July 15, 1999

Mr. Douglas Rodgers, P.E.
Groundwater Technology Incorporated
3110 Cherry Palm Drive, Suite 355
Tampa, Florida 33619

Re: **Potassium Permanganate**

Dear Mr. Rodgers:

The Bureau of Petroleum Storage Systems and the Bureau of Waste Cleanup have jointly reviewed an application by Groundwater Technology Incorporated (GTI) for an innovative technology evaluation, and hereby accept chemical oxidation via potassium permanganate as a viable method for the remediation of petroleum and non-petroleum contaminated sites in Florida. Acceptance is for both in situ and ex situ applications in soil or groundwater. Also, the two bureaus hereby acknowledge an indication by GTI that the use of potassium permanganate, as an oxidizer, is common practice in the treatment of drinking water, and that no exclusive right is claimed regarding the extension of applications to groundwater and soil remediation.

There are no objections to the use of potassium permanganate, provided: (a) the considerations of this letter are taken into account; (b) a Remedial Action Plan is approved by the Department; and (c) the terms of a June 30, 1999 variance granted by the Department to GTI are observed. The terms of the variance, which creates a zone of discharge, in which a temporary exceedance of five specific secondary drinking water parameters is tolerated, are summarized in enclosure 1. The enclosure also includes a list of environmental and regulatory considerations.

The following chapters of the Florida Administrative Code are cited as pertinent, as portions of them are applicable to the potassium permanganate oxidation process: 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; and Chapter 62-528, F.A.C., for underground injection control, particularly Part V, for Class V, Group 4 aquifer remediation wells. Please note that 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 also constitutes the granting of a Class V injection well permit.

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.

Preparers of 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 the Department of Environmental Protection has determined the environmental acceptability of this process. To aid those reviewers, supplemental information is provided in enclosure 2.

Even though the concentrations of potassium permanganate covered by this acceptance letter are relatively dilute in comparison to other oxidizers currently in use in Florida for remediation purposes, and a vigorous chemical reaction is not expected, the Department does not want to be remiss in providing reminders about safety considerations. Since the process involves an exothermic reaction that could create a temperature rise, an in situ chemical oxidation safety advisory is included as enclosure 3.

The Department reserves the right to revoke its acceptance of a product or process if the nature or composition of either or any of its principal and proprietary ingredients, or its 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.

A site specific evaluation of applicability and cost-effectiveness must be considered for any product or process, whether conventional or innovative, and adequate site specific design details must be provided in Remedial Action Plans prescribing the product or process.

Questions regarding petroleum applications of the potassium permanganate process may be directed to Rick Ruscito at (850) 487-3299. Questions about non-petroleum applications may be directed to Bill Neimes at (850) 488-3935.

Sincerely,

Bill Neimes, P.E.
Bureau of Waste Cleanup

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

enclosures (4)

cc: Rich Deuerling - UIC, FDEP/Tallahassee
Cynthia Christen - OGC, FDEP/Tallahassee
Tom Conrardy - BPSS, FDEP/Tallahassee

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ENCLOSURE 1

POTASSIUM PERMANGANATE: ENVIRONMENTAL AND REGULATORY INFORMATION

For potassium permanganate, the major environmental and regulatory concerns are listed below.

a. Groundwater cleanup standards: The onus shall be on users of the potassium permanganate process to ensure that all applicable groundwater contaminant standards will be met at the time of project completion. This includes the contaminants of concern, any residuals associated with the potassium permanganate injectant, and any by-products produced as a result of chemical reactions. The following chapters of the Florida Administrative Code are cited: Chapter 62-550, F.A.C., for primary and secondary water quality standards; Chapter 62-520, F.A.C. for groundwater classes and standards; Chapter 62-522, F.A.C., for groundwater permitting and monitoring requirements; Chapter 62-528, F.A.C., for underground injection control, particularly Part V, for Class V, Group 4 aquifer remediation projects.

b. Groundwater injection standards: For in situ aquifer remediation, the composition of the 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. Additionally, any non-regulated substances injected must meet the minimum criteria for groundwater as defined in Rule 62-520.400(1), F.A.C.

c. Variance summary: The June 30, 1999 variance granted to GTI is for an exemption from Rule 62-522.300(2)(a), F.A.C., in order to create a 100 foot zone of discharge in the aquifer around each injection point. Within this zone of discharge, a temporary exceedance of the standards for five (5) secondary drinking water parameters will be tolerated for a period of time not to exceed two (2) years. The secondary drinking water standards set forth by Chapter 62-550, F.A.C., for the five parameters are: total dissolved solids (TDS), 500 milligrams per liter (mg/l) maximum; manganese, .05 mg/l, maximum; pH, range 6.5-8.5; chloride, 250 mg/l, maximum; and color, 15 color units, maximum. By the end of the 2-year period, the groundwater must meet these values, or their naturally occurring background values at a given remediation site, whichever is less stringent.

The terms of the variance also place a maximum limit on the concentrations of aqueous potassium permanganate solutions that may be injected into an aquifer, depending on the grade of potassium permanganate used and whether the solution is filtered or unfiltered. The maximum concentrations range from 0.726 to 1.21 percent by weight as follows: 0.726% for filtered technical grade; 0.730% for unfiltered technical grade; 0.779% for filtered “free flow” grade; 0.765% for unfiltered “free flow” grade; 1.15% for filtered pharmaceutical grade; and 1.21% for unfiltered pharmaceutical grade.

These concentration limits are necessary to ensure that potassium permanganate solutions to be injected do not exceed drinking water standards, because of naturally occurring impurities in the ore from which potassium permanganate is manufactured. The most troublesome impurities are metals, which could cause exceedances of primary drinking water standards. Enclosure 2 contains a chemical analysis for what may be considered a typical potassium permanganate solution containing such metals. The manufacturer of the potassium permanganate is Carus Chemical Company of Peru, Illinois.

The variance granted by the Department is a general variance, which may be applied to each site-

specific potassium permanganate Remedial Action Plan submitted by GTI hereafter. You do not have to petition for a new variance each time potassium permanganate is proposed for the remediation of a site, provided you do not deviate from the terms of the variance.

d. Re-injection: The Department has no objection to the use of potassium permanganate in any type of equipment configuration, provided all applicable and appropriate rules and regulations are observed. System configurations may include direct one-time injection of the product, or recirculating loop-type re-injections in which contaminated groundwater is recovered from one end of the groundwater contamination plume, and treated above ground prior to re-injection at the other end. GTI indicated that it had this type of a recirculation/re-injection loop in mind when it petitioned for a variance to create a 100-foot zone of discharge, in order to locate the injection and recovery wells 100 feet apart.

For a recirculating loop-type system, involving re-injection of groundwater, it may be necessary to take into account the re-injection concentration of the contaminants of concern already at the site itself, if they are federal primary drinking water contaminants such as benzene, perchloroethylene, trichloroethylene, etc. In order to operate such a system without violating the underground injection control rules of Chapter 62-528, F.A.C., it may be necessary to totally treat the recovered groundwater (above ground) to applicable water quality standards prior to re-injection as a mixture with potassium permanganate for in situ oxidation. While this may not be as cost-effective as a partial treatment system, it still offers a cost-effectiveness advantage over conventional pump-and-treat systems.

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 potassium permanganate. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used for injection. 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. Groundwater monitoring: As in any remediation effort, the actual petroleum and/or non-petroleum contaminants of concern are to be monitored in accordance with applicable rules and regulations. Several aspects of monitoring are discussed below.

1. Active remediation monitoring: During the period of active remediation, groundwater shall be monitored for contaminants of concern in accordance with the requirements set forth in Section 62-770.700, F.A.C., for petroleum contaminated sites, or in accordance with the provisions of an approved Remedial Action Plan for non-petroleum sites, whichever applies. The selection of designated monitoring wells shall be of sufficient quantity to demonstrate remediation of the aquifer.

2. Post remediation monitoring: At least one (1) year of quarterly post remediation groundwater monitoring for contaminants of concern shall be conducted at a minimum of two (2) wells, one located in the area of maximum contamination, the other downgradient of the area of maximum contamination. (For specific information about post active remediation monitoring at petroleum contaminated sites, please refer to Section 62-770.750, F.A.C.)

3. Underground injection control monitoring: The Department, for environmental protection purposes, has determined that a limited amount of groundwater sampling, before and after injection, shall be conducted when potassium permanganate is injected into an aquifer. The required parameters to be sampled before and after injection, for comparison to their standards (or a site's background concentrations) are as follows: total dissolved solids [500 milligrams per liter (mg/l) maximum], manganese (.05 mg/l maximum), pH (range 6.5 - 8.5), and color (15 color units maximum). For sites contaminated by chlorinated hydrocarbons, the sampling shall also include chloride, which has a standard of 250 mg/l, maximum.

   The Department has determined that the monitoring schedule for injected potassium permanganate solutions, pursuant to Rule 62-528.615(2), F.A.C., shall include at least one pre-injection background sampling event for total dissolved solids, manganese, pH, and color. At least one (1) monitoring well located upgradient of the contamination plume, or at least one (1) non-upgradient monitoring well, located beyond the edge of the plume, shall be sampled and analyzed. Additionally, for the remediation of sites contaminated by chlorinated hydrocarbons, the Department recommends a background sample for chloride. If more than one well is sampled, then the average value of each parameter can be used as the background value for the site.

   Post injection sampling shall be conducted for at least two (2) wells, one located in the central region of the injection points, where concentrations are likely to be highest, the other downgradient, to determine if unwanted migration has occurred. For a given remediation site, costs may be kept to a minimum by installing only two monitoring wells for this purpose, whose locations are such that they may serve as both the underground injection control wells required for compliance with Rule 62-528.615(2), F.A.C., and the post remediation monitoring wells for compliance with above paragraph f.2. If post injection sample results indicate that a parameter meets an applicable standard (or its naturally-occurring background level) then sampling of that parameter may be reduced in frequency or discontinued.

g. Underground injection control inventory: Remedial Action Plans prescribing in situ aquifer injection-type remediation shall include information pursuant to Rule 62-528.630(2)(c)1 through 6, F.A.C., for the inventory purposes of underground injection control. Per Rule 62-528.630(2)(c), F.A.C., aquifer remediation projects involving injection wells may be authorized under the provisions of a Remedial Action Plan, provided the construction, operation, and monitoring requirements of Chapter 62-528, F.A.C., are met. A memorandum outlining the inventory information about injection-type aquifer remediation plans to be transmitted by Department reviewers to the Underground Injection Control Section is provided as enclosure 4.

h. Operation:

1. Avoidance of migration: Injection of potassium permanganate solution shall be performed in such a way, and at such a rate and volume, that no undesirable migration of either the potassium permanganate or the contaminants already in the aquifer occurs, 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 contamination plume is expected to accompany the potassium permanganate 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 amount of potassium permanganate that will be injected.

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 the injection wells can be removed from the inventory tracking list.

j. Soil treatment: For sites where only vadose soil is treated in situ, using potassium permanganate, or ex situ using potassium permanganate and then returned to the excavation pit, it is suggested that the amount of potassium permanganate applied be such that the treated soil does not exceed allowable limits for manganese. The direct exposure limits, as well as a calculation method for the leachability of manganese from the vadose to the underlying groundwater, as of the date of this letter, appear in the Table II Soil Cleanup Levels of Chapter 62-785, F.A.C.

ENCLOSURE 2

POTASSIUM PERMANGANATE: SUPPLEMENTAL INFORMATION

The information below, compiled from various sources, may be helpful to reviewers of Remedial Action Plans prescribing potassium permanganate oxidation. It is provided as information only and should not be construed as absolute, nor should it be used as a substitute for technical judgments that should be made on a site specific basis.

a. UIC Notification: 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 4 memorandum, whose subject is "Proposed Injection Well(s) for In Situ Aquifer Remediation at a Contaminated Site". The completed form must be submitted to the Underground Injection Control Section at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.

Local governments contracted by the Department to conduct technical reviews of petroleum Remedial Action Plans and Remedial Action Plan Modification proposals are instructed to follow the September 29, 1998 instructions for approval of such documents, and for submittal of the above memorandum. The September 29, 1998 instructions are included in the Bureau of Petroleum Storage Systems guidance package BPSS-10, titled "In Situ Chemical Additives for Petroleum Remediation", at web page address /www.dep.state.fl.us/dwm/programs/pcp/active.htm.

b. Applications: Potassium permanganate may be used for either in situ or ex situ remediation of groundwater or soil.

c. Trace metal analysis: The results of a trace metal impurities analysis for a 3% aqueous solution of potassium permanganate is tabulated below. A dilution calculation can be performed to estimate their concentrations at solution strengths other than 3% by weight.

Metal *	Technical Grade Unfiltered	Filtered	Free Flow Grade Unfiltered	Filtered	Pharmaceutical Grade Unfiltered	Filtered
Barium	0.0772	0.0598	0.0898	0.0457	0.809	0.25
Beryllium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cadmium	<.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	0.411	0.413	0.392	0.385	0.248	0.261
Nickel	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Sodium	14.57	14.9	14.76	15.97	2.94	2.64
Arsenic	0.18	0.1	0.16	0.11	0.025	0.016
Lead	0.0036	0.0054	<0.002	<0.002	0.008	<0.002
Antimony	0.0029	0.0028	0.0031	0.003	0.0021	0.0015
Thallium	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium	0.006	0.006	0.0015	0.0008	0.004	0.0016
Mercury	0.0029	0.0019	0.0012	0.0012	0.0029	0.0014

* All concentrations in the table are milligrams per liter (mg/l).

* The concentration of these impurities may vary slightly from batch to batch because they are naturally occurring, and therefore not necessarily of uniform presence in the ore from which the potassium permanganate is manufactured.

d. Characteristic behavior of the process: The potassium permanganate oxidation process may cause the following temporary effects on groundwater at a site: an increase in the concentration of TDS; an increase in the concentration of manganese; a change in pH; a change in groundwater color; a slight rise in temperature; and in the case of chlorinated solvent site cleanups, and increase in the concentration of chlorides.

e. Reaction products and by-products: When petroleum hydrocarbons are destroyed by potassium permanganate ($KMnO_4$), the ultimate degradation products are carbon dioxide (CO_2) and water (H_2O). When chlorinated hydrocarbons are destroyed, the products are CO_2, H_2O, and chloride ions. The by-products from the destruction of both petroleum and chlorinated hydrocarbons will include potassium carbonate (K_2CO_3) and manganese dioxide (MnO_2). Depending on the type of contaminant being remediated and the naturally occurring chemical species already present at a site, there may be numerous other chemical interactions. Such interactions take place even at sites that are not contaminated, as the naturally occurring chemical species in the groundwater maintain their equilibrium.

f. Pilot tests: For any innovative remediation product or process that is proposed for the cleanup of a site, 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 the decision not to perform a pilot study shall be submitted for review. More information about pilot study requirements for petroleum site cleanups can be found in Section 62-770.700, F.A.C.

g. Design parameters: For the preparation of Remedial Action Plans for petroleum contaminated sites, a Remedial Action Plan Checklist, which includes a section on chemical oxidation is available. A checklist is also available for dry cleaning solvent site Remedial Action Plans.

h. Operating parameters: The concentration of potassium permanganate injected may be adjusted to meet each site's specific needs. Applications in Florida, per indication of GTI, may involve concentrations up to 1.21 percent by weight. Injection flow rates and injection pressures will depend on site specific conditions.

i. Stoichiometry: Each potassium permanganate Remedial Action Plan submitted should include the estimated mass of the contaminants of concern which are present at the site, and the amount of potassium permanganate that will be needed to remediate that given mass. An amount greater than the theoretical minimum is likely to be needed, as naturally occurring total organic carbon (TOC) will compete with the contaminants of concern for oxidation by the potassium permanganate. There may also be a minimum injection volume (or flow rate in the case of recirculating type re-injection systems) in order to completely permeate the contaminated area of interest.

j. Aquifer porosity: Although there are no regulations pertaining to the amount of manganese dioxide (MnO_2), a by-product of the oxidation reaction which may be deposited as immobile, nonsuspended solid particles in an aquifer, each Remedial Action Plan prescribing the potassium permanganate process should evaluate the potential impact of this substance on aquifer porosity, and whether or not it could hamper the cleanup of future contaminant discharges into the same aquifer at the same site. The Department, based on its experience with other in situ oxidation process, believes that the effect on porosity will be minimal at most sites.

k. Air monitoring: It is anticipated that no air emissions monitoring will be necessary for the potassium permanganate process since it produces mainly carbon dioxide and water. Additionally, it is not expected that the heat of the exothermic reaction, at the concentrations of potassium permanganate to be used, will be sufficient to cause air emissions by volatilizing a portion of the contaminants before they can be oxidized.

l. Color: The permanganate ion (MnO_4^-) gives solutions of potassium permanganate its purple color. Upon injection into an aquifer, it is expected that the intensity of the color will decrease as it is diluted by the groundwater. Additionally, as the potassium permanganate is consumed by the chemical reactions which oxidize both the contaminants of concern and the naturally occurring total organic carbon at a site, the groundwater will become clearer as most of the manganese is precipitated in the form of manganese dioxide (MnO_2). Chemists advise that problems with groundwater color can be minimized by not using too much potassium permanganate.

m. Certification: Potassium permanganate is certified by National Sanitary Foundation (NSF) Standard 60 as a drinking water treatment chemical for disinfection and oxidation, in dosages up to 50 mg/l. NSF provides a footnote as a reminder to indicate that the finished drinking water should be monitored to ensure that the level of manganese does not exceed the secondary drinking water standard of .05 mg/l maximum. To ensure compliance, water treatment plants may use filtration after the addition of potassium permanganate to reduce the manganese to the desired level, removing it as solid MnO_2. In the case of in situ injection-type groundwater remediation at a contaminated site in Florida, however, for

which the remediator has been granted a temporary variance for the application of potassium permanganate in concentrations greater than .05 mg/l, the maximum dosage granted by the variance is greater than the 50 mg/l maximum used for drinking water treatment.

n. Additional information: Chemical and physical properties data about potassium permanganate is readily available in the literature. There is also a web page at /www.caruschem.com/CXPOTPER.HTM that summarizes a number of properties that may be of interest to a technical reviewer or the preparer of a Remedial Action Plan.

ENCLOSURE 3

IN SITU CHEMICAL OXIDATION SAFETY ADVISORY

The volatility of some contaminants may be sensitive to temperature and there could be a significant change in both the concentration and distribution of flammable vapors and/or toxic non-flammable vapors when using an in situ chemical oxidation method. This dynamic environment is less predictable than most other cleanup situations, where less powerful remediation methods are unable to drive the cleanup by greatly changing a site's established equilibrium of contaminants that are distributed amongst the vapor, liquid, and adsorbed phases. Therefore, both precautionary and preventative measures are appropriate.

As is the case in any petroleum or flammable solvent remediation effort, design considerations must take potential fire and explosion hazards into consideration, so that appropriate equipment and operating procedures can be specified for their prevention. For petroleum cleanups, a Remedial Action Plan Checklist recognizes the potential for a fire or explosion, so it includes reminders regarding the following items: migration via underground conduits and utilities; lower explosive level (LEL); National Electrical Code practices intended to minimize ignitions from electrical devices; explosion-proof motors; spark-resistant materials of construction for vapor blower housings and impellers; and in the case of thermal oxidizers, items to consider for the prevention of furnace explosions.

The Remedial Action Plan Checklist for petroleum cleanup sites has been revised to include a section addressing in situ chemical oxidation. The items listed below summarize a portion of the checklist and should be helpful to preparers and reviewers of in situ chemical oxidation remediation plans in identifying potential fire and explosion hazards. The suggested items to consider are, but not necessarily limited to:

a. the potential for subsurface migration of vapors, either through pathways in the aquifer and soil itself, or via underground conduits such as sewer lines, utilities, storm drains, etc., and the destination of those pathways should migration occur;

b. the presence of free product in the subsurface, either in underground utilities, or in the form of non-aqueous phase liquids, which could be volatilized by the heat of an exothermic chemical reaction, in concentrations which exceed the lower explosive level;

c. the presence of underground petroleum or flammable liquid storage tanks and dispenser pipelines which may be near the source of heat generated by chemical oxidation reactions, and measures to prevent them from exposure to excessive amounts of heat;

d. identification and control of possible ignition sources (electrical equipment, devices, and switches, vehicle exhaust sparks, mechanical sources of sparks, etc.) at potential vapor migration pathway destinations;

e. monitoring of vapor concentrations, for comparison with lower explosive levels, at the site and/or in conduits and other potential pathways during operation of the chemical oxidation system;

f. the chemical reactants involved and the amount of heat liberated by their reaction;

g. monitoring of aquifer and/or vadose temperature during treatment;

h. a maximum temperature that may be tolerated before shutting down the operation is necessary;

i. control of reactant concentrations and/or quantities as a means of controlling temperature;

j. the possibility of using a vacuum extraction system to collect vapors at sites where significant amounts of volatilization is expected to occur; and

k. safety of workers involved with the actual handling of chemicals.

The foregoing list should not be applied in blanket fashion, and technical judgments should be made on a site-specific basis. For chlorinated hydrocarbon remediation via chemical oxidation methods, the risk of a fire is reduced, since those compounds are not flammable. However, caution should be exercised in order to prevent the release or migration of quantities and concentrations of chlorinated vapors that may be harmful from a toxicological or environmental standpoint.

Florida Department of
Memorandum **Environmental Protection**

TO: Richard Deuerling
Division of Water Facilities
Bureau of Resource Protection
Underground Injection Control Section

FROM:_____ (Local programs
_____ see Note 1.)

DATE:_____

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

This is to notify you of proposed injection well(s) construction for the in situ remediation of groundwater at a petroleum contaminated site. The following is a description of the site location.

Name:_____
Address:_____
City/County:_____
Latitude/Longitude:_____
FDEP Facility Number:_____

The design of the injection-type aquifer remediation system consists of the following:

Areal extent of contamination (square feet):_____
Number of injection wells:_____
Composition of injected fluid (See note 2)
(ingredient, wt. %):_____
_____
_____
_____
Injection volume per well (gallons):_____
Single or multiple injection events:_____
Injection volume total (all wells, all events):_____

Note 1. Local programs are not authorized to approve underground injections into aquifers. Reason: The Department, per agreement with EPA, has been delegated this authority but is not allowed to delegate it any further. Local programs should arrange with either Department district offices or Department headquarters to approve such injections after reviewing the Remedial Action Plan.
Note 2. Complete chemical analysis of injected fluid is required by Chapter 62-528, Florida Administrative Code (no exceptions). 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.

A site map showing the areal extent of the groundwater contamination plume and the location and spacing of injection wells is attached.

Excerpts from the remedial action plan which describe the site lithology are attached. The following is a summary description of the affected aquifer:

Name of aquifer:_____
Depth to groundwater (feet):_____
Aquifer thickness (feet):_____

A schematic of the injection well(s) is attached. The following is a summary:

Depth of well (feet):_____
Screened interval:_____ to _____ feet below surface
Well casing diameter (inches):_____
Bore hole diameter:_____
If direct-push type well(s), describe
diameter (inches):_____ and depth (feet):_____

The in situ injection-type aquifer remediation plan for this petroleum contaminated site is a design 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 byproducts 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 groudwater quality criteria are set forth in Chapter 62-520, F.A.C.

The remedial action plan estimates that the 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 system was approved on _____ by a Remedial Action Plan Approval Order (or other enforceable document) signed by the Director of the Division of Waste Management (copy attached). The remediation system installation is expected to commence within 60 days. Please call me at _____ if you require any additional information.