



INCORPORATED

Injection Ready 60% QRS-PL™ Plus Potassium Lactate Quick Release Substrate with NutriPlus™ a Proprietary Nutrient Package For Aquifer Remediation and Conditioning

Terra Systems "injection ready" **60% QRS™-PL Plus** Potassium Lactate Quick Release Substrate with nutrients is added to the groundwater to rapidly generate reducing conditions and provide the necessary carbon and hydrogen to support native or introduced microorganisms (*Dehalococcoides*) for the biodegradation of chlorinated solvents such as tetrachloroethene (PCE) and trichloroethene (TCE) to innocuous end products including ethene and ethane (Ellis et al. 2000). The addition of nutrients and Vitamin B12 has been statistically demonstrated to support biodegradation of chlorinated solvents with soluble substrates like lactate and emulsified vegetable oil. (He et al 2007 and Harkness et al 2012).

Key Communication Points

- 60% QRS™-PL potassium lactate is an inexpensive, soluble, food grade substrate
- Often used in areas of Florida and California, which have restrictions on the amount of sodium (sodium lactate) that can be injected.
- Contains our Proprietary *NutriPlus*™ nutrient (Harkness et al 2012) and Vitamin B₁₂ package (He et al 2007), which supports enhanced in-situ bioremediation and increases dechlorination kinetics and donor efficiency.
- It rapidly establishes reducing conditions to support the biodegradation of PCE, TCE, TECA, DNAPL (Sabre Project), Perchlorate, TCA, Cr⁶⁺, TNT, Uranium and Nitrate
- It is one of the most efficient electron donors available
- Provides 60% fermentable carbon
- 100% biobased content. The U.S. Food and Drug Administration have designated 60% QRS™-PL-Plus potassium lactate as Generally Recognized as Safe (GRAS).
- Its low viscosity and high solubility in water allow for rapid transport with groundwater, which enhances distribution in the aquifer and minimizes the number of injection points.
- It arrives as a homogenous **injection ready substrate**, which results in lower field labor costs
- Proven effective at dry cleaners, semiconductor manufacturers, fabricators, manufacturing firms and military installations, that use and clean metal parts (air conditioners, dishwashers, etc.).

Table I: 60% QRS™-PL Potassium Lactate Specifications

Ingredient	Percent	Description	Benefit
Potassium lactate	60%	Rapidly biodegradable soluble substrate; miscible in water	Fast release source of carbon and hydrogen Rapidly generates reducing conditions High radius of influence Provides 60% fermentable carbon

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Proprietary Nutrients	<5%		
pH	6.5 - 7	6.5 - 7	Optimum microbial activity
Organic Carbon (wt%)	60%		Provides 60% fermentable carbon
Biobased Content	100%		

Packaging: 5-gallon buckets, 55-gallon drums, 275-gallon IBC totes or bulk tankers.



Technical References for the benefits of using a nutrient package for in-situ Bioremediation?

Ellis, D. E., E. J. Lutz, J. M. Odom, R. J. Buchanan, Jr., C. L. Bartlett, M. D. Lee, M. R. Harkness, and K. A. DeWeerd. 2000. Bioaugmentation for accelerated *in situ* anaerobic bioremediation. *Environ. Sci. Technol.* 34:2254-2260.

He, J., V. F. Holmes, P. K. H. Lee, and L. Alvarez-Cohen. 2007. Influence of Vitamin B₁₂ and cocultures on the growth of *Dehalococcoides* isolates in defined medium. *Appl. Environ. Microbiol.* 73(9):2847-2853.

Harkness, M., A. Fisher, M. D. Lee, E. E. Mack, J. A. Payne, S. Dworatzek, J. Roberts, C. Acheson, R. Herrmann, and A. Possolo. 2012. Use of statistical tools to evaluate the reductive dechlorination of high levels of TCE in microcosm studies. *Journal of Contaminant Hydrology* 131(1-4):100-118.