injection, remediation well injection and into open excavations.

Pre-Application Process

Prior to ORC Advanced application via direct push or wells, REGENESIS recommends completing a pre-application test injection using clean water. This procedure is useful to determine the quantity of liquid the target zone can accept and will provide valuable flow rate and pressure information. REGENESIS recommends the injection test volume of water is in the range of **15-20% greater** than the single-point design volume e.g. if the design specifies an ORC Advanced volume of 100L per point then the water test injection should aim for 115 – 120L.

Injection Solution Mixing Procedures

Before application, the ORC Advanced powder is mixed with water to create an injectable slurry, this should be done by preparing the requisite amount of water in a mixing vessel and adding the powder to it. For most applications REGENESIS suggests a **20% solution** (see table on the following page).

Solution to be prepared (%)	Mass of ORC Advanced (kg)	Volume of mix water (L)
15	18.1	121
20	18.1	91
25	18.1	73
30	18.1	60

ORC Advanced should be mixed in appropriately sized tanks that match the project's requirements. Ideally, the tank should be designed to ensure thorough and continuous mixing to avoid settlement of solids. A suitable pump, capable of dealing with thick liquids such as grouts, would be most appropriate when injecting ORC Advanced. Typically, REGENESIS would recommend a positive displacement pump such as a progressive cavity or piston pump. Diaphragm pumps are usually not considered suitable for the application of ORC Advanced.

The slurry should be mixed shortly before it is used. It is best to not hold it for more than 30 minutes. Thinner slurries especially, can experience a separation upon standing and it may form a thin layer (similar to weak cement) when left standing, therefore continuous gentle mixing is recommended. If a slurry begins to thicken too much, add additional water. Care should be taken not to leave slurry standing in the pump or hose. Problems can generally be avoided by periodically re-circulating the slurry through the pump and hose back into the pump's mixing or holding tank.

Once a mixing tank has been emptied it is recommended to use clean water to flush/clean out the tank to ensure there is no build-up of solids over time. This will also help to flush out the injection pump, hoses and direct push injection rods/remediation well screens. REGENESIS would also advise that all equipment is flushed through with plenty of clean water at the end of each working day and on completion of the injection works.



OXYGEN RELEASE COMPOUND

Direct Push Applications

The injection rods should be advanced to the target depth and the ORC Advanced injected, while a note is taken of the flow rate and pressure. Once the requisite volume has been applied, clean water should be used to flush through the pump, hoses and injection tip to ensure all ORC Advanced has been displaced into the target formation. This will also prevent ORC Advanced slurry from cementing in hoses or the pump.

Once the point has been completed the injection hole should be properly grouted/sealed upon completion of the injection activities. The purpose of this effort is to seal off any potential pathways to the surface which may allow “daylighting” of injected ORC Advanced and/or groundwater. Whenever possible, the application should be performed by systematically working from the outside to the centre of the injection array to minimise displacement of contamination from the target area.

Well Applications

Whilst direct push injection would be the recommend application to achieve the most accurate placement, where this is not appropriate well application may be used. When using injection wells, there should be an expectation that these may become blocked over time with ORC-Advanced cement and therefore should not be used for monitoring purposes. See below for advice on flushing wells.

REGENESIS recommends that injection wells should generally be constructed using **≥50mm diameter HDPE**. It is not advised to use slot widths less than 0.5mm. Where possible, the well seal should consist of a maximum of 300mm of bentonite pellets, above which a sand and cement mix should be applied to seal to the surface. Prior to injection of any remedial reagent, REGENESIS recommends that the injection wells be purged of fine-grained particles present in the well bore to the extent practicable.

After each ORC Advanced injection event, each injection well should be flushed with clean water. The volume of the clean flush should be equivalent to approximately 2-3 borehole volumes. When wells are used for ORC Advanced application, the injection wells and nearby groundwater monitoring wells should be either tightly capped or alternatively equipped with a pressure gauge and relief valve. This will reduce potential for short circuiting to the surface.

Whenever possible, the application should be performed by systematically working from the outside to the centre of the injection array to minimise displacement of contamination from the target area. Once the injection works have been completed, it is best practice to revisit all the injection wells and take a sample with a bailer. If white or milky liquid is observed, then the well should be flushed again with water to push any residual ORC Advanced into the surrounding formation.



OXYGEN RELEASE COMPOUND

Excavation Applications

For easy application into excavations REGENESIS would usually recommend the use of ORC Advanced Pellets although it may be applied in its powder form. If using powder it should be diluted with water to form a slurry before application.

ORC Advanced can be placed in an excavation by several methods including mixing with the backfill material in an excavator bucket before placement or by directly placing the product into the bottom of the excavation prior to backfill.

Ideally, divide the excavation into quadrants, within which to a known quantity of pellets/slurry is applied. Then use the excavator to 'rake' the ORC Advanced into the base of the excavation. Proceed with filling the excavation immediately after application to the bottom of the excavation (it is inadvisable to leave the excavation open for days after applying the ORC Advanced).

Remediation products should not be applied by hand from within the excavation unless this has been specifically assessed by the user as a safe method. REGENESIS would advise that all equipment is flushed through with clean water at the end of each working day and on completion of the injection works.