

Florida Department of Environmental Protection

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

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

April 19, 2007

Bob Elliott
Remediation Products Incorporated
6390 Joyce Drive, Suite 150 West
Golden, Colorado 80403

Re: **Trap & Treat BOS 100™**

Dear Mr. Elliott:

The Florida Department of Environmental Protection (the Department) hereby accepts Trap & Treat BOS 100™ as an innovative product for the remediation of halogenated compounds such as trichloroethylene (TCE) and perchloroethylene (PCE) in groundwater, soil and vapor: in situ and ex situ. Other contaminants that may be suitable for remediation by this product include certain explosives, rocket propellants and heavy metals.

As Remediation Products Incorporated (RPI) has indicated, BOS 100™ is a specially manufactured granular (20/40 mesh) product that primarily consists of activated carbon (94% by weight) and is impregnated with elemental iron (approximately 6% by weight). Although essentially insoluble, it is usually mixed with water and applied as a slurry. The ratio of water to BOS 100™ in the slurry is not critical since the water serves only as a carrier. Bacteria are not added to the slurry because BOS 100™ is not a biological treatment process. It destroys contaminant molecules by first removing them from soil, vapor or groundwater and adsorbing them onto activated carbon pore surface, where they are subsequently degraded by a reductive chemical reaction. In the case of TCE and PCE, the reaction is a reductive dechlorination.

There are no objections to the use of BOS 100™ provided: (1) the considerations of this letter are taken into account; (2) a site-specific Remedial Action Plan is approved prior to its use; (3) for injection-type applications, the site-specific Remedial Action Plan complies with the requirements of Rule 62-522.300(2)(c), Florida Administrative Code (F.A.C.), in-order to receive, by rule, permission for a temporary injection zone of discharge for iron; and (4) groundwater is monitored for by-product halogens (for example, chloride when contaminants such as TCE and PCE are reductively dechlorinated). Since in situ, injection-type remediation is likely to be the most common application of this product, the bulk of the regulatory requirements discussed in enclosure 1 are directed to that topic.

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, however, shall this regulatory acceptance be construed as certification of product or process performance.

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

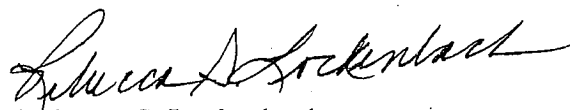
Those who prepare Remedial Action Plans are advised to include a copy of this letter in the appendix, and call attention to it in the text of their document. In this way, technical reviewers throughout the state will be informed that you have contacted the Florida Department of Environmental Protection in regard to the acceptability of BOS 100™. To aid those reviewers, the Department provides supplemental information as enclosure 2.

The Department reserves the right to revoke acceptance of any product or process if it has been falsely represented. Additionally, Department acceptance of a 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. Technical questions regarding acceptance of BOS 100™ should be directed to Rick Ruscito at 850-877-1133, extension 3722.

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

Enclosures: (1) Regulatory Information
(2) Supplemental Information
(3) Underground Injection Control Notification

c: T. Conrardy - FDEP/Tallahassee

ENCLOSURE 1
REGULATORY INFORMATION

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- a. Applicable rules and regulations: The onus shall be on Remediation Products Incorporated and users of BOS 100™ to comply with all applicable regulations, particularly those regarding underground injection control and groundwater quality. All applicable groundwater contaminant standards shall be met at the time of project completion for the contaminants of concern, any residuals associated with the ingredients of BOS 100™, and any by-products produced as a result of chemical reactions involving those ingredients. The following chapters of the Florida Administrative Code are cited as applicable but should not be construed as an exhaustive list: 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 wells; Chapter 62-770, F.A.C., for petroleum cleanup; and Chapter 62-777, F.A.C., for contaminant cleanup target levels.

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: 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. The issuance of a site-specific Remedial Action Plan Approval Order for an injection-type aquifer remediation plan that meets these requirements constitutes the granting of a Class V injection well permit.
- c. Groundwater injection standards: For in situ aquifer remediation, the composition of an injected fluid must meet the drinking water standards set forth in Chapter 62-550, F.A.C., pursuant to underground injection control Rule 62-528.600(2)(d), F.A.C., and the minimum groundwater criteria set forth in Chapter 62-520, F.A.C. If the fluid composition does not meet these standards, then permission for a temporary, injection zone of discharge must be obtained by way of rule and/or variance, depending on the nature of the fluid's ingredient(s) in excess of the applicable groundwater standard(s). If Remediation Products Incorporated makes any changes to the composition of its product in the future, then the Department should be notified and provided with a complete chemical analysis of the reformulated product for the purpose of re-evaluating it with respect to groundwater injection standards.
- d. Zone of Discharge: For BOS 100™, the Department has determined that permission for a temporary injection zone of discharge must be obtained for iron before injection can occur. In the case of BOS 100™ such permission can be obtained by complying with Rule 62-522.300(2)(c), F.A.C.

In order to obtain permission by way of this rule, a Remedial Action Plan proposing the injection of BOS 100™ must: (a) specify the size of the zone of discharge that is requested (typically expressed

as an injection point radius of influence); (b) specify the amount of time that a temporary zone of discharge is needed; (c) indicate that iron is the chemical species of concern; and (d) propose monitoring of the groundwater for iron. Monitoring on a quarterly basis should suffice. If halogenated contaminants are targeted for remediation, then the monitoring should also include the halogen liberated by reductive chemical processes (e.g. chloride when contaminants such as TCE or PCE are remediated). Approval of a Remedial Action Plan that meets the requirements of Rule 62-522.300(2)(c), F.A.C., also constitutes the granting of permission for the temporary injection zone of discharge.

- 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 for the application of BOS 100™. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply BOS 100™. This will avoid 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.

f. Groundwater monitoring:

1. Active remediation monitoring: During the period of active remediation, groundwater shall be monitored for contaminants of concern in accordance with the provisions of an approved Remedial Action Plan.
2. Post remediation petroleum monitoring: Groundwater monitoring of contaminants of concern shall be conducted in accordance with the provisions of an approved Remedial Action Plan. If halogenated contaminants were targeted for remediation, then the monitoring should also include the by-product halogens liberated by reductive chemical processes.
3. Underground injection control monitoring: For in situ, injection-type applications of BOS 100™, it will be necessary to monitor the groundwater for iron, in order to comply with Rule 62-522.300(2)(c), F.A.C. If halogenated contaminants were targeted for remediation, then the monitoring should also include the by-product halogens liberated by reductive chemical processes. The frequency of the monitoring shall be that which was specified in the approved Remedial Action Plan. In most cases, a quarterly sampling frequency should suffice.

g. Operation:

1. Avoidance of migration: For in situ, injection-type aquifer remediation projects, injection of BOS 100™ 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. [Rule 62-528.630(3), F.A.C.]
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 petroleum contamination plume is expected to accompany the BOS 100™ 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. Additionally, each Remedial Action Plan should clearly indicate the total volume of fluid and the concentration of BOS 100™ that will be injected.

- h. Abandonment of wells: Upon issuance of a petroleum 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 excavation applications: The addition of BOS 100™ to the groundwater exposed by an open excavation is not an injection. For this reason, it is not necessary to use the Underground Injection Control Notification of enclosure 3. This does not, however, relieve the user of the product from an obligation to be mindful of groundwater quality standards and any toxicological effects that the ingredients of the applied remediation product could have on the groundwater.

A simple way of handling the addition of BOS 100™ to the exposed groundwater in an open excavation (or to a dry pit, from whose bottom the effects could reach the water table) is to monitor the groundwater for the same BOS 100™ "ingredients of concern" as if the application had actually been an injection. A well installed in the excavation area after it is backfilled should be monitored for iron. In most cases, a sampling frequency of quarterly should suffice.

ENCLOSURE 2
SUPPLEMENTAL INFORMATION

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- a. Florida Department of Environmental Protection reviewers of in situ, injection-type 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 Petroleum Remedial Action Site". The completed form must be submitted to the Underground Injection Control Section at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.

Only reviewers within the Department and its district offices may approve in situ, injection-type remediation plans in which the approval constitutes the issuance of a Class V injection permit; local programs are not authorized to grant such approvals. These local programs, however, can arrange to have enforceable approval orders for their injection-type projects processed by the Department's headquarters in Tallahassee. The procedure is the same as it would be for the issuance of any other approval order that is processed by the Department for a local program cleanup project.

- b. Pilot study: For innovative technologies, per Section 62-770.700, F.A.C., a pilot study proposal shall be submitted for review, and a pilot test shall be performed prior to designing a treatment system. If conditions or the situation at a site do not warrant a pilot study, then a proposal explaining the rationale for a decision to forego a pilot study shall be submitted for review.
- c. By-products: As indicated by Remediation Products Incorporated, the by-products from the reductive dehalogenation of contaminants such as trichloroethane and trichloroethylene by BOS 100™ are ethane, ethene, chloride and ferrous iron.
- d. Dosage and application: Since BOS 100™ is essentially insoluble in water, the dosage is expressed simply as the number of pounds of BOS 100™ powder (dry weight) to be applied at each node of a 3-dimensional grid designed to cover the contamination plume both horizontally and vertically. Although the amount of carrier water used to prepare the injection slurry is not critical, adjustments in the amount may be necessary to suit site-specific hydrology.

As for dosage and application, Remediation Products Incorporated offers two examples. For a relatively high TCE concentration of 54,000 parts per billion (ppb) in groundwater, "shots" of slurry containing 75 to 100 pounds of BOS 100™ (dry weight) may be introduced at multiple depths in each borehole of an injection point grid that is laid out with horizontal injection points spaced at 5 to 15 feet. For a cleanup site where there is a relatively low 2,000 ppb concentration of TCE in the groundwater, it may suffice to inject slurry "shots" containing only 10 pounds of BOS 100™ (dry weight) at multiple depths.

- e. Technique: Remediation Products Incorporated indicates that injections of BOS 100™ should begin in the area of lowest contaminant concentration, with those that follow working their way toward the area of highest contaminant concentration.
- f. Free product: BOS 100™ can be used to treat free product (non-aqueous phase liquid) but Remediation Products Incorporated advises that a cost/benefit analysis be conducted beforehand in comparison to excavation. If the amount of free product is significant, then the most cost-effective remediation strategy may be to first remove the free product by excavation, and then inject BOS 100™ to treat the remaining dissolved contaminant area.

Memorandum

Florida Department of Environmental Protection

TO: Richard Deuerling, Mail Station 3530
Division of Water Resource Management
Underground Injection Control Section
Florida Department of Environmental Protection
2600 Blair Stone Road, Tallahassee, FL 32399-2400

FROM: _____ [see Note 1.]

DATE: _____

SUBJ: **Proposed Injection Well(s) for In Situ Aquifer
Remediation at a Petroleum 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 petroleum-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: _____ [see Note 2.]

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: _____

Date: _____

Site name: _____

FDEP Facility No.: _____

Composition of injected fluid [see Note 3.]

(ingredient, wt. %): _____

Injection volume per well (gallons): _____

Single or multiple injection events: _____

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

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 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: _____

The in situ injection-type aquifer remediation plan for this petroleum contaminated site is intended to meet the groundwater petroleum cleanup criteria set forth in Chapter 62-770, 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 contaminating petroleum 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. Local programs are not authorized to approve underground injections into aquifers. Reason: Per agreement with the USEPA, the FDEP cannot delegate this authority. Local programs, after reviewing a Remedial Action Plan or an injection proposal document, should prepare the Approval Order and route it to Tallahassee for Department Chief's signature, and then complete this form. This form is primarily for use by state and local program technical reviewers, but petroleum 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. Those blanks should be completed only by a state or local program reviewer.

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 injected fluid is required by Chapter 62-528, F.A.C. Proprietary formulations shall make confidential disclosure. Injected fluids must meet drinking water standards of Chapter 62-550, F.A.C., unless an exemption or variance has been granted.