July 16, 1998

Mr. Matt Dingens
Geo-Cleanse International, Inc.
4 Mark Road, Suite C
Kenilworth, New Jersey 07033

Re: Geo-Cleanse Process

Dear Mr. Dingens:

The Bureau of Petroleum Storage Systems has reviewed your June 11, 1998 submittal of information, and hereby accepts Geo-Cleanse as an innovative technology for the remediation of contaminated sites in Florida.

Geo-Cleanse is an in situ chemical oxidation process for the remediation of organic contaminants such as petroleum and chlorinated hydrocarbons in groundwater and soil. In this patented process, a mixture of hydrogen peroxide (an oxidizer) and ferrous sulfate (a catalyst) is injected into the contaminated groundwater. Air is also injected to promote mixing within the aquifer. Enclosure 1 shows the expected maximum concentrations for the chemical species of regulatory concern for Florida injections of the Geo-Cleanse mixture.

In a Fenton reaction, the catalyst converts hydrogen peroxide to hydroxyl radicals, which in turn oxidize petroleum and/or chlorinated hydrocarbon contaminants to carbon dioxide, water and chloride ions. In the process of creating hydroxyl radicals, the Fenton reaction converts ferrous (Fe^{+2}) iron in the catalyst to ferric (Fe^{+3}) ions and precipitated ferric compounds.

The Geo-Cleanse process differentiates itself from other catalyzed hydrogen peroxide processes in that: (a) it uses a pressurized delivery system to effectively disperse reagents in the subsurface, and therefore does not rely solely on diffusion; and (b) the oxidizer and catalyst are combined as they are injected, thereby entering the aquifer as a mixture, not as separate sequential injections.

The Department recognizes Geo-Cleanse as a viable technology for the remediation of petroleum and non-petroleum contaminated sites in Florida. There are no objections to its use, provided:

(a) the considerations of this letter are taken into account; (b) a Remedial Action Plan is approved by the Department; and (c) an appropriate administrative mechanism is identified, in cooperation with the Underground Injection Control (UIC) Section, to allow a temporary exceedance of secondary drinking water quality standards for iron, sulfate, total dissolved solids, and pH, or a temporary exceedance of their naturally occurring background values for a given remediation site, whichever is less stringent. Such a mechanism may be the granting of a variance from Rule 62-522.300(2)(a), Florida Administrative Code (F.A.C.), which does not allow a zone of discharge when fluids are directly injected into Class G-I or G-II groundwater.

The duration of a variance which establishes a temporary zone of discharge for a Fenton-type process such as Geo-Cleanse is typically one (1) year. This works well with most remediation timetables which include a required one year post remediation monitoring period. By the end of that period, the variance may require that groundwater concentrations of iron, sulfate, total dissolved solids, and the pH, meet their applicable secondary drinking water quality standards or match their naturally occurring background values, whichever is less stringent. All petroleum and non-petroleum contaminants being remediated must meet their appropriate cleanup target levels too, but the goals for these contaminants of concern will be declared in an approved remediation plan, not the variance.

The following chapters of the Florida Administrative Code are cited as pertinent, as portions of them are applicable to the Geo-Cleanse process: Chapter 62-550, F.A.C. for primary and secondary drinking 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. For Geo-Cleanse, the major environmental and regulatory considerations are set forth in enclosure 2.

Preparers of Remedial Action Plans may 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 3.

Since this remediation process involves an exothermic reaction which elevates aquifer temperature, appropriate safety precautions must be considered. An in situ chemical oxidation safety advisory is included as enclosure 4.

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 may be directed to Rick Ruscito at (850) 487-3299.

Sincerely,

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

enclosures (5)

cc: Will Evans - UIC, FDEP/Tallahassee
Tom Conrardy - FDEP/Tallahassee

inn_016.doc

ENCLOSURE 1

THE GEO-CLEANSE INJECTION MIXTURE (Note 1)

CHEMICAL SPECIES OR PARAMETER (Notes 2 & 3)	AMOUNT	UNITS
Iron	200	mg/L
Sulfate	350	mg/L
Total dissolved solids	550	mg/L
pH	1 to 4	SU

Notes:

1. These are the expected maximum concentrations and values for the chemical species and parameters of regulatory concern for the injected Geo-Cleanse mixture in Florida. Actual values for a given remediation project may vary, depending on site specific conditions.

2. The actual ingredients of the injection mixture are hydrogen peroxide (usually a 50 percent by weight aqueous solution), ferrous sulfate, and small amounts of sulfuric acid (for pH adjustment), phosphoric acid (for pH adjustment), and calcium phosphate (stabilizer).

3. Geo-Cleanse International, Inc., has petitioned the Department's Underground Injection Control Section for a variance from Rule 62-522.300(2)(a), F.A.C., in order to temporarily exceed the secondary drinking water standards, or the naturally occurring background levels at a site, whichever is less stringent, for these chemical species and parameters, for a period of one (1) year. Their maximum allowable secondary drinking water levels, set forth in Chapter 62-550, F.A.C., are: iron, 0.3 mg/L; sulfate, 250 mg/L; total dissolved solids, 500 mg/L; and pH, range 6.5 to 8.5.

4. Abbreviations: mg/L denotes milligrams per liter.

ENCLOSURE 2

Geo-Cleanse: ENVIRONMENTAL AND REGULATORY INFORMATION

For Geo-Cleanse, the major environmental and regulatory concerns are listed below.

a. Groundwater cleanup standards: The responsibility shall be on users of Geo-Cleanse 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 ingredients of Geo-Cleanse's injectants, and any byproducts 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 drinking 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 must meet the minimum criteria for groundwater as defined in Chapter 62-520.400(1), F.A.C.

   A variance, issued by the Department's Division of Water Facilities, Underground Injection Control Section, must be obtained for Geo-Cleanse's iron, sulfate, total dissolved solids and pH, which may not always meet the secondary drinking water standards of Chapter 62-550, F.A.C. As of this date, the petition for such a variance from these secondary parameters has been submitted by Geo-Cleanse International, Inc. In regard to primary drinking water standards, there are no issues associated with Geo-Cleanse, since none of its ingredients are listed as primary contaminants.

c. 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 Geo-Cleanse injectants. 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.

d. 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 <u>minimum</u> 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 groundwater sampling, before and after injection, shall be conducted for regulated substances common to both groundwater and the injected Geo-Cleanse fluid. The <u>required</u> parameters to be sampled before and after injection, for comparison to their standards (or a site's background levels) are as follows: iron [0.3 milligrams per liter (mg/l) maximum], sulfate (250 mg/l maximum), total dissolved solids (500 mg/l maximum), and pH (range 6.5 - 8.5).

The Department has determined that the monitoring schedule for injected Geo-Cleanse fluids, pursuant to Rule 62-528.615(2), F.A.C., shall include at least one (1) pre-injection background sampling event for iron, sulfate, total dissolved solids and pH, and post injection sampling event.

For <u>pre-injection</u> background sampling, 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 for the background concentration of iron, sulfate, total dissolved solids, and pH. 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.

The 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 d.2. If post injection sample results indicate that a secondary parameter meets an applicable standard (or its naturally occurring background level) then sampling of that parameter may be reduced in frequency or discontinued.

For Geo-Cleanse's hydrogen peroxide oxidizer, which is reactive and decomposes at a relatively quick rate, the Department will not require injection control monitoring.

e. 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 5.

f. Operation:

1. Avoidance of migration: Injection of Geo-Cleanse fluids 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 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 contamination plume is expected to accompany the Geo-Cleanse 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 amount of catalyst and hydrogen peroxide that will be injected.

g. 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.

ENCLOSURE 3

Geo-Cleanse: SUPPLEMENTAL INFORMATION

The information below may be helpful to reviewers of Remedial Action Plans prescribing the Geo-Cleanse technology. Some items are provided as information only and should not be construed as absolute, nor should they 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 5 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 January 12, 1998 instructions for submittal of the memorandum.

b. Stoichiometric amount of hydrogen peroxide: Each Remedial Action Plan should indicate the mass of contaminants which are present at the site. As a rule of thumb, for estimating the theoretical minimum amount of pure hydrogen peroxide needed to destroy that mass, Geo-Cleanse indicates that approximately 6.5 pounds of hydrogen peroxide is needed per pound of petroleum contaminant, and that approximately 4 pounds of hydrogen peroxide is needed per pound of chlorinated hydrocarbon contaminant.

c. Actual amount of hydrogen peroxide: The Geo-Cleanse process requires a minimum volume of hydrogen peroxide per injection point to create a desired radius of influence. This minimum volume (typically 250 gallons) is irrespective of stoichiometry and peroxide purity. Geo-Cleanse, in deciding how much peroxide to actually inject at each point, compares the required stoichiometric amount to that which is necessary to create the desired radius of influence, then uses the larger of the two.

d. Total organic carbon (TOC): Naturally occurring TOC at a site will compete with the contaminants of concern for hydroxyl radicals. Given that a minimum hydrogen peroxide volume of 250 gallons is required to establish a radius of influence, it appears that sufficient excess peroxide will be present to offset any additional demand from naturally occurring TOC.

e. Volumetric ratio of catalyst to peroxide: A Geo-Cleanse case history indicates that for each gallon of ferrous sulfate catalyst solution injected, approximately 1.2 to 1.4 gallons of 50% hydrogen peroxide was injected. The Department assumes this range is typical of the process, and that combinations in other ratios outside the range may be possible, depending on site specific conditions.

f. Plume control: The Department believes that the “liquid fence” approach discussed in the Geo-Cleanse patent is a logical strategy for the prevention of unwanted contaminant migration. The strategy is to perform the first injections at the perimeter of the groundwater contamination plume, so that any contaminants which later attempt to migrate from the center must pass through the reactive perimeter, where they will be destroyed before they can travel any further.

g. Radius of influence: The Geo-Cleanse variance petition seeks to establish a zone of discharge which extends 10 feet radially from each point of injection. The intent is to create a working area where a temporary exceedance of the secondary drinking water parameters of iron, sulfate, total dissolved solids and pH may be toler-

ated in order to conduct the remediation. It must be understood that the variance is not site specific, and that the 10 foot radius is the best estimate of the approximate zone of discharge that will be needed in Florida.

If the geology of a specific site is such that the injected fluid may travel more than 10 feet, then it may be possible to install a few injection points at the periphery of the plume, where only small volumes of hydrogen peroxide and catalyst will be injected, thereby creating a smaller radius of influence at these outlying points. For injection points near the center of the plume, the 10 foot travel distance may not be critical, since it may be more than 10 feet from the center to the edge of the plume.

Technical reviewers should make judgments regarding this matter on a case by case basis, and are advised to keep in mind that the presence of reactive Geo-Cleanse fluid beyond a 10 foot radius at the edge of a plume is not likely to be an environmental problem or a threat to an adjacent property; it will destroy any contaminants in its path, or itself if no contaminants are present.

h. Aquifer porosity: Although there are no regulations pertaining to the amount of precipitated iron (spent catalyst in the form of solid ferric oxide, commonly known as rust) which may be deposited as immobile, nonsuspended particles in an aquifer, each Remedial Action Plan prescribing the Geo-Cleanse 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 similar in situ oxidation processes, believes that in most cases the overall effect on porosity will be minimal.

i. Sampling parameters while injecting: For its own process control purposes, Geo-Cleanse, while injecting, monitors the groundwater for pH, iron, conductivity, hydrogen peroxide, and chlorides.

The concentrations of carbon dioxide and oxygen in the offgas are also measured, on a daily basis, to gauge the progress of remediation. Measurement of carbon dioxide is informative because its concentration in the offgas will typically reach a peak in 2 to 3 days, and then decline as the supply of contaminants is exhausted. Oxygen concentration in the offgas typically rises steadily during the first 5 days of injection. This too is informative because, as the supply of contaminants is exhausted, less oxygen is needed to convert contaminant carbon atoms to carbon dioxide, so the hydroxyl radicals begin to consume themselves, liberating increasing amounts of oxygen in the process.

Offgas measurements of carbon dioxide and oxygen can be made in the vapor space of monitoring wells, using a meter, or by making a temporary 3 to 6 inch deep hole in the ground with a stake, thereby creating a place to insert the meter's probe.

j. Air emissions monitoring: Although the Geo-Cleanse process quickly converts contaminants to carbon dioxide and water, it is possible that the heat of reaction may volatilize a portion of them before they can be destroyed. Therefore, in order to evaluate the potential for air emission problems, Geo-Cleanse monitors soil gas levels with a photoionization detector (PID) during the injection process.

The Department believes that the need to use a soil vapor extraction (SVE) system in conjunction with the Geo-Cleanse process should be determined on a case by case basis. In some situations, an SVE may be necessary for air emissions control or a reduction in the concentration of flammable vapors, while in others it may be prescribed mainly for the removal of volatile organic chemicals (VOC) from the soil, in order to prevent recontamination of the underlying groundwater by leaching.

k. Limitations: The Geo-Cleanse process will not remediate inorganic contaminants. Additionally, Geo-Cleanse cites EPA guidance regarding limitations on in situ chemical oxidation processes. They are listed below. The Department suggests that judgment be used to determine limitations on a site by site basis. A site may not be applicable if:

- contaminants are in a meadow mat or peat;
- there are clays where loading factors are an issue;
- only soil contamination is present;
- hydraulic conductivity is less than 10^{-7} cm/sec;
- depth to contamination is less than 5 feet below ground surface;
- free product, as light nonaqeous phase liquid (LNAPL), is greater than 6 inches thick;
- there is no drilling access;
- pH is greater than 8;
- water hardness is greater than 400 mg/L;
- an active tank field is present;
- utility trenches with free product are present; or
- fiber optic lines are present.

l. Temperature rise: The Geo-Cleanse process causes a temporary rise in the temperature of the aquifer. At an actual site, the initial temperature was 57 deg. F. Three (3) days after treatment it was 126 deg. F, and by thirteen (13) days it had cooled to approximately 85 deg. F. It may be useful to know that each gallon of 50% hydrogen peroxide injected releases 39,000 BTU as it decomposes to hydroxyl radicals.

m. Applications: The Geo-Cleanse process is capable of remediating groundwater, along with vadose in the vicinity of the water table. It is generally not considered to be cost-effective as a method of remediating vadose only.

n. Design and operating parameters:

Parameter	Range	Optimum
Depth to contamination	Grade to drilling limit	> 5 ft bls
Soil density lbs/yd^3	< 4,000 lbs/yd^3	< 3,600
Porosity 30%	> 15%	
pH	< 8	6
Groundwater hardness ppm	< 400 ppm	< 100
Groundwater iron concentration	< 5 ppm	2 ppm
Soil radius of influence	10-40 ft	15 ft
Groundwater radius of influence	10-60 ft	25 ft
Injection pressure	5-120 psi	Varies w/ depth
Injection rate (liquids)	0.25-3 gpm	Varies w/ lithology
Injection rate (air)	3 cfm	

o. Remedial Action Plans: 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. Most of the items in that section of the checklist can apply to the preparation of Remedial Action Plans for non-petroleum sites as well.

ENCLOSURE 4

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 includes 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 near the source of heat generated by chemical oxidation reactions, and measures to prevent them from exposure to excessive amounts of heat, and/or removal of their flammable contents for replacement with inerts such as nitrogen or carbon dioxide;

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 and buildings 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 it is necessary to shut down the operation;

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.