



# Department of Environmental Protection

Jeb Bush  
Governor

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

Colleen M. Castille  
Secretary

September 7, 2005

Jim Mueller, Ph.D.  
Adventus Americas, Inc.  
109 Fairfield Way, Suite 207  
Bloomington, Illinois 60108

Re: **EHC™**

Dear Mr. Mueller:

The Florida Department of Environmental Protection (Department) hereby accepts the six EHC™ products listed below for in situ and ex situ remediation of contaminated groundwater and soil.

- **EHC™**: A slow, controlled-release carbon source and zero-valent iron (aluminum or zinc) for the anaerobic chemical reduction of chlorinated hydrocarbons and other suitable contaminants. It is available as a solid in the form of pellets, granules or powder that the user mixes with water prior to application. EHC, as shipped, contains 30-50% by weight zero-valent iron in the particle size range of 50-250 microns.
- **EHC – L**: A fast-release, highly soluble form of EHC that is shipped as a dry powder. The end user mixes it with water and applies it as an aqueous suspension for the anaerobic chemical reduction of chlorinated contaminants. As shipped, it contains 20-40% by weight zero-valent iron in the particle size range of 25-45 microns.
- **EHC – LB**: Similar to EHC – L but containing 5-20% by weight nanoscale zero-valent iron, for the anaerobic chemical reduction of chlorinated contaminants in very tight soils.
- **EHC – A**: An aqueous form of EHC containing 10% soluble iron by weight, for the anaerobic chemical reduction of chlorinated contaminants. It may also contain 2-5% by weight nanoscale zero-valent iron.
- **EHC – M**: EHC plus a sulfide for in situ immobilization of metals via precipitation and adsorption.
- **EHC – O**: A slow-release source of oxygen and nutrients that stimulate the indigenous microorganisms at remediation site to aerobically biodegrade petroleum and other contaminants amenable to aerobic biodegradation. Calcium oxide or magnesium

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peroxide is the oxygen-releasing component of the product. The product does not contain iron.

As Adventus has indicated, EHC™ products can be introduced to the subsurface by a number of methods; for example: into an open excavation pit; as a permeable reactive barrier; via direct-push injection; hydraulic fracturing; pneumatic fracturing and injection; high pressure jetting; or mechanical soil mixing.

Florida's groundwater and underground injection control regulations apply to these EHC™ products when they are used for the in situ remediation of groundwater, or the in situ remediation of soil from which the chemical constituents of the products could leach into the underlying groundwater. Enclosure 1 discusses these regulations.

The Department recognizes these EHC™ products as viable means by which to remediate contaminated sites in Florida. There are no objections to their 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, when applicable.

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 EHC's acceptability. To aid those reviewers, the Department provides supplemental information as Enclosure 2.

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

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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

enc: (1) Regulatory Information  
(2) Supplemental Information  
(3) Underground Injection Control Memorandum

c: T. Conrardy - FDEP/Tallahassee

## ENCLOSURE 1

### REGULATORY INFORMATION

- a. Groundwater regulations and cleanup standards: The onus shall be on users of EHC™ 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 EHC™, 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 EHC™ 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. Zone of Discharge (ZOD): For injection-type, in situ aquifer remediation, pursuant to Chapter 62-528, F.A.C., the composition of an injected fluid must meet the drinking water standards of Chapter 62-550, F.A.C., and the overall minimum groundwater criteria of Chapter 62-520 F.A.C. It must also meet the specific minimum groundwater criteria set forth in Chapter 62-777, F.A.C. Injection fluids that do not fully meet these requirements must obtain permission for a temporary ZOD. In most cases where permission for a temporary ZOD is needed, it can be obtained by way of rule 62-522.300(2)(c), F.A.C., rather than by variance. Such is the case with the six EHC™ products covered by this acceptance letter.

The Department, having considered the chemical constituents of each of the six products, has determined that rule 62-522.300(2)(c), F.A.C., applies as shown in the table below for ingredients and parameters that do not meet injection standards. Only those ingredients and parameters listed in the table need permission for a temporary ZOD. All others are

food-grade and listed by the U.S. Food and Drug Administration as food additives. The Department therefore judges those others to be relatively benign from a toxicological standpoint.

<u>Product</u>	<u>Ingredient or Parameter in Need of Permission for a Temporary ZOD via Rule 62-522.300(2)(c), F.A.C., and its Applicable Groundwater Standard</u>
EHC	Iron, 0.3 milligrams per liter (mg/L), maximum
EHC – L	Iron, 0.3 mg/L, maximum
EHC – LB	Iron, 0.3 mg/L, maximum
EHC – A	Iron, 0.3 mg/L, maximum
EHC – M	Sulfate, 250 mg/L, maximum
EHC – O	Total Dissolved Solids, 500 mg/L, maximum; and pH, range 6.5 - 8

Rule 62-522.300(2)(c), F.A.C., effective August 27, 2001, permits a temporary ZOD for aquifer remediation purposes, for primary standards of groundwater for closed-loop re-injection systems and for the prime constituents of the reagents used to remediate site contaminants, and for the secondary standards for groundwater. In order to obtain permission and to comply with this rule, a Department-approved site-specific remediation plan proposing EHC™ must: (a) identify the parameter(s) from the table above that apply, depending on the product(s) to be used; (b) indicate the size and duration of the temporary zone of discharge; and (c) propose groundwater monitoring for the parameter(s).

The frequency of the groundwater monitoring required by rule 62-522.300(2)(c), F.A.C., need not be excessive: quarterly should suffice, and as the concentration or measured value of each parameter declines to its respective groundwater standard, or natural-occurring background level, whichever is less stringent, its monitoring can be discontinued or reduced in frequency. In the case of iron, the analytical results from the groundwater monitoring samples can serve both to comply with the monitoring requirement aspect of rule 62-522.300(2)(c), F.A.C., and to provide the user with information for treatment process control and optimizing adjustments.

The Department would like to encourage those who prepare Remedial Action Plans to use a non-excessive duration time and ZOD 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 or less and a zone size in the range of 10 to 50 feet radially from each injection point. The term “zone of discharge” which appears in underground injection control regulations is similar to the term “radius of influence” for an 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 EHC™. However, no “designated” monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply EHC™. 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 EHC™ parameters for underground injection control purposes: Pursuant to Rule 62-522.300(2)(c), F.A.C., the groundwater monitoring of parameters listed in the table of paragraph c must be addressed in a site-specific, Department-approved Remedial Action Plan for the particular EHC™ product(s) that the plan proposes for injection.
- 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 3.
- g. Avoidance of migration: For injection-type, in situ aquifer remediation projects, injection of EHC™ 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 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.

- i. Open pit applications: The application of EHC™ 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 3. 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 EHC™, it would be prudent to monitor the groundwater in the pit for the parameter(s) in the table in paragraph *c* for the particular EHC™ product(s) used at a site. This should be done prior to product application, and again some time after the application, in order to demonstrate that the groundwater meets the standard(s) for the EHC™ parameter(s), or the natural-occurring background level(s), whichever is less stringent, by the time the cleanup project reaches cleanup target levels for the contaminants of concern.

ENCLOSURE 2

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 3 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. Dosage and application rates: The Department suggests that prospective users of the six EHC™ products covered by this acceptance letter contact the manufacturer for instructions and advice in regard to dosage and application rates.
- d. Disclaimer: The Department would like to make clear that this regulatory acceptance is intended to cite rules and regulations applicable to the ingredients of six EHC™ products. In no way shall it be construed as a certification of performance, including the ability of the product EHC-M to immobilize metals on a long-term basis.

**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.