



Department of Environmental Protection

Jeb Bush
Governor

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

David B. Struhs
Secretary

July 22, 2002

Mr. James C. Vaughn, Jr., P.E.
eGeo Services, Inc.
P.O. Box 13646
Savannah, Georgia 31416

Re: **PHOSter II™ Bioremediation Technology**

Dear Mr. Vaughn:

The Bureau of Petroleum Storage Systems hereby acknowledges that eGeo Services, Inc. is a licensee of the PHOSter vapor-phase nutrient injection system for in situ bioremediation of petroleum hydrocarbons and other suitable contaminants in soil and groundwater. The PHOSter technology was originally developed by the U.S. Department of Energy (D.O.E.) and the Savannah River Technology Center in 1995. eGeo Services, Inc. (formerly Freeman & Vaughn Engineering, Inc.) was paid by D.O.E. to redesign and commercialize the technology for remediation of petroleum sites. eGeo Services, Inc. has provided further enhancements to the technology including redesigning the nutrient delivery system and making provisions to inject an additional carbon-based food source. This new system is trademarked and marketed under the name of PHOSter II™. This letter supersedes the original August 8, 1997 acceptance letter issued by this bureau to Freeman and Vaughn Engineering for the original PHOSter remediation process.

The process is a pulsed injection system that stimulates the growth of indigenous microorganisms by supplying an optimum quantity of oxygen, nitrogen, phosphorous, and a carbon-based food source if required. Briefly, a predetermined amount of liquid triethylphosphate (TEP) (the phosphate source) is injected into the compressed air (the oxygen source) in a vessel, and emerges as an air/triethylphosphate mixture. This TEP-mixture is combined with nitrous oxide or atmospheric nitrogen (the nitrogen source), and propane (a carbon-based food source) if needed. The entire combined mixture is then forced into the soil or groundwater to be remediated via injection wells. The system has a programmable logic controller (PLC) to control each injection well's pulsed injection cycle. Indigenous microorganisms utilize the injected nutrients to aerobically degrade petroleum contamination, producing biomass, carbon dioxide and water.

This acceptance applies to the jurisdiction of this bureau, but other bureaus within the Department of Environmental Protection, or other state agencies and local governments may choose to recognize it if their needs and regulations are similar. This bureau, however, is not responsible for applications beyond its jurisdiction, which is primarily the cleanup of subsurface petroleum pursuant to Chapter 62-770, Florida Administrative Code (F.A.C.), typically at gasoline service stations.

Even though the content of this letter is similar to that of the original August 8, 1997 acceptance of the PHOSter system, albeit the format modified

for clarity, it shall supersede the original acceptance because there have been some changes. In enclosure 1, the bureau has condensed and reworded its explanation of the groundwater sampling requirements for nitrate, nitrite, and phosphorus when the PHOSter system is used to remediate a contaminated site. The enclosure discusses the sampling frequencies for these chemical species before, during, and after PHOSter injections, and allows their sampling to be reduced in frequency or discontinued during the post-injection period as they meet their respective groundwater standards. Other licensees of the PHOSter remediation process holding earlier versions of a PHOSter acceptance letter by the Bureau of Petroleum Storage Systems may also decrease or discontinue their post-active remediation monitoring of nitrate, nitrite, and phosphorus as they meet their respective groundwater standards. It is not necessary at this time to revise or amend the acceptance letters of these other licensees in regard to this post-active remediation monitoring option. They may cite this letter as their authorization to reduce or discontinue such sampling when it is possible.

The bureau recognizes PHOSter II™ as a viable technology for the bioremediation of petroleum contaminated sites in Florida. There are no objections to its use provided the considerations of this letter are taken into account, and a Remedial Action Plan is prepared in accordance with Chapter 62-770, F.A.C., for approval by the Department. Environmental and regulatory requirements that apply to PHOSter II™ are provided in enclosure 1.

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, safety and welfare. 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 letter be construed as Department certification of performance. Additionally, the Department emphasizes a distinction between its regulatory "acceptance" and an approval: products and processes are accepted but they are not approved.

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, especially those of the Florida Administrative Code.

Those who prepare Remedial Action Plans are advised to 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 of Environmental Protection to inquire about the environmental acceptability of PHOSter II™. To aid those reviewers, the Bureau of Petroleum Storage Systems provides supplemental information as enclosure 2.

The Department reserves the right to revoke its acceptance of a product or process if its nature or performance 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.

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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. You may contact me at 850/487-3299 if there are any questions.

Sincerely,

Rick Ruscito, P.E.
Bureau of Petroleum Storage Systems

c: T. Conrardy - FDEP/Tallahassee

History:

8/8/1997
INN_007.doc
ppl #007

7/22/2002
inn_007a.doc
ppl #189

ENCLOSURE 1

PHOSTER II™: ENVIRONMENTAL AND REGULATORY CONSIDERATIONS

For PHOSter II™ applications, the major environmental regulatory considerations are listed below.

- a. Groundwater standards: The onus shall be on users of PHOSter II™ to ensure that all applicable groundwater contaminant standards will be met at the time of project completion, for petroleum, other contaminants that may be present, any residuals associated with the ingredients of PHOSter II™, 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, and minimum criteria; 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; Chapter 62-770, F.A.C., for petroleum cleanup criteria; and Chapter 62-777, F.A.C., also for minimum groundwater 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 which 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 Petroleum Storage Systems or the Bureau of Waste Cleanup, for remediation via PHOSter II™ injections into an aquifer, 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., and the minimum groundwater criteria of Chapter 62-520, F.A.C., (and minimum criteria in Chapter 62-777 as well) pursuant to underground injection control Rule 62-528.600(2)(d), F.A.C.

Even though Chapter 62-528, F.A.C. is a comprehensive document pertaining to underground injection, it could not have anticipated technological advances creating the need to regulate vapor-phase injection concentrations for the purpose of injection-type in situ aquifer remediation, just those of a liquid. And Chapter 62-550, F.A.C., whose primary and secondary drinking water standards are cited as criteria for the underground injection of fluids, pertains only to liquid-phase concentrations as well. The Department, in response to this situation, instead of using a front-end approach to protecting groundwater quality by ensuring that injected liquids meet drinking water standards, will seek assurance, through monitoring, that no primary or secondary water quality standards or minimum groundwater criteria are exceeded.

- 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 PHOSter II™. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply PHOSter II™. 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: For underground injection control monitoring, the Department, pursuant to rule 62-528.615(2), F.A.C., has determined that the groundwater at a PHOSter II™ remediation site shall be sampled for nitrate, nitrite, and total phosphorus. For the petroleum contaminants of concern, the monitoring requirements of Chapter 62-770, F.A.C., apply, as they would for any other petroleum remediation project.
1. Before PHOSter injections begin, the natural-occurring background concentrations of nitrate, nitrite, and phosphorus in the groundwater shall be determined by sampling at least one (1) monitoring well that is upgradient of the groundwater contamination plume. If an upgradient well is not available, then a well in a location beyond the groundwater contamination plume that can be considered representative of the site's background water quality may be sampled in lieu. The Bureau of Petroleum Storage Systems does not recommend the selection of a well directly downgradient of the contamination plume for background sampling because it may not be representative. Additionally, if more than one background well is sampled for background concentrations of nitrate, nitrite, and phosphorus, then the average concentration of each of these chemical species can be considered the site's natural-occurring background concentration.
 2. During active remediation, for underground injection control purposes, pursuant to rule 62-528.615(2), F.A.C., the Bureau of Petroleum Storage Systems suggests that sampling of nitrate, nitrite, and phosphorus be conducted at a minimum of two (2) wells. One of the wells should be located in the central region of the PHOSter injection points, the other downgradient. This sampling should be conducted at least quarterly, once injection begins.

During active remediation, the appropriate petroleum contaminants of concern shall be sampled in accordance with the frequency specified in Rule 62-770.700(3)(i), F.A.C. For the cleanup of sites where the period of active remediation is expected to be brief (60 to 90 days for example) it may be necessary to conduct sampling more frequently than quarterly, in order to accurately gauge the progress of the cleanup.

3. After PHOSter injections have ceased, sampling of nitrate, nitrite, and phosphorus should be conducted at least quarterly, at a minimum of two (2) wells, one located in the central region of the PHOSter injection points, the other downgradient. The sampling results shall be compared to the drinking water standards listed in Chapter 62-550, F.A.C., (or the cleanup site's natural-occurring background concentrations, whichever is less stringent. The drinking water standards are as follows: nitrate [10,000 micrograms per liter (ug/L) maximum, as nitrogen, N], nitrite (1,000 ug/L maximum, as N), and total phosphorus [groundwater concentration not regulated, (as P)]. As each of these chemical species meets its drinking water

standard (or natural-occurring background concentration, whichever is less stringent) during the post injection period, its sampling may be reduced in frequency or discontinued.

Like any other petroleum site remediation project, PHOSter system projects shall include at least one (1) year of quarterly post-active remediation groundwater monitoring for the petroleum contaminants of concern. Pursuant to Section 62-770.750, F.A.C., such monitoring shall be conducted at a minimum of two (2) wells, one located in the area of maximum contamination, the other downgradient.

- f. Bureau of Petroleum Storage Systems' rationale regarding underground injection control monitoring for the PHOSter system: The selection of nitrate, nitrite, and phosphorus for underground injection monitoring purposes is a technical decision to track the fate of nitrogen and phosphorus atoms contained in the originally injected nitrous oxide and triethylphosphate. In the event that chemical or biochemical processes transform the nitrogen to nitrate and/or nitrite, in concentrations that exceed primary drinking water standards, then monitoring will detect the exceedance.

Phosphorus tracking does not allow for a comparison to groundwater or primary or secondary drinking water standards, since phosphorus compounds in groundwater are not regulated. Attention usually focuses on the eutrophication of surface waters. So, in cases where a PHOSter groundwater remediation project may impact surface water, it is advised that the concentration of phosphorus in the surface water not be raised above the 0.1 microgram per liter (ug/L), as P. This concentration set forth in Rule 62-302.530(54), F.A.C., as a surface water quality standard.

For oxygen injected by the PHOSter system in the form of compressed air, the bureau believes that tracking should not be necessary for injection control purposes, since the presence of dissolved oxygen in groundwater is generally not considered to be a problem. It is, however, recommended that dissolved oxygen concentration be measured as a matter of good bioremediation practice.

As for **propane**, which may be injected during the PHOSter II™ process in remote instances, where conditions require an additional carbon-based food source to sustain microbial populations, the bureau's judgment is that monitoring of it, as a dissolved gas, for underground injection control purposes may not be absolutely necessary. This judgment is based on a combination of factors: the amount of propane and its rate of injection will be low; it is anticipated that the average rate of propane consumption by the aquifer's indigenous microorganisms will be equivalent to the rate of propane injection; and the EPA, in a November 1977 report, "Multimedia Environmental Goals for Environmental Assessment", EPA-600/7-77-136, suggested a relatively high ambient goal concentration of 120 milligrams per liter (mg/L) for propane, which is roughly equal to its solubility in water.

If there is, however, concern that residual levels of propane could be high or persistent in the groundwater at a particular PHOSter II™ remediation site, then it would be prudent to monitor its concentration. The Bureau of Petroleum Storage Systems used the same algorithm for the calculation of a groundwater cleanup target level (GWCTL) for propane that the University of Florida's Center for Environmental and Human Toxicology used for its calculation for

butane, a close alkane family member. The calculated GWCTL for propane by this method is 8.5 milligrams per liter. In comparison, the GWCTL for butane was calculated to be 9 mg/L. Both calculations used a conservative safety factor of 100, to allow for consumption of the water by other than just healthy humans. The 8.5 mg/L concentration calculated by the bureau has not been validated by the University or other recognized toxicological authority, but arrangements can be made for its validation should there be a need.

- g. Underground injection control inventory and notification: Remedial Action Plans prescribing in situ injection-type aquifer 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. It will be necessary to modify appropriate portions of the memorandum to report PHOSter II™ system vapor-phase injections in terms of pounds of gas, purity of gas, and cubic feet per minute, instead of the units listed, which were intended to cover only liquid-phase injections.

h. Operation:

1. Avoidance of migration: For in situ injection-type aquifer remediation projects, injection of PHOSter II™ shall be performed in such a way, and at such a rate and volume, that no undesirable migration of either the nutrients or the petroleum contaminants in the aquifer results, pursuant to 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 PHOSter II™ treatment process, the Bureau of Petroleum Storage Systems suggests 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.
 3. Operating parameter measurements: 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 reduction in the frequency or discontinuation of some measurements in situations when appropriate.
- i. 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.

ENCLOSURE 2

PHOSTER II™: SUPPLEMENTAL INFORMATION

The information below, compiled from several sources, may be helpful to reviewers of Remedial Action Plans prescribing bioremediation.

- a. Department of Environmental Protection reviewers of in situ injection-type aquifer remediation plans, regardless of whether in Tallahassee, district offices, or contracted local programs 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 the appropriate administrators in the Department and its district offices can sign the enforceable approval orders for in situ injection-type aquifer remediation plans, for which such approval constitutes the issuance of a Class V injection permit. Local programs are not authorized to grant such approvals. Reason: Although an arrangement between the Environmental Protection Agency and the Department delegates underground injection control authority to the Department, it does not allow the Department to delegate that authority any further. This includes delegation to the Department's contracted remediation review agencies such as those operated by the counties and other local governments. The local programs, however, can still conduct the technical review of an injection-type aquifer remediation plan, but they must prepare an enforceable approval order on Department letterhead for signature by an appropriate Department administrator.

- b. Pilot study: For bioremediation, per rule 62-770.700(2), 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 the rule allows that a proposal explaining the rationale to forego a pilot study may be submitted for review.
- c. Nutrient ratio: **The 20:12:1 molar ratio of oxygen, nitrogen, and phosphorus is the cornerstone of the PHOSter technology. The objective is to encourage microorganism growth by supplying these essential nutrients in a ratio that closely approximates their molar ratios in a standard cell of composition C₆₀H₈₇O₂₃N₁₂P.** The general equations describing the biological oxidation process for a hydrocarbon, and an example of an approximately balanced equation for the oxidation of ethylbenzene (C₈H₁₀), using nitrous oxide (N₂O) as the nitrogen source and triethylphosphate [(C₂H₅O)₃PO] as the phosphorus source are:

HYDROCARBON + OXYGEN + NITROGEN + PHOSPHORUS --> CELL MASS + CARBON DIOXIDE + WATER

C₈H₁₀ + 2.857O₂ + 0.857N₂O + 0.143 (C₂H₅O)₃PO --> 0.143 C₆₀H₈₇O₂₃N₁₂P + 0.286CO₂ + 2.43 H₂O

It should be noted that not all of the carbon in the ethylbenzene is converted directly to carbon dioxide, and that a portion is assimilated as cell mass, which will, in turn, degrade when the microorganisms die.

- d. Mass ratios: If the molar ratios of the equation in the preceding paragraph are converted to mass ratios, then for every pound of C_8H_{10} contaminant degraded it can be seen that 0.862 pounds of O_2 , 0.356 pounds of N_2O , and 0.232 pounds of $(C_2H_5O)_3PO$ must be injected via the PHOSter system. Since ethylbenzene is one of the heaviest molecules in the BTEX group (benzene, toluene, ethylbenzene, and xylene), thereby requiring the largest injection quantities of N_2O , O_2 , and $(C_2H_5O)_3PO$ for degradation, it may be reasonable to use the above mass ratios to make a quick and conservatively high estimate of the injection amounts needed to remediate a BTEX mixture of any proportions at any site.
- e. Nitrogen source: Nitrogen (N_2), which comprises approximately 78% of the Earth's atmosphere, enters the PHOSter II™ remediation system by way of an air compressor. When the original acceptance of the PHOSter process was issued in August 1997, it was not known that atmospheric nitrogen could play a role. eGeo has since indicated that in the majority of cases, the microorganisms are capable of directly utilizing the diatomic nitrogen molecule. In instances where nitrification is not occurring (nitrates greater than or equal to 0.5 mg/L) bottled nitrous oxide may be used as the nitrogen source. Nitrous oxide readily dissolves in water: 1.0 liter of it dissolves in 1.5 liters of water at 20 degrees Centigrade and 2 atmospheres.
- f. Additional food source: In instances where low levels of contamination are not adequate to sustain required microbiological activity to further reduce the contamination levels, an additional carbon-based food source may be required. Propane is a very simple carbon source and can readily be converted to cell mass by microorganisms. Injection concentrations will not exceed 5,000 mg/l.
- g. Cleanup time: Twelve (12) months or more, depending on site conditions and the nature of contaminants.
- h. Installation: trailer-mounted.
- i. Design and operating parameters: Remedial Action Plans prescribing the PHOSter system should include all pertinent design and operating parameters, including but not necessarily limited to: radius of influence; number of injection cycles per day; number of injection wells; location of injection wells; injection gas flow rates; the mass of petroleum contaminants to be remediated; the mass of nutrients to be injected over the life of the project; injection pressure; well construction details; a sampling plan, including a pre-remediation background sampling for nitrates, nitrites, and phosphorus; and the estimated cleanup time.
- j. Pulsing: Injection of vapor-phase nutrients is pulsed on a timed cycle to keep microorganisms fed at an optimum rate. Too little nutrient addition causes them to die, while too much will be wasteful. For active petroleum sites in Florida, the vapor-phase nutrient pulse rate is at least every three (3) to six (6) hours. **The strategy of the PHOSter system is to inject vapor-phase nutrients in small enough timed intervals and quantities to keep the microorganisms fed at an optimum rate. Therefore, very little injected material is wasted, and the risk of overdosing is minimal, which in turn minimizes the risk of injecting unnecessary and excessive quantities of nitrogen and phosphorus into the aquifer.** Likewise, the same reasoning can be applied to propane when it is used.

- k. Sites: The PHOSter II™ system has been used by eGeo Services at sixteen (16) petroleum sites in Florida, Georgia, South Carolina and Pennsylvania.
- l. Equipment: An air compressor, nutrient delivery system, controls, and a programmable logic controller (PLC) are totally enclosed in a lockable cargo trailer that is forced-air ventilated. A refrigerated compressed air dryer is used to cool and dry the compressed air, and a filter is used to remove oil prior to injection.
- m. Triethylphosphate: This compound is also known as triethyl ester phosphoric acid. Its vapor pressure is 1 millimeter of mercury (mm Hg) at 39°C. It has been indicated to the Department that microorganisms utilize the phosphorus component of this molecule as a nutrient, and consume the ethyl groups as a food source.
- n. Phosphorus: There are no groundwater or primary or secondary drinking water standards for phosphorus. For reference purposes only, it may be helpful to know that the European Economic Community guide level is 400 micrograms per liter (ug/L), as P₂O₅, for drinking water, and that a recent surficial aquifer sample at a petroleum remediation site in Volusia County contained 1,200 ug/L of naturally occurring phosphorus, as PO₄. This concentration may not be unusual for Florida.
- o. Advantage of vapor-phase injection: Quicker and more thorough dispersal of nutrients can occur if they are injected in the vapor-phase, rather than as liquids or solids, especially at sites where permeability of the soil is low. For a petroleum test site in Aiken, South Carolina, where significant contaminant reductions were obtained in 131 days, the soil permeability was relatively low: 10⁻⁸ cm².
- p. Radius of influence: A pilot test to determine a site-specific radius of influence, for design purposes, may be necessary. Such a test could be more of a quick and inexpensive pressure sensing at various distances from an air injection point, and not an expensive in-depth study resembling a treatise on bioremediation. The Bureau of Petroleum Storage Systems does not object to the bypassing of a radius of influence pilot test if there is enough experience and data on hand from geologically similar sites in Florida. The decision, however, should be made on a case-by-case basis, involving both the preparer of a remediation plan and the technical reviewer. The radii of influence for petroleum sites in Indiantown, Pompano Beach, Marianna, DeLand and Miami were 36 feet, 50 feet, 53 feet, 65 feet, and 80 feet, respectively. The delivery system producing those radii for those sites operated at 1 to 3 standard cubic feet per minute (scfm) and 15 to 20 pounds per square inch (psi).
- q. Air emissions: No air emissions monitoring is necessary for the PHOSter system since injection gas flow rates are not intended to be high enough to volatilize appreciable amounts of petroleum.

Memorandum **Florida Department of
Environmental Protection**

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: _____ (Note 1.)

DATE: _____

SUBJ: **Proposed Injection Well(s) for In Situ Aquifer
Remediation at a Petroleum Remedial Action 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 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: _____ (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: _____
Composition of injected fluid (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 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 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 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.

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- Note 1. 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 a March 16, 2000 memorandum to arrange for Department headquarters' execution of an approval order, 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", "DATE", and "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, 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 exemption or variance has been granted.