Florida Department of Environmental Protection
Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Rick Scott
Governor

Jennifer Carroll
Lt. Governor

Herschel T. Vinyard Jr.
Secretary

June 6, 2011

Bob Brooks
Biovation Environmental Services, LLC
15725 80th Drive North
Palm Beach Gardens, Florida 33418

Re: **Advanced Bio-Cycle Treatment Method (ABC)**

Dear Mr. Brooks:

The Bureau of Petroleum Storage Systems hereby updates its acceptance of the Advanced Bio-Cycle Treatment Method (ABC), a process for in situ and ex situ bioremediation of petroleum contaminants, chlorinated solvents, organic pesticides and other suitable contaminants in groundwater and soil. This update supersedes the previous November 19, 2010 acceptance and all earlier acceptances of the ABC Method. There are two main changes associated with this update: the first is the restoration of a Department-published acceptance letter that provides an option for Biovation to use its own Department-accepted remediation formula called Cogen V with the ABC delivery system; the second is an update of the Underground Injection Control (UIC) notification memorandum. All other changes in this update are minor.

The ABC Method is a closed-loop re-injection/re-infiltration system that combines groundwater recovery, soil washing and groundwater injection, air enhancement and bioremediation in a synergistic fashion. The process does not rely on a single remediation product or reagent, thereby allowing the flexibility to select any remediation product or reagent that is appropriate for the contaminants and conditions of a given cleanup site. As you have indicated, Biovation Environmental Services prefers to use only Department-accepted remediation products with the ABC delivery method, even though it is not a requirement, and will follow the Department's requirements when using them.

Your own non-pathogenic bioremediation formula known as Cogen V was accepted by the Department on April 21, 1999, but since the original acceptance letter for it fell out of

circulation as a Department-published document as a result of changes to your company's name and treatment method over the years, this update serves to formally restore a published acceptance letter for Cogen V. As indicated in your June 1, 2011 correspondence, the March 17, 1999 chemical analysis of Cogen V for Underground Injection Control compliance purposes is still valid.

There are no objections to the use of the ABC Method provided: (a) the considerations of this letter are taken into account; (b) a site-specific Remedial Action Plan is approved by the Department; and (c) all applicable and appropriate regulations are observed. Enclosure 1 is a summary of the March 17, 1999 Cogen V chemical analysis, and Enclosure 2 is a citation of the major regulations that apply.

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 shall this regulatory acceptance be construed as Department certification of performance. Additionally, the Department emphasizes a distinction between its regulatory acceptance and an approval, since products and processes are accepted, not approved.

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, but the plan must contain sufficient information about the product or process to show that it meets all applicable and appropriate rules and regulations.

Those who prepare Remedial Action Plans are advised to include a copy of this letter in the appendix of those plans. In this way, technical reviewers will be informed that you have contacted the Department of Environmental Protection to inquire about the environmental acceptability of the ABC Method. To aid those reviewers, the Bureau of Petroleum Storage Systems provides supplemental information as Enclosure 3, and an Underground Injection Control Notification Memorandum as Enclosure 4.

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 design details must be provided in a site-specific Remedial Action Plan. You may contact me at (850) 877-1133, extension 3722, if there are any questions.

Sincerely,

Rick Ruscito

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

Enclosures: (1) Cogen V Chemical Analysis
(2) Regulatory Information
(3) Supplemental Information
(4) Underground Injection Control Notification Memorandum

History:

INN_026.doc
4/21/1999

INN_158c.doc
11/19/2010

INN_158d.doc
6/6/2011

# ENCLOSURE 1

## COGEN V CHEMICAL ANALYSIS *

| CHEMICAL SPECIES OR PARAMETER | AMOUNT | DETECTION LEVEL | UNITS |
|---|---|---|---|
| **Primary Drinking Water Contaminants** | | | |
| Nitrate (as nitrogen) | ND † | 0.050 | mg/L ‡ |
| Nitrite (as nitrogen) | ND † | 0.050 | mg/L |
| Sodium § | 69.3 | 0.500 | mg/L |
| **Non-regulated Drinking Water and Minimum Groundwater Criteria Parameters** | | | |
| Ammonia Nitrogen | ND | 0.040 | mg/L |
| Calcium | 17.6 | 0.100 | mg/L |
| Magnesium | 3.25 | 0.050 | mg/L |
| Potassium | 5.90 | 0.500 | mg/L |
| Total Nitrogen | 0.392 | n.a. | mg/L |
| Total Kjeldahl Nitrogen 🕭 | 0.392 | 0.040 | mg/L |
| Total Phosphorus | 0.186 | 0.010 | mg/L |
| **Secondary Drinking Water Contaminants** | | | |
| Iron | ND | 0.020 | mg/L |
| pH | 8.03 | n.a. | pH units |
| Total Dissolved Solids | 338 | 4 | mg/L |

* March 17, 1999 laboratory analysis of Cogen V, as shipped to the job site, where it might be further diluted prior to injection depending on site-specific conditions. **This analysis meets Underground Injection Control standards, and it does not need permission for a temporary injection zone of discharge (ZOD).**

† ND denotes not detected at the indicated detection level.

‡ 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.

🕭 Total Kjeldahl Nitrogen (TKN) is the sum of free ammonia and organic nitrogen compounds, expressed as elemental nitrogen.

# ENCLOSURE 2

## REGULATORY INFORMATION

a. Regulations: Chapters of the Florida Administrative Code (F.A.C.) that may be applicable, either in part or in their entirety, include but are not necessarily limited to 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 62-520, 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 62-770, 62-780, 62-782, and 62-785, F.A.C., for cleanup criteria; and Chapter 62-777, F.A.C., for cleanup target levels.

b. Zone of Discharge (ZOD): Rule 62-520.310(8)(c), F.A.C., applies to the ABC Method, which is a re-injection loop-type aquifer remediation process. This rule allows a temporary injection zone of discharge for the primary groundwater standards that apply to the contaminants of concern, the prime constituents of the remediation products and reagents used to remediate a site's contaminants, and for the secondary groundwater standards.

In order for users of the ABC process to comply with this rule, a Department-approved Remedial Action Plan must address the duration and size of the zone of discharge, and provide for groundwater monitoring of ingredients of the remediation products and reagents and any site contaminants in the re-injected fluid **if** they do not meet their respective primary or secondary drinking water standards, or their respective minimum groundwater criteria. In most cases, quarterly groundwater sampling will suffice. Upon expiration of the time permitted for a temporary injection zone of discharge, each chemical species and parameter associated with the remediation products and reagents must meet its respective groundwater water standard, or be no worse than its natural-occurring background level at the cleanup site, whichever is less stringent.

For commercial bioremediation products that will be used by the ABC Method, the temporary injection zone of discharge --- **if** a temporary zone of discharge is needed --- is most likely to be permitted by Rule 62-520.310(8)(c), F.A.C., rather than a variance. Nevertheless, it should be kept in mind that a variance allowing a temporary injection zone of discharge will be necessary in cases where a chemical species in a remediation product is not a prime constituent of the reagents needed to remediate the contaminants at a site, and that species causes the re-injected fluid to exceed a primary groundwater standard. More information about this topic can be found in the Bureau of Petroleum Systems' guidance document "BPSS-10, In Situ Chemical Additives", currently located at web page www.dep.state.fl.us/waste/categories/pcp/pages/active.htm.

c. Re-infiltration: ABC Method remedial action plans proposing reintroduction of fluid to the subsurface by re-infiltration gallery (rather than re-injection well) for in situ soil washing that flushes contaminants to the water table for subsequent collection by groundwater recovery, must include groundwater monitoring of any chemical species in the re-infiltration fluid that that exceeds a primary or secondary drinking water standard, or a minimum groundwater criterion. In other words, during a re-infiltration-type cleanup, monitor the groundwater for the same chemical species and parameters that would have been monitored if the fluid had been re-injected instead of re-infiltrated. The reason is that the toxicological effects of chemicals on groundwater are irrespective of the method by which they are introduced to an aquifer, and the groundwater and drinking water criteria of Chapters 62-520, 62-550, and 62-777, F.A.C., still apply.

d. Injection well permit: The issuance of an enforceable, site-specific Remedial Action Plan Approval Order by the Department for injection-type aquifer remediation using the ABC Method constitutes the granting of a Class V injection well permit.

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 as ABC injection points. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used as an ABC injection point. 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. Underground injection control inventory: Remedial Action Plans proposing in situ, injection-type aquifer remediation shall include information pursuant to Rules 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 projects to be transmitted by remediation plan reviewers to the Underground Injection Control Section is provided as Enclosure 4.

g. Avoidance of migration: For in situ, injection-type aquifer remediation projects, operation of the ABC process shall be performed in such a way that no undesirable migration of either the ingredients of the remediation products or reagents used or the contaminants of concern in the aquifer results, pursuant to Rule 62-528.630(3), F.A.C.

h. Operating parameters: For petroleum cleanup, Section 62-770.700, 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 a reduction in the frequency or discontinuation of some measurements in situations when appropriate.

i. 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 ABC Method injection wells can be removed from the inventory-tracking list.

j. Biovation Environmental Services, LLC policy: Even though a variety of commercially available remediation products can be used by the ABC process, Biovation Environmental Services, LLC, as a prudent measure, has indicated a preference to use only those products already accepted by the Department, and to follow the Department's requirements when using them. The Department appreciates this prudent approach, but it should be noted that there is no requirement that a product first be accepted in order to propose its use in a site-specific Remedial Action Plan, provided the plan addresses all applicable and appropriate rules and regulations. If in the future a situation arises in which a departure from this policy is necessary, then the site-specific Remedial Action Plan should include a complete chemical description of the fluid to be re-injected or re-infiltrated, and all applicable and appropriate rules and regulations must be met.

# ENCLOSURE 3

## SUPPLEMENTAL INFORMATION

a. Underground Injection Control Notification: Reviewers of in situ, injection-type aquifer remediation plans, regardless of whether in Tallahassee, the Department's district offices, or contracted local programs must fill in the blanks on the Enclosure 4 Underground Injection Control Notification Memorandum. The completed form must be submitted to the Underground Injection Control Section, Mail Station 3530, at 2600 Blair Stone Road, Tallahassee, Florida, 32399-2400.

b. Pilot study: For petroleum cleanup using bioremediation, a pilot study proposal pursuant to Section 62-770.700, F.A.C., shall be submitted for review, and a pilot test shall be performed prior to designing a full-scale 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.

c. Bacteria: Biovation Environmental Services indicates that its policy will be to use only microorganisms that are non-pathogenic.

d. pH buffer: Biovation Environmental Services, LLC may use sodium bicarbonate when necessary to buffer the ABC system. In those cases, if the concentration of sodium, total dissolved solids or the pH of the fluid to be re-injected or re-infiltrated does not meet its respective groundwater standard, then a temporary zone of discharge must be established and the groundwater must be monitored for any of those parameters that do not meet their standards. The current groundwater standards for these parameters are as follows: sodium, 160 milligrams per liter (mg/L); total dissolved solids, 500 mg/L; and pH, range 6.5 to 8.5.

e. Process configuration: Extracted groundwater is pumped to the ABC trailer-mounted treatment system, where microorganisms and amendments are added. The amended groundwater is then re-injected or re-infiltrated to the subsurface, where it treats contaminants as it percolates downward. When it reaches the water table, it is captured again by the groundwater pump to begin another treatment cycle in this loop-type, re-circulation/re-infiltration-type process.

f. Dosage and application rate: Given that the ABC Method can deliver a variety of remediation fluids and products, the Bureau of Petroleum Storage Systems suggests that users of the method consult Biovation Environmental Services, LLC to determine a dosage and application rate based on the specific remediation product to be applied and the specific conditions of the site to be remediated.

g. ABC Method operating parameters: Biovation Environmental Services, LLC provided information about ABC Method operating parameters, which the Bureau

of Petroleum Storage Systems would like to pass along. It should be kept in mind that the values below are provided for information only, and that they are not to be construed as absolute. Site-specific conditions will have an effect on operating parameter values, and adjustments should be made accordingly. The parameters are given below.

| Parameter | Value |
|---|---|
| Injection depth | Begin injection 1 to 3 feet above the layer of contaminated soil. |
| Recovery well radius of influence | Expect at least 10 to 15 feet, depending on permeability of the soil. |
| Flow rate | 0.5 to 50 gallons per minute, depending on aquifer characteristics. Optimum range: 20 to 50 gpm. |
| Injection pressure | 0 to 5 pounds per square inch, depending on aquifer characteristics. |
| Temperature range | 32 to 100 degrees Fahrenheit |
| pH | 5 to 10 (buffer as necessary) |
| Dissolved oxygen | 5 to 8 milligrams per liter in the fluid prior to injection. |

h. Limitations: The ABC Method is a bioremediation process for organic compounds. It is not intended for the remediation of elements such as metals.

ENCLOSURE 4

# Florida Department of Environmental Protection

## Memorandum

{This version of UIC Notice memo is for use by staff of the BPSS and District offices}

TO: Cathy McCarty, P.G.
Florida Department of Environmental Protection
Bureau of Water Facilities Regulation
Underground Injection Control Section – MS 3530
2600 Blair Stone Road, Tallahassee, Florida 32399-2400

FROM: _____

(An employee of Div. of Waste Management or DEP District Office)

_____

_____

DATE: _____

Reminder: This memorandum must be completed by an FDEP employee of the Bureau of Petroleum Storage Systems or an FDEP District Office. A person working for a consultant company preparing a RAP may complete some portions of this memo to expedite the FDEP's review but if so, the "From" and "Date" blanks and the date of RAP approval and phone number should be left blank for the FDEP technical reviewer to complete after verifying other information in the memo is accurate and conforms to applicable rules and procedures.

oOo

Please remove this message box prior to submittal of this memorandum to the Underground Injection Control Section.

SUBJECT: **Remediation Product Injection Well(s) for In Situ Aquifer Remediation at a Petroleum Contaminated Site**

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

Facility name: _____

Facility address: _____

City/County: _____

Latitude/Longitude: _____

FDEP Facility Number: _____

Facility owner's name: _____

Facility owner's address: _____

_____

_____

_____

Well contractor's name: _____

Well contractor's address: _____

_____

_____

_____

Facility name: _____
FDEP facility no.: _____

## AFFECTED AQUIFER

Name of aquifer: _____
Depth to groundwater (feet): _____
Aquifer thickness (feet): _____
Areal extent of contamination (square feet): _____

## INJECTION WELLS

A site map showing the location and spacing of injection wells, the areal extent of the groundwater contamination plume, and associated monitoring wells is attached. The injection well(s) features are summarized below, and/or a schematic of the injection well(s) is attached.

Direct-push or HSA/Mud rotary *(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 land surface
Grouted interval, if applicable: _____ to _____ feet below land surface
Casing diameter, if applicable (inches): _____
Cased depth, if applicable: _____ to _____ feet below land surface
Casing material, if applicable: _____
If a remediation product will be injected as a DP rod is inserted, indicate injection interval: _____ to _____ feet below land surface.

## PROJECT DESCRIPTION

The in situ, injection-type aquifer remediation product/process remediates contaminants by:
(check those that apply)

- ☐ use of a bioremediation product,
- ☐ use of a chemical oxidation product,
- ☐ recirculation of partially treated contaminated groundwater, or
- ☐ other (describe) _____

Brief description of the project: _____

_____

Summary of major design considerations and features of the project:

Number of injection wells: _____
Injection volume per well (gallons): _____
Single or multiple injection events: _____
Injection volume total (all wells, all events): _____
For continuous recirculation of partially treated water, indicate total daily design flow rate: _____ gallons per day

Facility name: _____
FDEP facility no.: _____

**FLUID TO BE INJECTED**

Brand name of remediation product(s): _____

Has an innovative technology acceptance letter been issued for this product by the BPSS:
__ yes __ no (Note: it is not required that an innovative technology acceptance letter be issued for the technology or product to be proposed in a RAP)

> If product formula is proprietary then non-disclosure of the formula to the PE reviewing the RAP for the Department is only acceptable if there is an innovative technology acceptance letter issued by the BPSS with an attached proprietary voucher of confidential disclosure and it is verified that the proposed application rates (dosage) is limited to the rates specified in the innovative technology acceptance letter.

Is product formulation proprietary? __ yes __ no.

If product formulation is proprietary are proposed application rates limited to that indicated in innovative technology acceptance correspondence? __ yes __ no __ N/A

Composition of injected fluid (e.g. ingredient, wt. %): _____

_____

_____

**TEMPORARY INJECTION ZONE OF DISCHARGE (ZOD)**

(check those that apply)

☐ No ZOD needed. The fluid to be injected meets the primary and secondary groundwater standards of Chapter 62-550, F.A.C., and the minimum groundwater criteria of Chapters 62-520 and 62-777, F.A.C.

_____

☐ ZOD permission by rule 62-520.310(8)(c) †, F.A.C., for reagent chemical species and/or parameter(s) in the fluid to be injected (or re-injected) that exceed secondary groundwater standards. ZOD permission by this rule also applies to chemical species in the fluid to be injected that exceed primary groundwater standards or minimum groundwater criteria, provided those species are prime constituents of the reagents used to remediate site contaminants. The chemical species and parameters for which the approved Remedial Action Plan identifies zone size and duration, and addresses groundwater monitoring are summarized below.

Chemical species & parameters:_____

_____

Zone size (sq. ft.)____ Duration (mos.)_____ Yes, monitoring addressed. ☐

☐ ZOD permission by rule 62-520.310(8)(c) †, F.A.C., for the following contaminants of concern that exceed their groundwater standards in the fluid to be re-injected as part of a closed-loop re-injection system for which the approved Remedial Action Plan identifies zone size and duration, and groundwater monitoring:

Contaminants of concern:_____

_____

Zone size (sq. ft.)____ Duration (mos.)_____ Yes, monitoring addressed. ☐

☐ ZOD permission by variance because the fluid to be injected contains the following impurities that are not prime constituents of the reagents used to remediate the site's contaminants, and the concentrations of those impurities in the fluid to be injected are in excess of their primary groundwater standards:

Facility name: _____
FDEP facility no.: _____

Impurities regulated as primary groundwater contaminants: _____

_____

Zone size (sq. ft.)____ Duration (mos.)_____ Yes, monitoring addressed. ☐

☐ A variance needs to be granted before the remediation can be conducted.

☐ A variance has already been granted for the impurities listed above:

Date variance granted: _____

Zone size (sq.ft.): _____

Duration (mos.): _____

☐ If ZOD permission by rule 62-520.310(8)(c) †, F.A.C., or by variance is checked above, then a figure that delineates the ZOD is attached. (Use the lines below to more fully describe the ZOD if a figure alone will not suffice).

_____

_____

_____

**CLEANUP CRITERIA AND ENFORCEABLE APPROVAL ORDER**

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 reactions induced by those ingredients or the contaminants of concern during their use. Applicable primary and secondary groundwater standards are set forth in Chapter 62-550, F.A.C., and minimum groundwater 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.

† Effective July 12, 2009, rule 62-522.300(2)(c), Florida Administrative Code (F.A.C.), was relocated to Chapter 62-520, F.A.C., and renumbered as rule 62-520.310(8)(c), F.A.C.