



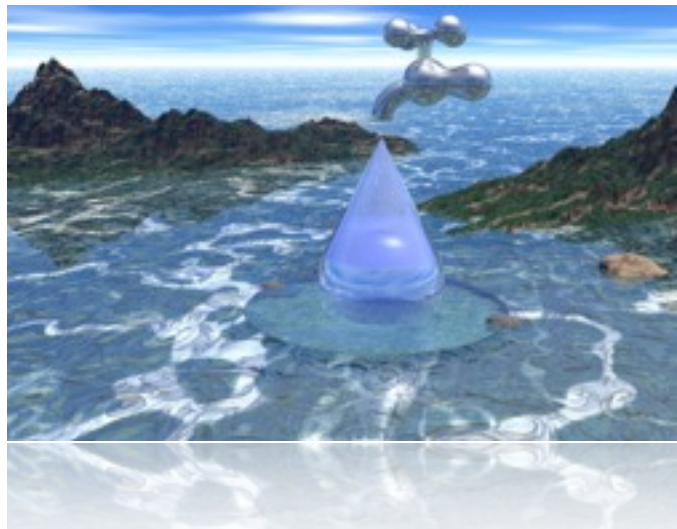
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Update 07-10-2012-1

<http://www.VirO2Syl.com/>

Description and General Information

VirO2Syl is a stabilized super oxidizing agent that acts as a peroxodisulfate. Viro2Syl is used to inactivate bacteria, fungus and viruses. It can pass through the cell's membrane and reach the DNA. The application of VirO2Syl using direct-injection techniques or wells will remove significant amounts of contamination from the subsurface (both soil and water). VirO2Syl creates a physical-chemical coagulation reaction for treatment of water containing petroleum hydrocarbons.



Viro2syl reacts with heavy metals, asbestos, mercury, cyanide, pesticides, and other inorganic contaminants producing pure oxygen and water as byproduct.

VIRO2SYL is also a powerful cleaner of biofilm in (drinking) water distribution systems and water apparatus; it acts without changing taste, creating odor or harmful by-products. It is effective in both clear and turbid, or colored water; and has a rapid rate of reaction.

VirO2Syl has a unique ability to penetrate and break up biological deposits such as biofilm. This is due to the super oxidizing effect. The ability of VirO2Syl to penetrate and break up biological deposits has been well demonstrated in numerous practical situations and evidenced through tests.

Please see Attachment 1 for more details on the operation of Viro2syl



Approvals



At the federal level, Viro2Syl has been approved by the United States Environmental Protection Agency (EPA), and is part of the National Oil and Hazardous Substances Pollution Plan (NCP).

In Louisiana, Viro2Syl is listed as one of the Oil Spill Alternative Response Technologies by the Louisiana Department of Environmental Quality. Viro2syl is also in the list of products to be deployed in the remediation of BP oil spill in gulf of Mexico and coastal areas of Louisiana.



In Florida, The Florida Petroleum Cleanup Program encompasses the technical oversight, management, and administrative activities necessary to prioritize, assess, and cleanup sites contaminated by discharges of petroleum and petroleum products.

Due to extensive nature of the Floridian aquifer (82,000 square miles beneath Florida and parts of Alabama, Georgia, and South Carolina), this program has a substantial list of requirements for the approval of products for remediation or cleanup. Viro2Syl received a distinguished mention from the Department of Environmental Protection, and is currently approved for aquifer, surface and deep drilling remediation.



Please see attachment 2 from more details.



Uses

Viro2syl has a vast range of applications, mainly because of its characteristics of super oxidizer and energetic agent. Viro2syl is formulated to react with inorganic materials, viruses, bacterias, fungi and even biochemical warfare agents.

Viro2syl creates an ideal condition for photosynthesis of the contaminants, and may leverage on the atmospheric oxygen and solar radiation to accelerate its reaction.

Mining

The mining industry uses products like Sodium Cyanide and Mercury to separate precious elements from other minerals. These products intoxicate miners and heavily pollute the environment. Viro2syl can super oxidize and break the covalent bonds holding the precious element in the same effectiveness, for a fraction of the cost.

Mine Remediation

There are multiple mines that have been closed for their pollution, either by government regulations, or because its impossible to operate them due to the high levels of contaminants. VirO2Syl can reverse and eliminate the contamination, making possible to reopen the mines for the extraction of the remainder of the deposits of the mine.

Soil Contamination

Soil contamination is caused by the presence of xenobiotic chemicals or other alteration in the natural soil environment. The standard processes for remediation of soil is to excavate and take the soil to a disposal site away from human or sensitive ecosystem contact, aeration of soils at the contaminated site with risk of creating air pollution or thermal remediation by introduction of heat to raise subsurface temperatures sufficiently high to volatize chemical contaminants out of the soil for vapor extraction.

Viro2syl eliminates contaminants from soil using direct-injection techniques or wells. The application process enables the product to be pressure injected into the zone of contamination and moved out into the aquifer media. Once in the subsurface, VirO2Syl produces efficient oxidation reactions via a number of mechanisms including: surface mediated oxidation, direct oxidation and free radical oxidation.



Water Pollution

Water pollution is the undesirable change of physical, chemical and biological characteristics in the water bodies which may cause harmful effects on human or aquatic life. Viro2Syl leverages solar radiation, atmospheric conditions and water movement to super oxidize contaminants and accelerate photosynthesis.

Oil Spills

An oil spill is the release of petroleum hydrocarbon into the ocean or land. Coagulation of oil containing petroleum hydrocarbons; is one of the most important physical-chemical reactions used in water treatment with VirO2Syl.

Under sunlight, petroleum discharged at sea is subjected to photochemical modification. The light-induced polymerization of petroleum components contribute to the photo-degradation process caused by photosynthesis of organic species. Aliphatic components do not significantly absorb solar light, and are by themselves photochemically inert. However, they can be degraded by photosensitized oxidation. The aromatic or polar components in petroleum and anthraquinone that is present in seawater can provoke the degradation of n-alkanes into terminal n-alkenes (a carbon-carbon double bond at position 1) and low-molecular-weight carbonyl compounds that can be digested by simple organisms.

Asbestos Remediation

Combining good reducing agents such as active metals including sodium, magnesium, aluminum, and zinc, which have relatively small ionization energies and low electro-negativities. Metal hydrides, such as NaH, CaH₂, and LiAlH₄, which formally contain the H⁻ ion, are also good reducing agents. Atoms, ions, and molecules that have an unusually large affinity for electrons tend to be good oxidizing agents. Elemental fluorine, for example, is the strongest common oxidizing agent. F₂ is such a good oxidizing agent that metals, quartz, coal tar and asbestos are reduced by an exothermic reaction to inert materials.

Coal Tar Hazardous Waste Remediation

Coal tar, coal tar creosote and oily wastes are often present as subsurface contaminants that may migrate below the water table, leaving a widely distributed residual source of contaminants leaching to the ground water. In situ chemical oxidation is a potentially viable technology for the remediation of aquifers contaminated with creosote and coal tars. Viro2syl will be flushed through the contaminated area to oxidize aqueous



contaminants and enhance the mass transfer of contaminants from the oil phase. Viro2syl will accelerate the natural occurring decomposition process utilizing good reducing agents such as active metals including sodium, magnesium, aluminum, and zinc, which have relatively small ionization energies and low electro-negativities. Metal hydrides, such as NaH, CaH₂, and LiAlH₄, which formally contain the H⁻ ion, are also good reducing agents.

These are only a few examples of the applications of Viro2syl. Please note that a detailed study is conducted prior each application of Viro2syl. This study includes the type of contaminants, contamination levels, topographic conditions, environmental constraints, among other variables. This study will yield data to formulate the precise concentration of Viro2Syl and the specific protocol for its application.

Please review Attachment 1 for more details on the operation of viro2syl.



Attachment 1

The High Performance Characteristics Of VirO2Syl

VirO2Syl is a stabilized super oxidizing agent that acts as a peroxodisulfate. It is known to react with educing radicals and a-hydroxyalkyl radicals that produce OH or sulfate radicals, respectively. This reaction may be due to either an electron transfer reaction or a radical substitution. The rate constants of these reactions are moderate. Methyl radical has been reported to react with hydrogen peroxide with a rate constant of 3.5×10^7 dm. Viro2Syl has been shown to effectively oxidize thiols over a range of temperatures and concentrations. Catalysis is sometimes required for vigorous oxidation. VirO2Syl is stabilized and acts as a high performance oxidizer forming the catalytic effect required to process the methane thiols and reduce their concentrations to safe levels and have the added bonus of reducing the odors normally associated with decomposition.

Viro2Syl is used to inactivate cells, e.g. microorganisms. It can pass through the cell's membrane and reach the DNA. VirO2Syl reacts with adventitious transition metal ions yielding OH radicals via a Fenton-type reaction. The VirO2Syl product ratios that are formed under such conditions differ from those formed by OH radicals that were generated by ionizing radiation. This reaction will allow for the depletion of methane gases permeating into the atmosphere and the ground water where both microbes and other organisms require oxygen to survive. Petroleum produces Methane Thiols which are toxic in high levels. Our product, VirO2Syl will react with the methane gases by acting as a reducing agent and will form the bonds to render it safe to the Eco systems. The reagents will continue to serve as a source of oxygen for indigenous microbes to polish the residual. This will result in the oxidation process that may kill some microbes, however it may not necessarily kill all of them, and they will recover to polish the residual content.

VirO2Syl application will remove significant amounts of contamination from the subsurface (both soil and water) and is applied using direct-injection techniques or wells. The application process enables the product to be pressure injected into the zone of contamination and moved out into the aquifer media. Once in the subsurface, VirO2Syl produces efficient oxidation reactions via a number of mechanisms including: surface mediated oxidation, direct oxidation and free radical oxidation. These reactions destroy a range of contaminants and can be propagated in the presence of the product for periods of up to 30 days on a single injection. VirO2Syl produces minimal heat and is highly compatible with follow-on enhanced bioremediation application. Electro-migration is the main mechanism for the VirO2Syl process. The direction and rate of movement of an ionic species will depend on its charge, both in magnitude and polarity, as well as the magnitude of the electro-osmosis-induced flow velocity of the particles in the redox reaction when the



catalyst is stimulated by contaminants. Non-ionic species, both inorganic and organic, will also be oxidized and reduced by the electro-osmosis mechanism. "Enhanced Oxidation" is achieved by electro-kinetic transport of contaminants toward the polarized silver particles that stabilize or catalyze the H₂O₂ concentrate. When organic or inorganic contaminants such as hydrocarbons, heavy metals or waste media are present in the water or soil, the reaction will be catalyzed by the electron balancing.

Coagulation of oil containing petroleum hydrocarbons; is one of the most important physical-chemical reactions used in water treatment with VirO₂Syl. The precipitation of ions (heavy metals) and silver colloids (organic and inorganic) are mostly held in solution by electrical charges. By the addition of ions with opposite charges, these colloids can be destabilized; coagulation can be achieved by chemical and electrical methods. It is generally accepted that coagulation is brought about primarily by the reduction of the net surface charge to a point where the colloidal particles, previously stabilized by electrostatic repulsion, can approach closely enough for Van Der Waals forces to hold them together and allow aggregation. The reduction of the surface charge is a consequence of the decrease of the repulsive potential of the electrical double layer by the presence of an electrolyte having opposite charge (colloidal silver). In this process, charged ionic species - metals or otherwise - are removed from wastewater by allowing it to react with an ion having an opposite charge.

Under sunlight, petroleum discharged at sea is subjected to photochemical modification. The light-induced polymerization of petroleum components contribute to the photo-degradation process caused by photosynthesis of organic species. An increase in the polar fraction and a decrease in the aromatic fraction have also been observed. Aliphatic components do not significantly absorb solar light, and are by themselves photochemically inert. However, they can be degraded by photosensitized oxidation. The aromatic or polar components in petroleum and anthraquinone that is present in seawater can provoke the degradation of n-alkanes into terminal n-alkenes (a carbon-carbon double bond at position 1) and low-molecular-weight carbonyl compounds that can be digested by simple organisms.

The in situ environment for most soil and/or groundwater sites includes a water table which is the uppermost level of the below-ground, geological formation that is saturated with water. Water pressure in the pores of the soil or sand is equal to atmospheric pressure. The source of the oxidizing agent and the substantially pH neutralized catalytic reagent can be administered to the in situ environment by any method considered conventional methodology. For example, administration can be directly into the groundwater through a horizontal or vertical well or into subterranean soil through a well or infiltration trenches at or near the site of contamination. In a preferred form of the present method, the capillary fringe constitutes the in situ environment for treatment of the majority of contaminants that are less dense than water.



Contamination that is denser than water (i.e. Dense non aqueous phase liquids or DNAPLs) mostly resides at or near the bottom of the saturated zone due to its tendency to sink in water (e.g. chlorinated solvents). In a preferred form of the present method, the saturated zone constitutes the in situ environment for treatment of the majority of contaminants that are denser than water. The stabilized source of the oxidizing agent and catalytic reagent are administered into the bottom layers of the saturated zone through wells or trenches and the like.

The saturation depth or depth of the saturated zone is very high at some contaminated sites (greater than 10-20 feet). Treatment of contamination in the saturated zone at such sites is achieved by varying the depth at which the stabilized source of the oxidizing agent and catalytic reagent are administered. Typically, injection wells with adjustable depth injectors are utilized at sites with high saturation depth. In a preferred form of the methodology, the depth variation is performed after each treatment cycle in increments varying from 5-10 feet.

As previously indicated, the product can be administered under elevated pressures into hard to reach places such as fractures within underlying shoreline. These fractures are collecting places for contaminants which are typically more dense than water. When administered the oxidizing agents are able to penetrate the fractures, contact the contaminants and convert the same to harmless compounds.

Injection of the stabilized source of the oxidizing agent and the catalytic reagent can be accomplished by installing steel lined wells or open hole type wells into the sediment and shoreline mud. Packers and bladders conventionally employed in downhole drilling can be employed to assist in isolating discrete fractures and accessing the contaminants with the reagents. The oxidizers are then injected into the fractures at applied elevated pressures, typically in the range of from about 20 to 100 psi.

In addition, unlike conventional Fenton's systems which are highly dependent on pH and require aggressive adjustment of site pH to acidic conditions, it has been found that the present system functions efficiently at substantially neutral pH ranges, consistent with native pH found in many subsurface environments.

As indicated above, the stabilized source of the oxidizing agent and the metal catalyst reagent can be administered directly into the in situ environment in a premixed solution. More specifically, a sample of the soil and/or groundwater is analyzed to determine the concentration of the contaminants of interest (e.g. hydrocarbons). Analysis of volatile hydrocarbons can be made by gas chromatographic/mass spectrometric systems which follow, for example, EPA Method 624 for aqueous samples and EPA Method 8260 for soil



samples. Semi-volatiles are analyzed in a similar manner according to, for example, EPA Method 625 for aqueous samples and EPA Method 8270 for soil samples.

Results from these analyses are used to determine the reagent combinations for treatment of the sample based on the type and concentration of the contaminants. A specific molar ratio of the reagents is used for the sample based on prior research, comparative samples and the like. Typical sample weights can be in the range of from about 120 to 150 grams.

Sample analysis is also employed to determine the number of treatment cycles which may be necessary to achieve the desired reduction in the level of contaminants. While one treatment cycle may be used, it is often desirable to employ a plurality of treatment cycles depending on the type and concentration of pollutants. The number of treatment cycles is determined in part by monitoring the performance of the reagents, particularly the source of the oxidizing agent once injected into the soil and/or groundwater.

Viro2Syl has been shown to effectively oxidize thiols over a range of temperatures and concentrations. Catalysis is sometimes required for vigorous oxidation. VirO2Syl is stabilized and acts as a high performance oxidizer forming the catalytic effect required to process the methane thiols and reduce their concentrations to safe levels. If methane thiol is present, or if a complete deodorization is desired, more rigorous oxidation is necessary. This requires all or some of the following: presence of catalyst, most conveniently in the form of a soluble iron salt (e.g., ferrous sulfate), excess hydrogen peroxide, and elevated temperatures. In salt water this process is accelerated by exposure to sunlight where the gases are converted to low to moderate levels combined with oxygen that is produced by the photo reaction and oxidative process. The final result will be a remediated environment that is safe, organic and friendly to the Eco System, yielding high levels of performance.



ATTACHMENT 2
Florida Department of Environmental Protection Approval



**Florida Department of
Environmental Protection**

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

Charlie Crist
Governor

Jeff Kotkamp
Lt. Governor

Mimi A. Drew
Secretary

November 8, 2010

Natural Solutions Group, Corp.

Re: VirO2Syl

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

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

Remedial Action Plans that propose the use of an accepted product or process should include a copy of the acceptance letter in its entirety in the plan's appendix, and reference it in the text of the document. It is 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.

"More Protection, Less Process"
www.dep.state.fl.us



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VirO2Syl

ent information about the product or process to show that
oes.

The Bureau reserves the right to revoke its acceptance of a product or process if it has been falsely represented. Additionally, Bureau acceptance of any product or process does not imply it has been deemed applicable for all cleanup situations, or that it is preferred over other treatment or cleanup techniques in any particular case. A site-specific evaluation of applicability and cost-effectiveness must be considered for any product or process, whether conventional or innovative, and adequate site-specific design details must be provided in a Remedial Action Plan submitted for Department review and approval. Please direct any questions about this acceptance to Rick Ruscito at telephone (850) 877-1133, extension 3722, or by e-mail at rruscito@ene.com.

Sincerely,

Rick Ruscito, P.E.
Ecology and Environment, Inc.
Bureau of Petroleum Storage Systems
Petroleum Cleanup Section 6

Rebecca S. Lockenbach
FDEP Section Leader
Bureau of Petroleum Storage Systems
Petroleum Cleanup Section 6

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

c: Tom Conrardy - FDEP/Tallahassee

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ENCLOSURE 1

VirO2Syl
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REGULATORY INFORMATION

- a. Regulations: Chapters of the Florida Administrative Code (F.A.C.) that may be applicable, either in part or in their entirety, include but are not necessarily limited to Chapter 62-550, F.A.C., for primary and secondary water quality standards; Chapter 62-520, F.A.C. for groundwater classes and standards; Chapter 62-522, F.A.C., for groundwater permitting and monitoring requirements; Chapter 62-528, F.A.C., for underground injection control, particularly Part V, for Class V, Group 4 aquifer remediation projects; Chapters 62-770, 62-780, 62-782, and 62-785, F.A.C., for cleanup criteria; and Chapter 62-777, F.A.C., for cleanup target levels.

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

- b. Underground Injection Control permit: Per Rule 62-528.630(2)(c), F.A.C., Class V injection-type aquifer remediation wells are exempt from the permitting requirements of Rule 62-528.635, F.A.C., when authorized by a Department-approved Remedial Action Plan or other enforceable mechanism, provided the requirements of the rules governing the remediation project, as well as the construction, operation, and monitoring requirements of Chapter 62-528, F.A.C., are met. Per Rule 62-528.630(2)(c), F.A.C., the issuance of an enforceable, site-specific Remedial Action Plan Approval Order by the Department for injection-type aquifer remediation constitutes the granting of a Class V injection well construction/clearance permit.
- c. Underground Injection Control notification: Remedial Action Plans proposing in situ, injection-type aquifer remediation shall include information pursuant to Rules 62-528.630(2)(c)1 through 6, F.A.C., for the inventory purposes of the Underground Injection Control program. Reviewers of those plans, upon issuance of an enforceable Remedial Action Plan Approval Order by the Department, must submit a completed copy of the Underground Injection Control inventory notification memorandum in Enclosure 3.
- d. General information about temporary injection zones of discharge: For in situ aquifer remediation, the composition of the fluid to be injected (before it is diluted by the receiving groundwater) must meet the primary and secondary drinking water standards set forth in Chapter 62-550, F.A.C., and the general minimum groundwater criteria of Chapter 62-520, F.A.C., pursuant to underground injection control Rule 62-528.600(2)(d), F.A.C. Additional minimum groundwater criteria for specific chemicals are set forth in Chapter 62-777, F.A.C. Aquifer remediation fluids that do not meet these requirements must seek permission for a temporary injection zone of discharge. Depending on the chemical composition and the physical properties of the fluid, it will be necessary to obtain permission for an injection zone of discharge by either one or both of the following methods: by Rule 62-520.310(8)(c), F.A.C., or by variance from Rule 62-520.310(9), F.A.C.



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

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

- e. Specific zone of discharge (ZOD) information for VirO2Syl: The Bureau of Petroleum Storage Systems, using information provided by the Natural Solutions Group Corporation, has identified pH and silver as parameters in need of permission for a temporary injection zone of discharge by way of Rule 62-520.310(8)(c), F.A.C., for which the groundwater must be monitored during the course of a cleanup. In order for temporary injection ZOD permission to be granted by way of Rule 62-520.310(8)(c), F.A.C., for pH and silver when VirO2Syl is injected, a site-specific Remedial Action Plan must: (a) identify pH and silver as parameters of the fluid to be injected that do not meet their injection standards; (b) specify the size of the ZOD needed for pH and silver; (c) specify the period of time for which a temporary ZOD is needed; and (d) provide for the monitoring of pH and silver in the groundwater during the course of the cleanup. In most cases, monitoring on a quarterly basis should suffice.
- f. Utilization of wells: If a remediation site happens to have an abundance of monitoring wells, then the Bureau has no objection to the use of some wells for the injection of remediation products. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to inject remediation products. This will avoid premature conclusions that the entire site meets cleanup goals. By making sure that designated tracking wells are not also used as treatment points, there will be more assurance that the remediation product has permeated the entire site and that it did not remain localized to the area immediately surrounding each injection well.
- g. Avoidance of migration: For injection-type, in situ aquifer remediation projects, pursuant to Rule 62-528.630(3), F.A.C., the injection of VirO2Syl shall be performed in such a way, and at such a rate and volume, that no undesirable migration of either the VirO2Syl or the contaminants of concern in the aquifer results.
- h. Abandonment of wells: Upon issuance of a Site Rehabilitation Completion Order, injection wells shall be abandoned pursuant to Section 62-528.645, F.A.C., and the Underground Injection Control Section of the Department shall be notified so that the treatment wells can be removed from the injection well inventory-tracking list.



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- i. Open-pit applications: While open-pit application of VirO2Syl is not an injection-type application, and notification of the Underground Injection Control Section therefore not required, the user must still be mindful of groundwater quality. For open-pit applications, the Bureau of Petroleum Storage Systems suggests that groundwater in the application area be sampled for the same parameters that would have been monitored had the application been an injection. Those parameters are pH and silver.
- j. "Soil-only" cleanups: For sites where VirO2Syl will be used in situ for the cleanup of only soil that is located above the water table, consideration should be given to the potential for its ingredients of concern to percolate to the underlying groundwater. The potential will have to be evaluated on a site-specific basis, and may at least have to take into account the depth to which the VirO2Syl will be applied in comparison to the depth of the groundwater, the amount of VirO2Syl applied, and the permeability of the soil. If it is determined that VirO2Syl has the potential to reach the water table, then the underlying groundwater should be monitored for pH and silver during the course of the cleanup, as if the VirO2Syl had been directly introduced below the water table.
- k. Soil and groundwater criteria for VirO2Syl ingredients of regulatory interest: The secondary groundwater standards for pH and silver, as indicated in the current issue of Chapter 62-550, F.A.C., are range 6.5-8.5 and 0.1 milligrams per liter (mg/L) respectively. These standards or their natural-occurring background values at the cleanup site, whichever is less stringent, must be met by the time that the temporary injection zone of discharge expires. For soil, the criteria for silver is the 17- milligram per kilogram (mg/Kg) maximum allowable leachability-based soil cleanup target level and the 410-mg/Kg direct residential exposure limit established in the current issue of Chapter 62-777, F.A.C. The lower value of the two (17-mg/Kg) has to be met in order for the site to qualify for an unconditional declaration of No Further Action. For additional information about alternate methods by which to demonstrate that soil meets unconditional cleanup target levels for leachability, see Rule 62-770.680(1)(c)2 in the current December 27, 2007 issue of Chapter 62-770, F.A.C.



ENCLOSURE 2
SUPPLEMENTAL INFORMATION

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- a. Chemical composition: Premixed VirO2Syl, as-shipped, contains 27% hydrogen peroxide and 0.03% colloidal silver. Since information provided to the Bureau of Petroleum Storage Systems by Natural Solutions Group Corporation discusses the use of VirO2Syl at this as-shipped concentration, the Bureau has offered its advice on how to comply with injection zone of discharge requirements for this composition. Whether it is advisable to dilute the as-shipped product with additional water prior to application at a specific site for an in situ cleanup is a matter that should be discussed between the user and Natural Solutions Group Corporation before a site-specific Remedial Action Plan is prepared and submitted for review and approval. In regard to the silver, the Bureau indicates that it will be necessary to obtain permission for a temporary injection zone of discharge, for the fluid to be injected, for any dilution that involves the addition of less than 3,000 volumes water to 1 volume of as-shipped VirO2Syl prior to injection. Whether permission for a temporary injection zone of discharge will be necessary for pH for various dilutions of VirO2Syl prior to injection will depend on the resulting pH of the mixture, which will be influenced in part by the pH of the local dilution water.
- b. Pilot study: For petroleum cleanup, per Rule 62-770.700(2), F.A.C., it is required that a pilot study proposal be submitted for review, and that a pilot test be performed prior to the design of a full-scale treatment system. If conditions at a site do not warrant a pilot study, then a proposal explaining the rationale to forego it must be submitted for review.
- c. Dosage: The amount of VirO2Syl to be used for the remediation of groundwater and soil at a contaminated site depends on site-specific conditions. The Bureau of Petroleum Storage Systems therefore advises users of VirO2Syl to consult Natural Solutions Group Corporation to determine an appropriate dosage. For in situ applications, the Bureau also advises that no more than the necessary amount be introduced to the subsurface, in order to avoid a situation in which a lengthy period of time is needed for residual concentrations of the ingredients of concern to decrease to their soil and groundwater standards, or their natural-occurring background levels at the cleanup site, whichever is less stringent.



ENCLOSURE 3

VirO2Syl
November 8, 2010

Memorandum **Florida Department of Environmental Protection**

TO: Cathy McCarty, P.G.
Florida Department of Environmental Protection
Bureau of Water Facilities Regulation
Underground Injection Control Section - MS 3530
2600 Blair Stone Road, Tallahassee, FL 32399-2400

FROM: _____ (Note 1.)

DATE: _____

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

Pursuant to paragraph 62-528.630(2)(c), F.A.C., inventory information is hereby provided regarding the proposed construction of temporary injection well(s) for the purpose of in situ aquifer remediation at a contaminated site.

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

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

Well contractor's name: _____ (Note 2.)
Well contractor's address: _____



Cathy McCarty, P.G.
Page 2 of 4
Date: _____

Facility name: _____
FDEP facility no.: _____

AFFECTED AQUIFER

Name of aquifer: _____
Depth to groundwater (feet): _____
Aquifer thickness (feet): _____
Areal extent of contamination (square feet): _____

INJECTION WELLS

A site map showing the location and spacing of injection wells, the areal extent of the groundwater contamination plume, and associated monitoring wells is attached. The injection well(s) features are summarized below, and/or a schematic of the injection well(s) is attached.

Direct-push or HSA/Mud rotary (circle the appropriate well type)
Diameter of well(s) (i.e., riser pipe & screen) (inches): _____
Total depth of well(s) (feet): _____
Screened interval: _____ to _____ feet below land surface
Grouted interval: _____ to _____ feet below land surface
Casing diameter, if applicable (inches): _____
Cased depth, if applicable: _____ to _____ feet below land surface
Casing material, if applicable: _____

PROJECT DESCRIPTION

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

- bioremediation,
- chemical oxidation, or
- other (describe) _____

Brief description of the project:

Summary of major design considerations and features of the project:

Number of injection wells: _____
Injection volume per well (gallons): _____
Single or multiple injection events: _____
Injection volume total (all wells, all events): _____



Cathy McCarty, P.G.
Page 3 of 4
Date: _____

Facility name: _____
FDEP facility no.: _____

FLUID TO BE INJECTED

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

TEMPORARY INJECTION ZONE OF DISCHARGE (ZOD)

(check those that apply)

- No ZOD needed. The fluid to be injected meets the primary and secondary groundwater standards of Chapter 62-550, F.A.C., and the minimum groundwater criteria of Chapters 62-520 and 62-777, F.A.C.
- ZOD permission by rule 62-520.310(8)(c), F.A.C., for reagent chemical species and/or parameter(s) in the fluid to be injected (or re-injected) that exceed secondary groundwater standards. ZOD permission by this rule also applies to chemical species in the fluid to be injected that exceed primary groundwater standards or minimum groundwater criteria, provided those species are prime constituents of the reagents used to remediate site contaminants. The list of chemical species and parameters for which the approved Remedial Action Plan identifies zone size, duration and groundwater monitoring are as follows:

- ZOD permission by rule 62-520.310(8)(c), F.A.C., for the following contaminants of concern that exceed their groundwater standards in the fluid to be re-injected as part of a closed-loop re-injection system for which the approved Remedial Action Plan identifies zone size, duration and groundwater monitoring:

- ZOD permission by variance because fluid to be injected contains the following impurities that are not prime constituents of the reagents used to remediate the site's contaminants, and the concentration of those impurities in the fluid to be injected are in excess of their primary groundwater standards:

- A variance needs to be granted before the remediation can be conducted.
- A variance has already been granted for the impurities listed above:

Date variance granted: _____ Zone size (feet): _____ Duration (time): _____

..... ◆◆◆

- If ZOD permission by rule 62-520.310(8)(c), F.A.C., or by variance is checked above, then a figure that delineates the ZOD is attached, or the ZOD is described as follows:



Cathy McCarty, P.G.
 Page 4 of 4
 Date: _____

Facility name: _____
 FDEP facility no.: _____

CLEANUP CRITERIA AND ENFORCEABLE APPROVAL ORDER

In situ injection-type aquifer remediation of the contaminants of concern at this site is intended to meet the groundwater cleanup target levels established for them in accordance with applicable and appropriate chapters of the Florida Administrative Code and cited in the approved Remedial Action Plan. Additionally, all other groundwater standards will be met at the time of project completion for any residuals associated with the ingredients of the injected remediation products, and any by-products or intermediates produced as a result of the chemical or biochemical transformation of those ingredients or the contaminants of concern during their use. Applicable primary and secondary drinking water standards are set forth in Chapter 62-550, F.A.C., and additional groundwater quality criteria are set forth in Chapters 62-520 and 62-777, F.A.C.

The remediation plan estimates that site remediation will take _____ months. We will notify you if there are any modifications to the remediation strategy which will affect the injection well design or the chemical composition and volume of the injected remediation product(s).

The proposed remediation plan was approved on _____ by an enforceable approval order. A copy is attached. The remediation system installation is expected to commence within 60 days. Please call me at _____ if you require additional information.

#####

- Note 1. This notification memorandum is primarily for use by state technical reviewers, but remediation contractors may fill in all blanks except those labeled "FROM" and "DATE" on page 1, and the "approval date", and "telephone number" blanks in the last paragraph on page 4. Those blanks are filled only by the regulator. In the case that the memorandum form is partially completed by the remediation contractor, the FDEP technical reviewer must verify that the information provided by the contractor is accurate and complete. Local programs are not authorized to approve underground injections into aquifers. Reason: Per agreement with EPA, the FDEP cannot delegate this authority. Local programs, after reviewing a Remedial Action Plan or an injection proposal document, should follow the instructions in the March 16, 2000, memorandum to arrange for Department headquarters' execution of an approval order, and then complete this memorandum.
- Note 2. If an injection well installation contractor has not yet been selected, then indicate the name and address of the project's general remediation contractor/consultant.
- Note 3. Complete chemical analysis of the fluid to be injected is required by Chapter 62-528, F.A.C. Some remediation products and processes may have already submitted this information at the time of application for acceptance by the Innovative Technology Acceptance Program. For those situations, when completing the Fluid To Be Injected section of this memorandum, it will suffice to indicate: (1) an Innovative Technology Acceptance letter has been issued; (2) the date of the acceptance letter; (3) the acceptance letter contains the chemical analysis, or a voucher for the confidential disclosure of the injected fluid's chemical composition if it is a proprietary formulation; and (4) the fluid will be injected at concentrations that are less than or equal to those cited in the acceptance letter. For products and processes that do not hold an Innovative Technology Acceptance letter, but for which the site-specific Remedial Action Plan provides a complete description of the chemical composition of the fluid to be injected, it will be necessary to enter this information into the Fluid To Be Injected section of this memorandum.



Attachment 3

Antimicrobial Activity of Viro2syl

1.0 SUMMARY OF ANTIMICROBIAL ACTIVITY OF Viro2Syl AGAINST TEST MICRO ORGANISMS				
ORGANISM	STRAIN	CONCN.	TEST HOUSE	METHOD
BACTERIA - Non-spore-forming				
<i>Enterococcus faecium</i>	ATCC 8043	0.5-1%	LOVAP	NF T 72-190
<i>Enterococcus hirae</i>	ATCC 10541	1.5%	Universiteit Antwerpen	EN 13727
<i>Escherichia coli</i>	ATCC 10536	0.5%	Universiteit Antwerpen	EN 13727
<i>Klebsiella pneumoniae</i>	ATCC 4352	0.5%	Institut Fresenius	DGHM 1981
<i>Lactobacillus brevis</i>	Laboratory	0.1%	Technical University Munchen	In-house
<i>Legionella pneumophila group 1</i>	ATCC 33152	0.2%	TNO Nutrition and Food Research	prEN 13623
<i>Mycobacterium avium</i>	ATCC 15769	5%	Universiteit Antwerpen	EN 14348
<i>Mycobacterium smegmatis</i>	ATCC 15755	1%	LOVAP	NF T 72-190
<i>Mycobacterium terrae</i> (surrogate for <i>M. tuberculosis</i>)	NCTC 10856	2.5%	Hospital Infection Research Lab (NHS)	In-house
<i>Mycobacterium terrae</i>	NCTC 10856	7.5%	Universiteit Antwerpen	EN 14348
<i>Mycobacterium tuberculosis</i>	ATCC 25618	0.5%	Institut Fresenius	DGHM 2 1
<i>Pediococcus damnosus</i>	Laboratory	0.1%	Technical University Munchen	In-house
<i>Proteus mirabilis</i>	NCTC 10975	0.1%	LOVAP	NF T 72-150
<i>Pseudomonas aeruginosa</i>	ATCC 15442	0.5%	Universiteit Antwerpen	EN 13727
<i>Staphylococcus aureus</i>	ATCC 6538	0.5%	Institut Fresenius	DGHM 2 1
<i>Streptococcus faecalis</i>	ATCC 6057	0.25%	Institut Fresenius	DGHM 1981
BACTERIA - Spore-forming				
<i>Bacillus cereus</i>	ATCC 9139	0.5-1%	LOVAP	NF T 72-190
<i>Bacillus subtilis</i>	ATCC 6633	0.5-1%	LOVAP	NF T 72-190
<i>Clostridium sporogenes</i>	ATCC 3584	0.5%	Institut Fresenius	DGHM 1981
YEASTS/MOULDS/ FUNGI				
<i>Absidia corymbifera</i>	ATCC 38957	0.2-1%	LOVAP	NF T 72-190
<i>Aspergillus niger</i>	ATCC 16404	2%	Universiteit Antwerpen	EN 13624
<i>Candida albicans</i>	ATCC 10231	1.5%	Universiteit Antwerpen	EN 13624
<i>Cladosporium cladosporioides</i>	ATCC 38906	0.2%	LOVAP	NF T 72-190
<i>Penicillium notatum</i>	ATCC 9179	1%	LOVAP	NF T 72-150
<i>Penicillium verrucosum</i>	ATCC 38905	0.5-1%	LOVAP	NF T 72-190
<i>Saccharomyces cerevisiae</i>	ATCC 9763	1%	Universiteit Antwerpen	EN 13624
VIRUSES - Encapsulated				
Newcastle disease virus	Montana	0.5%	Institute for Applied Animal Hygiene	DVG 1988
Vaccinia virus	Elstree	0.5%	Institute for Applied Animal Hygiene	DVG 1988
VIRUSES - Non-encapsulated				
Adenovirus	Type 5	1%	Universiteit Antwerpen	EN 14476
Echovirus	LCR 4	0.5%	Institute for Applied Animal Hygiene	DVG 1988
Feline calicivirus (surrogate for human Norovirus)	62804 (primary)	0.5%	Glasgow Caledonian University EPA SOP	In-house /
Poliovirus	Type 1	1%	Universiteit Antwerpen	EN 14476
Reovirus	Type 1	0.5%	Institute for Applied Animal Hygiene	DVG 1988
PROTOZOA - Amoebae & amoebic cysts				
<i>Acanthamoeba culbertsoni</i>	Laboratory	1%	Jeune Equipe Universitaire, Rennes	In-house
<i>Acanthamoeba MR4</i>	Laboratory	1%	Jeune Equipe Universitaire, Rennes	In-house
<i>Hartmannella vermiformis</i>	Laboratory	1%	Jeune Equipe Universitaire, Rennes	In-house
<i>Naegleria fowleri</i>	0359	1%	Jeune Equipe Universitaire, Rennes	In-house
<i>Naegleria gruberi</i>	1518	1%	Jeune Equipe Universitaire, Rennes	In-house
<i>Naegleria gruberi</i>	Paris	1%	Jeune Equipe Universitaire, Rennes	In-house
<i>Naegleria gruberi</i>	M05	1%	Jeune Equipe Universitaire, Rennes	In-house
SPOROZOA				
<i>Cryptosporidium parvum</i> oocysts	Laboratory	1%	Jeune Equipe Universitaire, Rennes	In-house