



FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

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SECRETARY

February 24, 2014

Via Electronic Mail

kdesanto@rhamnolipid.com

Keith DeSanto
Rhamnolipid Companies, Inc.
511 West Bay Street, Suite 350
Tampa, Florida, 33606

Re: Rhamnolipid Biosurfactant Technology

Dear Mr. DeSanto:

The Division of Waste Management (Division) hereby accepts Rhamnolipid Aqueous Solution for in situ bioremediation of petroleum hydrocarbons and metals in groundwater and soil. The product is shipped as a mixture of mono- and di-rhamnolipids dissolved in water at a total concentration of 25%, and typically diluted prior to use depending on site-specific conditions. Rhamnolipids are naturally-occurring organic molecules consisting of a rhamnose sugar molecule attached to a fatty acid tail. Rhamnolipids possess a very low order of toxicity, and are approved for commercial use in a variety of food products and cosmetics. The mode of action of this product for petroleum is reported to be through enhanced dissolution of hydrophobic contaminants through surfactant action, leading to enhanced extraction or increased bioremediation rate. The mode of action for treatment of metals is reported to be through chelation, resulting in enhanced removal via groundwater extraction. The molecules are biodegradable, and are not expected to persist in the treatment volume far past the period of active remediation. Enclosure 1 contains regulatory information and advice regarding the use of this product.

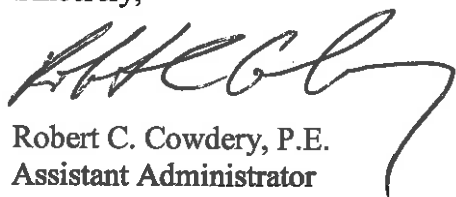
The Division does not provide endorsement of specific or brand name remediation products or processes, but it does recognize the need to determine their acceptability in the context of environmental regulations, safety and the protection of public health. For that reason, the Division issues an "acceptance" letter, not an approval. In no way shall an acceptance be construed as a certification of performance. Additionally, vendors, upon receipt of an acceptance, must market their product or process on its own merits regarding performance, cost, and safety in comparison to competing alternatives in the marketplace.

Remedial Action Plans that propose the use of an accepted product or process should include a copy of the acceptance letter in the plan's appendix, and reference it in the text of the document. It is not a requirement that a particular remediation product or process have an official

acceptance letter in order for it to be proposed in a site-specific Remedial Action Plan. The plan, however, must contain sufficient information about the product or process to show that it meets all applicable rules and regulations.

The Division reserves the right to revoke its acceptance of a product or process if it has been falsely represented. Additionally, Division acceptance of any product or process does not imply it has been deemed applicable for all cleanup situations, or that it is preferred over other treatment or cleanup techniques in any particular case. A site-specific evaluation of applicability and cost-effectiveness must be considered for any product or process, whether conventional or innovative, and adequate site-specific design details must be provided in a Remedial Action Plan submitted for Department review and approval. If you have any questions, please contact me at the number below.

Sincerely,



Robert C. Cowdery, P.E.
Assistant Administrator
Petroleum Restoration Program
Email: Robert.Cowdery@dep.state.fl.us
Telephone: 850.245.8899

enc: (1) Regulatory Information

c: Rick Ruscito, P.E. – PRP Team 6/Tallahassee
Mubeen Darji, P.E. – FDEP/Tallahassee

History:

2/24/14
PPL #478
BurLab (1454)
ITR #70814
INN_207

ENCLOSURE 1

REGULATORY INFORMATION

- a. Regulations: Chapters of the Florida Administrative Code (F.A.C.) that may be applicable, either in part or in their entirety, include but are not necessarily limited to Chapter 62-550, F.A.C., for primary and secondary water quality standards; Chapter 62-520, F.A.C. for groundwater classes and standards, and groundwater permitting and monitoring requirements; Chapter 62-528, F.A.C., for Underground Injection Control (UIC), particularly Part V, for Class V, Group 4 aquifer remediation projects; Chapters 62-780, 62-782, and 62-785 F.A.C., for cleanup criteria; and Chapter 62-777, F.A.C., for cleanup target levels.

Users of Rhamnolipid Aqueous Solution shall comply with all applicable regulations. This includes meeting applicable groundwater cleanup target levels for the contaminants of concern, the residual concentrations of reagent ingredients, and any byproducts of concern produced by chemical and biological reactions induced by those ingredients during the timeframe of the cleanup project. For the ingredients of concern that are present in excess of their groundwater standards, the timeframe is that which is permitted for a temporary injection zone of discharge (ZOD) as described below.

- b. UIC and ZOD permits: Per Rule 62-528.630(2)(c), F.A.C., Class V injection-type aquifer remediation wells are exempt from the permitting requirements of Rule 62-528.635, F.A.C., when authorized by a Department-approved Remedial Action Plan or other enforceable mechanism, provided the requirements of the rules governing the remediation project, as well as the construction, operation, and monitoring requirements of Chapter 62-528, F.A.C., are met. Per Rule 62-528.630(2)(c), F.A.C., the issuance of an enforceable, site-specific Remedial Action Plan Approval Order by the Department for injection-type aquifer remediation constitutes the granting of a Class V injection well construction/clearance permit. And per Rule 62-520.310(8)(c), F.A.C., if a temporary ZOD is necessary, and permissible by way of that rule, then the issuance of the site-specific Remedial Action Plan Approval Order also constitutes the granting of permission for the temporary ZOD.
- c. UIC notification: Remedial Action Plans proposing injection-type aquifer remediation shall include information pursuant to Rules 62-528.630(2)(c)1 through 6, F.A.C., for the inventory purposes of the UIC program. Reviewers of those plans, upon issuance of an enforceable Remedial Action Plan Approval Order by the Department, must submit a completed copy of the UIC inventory notification form to the UIC program in Tallahassee.
- d. General information about temporary ZODs: For groundwater remediation, the composition of an injected material must meet the primary and secondary drinking water standards set forth in Chapter 62-550, F.A.C., and the minimum groundwater criteria of Chapter 62-520, F.A.C., pursuant to UIC Rule 62-528.600(2)(d), F.A.C. Aquifer remediation products that do not meet these requirements must seek relief from water quality criteria by one of two mechanisms. Permission for a temporary ZOD may be obtained via Rule 62-520.310(8)(c), F.A.C. If a ZOD cannot be obtained by rule, it will be necessary to seek a variance from Department rules in accordance with Section 120.542, Florida Statutes.

Rule 62-520.310(8)(c), F.A.C., allows for a temporary ZOD for closed-loop re-injection systems, for the prime constituents of the reagents used to remediate site contaminants, and for groundwater secondary standards. In order to obtain permission for a temporary ZOD by rule, a site-specific Remedial Action Plan must indicate: (a) the chemical ingredients of concern in the fluid to be injected that will be present in excess of groundwater standards; (b) the size of the ZOD that is needed; (c) the amount of time that the ZOD will be needed; and (d) a plan for monitoring the injected chemical ingredients of concern. The size of the temporary ZOD will usually be the injection well radius of influence when the treatment system is a single injection point. For a multiple point system, the ZOD can usually be expressed and illustrated as the total area of the cluster formed by all the injection points, located side-by-side with overlapping radii of influence.

- e. Specific ZOD information for Rhamnolipid Aqueous Solution: ZOD permission and monitoring is necessary for TRPH. Prior FL-PRO laboratory analysis of a reference sample of one-half percent (0.5%) rhamnolipid [5,000 milligrams per liter (mg/L)] showed a method response of 0.022% (i.e., 5,000 mg/L was detected as 1.1 mg/L). Site-specific Remedial Action Plans shall indicate the volume and concentration at which the Rhamnolipid Aqueous Solution will be injected, and seek permission for a temporary ZOD by way of Rule 62-520.310(8)(c), F.A.C., as described in paragraph d above.

Rhamnolipid Companies Incorporated has indicated that the dosage of Rhamnolipid Aqueous Solution is site-specific, and that the 25% “as-shipped” product might typically be diluted volumetrically prior to application over a range of ratios from as low as 10:1 to as high as 2,000:1. The Division of Waste Management does not object to the use of this product at the full 25% “as-shipped” concentration, but from a ZOD-duration standpoint recommends application of only the minimum amount needed to remediate a site’s contaminants of concern.

- f. ZOD monitoring advice for Rhamnolipid Aqueous Solution: For the ZOD parameter discussed in above paragraph e, quarterly monitoring of groundwater should suffice in most cases. The current groundwater standard for total recoverable petroleum hydrocarbons (TRPH) is 5 mg/L. The fatty acid tail of the rhamnolipid molecule is a source of TRPH, a groundwater contaminant in the State of Florida, regardless of whether the source is a petroleum contaminant or the fatty acid component of a bioremediation product. Upon expiration of the time period granted for the ZOD, the concentration of TRPH must meet its groundwater standard or its natural-occurring background value at the specific cleanup site, whichever is less stringent.
- g. Utilization of wells: If a remediation site happens to have an abundance of monitoring wells, then the Division has no objection to the use of some wells for the application of Rhamnolipid Aqueous Solution. However, no “designated” monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply reagents. This will avoid premature conclusion that the entire site meets cleanup goals. By making sure that designated tracking wells are not also used for treatment, there will be more assurance that the treatment process has permeated the entire site and that it did not remain localized to the area immediately surrounding each injection well.

- h. Avoidance of migration: For injection-type, in-situ aquifer remediation projects, pursuant to Rule 62-528.630(3), F.A.C., injection of Rhamnolipid Aqueous Solution shall be performed in such a way, and at such a rate and volume, that no undesirable migration of either the ingredients of concern, site contaminants, or remediation byproducts results.
- i. Abandonment of wells: Upon issuance of a Site Rehabilitation Completion Order, injection wells shall be abandoned pursuant to Section 62-528.645, F.A.C., and the Underground Injection Control Section of the Department shall be notified so that the treatment wells can be removed from the injection well inventory-tracking list.
- j. Open-pit application: Applications of Rhamnolipid Aqueous Solution to an open pit in which the groundwater is exposed is not injection, and notification of the UIC Section is not required. However, the applied material must still meet the requirements of paragraph 62-520.310(8)(c), F.A.C., and the groundwater in the application area should be monitored in the same manner as if the material had actually been injected.
- k. Additives: If an additive is used with Rhamnolipid Aqueous Solution in the future, then a site-specific Remedial Action Plan must include a complete description of the additive's chemical composition and physical properties, the concentration of the additive in the fluid to be injected, the volume of the fluid to be injected, and seek permission for a temporary ZOD as described in paragraph d above if the fluid does not meet primary, secondary, and minimum groundwater standards.