



**FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION**

BOB MARTINEZ CENTER
2600 BLAIRSTONE ROAD
TALLAHASSEE, FLORIDA 32399-2400

RICK SCOTT
GOVERNOR

HERSCHEL T. VINYARD JR.
SECRETARY

July 30, 2013

Via Electronic Mail
rossabi@redox-tech.com

Joe Rossabi, Ph.D., P.E.
Redox Tech LLC
200 Quade Drive
Cary, North Carolina 27513

Re: **Oxygen BioChem Plus (OBC+)™**

Dear Dr. Rossabi:

The Florida Department of Environmental Protection's Division of Waste Management (Division) hereby accepts Oxygen BioChem Plus (OBC+)™ for the anaerobic oxidation of petroleum hydrocarbons and other suitable contaminants in groundwater and soil, in situ and ex situ. As indicated by Redox Tech LLC, OBC+™ is a proprietary mix of soluble sulfates, with magnesium sulfate as the main source of sulfate electron acceptors, for use by microorganisms that are capable of oxidizing contaminants by sulfate reduction. It is shipped dry, and mixed with water at the remediation site prior to injection as an aqueous solution. The OBC+™ itself does not contain microorganisms. A proprietary ingredients voucher is provided in Enclosure 1, and regulatory information is provided in Enclosure 2.

There are no objections to the use of OBC+™ provided: (a) the considerations of this letter are taken into account; (b) a site-specific Remedial Action Plan is submitted for review and approval by the Department; and (c) the Remedial Action Plan specifies the size and duration of a temporary injection zone of discharge for sodium, sulfate, and total dissolved solids, and proposes adequate groundwater monitoring of them pursuant to Rule 62-520.310(8)(c), F.A.C. [formerly 62-522.300(2)(c), F.A.C.].

While the Department of Environmental Protection does not provide endorsement of specific or brand name remediation products or processes, it does recognize the need to determine their acceptability from an environmental standpoint with respect to applicable rules and regulations, and the interests of public health and safety. Vendors, upon receipt of an acceptance, must market the products and processes on their own merits regarding performance, cost and safety in comparison to competing alternatives in the marketplace. This acceptance letter shall not be construed as either an approval of the product or a certification of its performance.

It is not a requirement that a remediation product or process obtain an acceptance from the Department in order to be proposed for use in a site-specific Remedial Action Plan, but the plan

must contain sufficient information to show that the product or process meets all applicable and appropriate rules and regulations. For OBC+™, a copy of this acceptance letter should be included in the appendix of each site-specific Remedial Action Plan that proposes its use.

The Department reserves the right to revoke its acceptance of a product or process if it has been falsely represented. Additionally, Department 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. Contact Rick Ruscito at (850) 877-1133, extension 3722, if there are any questions.

Sincerely,



Rick Ruscito, P.E.
Ecology and Environment, Inc.
Bureau of Petroleum Storage Systems
Petroleum Cleanup Section 6



Rebecca S. Lockenbach
FDEP Section Leader
Bureau of Petroleum Storage Systems
Petroleum Cleanup Section 6

Enclosures: (1) Proprietary Information Voucher
(2) Regulatory Information

c: Tom Conrardy - FDEP/Tallahassee

History

PPL 468 - INN 203 - 7/30/2013

PROPRIETARY INGREDIENTS VOUCHER

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July 30, 2013

Joe Rossabi, Ph.D., P.E.
Redox Tech LLC
200 Quade Drive
Cary, North Carolina 27513

Re: Proprietary Information Voucher for Oxygen BioChem Plus (OBC+™)

Dear Dr. Rossabi:

On July 1, 2013 the Division of Waste Management (Division) received a confidential version of the Material Safety Data Sheet (MSDS) that discloses the ingredients and their proportions in Oxygen BioChem Plus (OBC+™). Having reviewed the confidential disclosure, the Division hereby vouches for its content, and in exchange provides advice in Enclosure 2 on how to comply with applicable regulations of the Florida Administrative Code (F.A.C.) when OBC+™ is used for the cleanup of contamination in accordance with a Department-approved, site-specific Remedial Action Plan. The Department, in offering its advice, has been careful to mention only enough general information about the chemical species and parameters that must be monitored by users in order to comply with Underground Injection Control regulations, but not so much information as to compromise the proprietary aspects of the product.

For Underground Injection Control purposes, injection-type aquifer remediation plans must specify both the volume and the complete chemical composition of the fluid to be injected. But since the details of the ingredients and their proportions in OBC+™ are proprietary, it will suffice to indicate just the fluid volume to be injected and the overall concentration of OBC+™ in that fluid, and then provide a note that a confidential disclosure of the proprietary details has already been submitted to the Department and accepted. Reference should be made to this voucher, and a copy of it should be included as an appendix to the plan. Contact Rick Ruscito at (850) 877-1133, extension 3722, if there are any questions.

Sincerely,

A handwritten signature in black ink that reads "Rick Ruscito".

Rick Ruscito, P.E.
Ecology and Environment, Inc.
Bureau of Petroleum Storage Systems
Petroleum Cleanup Section 6

A handwritten signature in black ink that reads "Rebecca S. Lockenbach".

Rebecca S. Lockenbach
FDEP Section Leader
Bureau of Petroleum Storage Systems
Petroleum Cleanup Section 6

REGULATORY INFORMATION

- a. Groundwater cleanup standards: The onus shall be on users of OBC+™ to ensure that all applicable groundwater contaminant standards will be met at the time of project completion, for petroleum and other contaminants that may be present, any residuals associated with the ingredients of OBC+™ and any by-products produced as a result of chemical or biochemical reactions involving those ingredients. The following chapters of the Florida Administrative Code (F.A.C.) are cited: 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; 62-780, 62-782, and 62-785 F.A.C., for cleanup criteria; and Chapter 62-777, F.A.C., for cleanup target levels.
- b. Ingredients: As indicated by Redox Tech LLC, OBC+™ is a mix of soluble sulfates, with magnesium sulfate as the main source of sulfate electron acceptors, for use by microorganisms that are capable of oxidizing contaminants by sulfate reduction. The complete list of ingredients and their proportions is proprietary, and it was provided to the Division of Waste Management in a confidential disclosure received on July 1, 2013.
- c. Injection well permit: The issuance of a site-specific Remedial Action Plan Approval Order by the Department for injection of OBC+™ into an aquifer constitutes the granting of a Class V injection well permit. [62-528.630(2)(c) and 62-528.640(1)(c), F.A.C.]
- d. How to obtain permission for a temporary injection zone of discharge: For injection-type, in situ aquifer remediation, the composition of an injected fluid must meet the drinking water standards set forth in Chapter 62-550, F.A.C., and the minimum general groundwater criteria of Chapter 62-520, F.A.C., pursuant to Underground Injection Control Rule 62-528.600(2)(d), F.A.C. Chapter 62-777, F.A.C., provides additional groundwater criteria for specific chemicals of regulatory interest. Aquifer remediation fluids that do not meet these requirements must seek permission for a temporary injection zone of discharge. In the case of OBC+™, the following parameters must seek permission for a temporary injection zone of discharge pursuant to Rule 62-520.310(8)(c), F.A.C.: sodium, sulfate, and total dissolved solids.

In order to obtain permission for a temporary injection zone of discharge by way of Rule 62-520.310(8)(c), F.A.C., a site-specific Remedial Action Plan proposing the use of OBC+™ must: (a) indicate the overall concentration of OBC+™ in the fluid to be injected, and cite the proprietary ingredients voucher of this acceptance letter; (b) specify the size of the injection zone of discharge in which the temporary exceedance could occur; (c) specify the period of time that the temporary injection zone of discharge will be needed; and (d) propose groundwater monitoring of sodium, sulfate, and total dissolved solids. Department approval of a site-specific Remedial Action Plan that meets the requirements of Rule 62-520.310(8)(c), F.A.C., constitutes the granting of permission for a temporary injection zone of discharge for aquifer remediation purposes.

The current groundwater standards for the OBC+™ parameters that require a temporary zone of discharge are sodium (160 milligrams per liter, mg/L), sulfate (250 mg/L), and

total dissolved solids (500 mg/L). If the groundwater's natural-occurring background level of any of these parameters at a specific remediation site does not meet the established groundwater standard, then the residual level of that parameter by the time the temporary zone of discharge period ends shall be no worse than the pre-existing, pre-injection background level.

- e. Utilization of wells: If a remediation site happens to have an abundance of monitoring wells, then the Division of Waste Management has no objection to the use of some wells for the application of OBC+™. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply OBC+™. This will avoid premature conclusions 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.
- f. Groundwater monitoring:
 - 1. Active remediation petroleum monitoring: During the period of active remediation, groundwater shall be monitored in accordance with the requirements set forth in Section 62-780.700, F.A.C., for the contaminants of concern.
 - 2. Post active remediation petroleum monitoring: At least one (1) year of quarterly post remediation groundwater monitoring for the contaminants of concern shall be conducted at a minimum of two (2) wells, one located in the area of highest contamination, the other at the downgradient edge of the contamination plume, pursuant to Section 62-780.750, F.A.C.
 - 3. Underground injection control monitoring: For Underground Injection Control purposes, when OBC+™ is injected the groundwater must be monitored pursuant to Rule 62-520.310(8)(c), F.A.C., for the parameters discussed above in paragraph d.
- g. Underground Injection Control (UIC) inventory: 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 Notification" to the UIC program in Tallahassee. The notification is currently located on the Internet at www.dep.state.fl.us/waste/categories/pcp/pages/innovative.htm.
- h. Operation:
 - 1. Avoidance of migration: For injection-type, in situ aquifer remediation projects, injection of the OBC+™ shall be performed in such a way, and at such a rate and volume that no undesirable migration of either the reagent or the contaminants in the aquifer results, pursuant to Rule 62-528.630(3), F.A.C.

2. Underground injection control operating permit: Although an operating permit is not required for aquifer remediation wells pursuant to Rule 62-528.640(1)(b), and 62-528.640(1)(c), F.A.C., since no movement of the contamination plume is expected to accompany the treatment process, the Department requests that the information items listed in Rule 62-528.640(1)(b), F.A.C., be considered and included in Remedial Action Plan proposals as a matter of good and thorough design practice. Briefly summarized, they are: quality of water in the aquifer; quality of the injected fluid; existing and potential uses of the affected aquifer; and well construction details.
- i. Abandonment of wells: Upon issuance of a Site Rehabilitation Completion Order, or a declaration of "No Further Action", injection wells shall be abandoned pursuant to Section 62-528.645, F.A.C. The Underground Injection Control Section of the Department shall be notified so that the injection wells can be removed from the inventory-tracking list.
- j. Open-pit applications: While open-pit application of OBC+ TM is not an injection-type application, and notification of the Underground Injection Control Section therefore not required, the user of OBC+ TM must still be mindful of groundwater quality. For open-pit applications, the Division of Waste Management suggests that groundwater in the application area be monitored for the same parameters that would be monitored had the application been an injection. These parameters are listed above in paragraph *d*.