



Florida Department of Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Rick Scott
Governor

Jennifer Carroll
Lt. Governor

Herschel T. Vinyard Jr.
Secretary

July 26, 2012

Via Electronic Mail
WBaird65@AOL.com

William E. Baird
MicroSorb Environmental Products, Inc.
106 Longwater Drive
Norwell, Massachusetts 02061

Re: **MicroSorb**

Dear Mr. Baird:

The Division of Waste Management (Division) hereby issues this superseding update of previous acceptance letters dated May 24, 2001 and March 14, 2007 for six MicroSorb products, issued by the Bureau of Petroleum Storage Systems, for in situ and ex situ bioremediation of contaminated soil and groundwater in Florida.

MicroSorb Super Concentrate (SC);
MicroSorb Biocatalyst;
MicroSorb Nutrient;
MicroSorb Emergency Response (ER);
MicroSorb De-Chlorinator Product (DC); and
MicroSorb Industrial Strength (IS).

The changes made in this update: (a) use the most recent acceptance letter format in which acceptance is no longer issued in the name of the Bureau of Petroleum Storage Systems but rather the Division of Waste Management; (b) indicate that zone of discharge (ZOD) permission is now obtained pursuant to Rule 62-520.310(8)(c), Florida Administrative Code (F.A.C.), which is identical in language to former Rule 62-522.300(2)(c), F.A.C., but now renumbered and listed in Chapter 62-520, F.A.C.; and (c) include a ZOD trigger concentration table for the ingredients of MicroSorb Nutrient.

As MicroSorb Environmental Products Incorporated has indicated, MicroSorb ER, MicroSorb IS, MicroSorb SC, and MicroSorb DC products contain varying concentrations of non-pathogenic, natural-occurring microorganisms that have been dehydrated and mixed with an inert preparation of natural clay. The microorganisms

are cultivated in seawater with ammonia as the only nitrogen source, and crude oil as the only source of carbon.

MicroSorb Biocatalyst is a liquid containing extracts and oxygen-enriching water that is used to supply the microbes with oxygen.

MicroSorb Nutrient is a blended fertilizer containing nitrogen, phosphorous, potassium, sulfur, and trace nutrients. When using this product for in situ, injection-type remediation, permission for a temporary injection zone of discharge (ZOD) may have to be sought for one or more groundwater standards pursuant to Rule 62-520.310(8)(c), Florida Administrative Code (F.A.C.), depending on the concentration of MicroSorb Nutrient in the fluid to be injected. Enclosure 1 contains chemical analyses of MicroSorb Nutrient and MicroSorb Biocatalyst. Enclosure 2 contains regulatory information and Enclosure 3 contains supplemental information.

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 Rick Ruscito at (850) 877-1133, extension 3722 or by e-mail at RRuscito@ene.com.

William E. Baird
July 26, 2012
Page 3

MicroSorb

Sincerely,



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



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

enc: (1) Chemical Analyses of MicroSorb Nutrient and MicroSorb Biocatalyst
(2) Regulatory Information
(3) Supplemental Information

c: Tom Conrardy, P.E. - FDEP/Tallahassee

History

PPL #450
INN_189 - 7/26/2012
ITR 63130
BurLabs #1163

INN_060a
3/14/2007

INN_060
5/24/2001

ENCLOSURE 1
CHEMICAL ANALYSES

MicroSorb
July 26, 2012

MICROSORB NUTRIENT FORMULA

<u>Parameter</u>	<u>Percent by Weight</u>
Total Nitrogen (N).....	21%
12.8% Ammoniacal Nitrogen	
8.2% Nitrate Nitrogen	
Available Phosphate (P ₂ O ₅).....	10%
Soluble Potash (K ₂ O).....	10%
Sulfur (S).....	7%
Boron (B).....	0.02%
Copper (Cu).....	0.005%
Iron (Fe) (chelated).....	0.10%
Manganese (Mn) (water soluble).....	0.05%
Molybdenum (Mo).....	0.001%
Zinc (Zn).....	0.05%

Note 1. Percent by weight analysis is for nutrient formula that is shipped as dry powder, which the user must mix with water prior to use.

MICROSORB BIOCATALYST FORMULA

<u>Parameter</u>	<u>Concentration</u>	<u>Reporting Limit</u>	<u>Units</u>
Nitrogen, Ammonia	0.3	0.2	mg/L
Nitrogen, total Kjeldahl	1.6	0.5	mg/L
Oxygen, Dissolved	8	1	mg/L
pH	7.3	n/a	pH
Turbidity	0.6	0.2	NTU
Phosphorus, total	1.7	0.5	mg/L

Note 1. All results are for an undiluted sample of MicroSorb Biocatalyst.

Note 2. Chemical analysis was conducted April 1997.

Note 3. Abbreviations: mg/l denotes milligrams per liter.

Note 4. Total Kjeldahl Nitrogen is the sum of organic nitrogen, ammonia (NH₃), and ammonium (NH₄⁺).

Note 5. Chemical analysis included the following eight metals, all of which were below the reporting limit (BRL) of the analytical method: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

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 62-770, 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 MicroSorb 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 MicroSorb Nutrient: Site-specific Remedial Action Plans shall indicate the volume of MicroSorb Nutrient solution to 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 for the applicable parameters listed in Table 1. Dilution calculations made by the Division of Waste Management to determine trigger point concentrations in the table were based on a conservative assumption (for regulatory purposes) that each chemical species of concern is totally dissolved in the fluid to be injected, regardless of whether or not that is actually the case.

Table 1. ZOD Trigger Concentrations for MicroSorb Nutrient

If the overall concentration of
MicroSorb Nutrient in the fluid
to be injected is greater than...

...then ZOD permission via Rule 62-520.310(8)(c), F.A.C., and groundwater monitoring is required for...

	<u>Ammonia</u>	<u>Manganese</u>	<u>Nitrate</u>	<u>Iron</u>	<u>Total Dissolved Solids</u>	<u>Sulfate</u>	<u>Molybdenum</u>	<u>Boron</u>	<u>Zinc</u>	<u>Copper</u>
21.8 mg/L (0.00218% by weight)	X									
100 mg/L (0.01000% by weight)	X	X								
121 mg/L (0.01219% by weight)	X	X	X							
300 mg/L (0.03000% by weight)	X	X	X	X						
500 mg/L (0.05000% by weight)	X	X	X	X	X					
1,190 mg/L (0.11900% by weight)	X	X	X	X	X	X				
3,500 mg/L (0.35000% by weight)	X	X	X	X	X	X	X			
7,000 mg/L (0.70000% by weight)	X	X	X	X	X	X	X	X		
10,000 mg/L (1.00000% by weight)	X	X	X	X	X	X	X	X	X	
20,000 mg/L (2.00000% by weight)	X	X	X	X	X	X	X	X	X	X

mg/L denotes milligrams per liter

- f. ZOD monitoring advice for MicroSorb: For the ten (10) ZOD parameters listed in Table 1, quarterly monitoring of groundwater should suffice in most cases. The current groundwater standards for those chemical species and parameters are as follows: ammonia, 2.8 milligrams per liter (mg/L); boron, 1.4 mg/L; copper, 1 mg/L; iron, 0.3 mg/L; manganese, 0.05 mg/L; molybdenum, 0.035 mg/L; nitrate, 10 ppm; total dissolved solids, 500 mg/L; sulfate, 250 mg/L; and zinc, 5 mg/L. Upon expiration of the time period granted for the ZOD, the concentration of each must meet its respective 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 MicroSorb. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply reagents. 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.
- h. Avoidance of migration: For injection-type, in-situ aquifer remediation projects, pursuant to Rule 62-528.630(3), F.A.C., injection of MicroSorb 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 MicroSorb Nutrient to an open pit in which the groundwater is exposed is not an injection, and notification of the UIC Section is not required. However, the groundwater should still be monitored in the pit. If the pit is backfilled after the application of MicroSorb Nutrient, then install monitoring wells in the backfill that are representative of the former pit area. Sample them for the same parameters that would have been granted ZOD permission via rule 62-520.310(8)(c), F.A.C., had the MicroSorb Nutrient actually been injected.

SUPPLEMENTAL INFORMATION

- a. General: MicroSorb products augment the bioremediation of contaminants by the application of a mixture of microbes, nutrients, and the biocatalyst. The rapid biodegradation of pollutants is achieved through the injection of a varied species of microbes in high densities; for example, MicroSorb ER contains 5 billion microbes per gram, MicroSorb IS contains 20 billion microbes per gram, and MicroSorb SC contains 90 billion microbes per gram.

The in situ application of MicroSorb can take two forms. In the first form, if free product is present or soils in the vadose zone are contaminated, then an interceptor trench or series of recovery wells are installed. Contaminated water from them is then pumped to a bioreactor tank, the MicroSorb is introduced, any free product is removed, and the treated fluid in the bioreactor drains back into the source area through leaching trenches or pits. The second form of application involves injecting a mixture of MicroSorb microbes, nutrients, and biocatalyst into a series of injection wells. This application is effective for the treatment of dissolved contamination. This MicroSorb mixture works biochemically, removing a carbon atom from the hydrocarbon and replacing it with two oxygen atoms to form a water-soluble fatty acid. The ultimate degradation products of hydrocarbon contaminants are carbon dioxide and water, and in the case of chlorinated hydrocarbon contaminants, chloride ions as well.

- b. Design and operating parameters: Recovery and injection system designs should be tailored to site-specific characteristics. However, as a rule-of-thumb, for estimating purposes, injection wells may be spaced 5 feet to 10 feet apart in a grid pattern. For the control of operating parameters, MicroSorb recommends the monitoring of groundwater for nitrate, nitrite, sulfate, and phosphate. These operating parameters are not to be confused with those that may have to be monitored for Underground Injection Control zone of discharge purposes, although some may be in common.
- c. Dosage and application rate: Per information about MicroSorb products submitted to the Division of Waste Management, a typical dose of MicroSorb for an injection point at a remediation site is 0.5 pounds of MicroSorb SC and 0.1 pound of MicroSorb Nutrient blended into 25 to 50 gallons of MicroSorb Biocatalyst. For bioreactor applications, 1.0 pound of MicroSorb SC and 0.2 pounds of MicroSorb Nutrient are applied to the bioreactor weekly. The application rate (expressed, for example, as gallons of MicroSorb mixture per cubic yard of contaminated vadose and/or aquifer) will depend on site-specific conditions.
- d. Testing: Double filtering may be required at the laboratory when analyzing samples for total recoverable petroleum hydrocarbons (TRPH), the reason being that fatty acids, which are water-soluble byproducts, can register as a false positive for TRPH.