



Jeb Bush
Governor

Department of Environmental Protection

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

Colleen M. Castille
Secretary

April 21, 2005

Mr. Peter Kalleres
Regenesis
1707 Forest Avenue
Neptune Beach, Florida 32266

Re: **HRC-X[®] (Hydrogen Release Compound)**
(Extended Release Formula)

Dear Mr. Kalleres:

The Florida Department of Environmental Protection (Department) hereby accepts HRC-X[®] (Hydrogen Release Compound) as an in situ groundwater remediation product for the reductive dechlorination and biodegradation of chlorinated hydrocarbon solvents and other suitable contaminants. As Regenesis has indicated, HRC-X[®] is biodegradable and non-toxic, and when hydrated, slowly releases lactic acid and glycerol. The lactic acid is metabolized by indigenous microorganisms already present at the site, to produce low concentrations of hydrogen, which in turn is also used by microorganisms to perform the reductive dechlorination. The Department finds both glycerol and lactic acid listed by the Food and Drug Administration as food additives. The chemical composition of HRC-X[®] is shown in Enclosure 1.

HRC-X[®] can be introduced to the subsurface either by direct injection, using conventional or direct-push wells or hand augers, or by mixing it into an excavation pit. Groundwater monitoring of pH will be necessary, regardless of which application mode is used. And if the concentrations of chlorinated hydrocarbon contaminants to be reductively dechlorinated are high, then groundwater monitoring of the chloride byproduct is recommended as a prudent measure. For the injection mode, in addition to groundwater monitoring requirements, there are other underground injection control regulations that apply. Since injection-type, in situ aquifer remediation is likely to be the most common application of HRC-X[®], the bulk of the regulatory requirements discussed herein are directed to that topic.

The Department recognizes HRC-X[®] as a viable product for the remediation of chlorinated solvents and other suitable contaminants. There are no objections to its use provided: (a) the considerations of this letter are taken into account; (b) a Remedial Action Plan is approved by the Department; and (c) the requirements of Rule 62-522.300(2)(c), Florida Administrative Code (F.A.C.) are observed for pH. For HRC-X[®], the major regulatory considerations are set forth in Enclosure 2.

"More Protection, Less Process"

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Printed on recycled paper.

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While the Florida 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 against competing alternatives in the marketplace. In no way, however, shall this regulatory letter of acceptance be construed as certification of product performance. Additionally, the Department emphasizes a distinction between its regulatory "acceptance" and an approval. Products and processes are accepted, not approved.

Those who prepare Remedial Action Plans may 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 to inquire about HRC-X's acceptability. To aid those reviewers, the Department provides supplemental information as Enclosure 3.

Even though it may be convenient to have an acceptance letter, for inclusion in the appendix of a site-specific Remedial Action Plan as suggested above, the Department would like to emphasize that such a letter is not a requirement. The plan, however, must contain sufficient information about the product or process to show that it meets all applicable and appropriate rules and regulations.

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 Remedial Action Plans prescribing the product or process. 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

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enc: (1) HRC-X[®] Chemical Composition
(2) Regulatory Information
(3) Supplemental Information
(4) Underground Injection Control Memorandum

c: T. Conrardy - FDEP/Tallahassee

Regenesis
1011 Calle Sombra
San Clemente, California 92673

ENCLOSURE 1

HRC-X[®] CHEMICAL COMPOSITION[†]

Glycerol Tripolylactate (CAS # 201167-72-8)	95 to 99 %
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Glycerol (CAS # 56-81-5)	1 to 5 %
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Lactic Acid * (CAS # 50-21-5)	
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† Information from Material Safety Data Sheet dated December 13, 2002.

* Lactic acid is produced in situ when the glycerol tripolylactate is hydrated by groundwater.

Note: The Material Safety Data Sheet describes HRC-X[®] as a viscous liquid / gel with a density of 1.48 g/cc.

ENCLOSURE 2

REGULATORY INFORMATION

- a. Groundwater regulations and cleanup standards: The onus shall be on users of HRC-X[®] to ensure that all applicable groundwater standards will be met at the time of project completion, for the contaminants of concern, any residuals associated with the ingredients of HRC-X[®], 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; 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; and Chapter 62-777, F.A.C., for cleanup 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 Waste Cleanup, the Bureau of Petroleum Storage Systems, or other bureau or district office of the Florida Department of Environmental Protection, for remediation via injection of HRC-X[®] 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, pursuant to Chapter 62-528, F.A.C., 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 described in Chapter 62-520, F.A.C. The minimum groundwater criteria set forth in Chapter 62-777, F.A.C., also apply. The Department, having considered the chemical constituents and physical properties of HRC-X[®], has determined that Rule 62-522.300(2)(c), F.A.C., should apply to pH.

The reason for monitoring pH of the groundwater is the organic acid fermentation products of the glycerol tripolylactate in HRC-X[®]. These acids are biodegradable, but while they are present they may cause a temporary decrease in groundwater pH. The secondary groundwater standard for pH is range 6.5 to 8.5, per the drinking water standards of Chapter 62-550, F.A.C.

In order to comply with Rule 62-522.300(2)(c), F.A.C., a Department-approved site-specific remediation plan proposing HRC-X[®] must: (a) identify pH as the parameters whose groundwater standard could be exceeded; (b) indicate the size and duration of the temporary zone of discharge; and (c) propose groundwater monitoring for pH.

The Department would like to encourage those who prepare Remedial Action Plans to use a non-excessive duration time and zone size when complying with Rule 62-522.300(2)(c), F.A.C. Historically, in Florida, most temporary zones of discharge for injection-type aquifer remediation have been for a period of approximately one (1) year and a zone size in the range of 10 to 50 feet radially from each injection point.

- 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 HRC-X[®]. However, no “designated” monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply HRC-X[®]. 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. Groundwater monitoring:
 - 1. Active remediation monitoring for contaminants of concern: Active remediation groundwater monitoring should be conducted in accordance with the provisions of an approved site-specific Remedial Action Plan for the contaminants of concern.
 - 2. Post remediation monitoring for contaminants of concern: During the period of post active remediation, groundwater monitoring for contaminants of concern shall be conducted in accordance with the provisions of an approved site-specific Remedial Action Plan.
 - 3. Monitoring of HRC-X[®] parameters for underground injection control purposes: Pursuant to Rule 62-522.300(2)(c), F.A.C., the monitoring of pH must be addressed in a site-specific, Department-approved Remedial Action Plan that proposes the injection of HRC-X[®].
- f. Underground injection control inventory: Remedial Action Plans proposing injection-type, in situ aquifer injection-type 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.

- g. Avoidance of migration: For injection-type, in situ aquifer remediation projects, injection of HRC-X[®] 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 contaminants of concern in the aquifer results, pursuant to Rule 62-528.630(3), F.A.C.
- h. Abandonment of wells: Upon issuance of a Site Rehabilitation Completion Order, or 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.
- i. Open pit applications: The application of HRC-X[®] to an open excavation pit prior to backfilling, for the purpose of remediating groundwater, is not an injection. In such cases, it is not necessary to notify the Underground Injection Control Section by using the notification memorandum in Enclosure 4. However, this does not release the user from the responsibility of making sure that no long-term negative groundwater impacts occur as a result of the chemicals added to the pit. In the case of HRC-X[®], it would be prudent to measure the pH of the groundwater in the pit area prior to application, and to measure again some time after the application, in order to demonstrate that the groundwater meets the 6.5 to 8.5 standard for pH, or its natural-occurring background level, whichever is less stringent.

ENCLOSURE 3

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 Contaminated Site”. The completed form must be submitted to the Underground Injection Control Section at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.
- b. Degradation products: The glycerol tripolylactate and glycerol constituents of HRC-X[®] contain only carbon, hydrogen and oxygen atoms, and are biodegradable. The ultimate degradation products are carbon dioxide and water.
- c. Dosage and parameters: Site-specific information about the concentrations of contaminants of concern and groundwater chemistry is needed to calculate an HRC-X[®] dosage. Regenesis indicates that five groundwater chemistry parameters needed: dissolved oxygen, nitrate, bioavailable manganese, bioavailable iron, and sulfate. Knowledge about these five is necessary because they are electron acceptors that will compete with the contaminants of concern for HRC-X[®]. It is therefore necessary to use enough HRC-X[®] to satisfy the demands of both the contaminants of concerns and the competing parameters. Regenesis also recommends the application of a safety factor to the calculated dose as well. The Department has not reproduced here the details provided by Regenesis on how to calculate a dosage, and instead suggests that prospective users of HRC-X[®] contact Regenesis to discuss the needs of their particular project.

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: _____

DATE: _____

SUBJ: **Proposed Injection Well(s) for In Situ Aquifer
 Remediation at a Contaminated 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 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 1.)

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 2)

(ingredient, wt. %): _____

Injection volume per well (gallons): _____

Single or multiple injection events: _____

Injection volume total (all wells, all
 events): _____

Richard Deuerling

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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 contaminated site is intended to meet the groundwater cleanup criteria set forth in Chapter 62-777, 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 contaminants of concern 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. 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 2. 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 injection zone of discharge has been permitted by Rule 62-522.300(2)(c), F.A.C., or by variance.