Florida Department of Environmental Protection

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

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Mimi A. Drew
Secretary

November 8, 2010

Marcos Gonzalez
Natural Solutions Group, Corp.
2272 West 78th Street
Hialeah, Florida 33016

Re: **VirO2Syl**

Dear Mr. Gonzalez:

The Bureau of Petroleum Storage Systems (Bureau) hereby accepts VirO2Syl, an aqueous mix of hydrogen peroxide and colloidal silver, as a remediation product for the destruction of petroleum hydrocarbons and other suitable contaminants in soil and groundwater, in situ and ex situ, via chemical oxidation. As you have indicated, VirO2Syl distinguishes itself from other products of this type in that a proprietary process is used to impart an extended stability and shelf life, and that lower concentrations of it are needed to remediate contaminated sites. The peroxide and the silver are premixed, and the stabilization is such that it allows lower concentrations of the colloidal silver to be used. The decomposition of the peroxide does not accelerate until it makes contact with organic matter, and it does not kill all of the indigenous microorganisms at a cleanup site. Enough of them will survive and recover to do some polishing after the initial treatment. Regulatory information regarding the use of VirO2Syl is provided as Enclosure 1; supplemental information as Enclosure 2; and Underground Injection Control notification as Enclosure 3.

The Bureau of Petroleum Storage Systems does not endorse specific or brand name remediation products or processes. It does, however, recognize the need to determine their acceptability in the context of environmental regulations, safety, and the protection of public health. For that reason, the Bureau issues an "acceptance" letter, not an approval. In no way shall an acceptance be construed as certification of performance, nor shall it be construed as approval for uses that are beyond the jurisdiction of the Bureau. Additionally, vendors, upon receipt of an acceptance, must market their product or process on its own merits regarding performance, cost, and safety in comparison to competing alternatives in the marketplace.

Remedial Action Plans that propose the use of an accepted product or process should include a copy of the acceptance letter in its entirety in the plan's appendix, and reference it in the text of the document. It is <u>not</u> 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 rules and regulations.

The Bureau reserves the right to revoke its acceptance of a product or process if it has been falsely represented. Additionally, Bureau 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 submitted for Department review and approval. Please direct any questions about this acceptance to Rick Ruscito at telephone (850) 877-1133, extension 3722, or by e-mail at rruscito@ene.com.

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) Regulatory Information
(2) Supplemental Information
(3) Underground Injection Control Notification Memorandum

c: Tom Conrardy - FDEP/Tallahassee

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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 62-522, 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 62-770, 62-780, 62-782, and 62-785, F.A.C., for cleanup criteria; and Chapter 62-777, F.A.C., for cleanup target levels.

   Users of VirO2Syl shall comply with all applicable regulations. This includes meeting applicable groundwater cleanup target levels for the contaminants of concern, the residual concentrations of VirO2Syl ingredients, and any byproducts of concern produced by chemical and biological reactions induced by the ingredients during the timeframe of the cleanup project. For the "ingredients of concern" in VirO2Syl that are present in excess of their groundwater standards, the timeframe is that which is permitted for a temporary injection zone of discharge.

b. Underground Injection Control permit: Per Rule 62-528.630(2)(c), F.A.C., Class V injection-type aquifer remediation wells are exempt from the permitting requirements of Rule 62-528.635, F.A.C., when authorized by a Department-approved Remedial Action Plan or other enforceable mechanism, provided the requirements of the rules governing the remediation project, as well as the construction, operation, and monitoring requirements of Chapter 62-528, F.A.C., are met. 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.

c. Underground Injection Control notification: 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 the Underground Injection Control program. Reviewers of those plans, upon issuance of an enforceable Remedial Action Plan Approval Order by the Department, must submit a completed copy of the Underground Injection Control inventory notification memorandum in Enclosure 3.

d. General information about temporary injection zones of discharge: For in situ aquifer remediation, the composition of the fluid to be injected (before it is diluted by the receiving groundwater) must meet the primary and secondary drinking water standards set forth in Chapter 62-550, F.A.C., and the general minimum groundwater criteria of Chapter 62-520, F.A.C., pursuant to underground injection control Rule 62-528.600(2)(d), F.A.C. Additional minimum groundwater criteria for specific chemicals are set forth in Chapter 62-777, F.A.C. Aquifer remediation fluids that do not meet these requirements must seek permission for a temporary injection zone of discharge. Depending on the chemical composition and the physical properties of the fluid, it will be necessary to obtain permission for an injection zone of discharge by either one or both of the following methods: by Rule 62-520.310(8)(c), F.A.C., or by variance from Rule 62-520.310(9), F.A.C.

Rule 62-520.310(8)(c), F.A.C., allows a temporary injection zone of discharge for closed-loop re-injection systems, the prime constituents of the reagents used to remediate site contaminants, and the secondary standards for groundwater, provided a Department-approved remedial action plan addresses the duration and size of the zone of discharge, and groundwater monitoring of the injected chemical species of concern.

In order to obtain permission for a temporary zone of discharge by way of Rule 62-520.310(8)(c), F.A.C., a site-specific Remedial Action Plan must indicate: (a) the chemical species of concern in the fluid to be injected that will be present in excess of their allowable concentrations; (b) the size of the zone that is needed; (c) the amount of time that the zone will be needed; and (d) a groundwater monitoring plan for the injected chemical species of concern. In most cases, monitoring on a quarterly basis should be sufficient. The size of the temporary injection zone of discharge in item (b) above will usually be the injection radius of influence when the treatment system is a single injection point. For a multiple point system, the zone of discharge can usually be expressed and illustrated as the total area of the cluster formed by all the injection points, located side-by-side with overlapping radii of influence.

e. Specific zone of discharge (ZOD) information for VirO2Syl: The Bureau of Petroleum Storage Systems, using information provided by the Natural Solutions Group Corporation, has identified pH and silver as parameters in need of permission for a temporary injection zone of discharge by way of Rule 62-520.310(8)(c), F.A.C., for which the groundwater must be monitored during the course of a cleanup. In order for temporary injection ZOD permission to be granted by way of Rule 62-520.310(8)(c), F.A.C., for pH and silver when VirO2Syl is injected, a site-specific Remedial Action Plan must: (a) identify pH and silver as parameters of the fluid to be injected that do not meet their injection standards; (b) specify the size of the ZOD needed for pH and silver; (c) specify the period of time for which a temporary ZOD is needed; and (d) provide for the monitoring of pH and silver in the groundwater during the course of the cleanup. In most cases, monitoring on a quarterly basis should suffice.

f. Utilization of wells: If a remediation site happens to have an abundance of monitoring wells, then the Bureau has no objection to the use of some wells for the injection of remediation products. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to inject remediation products. This will avoid premature conclusions that the entire site meets cleanup goals. By making sure that designated tracking wells are not also used as treatment points, there will be more assurance that the remediation product has permeated the entire site and that it did not remain localized to the area immediately surrounding each injection well.

g. Avoidance of migration: For injection-type, in situ aquifer remediation projects, pursuant to Rule 62-528.630(3), F.A.C., the injection of VirO2Syl shall be performed in such a way, and at such a rate and volume, that no undesirable migration of either the VirO2Syl or the contaminants of concern in the aquifer results.

h. Abandonment of wells: Upon issuance of a Site Rehabilitation Completion Order, injection wells shall be abandoned pursuant to Section 62-528.645, F.A.C., and the Underground Injection Control Section of the Department shall be notified so that the treatment wells can be removed from the injection well inventory-tracking list.

i. Open-pit applications: While open-pit application of VirO2Syl is not an injection-type application, and notification of the Underground Injection Control Section therefore not required, the user 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 sampled for the same parameters that would have been monitored had the application been an injection. Those parameters are pH and silver.

j. "Soil-only" cleanups: For sites where VirO2Syl will be used in situ for the cleanup of only soil that is located above the water table, consideration should be given to the potential for its ingredients of concern to percolate to the underlying groundwater. The potential will have to be evaluated on a site-specific basis, and may at least have to take into account the depth to which the VirO2Syl will be applied in comparison to the depth of the groundwater, the amount of VirO2Syl applied, and the permeability of the soil. If it is determined that VirO2Syl has the potential to reach the water table, then the underlying groundwater should be monitored for pH and silver during the course of the cleanup, as if the VirO2Syl had been directly introduced below the water table.

k. Soil and groundwater criteria for VirO2Syl ingredients of regulatory interest: The secondary groundwater standards for pH and silver, as indicated in the current issue of Chapter 62-550, F.A.C., are range 6.5-8.5 and 0.1 milligrams per liter (mg/L) respectively. These standards or their natural-occurring background values at the cleanup site, whichever is less stringent, must be met by the time that the temporary injection zone of discharge expires. For soil, the criteria for silver is the 17- milligram per kilogram (mg/Kg) maximum allowable leachability-based soil cleanup target level and the 410-mg/Kg direct residential exposure limit established in the current issue of Chapter 62-777, F.A.C. The lower value of the two (17-mg/Kg) has to be met in order for the site to qualify for an unconditional declaration of No Further Action. For additional information about alternate methods by which to demonstrate that soil meets unconditional cleanup target levels for leachability, see Rule 62-770.680(1)(c)2 in the current December 27, 2007 issue of Chapter 62-770, F.A.C.

SUPPLEMENTAL INFORMATION

a. Chemical composition: Premixed VirO2Syl, as-shipped, contains 27% hydrogen peroxide and 0.03% colloidal silver. Since information provided to the Bureau of Petroleum Storage Systems by Natural Solutions Group Corporation discusses the use of VirO2Syl at this as-shipped concentration, the Bureau has offered its advice on how to comply with injection zone of discharge requirements for this composition. Whether it is advisable to dilute the as-shipped product with additional water prior to application at a specific site for an in situ cleanup is a matter that should be discussed between the user and Natural Solutions Group Corporation before a site-specific Remedial Action Plan is prepared and submitted for review and approval. In regard to the silver, the Bureau indicates that it will be necessary to obtain permission for a temporary injection zone of discharge, for the fluid to be injected, for any dilution that involves the addition of less than 3,000 volumes water to 1 volume of as-shipped VirO2Syl prior to injection. Whether permission for a temporary injection zone of discharge will be necessary for pH for various dilutions of VirO2Syl prior to injection will depend on the resulting pH of the mixture, which will be influenced in part by the pH of the local dilution water.

b. Pilot study: For petroleum cleanup, per Rule 62-770.700(2), F.A.C., it is required that a pilot study proposal be submitted for review, and that a pilot test be performed prior to the design of a full-scale treatment system. If conditions at a site do not warrant a pilot study, then a proposal explaining the rationale to forego it must be submitted for review.

c. Dosage: The amount of VirO2Syl to be used for the remediation of groundwater and soil at a contaminated site depends on site-specific conditions. The Bureau of Petroleum Storage Systems therefore advises users of VirO2Syl to consult Natural Solutions Group Corporation to determine an appropriate dosage. For in situ applications, the Bureau also advises that no more than the necessary amount be introduced to the subsurface, in order to avoid a situation in which a lengthy period of time is needed for residual concentrations of the ingredients of concern to decrease to their soil and groundwater standards, or their natural-occurring background levels at the cleanup site, whichever is less stringent.

Florida Department of

Memorandum — Environmental Protection

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, FL 32399-2400

FROM: _____ (Note 1.)
_____
_____

DATE: _____

SUBJ: **Proposed Injection Well(s) for In Situ Aquifer Remediation at a Remedial Action Site**

Pursuant to paragraph 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.

Facility name: _____
Facility address: _____
City/County: _____
Latitude/Longitude: _____
FDEP Facility Number: _____

Facility owner's name: _____
Facility owner's address: _____
_____
_____
_____

Well contractor's name: _____ (Note 2.)
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: _____ to _____ feet below land surface
Casing diameter, if applicable (inches): _____
Cased depth, if applicable: _____ to _____ feet below land surface
Casing material, if applicable: _____

PROJECT DESCRIPTION

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

- ☐ bioremediation,
- ☐ chemical oxidation, 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): _____

Facility name: _____
FDEP facility no.: _____

FLUID TO BE INJECTED

Composition of injected fluid:
(ingredient, wt. %) (Note 3.): _____
_____
_____
_____

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 list of chemical species and parameters for which the approved Remedial Action Plan identifies zone size, duration and groundwater monitoring are as follows:

_____
_____
_____

☐ 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, duration and groundwater monitoring:

_____
_____
_____

☐ ZOD permission by variance because 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 concentration of those impurities in the fluid to be injected are in excess of their primary groundwater standards:

_____
_____
_____

☐ 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 (feet):_____ Duration (time):_____

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☐ 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, or ☐ the ZOD is described as follows:

_____
_____

Facility name: _____
FDEP facility no.: _____

CLEANUP CRITERIA AND ENFORCEABLE APPROVAL ORDER

In situ injection-type aquifer remediation of the contaminants of concern at this site is intended to meet the groundwater cleanup target levels established for them in accordance with applicable and appropriate chapters of the Florida Administrative Code and cited in the approved Remedial Action Plan. 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 Chapters 62-520 and 62-777, 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. This notification memorandum is primarily for use by state technical reviewers, but remediation contractors may fill in all blanks except those labeled "FROM" and "DATE" on page 1, and the "approval date", and "telephone number" blanks in the last paragraph on page 4. Those blanks are filled only by the regulator. In the case that the memorandum form is partially completed by the remediation contractor, the FDEP technical reviewer must verify that the information provided by the contractor is accurate and complete. 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 follow the instructions in the March 16, 2000, memorandum to arrange for Department headquarters' execution of an approval order, and then complete this memorandum.

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 the fluid to be injected is required by Chapter 62-528, F.A.C. Some remediation products and processes may have already submitted this information at the time of application for acceptance by the Innovative Technology Acceptance Program. For those situations, when completing the Fluid To Be Injected section of this memorandum, it will suffice to indicate: (1) an Innovative Technology Acceptance letter has been issued; (2) the date of the acceptance letter; (3) the acceptance letter contains the chemical analysis, or a voucher for the confidential disclosure of the injected fluid's chemical composition if it is a proprietary formulation; and (4) the fluid will be injected at concentrations that are less than or equal to those cited in the acceptance letter. For products and processes that do not hold an Innovative Technology Acceptance letter, but for which the site-specific Remedial Action Plan provides a complete description of the chemical composition of the fluid to be injected, it will be necessary to enter this information into the Fluid To Be Injected section of this memorandum.