



Department of Environmental Protection

Jeb Bush
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

David B. Struhs
Secretary

July 17, 2002

Ms. Anne Cafferty-Turnbough, Ph.D.
International Biochemicals Limited
9200 New Trails Drive
The Woodlands, Texas 77381

Re: **Micro Pro SSC**

Dear Ms. Cafferty-Turnbough:

The Bureau of Petroleum Storage Systems hereby accepts Micro Pro SSC as a product for in situ and ex situ bioremediation of petroleum and other suitable contaminants in groundwater and soil. It is a mixture of natural-occurring, non-pathogenic, aerobic microorganisms and nutrients. The product is shipped as a dry powder that is hydrated by the user prior to application at a remediation site. Enclosure 1 is a chemical analysis of the Micro Pro SSC.

Although this acceptance applies only to the jurisdiction of this bureau, other bureaus within the Department of Environmental Protection, or other state agencies and local governments may choose to recognize it if their needs and regulations are similar. This bureau, however, is not responsible for applications beyond its jurisdiction, which is primarily the cleanup of subsurface petroleum, pursuant to Chapter 62-770, Florida Administrative Code (F.A.C.), typically at gasoline service stations.

For soil remediation where the underlying groundwater will not be affected by the leaching of Micro Pro SSC, there are no special concerns beyond those that normally need to be addressed in preparing a Remedial Action Plan and conducting a cleanup in accordance with the petroleum cleanup requirements of Chapter 62-770, F.A.C. For ex situ groundwater treatment, where an aboveground treatment system produces effluent meeting the petroleum cleanup criteria of Chapter 62-770, F.A.C., and the drinking water standards of Chapter 62-550, F.A.C., for disposal via recharge gallery or NPDES permit, there are no special concerns. But for in situ groundwater remediation, via direct injection of Micro Pro SSC into an aquifer, there are underground injection control (UIC) regulations that must be observed. Since in situ aquifer remediation via injection is likely to be the most common application of this product, the bulk of the regulatory requirements discussed herein will be directed to that topic.

The bureau recognizes Micro Pro SSC as a viable product for the bioremediation of petroleum contaminated sites in Florida. There are no objections to its use provided the considerations of this letter are taken into account, and a Remedial Action Plan is prepared in accordance with Chapter 62-770, F.A.C., for approval by the Department. Environmental and regulatory requirements that apply to Micro Pro SSC are provided in enclosure 2.

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, safety and welfare. Vendors must then market the products and processes on their own merits regarding performance, cost and safety in comparison to competing alternatives in the marketplace. In no way, however, shall this regulatory acceptance letter be construed as Department certification of performance. Additionally, the Department emphasizes a distinction between its regulatory "acceptance" and an approval. Products and processes are accepted but they are not approved.

It is also 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 and appropriate rules and regulations, especially those of the Florida Administrative Code.

Those who prepare Remedial Action Plans are advised to include a copy of this letter in the appendix of plans they submit, and call attention to it in the text of their document. In this way, technical reviewers throughout the state will be informed that you have contacted the Department of Environmental Protection to inquire about the environmental acceptability of Micro Pro SSC. To aid those reviewers, the Bureau of Petroleum Storage Systems provides supplemental information as enclosure 3.

The Department reserves the right to revoke its acceptance of a product or process if its nature or performance 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. You may contact me at 850/487-3299 if there are any questions.

Sincerely,

Rick Ruscito, P.E.
Bureau of Petroleum Storage Systems

c: T. Conrardy - FDEP/Tallahassee

MICRO PRO SSC CHEMICAL ANALYSIS *

CHEMICAL SPECIES OR PARAMETER

	<u>AMOUNT</u>	<u>UNITS</u>
<u>Primary Drinking Water Contaminants</u>		
Sodium §	6.1	mg/L ‡
<u>Secondary Drinking Water Contaminants</u>		
pH (of a 10% solution) ☞	7	pH units
Sulfate	<2	mg/L
<u>Minimum Groundwater Criteria Contaminants of Chapter 62-777, F.A.C.</u>		
Ammonia † (as N)	0.15	mg/L
<u>Other Parameters and Measurements</u>		
Calcium	1.68	mg/L
Carbonate (as CaCO ₃)	40	mg/L
Phosphate	9.18	mg/L

* Analysis of a 0.6% by weight aqueous Micro Pro SSC solution, except for pH. (A 0.6% by weight is equivalent to 6,000 mg/L, which can be produced by mixing 50 pounds of Micro Pro SSC into 1,000 gallons of water).

‡ mg/L denotes milligrams per liter.

§ Sodium is a State of Florida primary drinking water contaminant with a maximum contaminant level (MCL) of 160 mg/L set forth in Chapter 62-550, F.A.C., but not a federal primary drinking water contaminant.

☞ pH of a 10% solution, as reported in the Micro Pro SSC Material Safety Data Sheet.

ENCLOSURE 2

MICRO PRO SSC: ENVIRONMENTAL AND REGULATORY CONSIDERATIONS

For Micro Pro SSC applications, the major environmental and regulatory considerations are listed below.

- a. Groundwater cleanup standards: The onus shall be on users of Micro Pro SSC to ensure that all applicable groundwater contaminant standards will be met at the time of project completion, for petroleum, other contaminants that may be present, any residuals associated with the ingredients of Micro Pro SSC, and any byproducts produced as a result of chemical or biochemical reactions involving those ingredients. The following chapters of the Florida Administrative Code 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 minimum criteria; Chapter 62-522, F.A.C., for groundwater permitting and monitoring requirements; Chapter 62-528, F.A.C., for underground injection control, particularly Part V, for Class V, Group 4 aquifer remediation projects; Chapter 62-770, F.A.C., for petroleum cleanup criteria; and Chapter 62-777, F.A.C., also for minimum groundwater criteria.

A noteworthy aspect of the minimum criteria set forth in Chapter 62-520, F.A.C., is that it requires groundwater to be free from substances which are harmful to plants, animals, and organisms, and free from substances that are carcinogenic, mutagenic, teratogenic or toxic to human beings. In effect, these "free from" requirements form a catchall. They close what would otherwise be a loophole in the regulations by preventing injection of a potentially harmful product in the event that any of its ingredients is not regulated as a specific primary or secondary drinking water contaminant.

- b. Injection well permit: The issuance of a site specific Remedial Action Plan Approval Order by either the Bureau of Petroleum Storage Systems or the Bureau of Waste Cleanup, for remediation via injection of Micro Pro SSC into an aquifer, constitutes the granting of a Class V injection well permit.
- c. Groundwater injection standards: For 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., pursuant to underground injection control Rule 62-528.600(2)(d), F.A.C.
- d. Utilization of wells: If a remediation site happens to have an abundance of monitoring wells, then the Department has no objection to the use of some wells for the application of Micro Pro SSC. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply Micro Pro SSC. 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.
- e. **Supplemental nutrients and chemicals:** If additional nutrients and/or chemicals are purchased separately by the user, and injected as supplements to Micro Pro SSC, then the injection of such nutrients and other chemicals into an aquifer must also be in accordance with the

underground injection control requirements of Chapter 62-528, F.A.C., which require that injected substances meet the drinking water standards set forth Chapter 62-550, F.A.C., and the minimum groundwater criteria of Chapter 62-520, F.A.C. Additional chemical-specific, minimum groundwater criteria can be found in Chapter 62-777, F.A.C. Any Remedial Action Plan proposing the use of such supplements must provide a complete chemical analysis of the supplements at the concentration they will be injected, and the volume that will be injected.

If the supplements meet all the drinking water standards and minimum groundwater criteria, then the Remedial Action Plan proposing their use can be approved. If the supplements do not meet all the standards and criteria, then the course of action to be taken before the plan can be implemented will depend on which standards and/or criteria are not met. Two particular situations are discussed below.

For the first situation, where a primary and/or secondary drinking water standard set forth Chapter 62-550, F.A.C., is not met by a supplemental chemical or nutrient to be injected, Rule 62-522.300(2)(c), F.A.C., applies. To comply with this rule, the Remedial Action Plan must include the following: (1) identification of the specific drinking water parameters that will not be met; (2) the size of the zone of discharge around each injection point (i.e. radius of influence); (c) the period of time during which the injected supplements could potentially cause an exceedance of groundwater standards; and (d) groundwater monitoring for each parameter of the injected supplemental fluid that does not meet drinking water standards. The Remedial Action Plan containing this information must be approved before the supplements can be injected.

An example of this first type of situation would be one in which the Micro Pro SSC injection will be supplemented calcium peroxide (an oxygen source) and disodium phosphate (an additional nutrient). If the pH, total dissolved solids or sodium concentration in the supplemental fluid to be injected exceeds its drinking water standard, then the Remedial Action Plan must comply with Rule 62-522.300(2)(c), F.A.C., as indicated in the preceding paragraph.

For the second situation, where one or more constituents of the supplemental fluid do not meet the minimum groundwater criteria of Chapter 62-777, F.A.C., the user must petition the Department for a variance from Rule 62-522.300(3), F.A.C., in order to permit a temporary zone of discharge. Information about variances can be found in Bureau of Petroleum Storage Systems guidance document "BPSS-10, In Situ Chemical Additives" at web page www.dep.state.fl.us/waste/categories/pcp/pages/active.htm. The petition format is at www.dep.state.fl.us/waste/categories/pcp/pages/innovative.htm. Even after a variance is granted, it is still necessary to obtain Department approval of a site-specific Remedial Action Plan before the injection can take place.

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 62-770.700, F.A.C. Two noteworthy rules within that section are 62-770.700(3)(i), F.A.C., for frequency of sampling, and 62-770.700(5)(f), F.A.C., which requires a sampling schedule for bioremediation.
2. Post remediation petroleum monitoring: At least one (1) year of quarterly post remediation groundwater monitoring shall be conducted

at a minimum of two (2) wells, one located in the area of maximum petroleum contamination, the other downgradient of the area of maximum petroleum contamination, pursuant to Section 62-770.750, F.A.C.

3. **Underground injection control monitoring:** Since no chemical species in the Micro Pro SSC itself, when mixed with water during injection as directed by the manufacturer, exceeds a maximum contaminant level (MCL) allowed by the drinking water standards of Chapter 62-550, F.A.C., the Department, pursuant to Rules 62-528.615(1)(b)1 and (2), F.A.C., has determined that the tracking of any particular chemical species shall not be mandatory for underground injection monitoring purposes. This determination applies only to the Micro Pro SSC itself, based on the chemical analysis shown in enclosure 1. If supplemental nutrients and chemicals are added to the Micro Pro SSC injection fluid by the user, and those chemicals do not meet injection standards as discussed in paragraph e above, then groundwater monitoring of the parameters that do not meet injection standards is necessary. Typically, the samples for such groundwater monitoring will be taken before and after the injections, and continue until it is shown that the supplemental nutrients and chemicals meet their applicable groundwater standards, or their natural-occurring background levels at the site, whichever is less stringent.
- g. **Underground injection control inventory:** Remedial Action Plans prescribing in situ injection-type aquifer remediation shall include information pursuant to Rule 62-528.630(2)(c)1 through 6, F.A.C., for the inventory purposes of underground injection control. Per Rule 62-528.630(2)(c), F.A.C., aquifer remediation projects involving injection wells may be authorized under the provisions of a Remedial Action Plan, provided the construction, operation, and monitoring requirements of Chapter 62-528, F.A.C., are met. A memorandum outlining the inventory information about injection type aquifer remediation plans to be transmitted by Department reviewers to the Underground Injection Control Section is provided as enclosure 4. Only reviewers within the Department, including its district offices, may approve in situ injection-type remediation plans in which the approval constitutes a Class V injection permit; local programs are not authorized to grant such approvals. See enclosure 3.
- h. **Operation:**
 1. **Avoidance of migration:** For in situ injection-type aquifer remediation projects, injection of Micro Pro SSC shall be performed in such a way, and at such a rate and volume, that no undesirable migration of either the product's ingredients or the petroleum 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 petroleum contamination plume is expected to accompany the Micro Pro SSC 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. Additionally, each Remedial Action Plan should clearly indicate the total volume and concentration of Micro Pro SSC and supplements that will be injected.

3. Operating parameter measurements: Rule 62-770.700(9)(h), F.A.C., sets forth frequency requirements for the measurement of bioremediation operating parameters such as dissolved oxygen levels, rates of nutrient addition, temperature, etc. It also includes an option for reduction in the frequency or discontinuation of some measurements in situations when appropriate.
- i. Abandonment of wells: Upon issuance of a petroleum 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.

ENCLOSURE 3

MICRO PRO SSC: SUPPLEMENTAL INFORMATION

The information below, compiled from several sources, may be helpful to reviewers of Remedial Action Plans prescribing bioremediation.

- a. Department of Environmental Protection reviewers of in situ injection-type aquifer remediation plans, regardless of whether in Tallahassee or district offices or contracted local programs, must fill in the blanks on the enclosure 4 memorandum, whose subject is "Proposed Injection Well(s) for In Situ Aquifer Remediation at a Petroleum Remedial Action Site". The completed form must be submitted to the Underground Injection Control Section at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.

Only the appropriate administrators in the Department and its district offices can sign the enforceable approval orders for in situ injection-type aquifer remediation plans, for which such approval constitutes the issuance of a Class V injection permit. Local programs are not authorized to grant such approvals. Reason: Although an arrangement between the Environmental Protection Agency and the Department delegates underground injection control authority to the Department, it does not allow the Department to delegate that authority any further. This includes delegation to the Department's contracted remediation review agencies such as those operated by the counties and other local governments. The local programs, however, can still conduct the review of an injection-type aquifer remediation plan, but they must prepare an enforceable approval order on Department letterhead for signature by an appropriate Department administrator.

- b. Pilot study: For bioremediation, per rule 62-770.700(2), F.A.C., a pilot study proposal shall be submitted for review, and a pilot test shall be performed prior to designing a treatment system. If conditions or the situation at a site do not warrant a pilot study, then a proposal explaining the rationale for the decision not to perform a pilot study shall be submitted for review. For state-funded projects, reviewers are encouraged to use judgment in balancing cost and the need for technical information to be obtained from a pilot study.
- c. Dosage: The Bureau of Petroleum Storage Systems recommends that users consult International Biochemicals Limited for site-specific dosages of Micro Pro SSC to treat contaminated soil or aquifer. However, for rule-of-thumb and estimating purposes, it may be helpful to know that the dosage recommended for one of the first Micro Pro SSC petroleum cleanup sites in Florida was 0.3 pounds (dry weight) of Micro Pro SSC per cubic meter of contaminated aquifer.
- d. Oxygen and other operating parameters: The information submitted by International Biochemicals Limited did not indicate a range or optimum concentration of dissolved oxygen for Micro Pro SSC, but the Bureau of Petroleum Storage Systems assumes it would be similar to the oxygen requirements of other aerobic bioremediation products for the cleanup of petroleum-contaminated aquifers. Generally, it may be desirable to have at least 1 mg/L of dissolved oxygen available. The Bureau of Petroleum Storage Systems suggests that users of Micro Pro SSC contact International Biochemicals Limited to determine whether or not it would be beneficial to add oxygen at a site, based on site-specific conditions. International Biochemicals Limited has indicated that the temperature

range for Micro Pro SSC is 50 to 100 degrees Fahrenheit, and the pH range is 6 to 8.5.

- e. Degradation products: Carbon dioxide and water are the ultimate products of aerobic and most anaerobic biodegradations of petroleum hydrocarbons. The intermediate products may include simple acids, alcohols, and fatty acids. Aerobic processes use oxygen as an electron acceptor to produce the carbon dioxide and water.
- f. Parameters: The following parameters may be useful in determining the potential for bioremediation at a site, or whether bioremediation is already occurring. They were selected from a list that appears in the publication "In Situ Treatment Technology" by E. Nyer et al., Lewis Publishers, 1996. The parameters are dissolved oxygen; redox potential; pH; temperature; specific conductance; volatile organic compounds; nitrate; nitrite; ammonia nitrogen; manganese (total and dissolved); iron (total, dissolved, and ferrous); sulfate; sulfide; and total organic carbon. Gaseous parameters include carbon dioxide, oxygen, nitrogen, and methane. Other parameters that may be helpful are chemical oxygen demand, biochemical oxygen demand, and total organic carbon. Those who prepare bioremediation plans, and their reviewers, should determine which parameters, if any, should be investigated on a site-specific basis.

Memorandum**Florida Department of
Environmental Protection**

TO: Richard Deuerling, Mail Station 3530
Division of Water Facilities
Underground Injection Control Section
Florida Department of Environmental Protection
2600 Blair Stone Road, Tallahassee, FL 32399-2400

FROM: _____ (Note 1.)

DATE: _____

SUBJ: **Proposed Injection Well(s) for In Situ Aquifer
Remediation at a Petroleum Remedial Action Site**

Pursuant to Rule 62-528.630(2)(c), F.A.C, inventory information is hereby provided regarding the proposed construction of temporary injection well(s) for the purpose of in situ aquifer remediation at a petroleum-contaminated site.

Site name: _____
Site address: _____
City/County: _____
Latitude/Longitude: _____
FDEP Facility Number: _____

Site owner's name: _____
Site owner's address: _____

Well contractor's name: _____ (Note 2.)
Well contractor's address: _____

Brief description of the in situ injection-type aquifer remediation project:

Summary of major design considerations and features of the project:

Areal extent of contamination (square feet): _____
Number of injection wells: _____
Composition of injected fluid (Note 3)
(ingredient, wt. %): _____

Injection volume per well (gallons): _____
Single or multiple injection events: _____
Injection volume total (all wells, all
events): _____

Richard Deuerling
Page Two
Date: _____

Site name: _____
FDEP facility no.: _____

A site map showing the areal extent of the groundwater contamination plume, and the location and spacing of injection wells and associated monitoring wells is attached.

The following is a summary description of the affected aquifer:

Name of aquifer: _____
Depth to groundwater (feet): _____
Aquifer thickness (feet): _____

The injection well(s) features are summarized below, and/or a schematic of the injection well(s) is attached.

Direct-push or Conventional (*circle the appropriate well type*)
Diameter of well(s) (i.e., riser pipe & screen)(inches): _____
Total depth of well(s) (feet): _____
Screened interval: _____ to _____ feet below surface
Grouted interval: _____ to _____ feet below surface
Casing diameter, if applicable (inches): _____
Cased depth, if applic.: _____ to _____ feet below surface
Casing material, if applic.: _____

The in situ injection-type aquifer remediation plan for this petroleum contaminated site is intended to meet the groundwater petroleum cleanup criteria set forth in Chapter 62-770, F.A.C. Additionally, all other groundwater standards will be met at the time of project completion for any residuals associated with the ingredients of the injected remediation products, and any by-products or intermediates produced as a result of the chemical or biochemical transformation of those ingredients or the contaminating petroleum during their use. Applicable primary and secondary drinking water standards are set forth in Chapter 62-550, F.A.C., and additional groundwater quality criteria are set forth in Chapter 62-520, F.A.C.

The remediation plan estimates that site remediation will take _____ months. We will notify you if there are any modifications to the remediation strategy which will affect the injection well design or the chemical composition and volume of the injected remediation product(s).

The proposed remediation plan was approved on _____ by an enforceable approval order. A copy is attached. The remediation system installation is expected to commence within 60 days. Please call me at _____ if you require additional information.

Note 1. Local programs are not authorized to approve underground injections into aquifers. Reason: Per agreement with EPA, the FDEP cannot delegate this authority. Local programs, after reviewing a Remedial Action Plan or an injection proposal document, should follow the instructions in a March 16, 2000 memorandum to arrange for Department headquarters' execution of an approval order, and then complete this form. This form is primarily for use by state and local program technical reviewers, but petroleum remediation contractors may fill in all blanks except those labeled "FROM", "DATE", and "approval date", and "telephone number" blanks in the last paragraph. Those blanks should be completed only by a state or local program reviewer.

Note 2. If an injection well installation contractor has not yet been selected, then indicate the name and address of the project's general remediation contractor/consultant.

Note 3. Complete chemical analysis of injected fluid is required by Chapter 62-528, Florida Administrative Code. Proprietary formulations shall make confidential disclosure. Injected fluids must meet drinking water standards of Chapter 62-550, F.A.C., unless an exemption or variance has been granted.