

Department of Environmental Protection

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

Colleen M. Castille
Secretary

April 12, 2005

Erik R. Piatt
EN Rx Incorporated
16350 Park Ten Place, Suite 221
Houston, Texas 77084

Re: **EN Rx SSO and
EN Rx Synergist**

Dear Mr. Piatt:

The Bureau of Petroleum Storage Systems hereby accepts EN Rx Sustained Singlet Oxygen (SSO) and EN Rx Synergist for the remediation of petroleum and other suitable contaminants in groundwater and soil, in situ and ex situ, via chemical oxidation. As En Rx has indicated, when SSO (a proprietary sodium form of peroxide) and Synergist (a catalyst) are used together, they generate hydroxyl radicals that destroy contaminants. The end products are carbon dioxide and water. In the case of chlorinated hydrocarbon contaminants, the end products include chloride. Additionally, as En Rx has indicated, the slow-release formulation minimizes the amount of heat and pressure that are generated, and it is not pH sensitive like conventional Fenton reaction-based systems.

This acceptance applies only to the regulatory jurisdiction and the remediation needs of the Bureau of Petroleum Storage Systems, which is primarily the cleanup of subsurface petroleum contamination pursuant to Chapter 62-770, Florida Administrative Code (F.A.C.). Other state agencies and local governments may choose to recognize this acceptance if their needs and regulations are similar. This Bureau, however, is not responsible for applications beyond its jurisdiction.

For vadose remediation, where the underlying groundwater will not be affected by the leaching of En Rx ingredients, there are no special concerns beyond those that would normally need to be addressed in preparing a Remedial Action Plan and conducting a cleanup in accordance with Chapters 62-770 and 62-777, F.A.C. However, for injection-type, in situ groundwater remediation, via direct injection of SSO and Synergist into an aquifer, there are underground injection control regulations that must be observed. Since injection-type, in situ aquifer remediation is likely to be the most common application of this formulation, the bulk of the regulatory requirements discussed herein will be directed to that topic.

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The Bureau recognizes EN Rx SSO and Synergist as a viable method for the remediation of petroleum contaminated sites in Florida. There are no objections to their use provided: (a) the considerations of this letter are taken into account; (b) a site-specific Remedial Action Plan is submitted pursuant to Chapter 62-770, F.A.C., and approved by the Department for each site where the use of En Rx is proposed; and (c) the Remedial Action Plan specifies the injection zone of discharge size and duration for sodium and chloride, and addresses groundwater monitoring of them, pursuant to Rule 62-522.300(2)(c), F.A.C. Additionally, even though pH is adjusted to match the receiving aquifer, the Bureau suggests that it, too, be monitored as a prudent measure. Enclosure 1 is a voucher for the confidential disclosure of proprietary ingredients in SSO and Synergist. Enclosure 2 provides regulatory information.

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 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" letters and an approval. Products and processes are accepted but they are not approved.

Also, 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 and appropriate rules and regulations, especially those of the Florida Administrative Code pertaining to underground injection control.

Those who prepare Remedial Action Plans are advised to include a copy of this letter in the appendix, and call attention to it in the text of their document. In this way, technical reviewers will be informed that you have contacted the Department of Environmental Protection to inquire about the environmental acceptability of EN Rx SSO and Synergist. 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 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

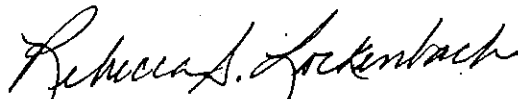
Erik R. Piatt
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innovative, and adequate site-specific design details must be provided in a Remedial Action Plan. You may contact me at (850) 877-1133, extension 29, if there are any questions.

Sincerely,



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

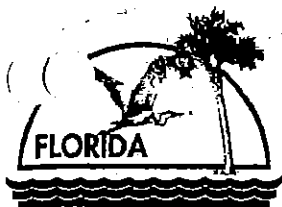


Rebecca S. Lockenbach
FDEP Section Leader
Bureau of Petroleum Storage Systems
Petroleum Cleanup Section 6

cc: Tom Conrardy - FDEP/Tallahassee

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ENCLOSURE 1



Department of Environmental Protection

Jeb Bush
Governor

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

Colleen M. Castille
Secretary

April 12, 2005

Mr. Erik R. Piatt
EN Rx Incorporated
16350 Park Ten Place, Suite 221
Houston, Texas 77084

Re: **Voucher for Disclosure of Proprietary Ingredients in
EN Rx SSO and EN Rx Synergist**

Dear Mr. Piatt:

The Bureau of Petroleum Storage Systems hereby acknowledges a confidential disclosure, by EN Rx Incorporated, dated March 31, 2005, of the proprietary ingredients in EN Rx Sustained Singlet Oxygen (SSO) and EN Rx Synergist. SSO and Synergist are reagents that -- when used together -- generate hydroxyl radicals that destroy petroleum and other suitable contaminants groundwater and soil via chemical oxidation, leaving only carbon dioxide and water as end products. Having reviewed the disclosure, the Bureau hereby vouches for the ingredients.

Without divulging any proprietary aspects of the product, we now provide the minimum amount of information necessary to prospective users, in order for them to meet the requirements of Rule 62-522.300(2)(c), Florida Administrative Code (F.A.C.). This rule requires that a Florida Department of Environmental Protection-approved Remedial Action Plan, for injection-type aquifer remediation, indicate an injection zone of discharge size and duration for any primary and secondary groundwater standards that will not be met by the fluid to be injected. It also requires that the Department-approved Remedial Action Plan also include groundwater monitoring of those chemical species. For SSO and Synergist, those chemical species are sodium and chloride. They apply to situations where EN Rx uses an organic acid for the purpose of adjusting pH.

There may, however, be situations when more than just sodium and chloride need to be monitored, depending on EN Rx's selection of acid for pH adjustment. For example: If a mineral acid containing sulfur is used, then the groundwater monitoring should also include sulfate. The onus shall be on EN Rx to advise its clients when other than the organic acid is used to adjust pH, and whether the groundwater must be monitored for additional chemical species in order to fully comply with Rule 62-522.300(2)(c), F.A.C. Similarly, if the situation should be

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EN Rx
Enclosure 1
Voucher

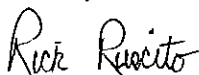
such that a base is needed for pH adjustment, then EN Rx must advise the client if it contains any chemical species that should be monitored.

The purpose of the pH adjustment is to match the pH of the receiving aquifer. The Bureau of Petroleum Storage Systems expects, in most cases, that the receiving aquifer will be in (or close to) the 6.5- to 8.5- range, which is the secondary groundwater standard for pH. For this reason, it is not necessary to monitor pH of the aquifer in order to comply with Rule 62-522.300(2)(c), F.A.C. However, the Bureau of Petroleum Storage Systems suggests that pH be monitored as well, as a prudent measure.

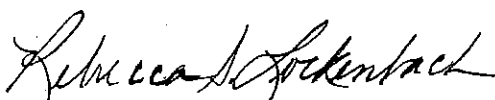
For underground injection control purposes, aquifer remediation plans proposing the use of EN Rx SSO and Synergist must indicate the volume and composition of SSO and Synergist to be injected. Since the composition is proprietary, it will suffice to indicate just the overall volume to be injected, and provide a footnote indicating that a one-time confidential disclosure dated March 31, 2005, identifying the proprietary ingredients, has already been submitted to the Bureau of Petroleum Storage Systems.

This voucher is issued solely for the purposes of the Bureau of Petroleum Storage Systems, for the remediation of petroleum contamination pursuant to Chapter 62-770, F.A.C. Other bureaus, state agencies and local governments may choose to recognize this voucher if their needs are similar. This Bureau, however, is not responsible for applications beyond its jurisdiction. Please direct questions regarding this voucher to Rick Ruscito at (850) 877-1133, extension 29.

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

REGULATORY INFORMATION

- a. Groundwater cleanup standards: The onus shall be on users of EN Rx 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 EN Rx, and any byproducts 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 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 cleanup and 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 that 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 EN Rx 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.]
-
- 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., and the minimum groundwater criteria of Chapter 62-520, F.A.C., pursuant to underground injection control Rule 62-528.600(2)(d), F.A.C. Aquifer remediation fluids that do not meet these requirements must seek permission for an injection zone of discharge. Depending on the ingredients of the fluid, it will be necessary to obtain an injection zone of discharge by either one or both of the following methods: by Rule 62-522.300(2)(c), F.A.C., or by variance from Rule 62-522.300(3), F.A.C. For EN Rx SSO and Synergist injection, only Rule 62-522.300(2)(c), F.A.C., needs to be observed in order to be permitted an injection zone of discharge for the sodium and chloride.
- d. Zone of discharge by rule: For the injection of EN Rx SSO and Synergist, Rule 62-522.300(2)(c), F.A.C., requires that a site-specific Remedial Action Plan proposing its use must: (a) indicate that the concentrations of sodium and chloride in the fluid to be injected will be in excess of their groundwater injection standards; (b) specify a temporary zone of discharge size; (c) specify the period of time for which the temporary zone of discharge will be needed; and (d) propose groundwater monitoring of the sodium and chloride. The current groundwater standard for sodium is 160 milligrams per liter (mg/L), and that of chloride is

250 mg/L. If the groundwater's natural-occurring background level for either of these parameters at a specific remediation site does not meet the established standard, then the residual level of that parameter by the time remedial action 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 Department has no objection to the use of some wells for the application of EN Rx. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply EN Rx 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.

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., for the petroleum contaminants of concern.

2. Post remediation petroleum monitoring: At least one (1) year of quarterly post remediation groundwater monitoring for the petroleum contaminants of concern 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: For Underground Injection Control purposes, when EN Rx SSO and Synergist is injected, the groundwater must be monitored for sodium and chloride, pursuant to Rule 62-522.300(2)(c), F.A.C., as discussed above in paragraph d.~~

g. Underground injection control inventory: Remedial Action Plans prescribing injection-type in situ 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 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 injection-type, in situ aquifer remediation projects, injection of the EN Rx reagents shall be performed in such a way, and at such a rate and volume, that no undesirable migration of either the reagents 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 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 of the EN Rx reagents that will be injected.

- 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.
- j. Open-pit applications: While open-pit application of EN Rx reagents is not an injection-type application, and notification of the Underground Injection Control Section therefore not required, ~~the user of EN Rx must still be mindful of groundwater quality.~~ For open-pit applications, the Bureau of Petroleum Storage Systems suggests that groundwater in the application area be monitored for the same parameters that would be monitored had the application been an injection.

SUPPLEMENTAL INFORMATION

- a. Department of Environmental Protection reviewers of injection-type in situ aquifer remediation plans, regardless of whether in Tallahassee or district offices, 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 (Mail Station 3530).

Only the Department and its district offices may approve injection-type in situ remediation plans in which the 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.

- b. Pilot study: Per rule 62-770.700(2), Florida Administrative Code (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 does 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. Reviewers are encouraged to use judgment in balancing cost and the need for technical information to be obtained from a pilot study.
- c. Safety reminders: Even though En Rx SSO and Synergist are formulated to minimize the amount of heat and pressure that are generated, it does not minimize the need for safety. Safety considerations to be kept in mind include but are not necessarily limited to the items below.

- Use of proper protective clothing.
- Oxidation is an exothermic reaction.
- Use storage containers, tanks and piping constructed from materials that are compatible with the oxidizer and catalyst being used.
- Proper disposal of unused or unwanted SSO and Synergist.

Additional safety items to consider for chemical oxidation-type remediation processes are listed in the Bureau of Petroleum Storage Systems' Remedial Action Plan checklist.

**Florida Department of
Environmental Protection****Memorandum**

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 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.