Florida Department of Environmental Protection

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

Rick Scott
Governor

Carlos Lopez-Cantera
Lt. Governor

Noah Valenstein
Secretary

August 1, 2017

Vie Electronic Mail to piatt@enrxinc.com

Erik R. Piatt, President
EN Rx, Inc.
P.O. Box 270586
Flower Mount, Texas 75027

Re: **EN Rx Vertebrae™**

Dear Mr. Piatt:

The Florida Department of Environmental Protection's Division of Waste Management (Division) has previously accepted EN Rx Vertebrae™ for collection of discrete groundwater samples (see attached September 29, 2015 approval document); this letter is being provided to document procedures to utilize EN Rx Vertebrae™ to collect data for use in screening for the presence or absence of petroleum compounds in groundwater, and to collect analytical data that will be used in future study to determine the use of EN Rx Vertebrae™ in a manner which will comply with the standard operating procedure outlined in DEP-SOP-001/01 FS 2200 Groundwater Sampling or propose appropriate variances on the standard operating procedures.

The Division has reviewed the EN Rx Vertebrae™ technology and determined that FS 2200 procedures for well purging and stabilization can be followed during sampling of EN Rx Vertebrae™ wells, with the following clarifications:

- Due to the construction of the EN Rx Vertebrae™ wells, depth to water readings cannot be collected from the wells. EN Rx Vertebrae™ wells should be placed as close to the top of the water table as possible. Historic and most recent groundwater elevation data collected from any existing conventional (vertical) monitoring wells available in the close proximity to the proposed location of the horizontal wells must be utilized for determination of the appropriate placement of EN Rx Vertebrae™ wells.
- Depth to water should be recorded from conventional (vertical) monitoring wells at the time of sampling in order to determine average depth to water during the sampling event.

- For shallow groundwater (~20 ft. or less to saturated zone), the shall will be connected directly to the EN Rx Vertebrae™ tubing at the surface that connects to the well system.
- For deeper groundwater sampling, a pump shall be installed into the well system, and the sampling tubing and flow cell are connected to the EN Rx Vertebrae™ tubing at the surface.
- Sampling procedures should follow all applicable portions of DEP-SOP-001/01, FS2200 Groundwater sampling, and Chapter 62-160 Florida Administrative Code.
- As the EN Rx Vertebrae™ well screens are installed horizontally below the groundwater surface, FS-2211 (Water Level and Purge Volume Determination), section 6. Purging Equipment Volume calculations should be used to determine the purge volume. Calculation of the tubing volume should include the screened interval, EN Rx Vertebrae™ tubing from the screened interval to the surface, and sample tubing connected to the EN Rx Vertebrae™ tubing surface connection.
- Since depth to water reading cannot be collected from the EN Rx Vertebrae™ wells, purging should be performed at a low rate to match the pumping rate with the recharge rate of the well. If the recharge rate is known from nearby conventional monitoring wells, the sampler may adjust the pumping rate as appropriate. If the well is running dry, the pumping rate should be reduced until the well is recharging sufficiently to continue purging.
- Well purging should follow the procedures outlined in FS 2212 (Well Purging Techniques) Section 2.4.
- When available and possible due to location, EN Rx Vertebrae™ wells must be paired with conventional (vertical) monitoring wells to collect comparative data.
- EN Rx Vertebrae™ well screen intervals used for injection of chemical or biological remediation compounds should not be used for collecting groundwater samples for tracking of the remediation progress during active remediation.

If you have any questions, contact Christopher J. Bayliss, P.G. at (850) 245-8866, through mail station 4530 at the letterhead address, or by email at christopher.j.bayliss@dep.state.fl.us.

Sincerely,

Christopher J. Bayliss, P.G.
Professional Geologist II
Petroleum Restoration Section 1
Petroleum Restoration Program
Christopher.J.Bayliss@dep.state.fl.us

Enclosure: Innovative Technology Approval

Florida Department of Environmental Protection

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

Rick Scott
Governor

Carlos Lopez-Cantera
Lt. Governor

Jonathan P. Steverson
Secretary

September 29, 2015

Via Electronic Mail
Piatt@EnRx.net

Erik Piatt, President
En Rx Incorporated
P.O. Box 270586
Flower Mound, Texas 75027

Re: **EN Rx FOCIS™**
EN Rx Vertebrae™

Dear Mr. Piatt:

The Florida Department of Environmental Protection's Division of Waste Management (Division) hereby accepts the EN Rx Feedback Optimized Continuous Injection System (FOCIS™) and EN Rx Vertebrae™ for in situ remediation of petroleum, chlorinated hydrocarbon solvents, and other suitable contaminants in groundwater and soil. Even though FOCIS™ and Vertebrae™ were developed to work together, they are each a stand-alone technology. Additionally, neither is limited to a single remediation method or the use of a single remediation chemical.

FOCIS™ is an aboveground, self-contained, automated, solar powered injection and/or extraction system initially developed to inject EN Rx reagents, but it can also be used for the injection of other chemical oxidizers and reducers; aerobic and anaerobic biological cultures; nutrients and substrates; and air for bio-sparging. It can also be used for the extraction of groundwater for pump-and-treat, and air for soil vapor extraction. FOCIS™ can be used in conjunction with segmented Vertebrae™ horizontal treatment wells, and/or conventional horizontal and vertical treatment wells.

Vertebrae™ is an underground system. It is a segmented set of horizontal wells in a single horizontal boring that are separated from each other by bentonite and grout, and individually plumbed to the surface for individual control. Vertebrae™ was also developed initially to inject EN Rx reagents, but it too can be utilized for the same operations listed above for FOCIS™. Additionally, Vertebrae's separated horizontal segments can be used to take discrete samples along its entire horizontal path, or used in such a way that some segments perform treatment while others perform sampling.

A site-specific Remedial Action Plan (RAP) for the use of FOCIS™ and/or Vertebrae™ should be submitted to the Department for review and approval, taking into account the regulatory advice and information provided in Enclosure 1. If the plan includes the use of a remediation chemical for which the Department has already issued an acceptance letter, then also take into account the regulatory advice provided by the Department in that letter, and place a copy of the letter in the appendix of the plan. Include a copy of this FOCIS™ and Vertebrae™ acceptance letter in the appendix as well.

A site-specific FOCIS™ and/or Vertebrae™ Remedial Action Plan may also propose the use of a remediation chemical that is not already accepted by the Department, provided the plan contains sufficient information to show that the chemical or product meets all applicable and appropriate rules and regulations.

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 product or processes on its 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 FOCIS™ and Vertebrae™ or a certification of their performance.

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. If you have any questions, contact Rick Ruscito at (850) 877-1133, extension 3722, through Mail Station 4590 at the letterhead address or by E-mail at RRuscito@ene.com.

Sincerely,

Rick Ruscito

Rick Ruscito, P.E.
Ecology & Environment, Inc.
Petroleum Restoration Program Section 6
RRuscito@ene.com

Susan K. Fields

Susan K. Fields
Environmental Administrator
Petroleum Restoration Program
Susan.Fields@dep.state.fl.us

Enclosure: (1) Regulatory Information

Burlab # unavail.
INN 211
PPL 509
ITR 73019
9/29/2015

ENCLOSURE 1

REGULATORY INFORMATION

a. In-situ physical treatment: When FOCIS™ and/or Vertebrae™ will be configured to operate as an in-situ, conventional remediation system [e.g., low flow air sparging (also known as biosparging), soil vapor extraction, recovery of groundwater for pump-and-treat, etc.] there are no special considerations to take into account. The review and approval of a Remedial Action Plan for any of these operating modes would be no different than that of any other Remedial Action Plan for the same treatment method, and the only Underground Injection Control (UIC) notification involved would be that which is required for the injection of air into an aquifer when air or biosparging is involved.

b. In-situ chemical treatment: When FOCIS™ and/or Vertebrae™ will be configured to operate as an in-situ, injection-type system for remediation chemicals, the review and approval of a RAP for this mode of operation would be similar to that of any other RAP for chemical injection, and the UIC Section of the Department's Aquifer Protection Program must be notified about the chemical(s) that will be injected. Since FOCIS™ and/or Vertebrae™ are not limited to the injection of any single chemical, regulatory reviewers should expect to see RAPs that may propose one or more the following: EN Rx and non-EN Rx remediation chemicals; commodity chemical oxidizers and reducers; aerobic and anaerobic biological cultures, nutrients, and substrates, etc. Since it is not possible for the Division of Waste Management to offer specific compliance advice for every conceivable injectate that could be used with FOCIS™ and Vertebrae™, only general advice is provided below.

c. Groundwater cleanup standards: The onus shall be on users of FOCIS™ and Vertebrae™ (when they are used to inject a fluid for an in-situ, injection-type cleanup) to ensure that all applicable groundwater standards will be met at the time of project completion for the contaminants of concern being remediated, and any by-products produced as a result of chemical or biochemical reactions induced by the injected fluid. 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; 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; 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.

d. Injection well permit: 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.

e. Underground Injection Control (UIC): Remedial Action Plans proposing injection-type aquifer remediation shall include the information required by rules 62-528.630(2)(c)1 through 6, F.A.C., for the purposes of the UIC program. Reviewers of those plans, upon issuance of a Department-enforceable Remedial Action Plan Approval Order must transmit this information to the UIC program in Tallahassee by submitting a completed copy of the "UIC Notification". The notification is in the form of a memorandum currently located on the Internet at www.dep.state.fl.us/waste/categories/pcp/pages/innovative.htm.

f. Temporary Zones of Discharge (ZOD): The chemical composition of a remediation fluid 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., before it is injected, not after it has been diluted by the receiving groundwater. Aquifer remediation chemicals that do not meet these requirements must seek relief from water quality criteria in one of two ways. The first (most common) way is to seek permission for a temporary ZOD via rule 62-520.310(8)(c), F.A.C. The second way only applies if permission for a ZOD cannot be obtained by rule. In that case 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 covered by all the injection points, located side-by-side with overlapping radii of influence.

g. Site-specific Remedial Action Plans shall indicate the volume, and the complete chemical composition (i.e., the identity and concentration of each ingredient) of the fluid to be injected. If the fluid to be injected is a proprietary product for which the Department has already issued an acceptance letter that contains a voucher for the confidential disclosure of ingredients and their proportions, then it will suffice in the Remedial Action Plan to indicate just the volume and overall concentration of the fluid to be injected, and that a confidential disclosure regarding the composition of the fluid to be injected has already been provided to the Department. Place a copy of the letter in the appendix of the plan

h. Frequency of ZOD monitoring: For most cleanup sites, quarterly monitoring of ZOD groundwater should suffice for chemical ingredients that are granted permission for a temporary injection ZOD as explained in above paragraph f. Upon expiration of the time period granted for the ZOD by way of rule 62-520.310(8)(c), F.A.C., the concentration of each ingredient must meet its groundwater standard or its natural-occurring background value in the groundwater at the specific cleanup site, whichever is less stringent.

i. 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 injection of remediation chemicals if the wells are suitable for the purpose. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply a remediation chemical. This will avoid a premature

conclusion that the entire site meets cleanup goals. By making sure that designated tracking wells are not 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.

j. Three categories of groundwater monitoring:

1. Active remediation monitoring for a cleanup site's contaminants of concern: 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.

2. Post Active Remediation Monitoring for a cleanup site's contaminants of concern: 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. Monitoring of the temporary injection ZOD: In order to comply with rule 62-520.310(8)(c), F.A.C., monitor the groundwater for the chemical ingredients of the remediation fluid that received permission for a ZOD (paragraph f) at an appropriate frequency (paragraph h). Use at least 2 monitoring wells: one located in the center of the ZOD area treated by injection, the other near the downgradient edge of the ZOD.

k. Operation:

1. Avoidance of migration: Pursuant to rule 62-528.630(3), F.A.C., for, in-situ, injection-type aquifer remediation projects, the injection of a remediation chemical shall be performed in such a way, and at such a rate and volume, that no undesirable migration results, for both the chemical ingredients that were granted a ZOD and the contaminants of concern that are being cleaned up.

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.

l. 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.