

December 11, 1998

Mr. Claude Council
Geo Resources, Inc.
P.O. Box 172096
Tampa, Florida 33672-0096

Re: **Polymeric Zorption/Oxidation**

Dear Mr. Council:

The Bureau of Petroleum Storage Systems hereby accepts a remediation system known as Polymeric Zorption/Oxidation for the remediation of petroleum contaminated sites. It is our understanding that the system can also be used for contaminant removal and destruction applications that are beyond the regulatory jurisdiction of this bureau; for example: industrial wastewater, chlorinated solvents, bottom sludge water in fuel oil tanks, glycols, pesticides, and other organic chemicals. The system is a patented process that is available through Geo Resources Incorporated.

Polymeric Zorption/Oxidation is a mobile package (although stationary versions are available) consisting of a process equipment train in which contaminated water passes through a series of columns filled with absorbent polymer (in much the same way as it passes through a series of granular activated carbon drums) followed by an oxidation polishing step involving ozonation.

The bureau recognizes Polymeric Zorption/Oxidation as a viable method for the cleanup of petroleum contaminated sites in Florida pursuant to Chapter 62-770, Florida Administrative Code (F.A.C.). There are no objections to its use provided the considerations of this letter are taken into account and a Remedial Action Plan is approved by the Department.

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. Vendor's 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 the Polymeric Zorption/Oxidation process, like any other equipment systems used for the remediation of petroleum contaminated sites, the Department expects that all appropriate safety precautions and codes associated with the design and operation of electrical equipment and machinery, fire safety, the use of chemicals, the compatibility of different chemicals, and the personal protection of workers and passersby will be observed.

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Preparers of remediation plans prescribing the Polymeric Zorption/Oxidation system are advised to include a copy of this letter in the appendix of plans they submit, and call attention to it in the text of their document. In this way, technical reviewers throughout the state will be informed that you have contacted the Department of Environmental Protection to inquire about the environmental acceptability of this process. To aid those reviewers, supplemental information is presented in enclosure 1.

The Department reserves the right to revoke the acceptance of any product or process it has accepted if the nature or composition of either or any of its principal and proprietary ingredients, its performance, or any other aspect 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 a Remedial Action Plan. You may contact me at 850/487-3299 if there are any questions.

Sincerely,

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

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ENCLOSURE 1

SUPPLEMENTAL INFORMATION ABOUT POLYMERIC ZORPTION/OXIDATION

1. Absorbent: A regenerable proprietary polymer with the trade name OZ-2000, by Omni-Zorb Environmental Technologies Incorporated, Lakeland, Florida is loaded into the absorbent columns. The Material Safety Data Sheet indicates that OZ-2000 contains approximately 94% block co-polymer, 5% calcium carbonate, and an antioxidant stabilizer. In dry form, it will not burn unless it is preheated. It may be stored safely for as long as 6 days at 200 degrees Fahrenheit, and is not a hazardous substance but can be a minor skin irritant. In dry form, during transport, the material can accumulate a static charge, so a potential fire hazard can exist if the statically charged dry material is handled in the

presence of volatile or flammable mixtures. The autoignition temperature of the polymer material itself is 450 degrees Fahrenheit.

2. Absorbent column configuration: The polymer absorbent columns are arranged in a series configuration within the process equipment train. Usually, 4 columns are used in series, and in a manner such that 3 of them are in service while the fourth is on standby. The volume and weight of polymer in each column, the absorption capacity of the polymer as a percentage of its own weight, and the contact time required for treatment were not indicated. However, Remedial Action Plans prescribing the Polymeric Zorption/Oxidation process should include such information as a matter of good design practice and for the sake of thoroughness.
3. Regeneration: Geo Resources indicates that the polymer absorbent can be regenerated at the job site, although the method by which this is accomplished is not specified. The Department therefore assumes that a heating type regeneration process is used, since it is the most common method of industrial absorbent and catalyst regeneration. Remedial Action Plans prescribing the Polymeric Zorption/Oxidation process should indicate the method of regeneration so that the state's technical reviewers may be fully informed about the type of process and equipment that they have been requested to review.

Geo Resources provided data regarding the performance of the regenerated polymer absorbent after each of five absorption/regeneration cycles. The Department notes that the absorbent performed adequately after each regeneration, although there may be a gradual decrease in performance. Overall, though, it appears that such an onsite regenerable absorbent can be cost-effective, since it can be used a number of times before it must be discarded. It is expected that all contaminants removed from the absorbent during the regeneration process will be safely collected and handled, and disposed in a proper manner.

4. Disposal of spent absorbent: The Department expects that all absorbent which is no longer regenerable will be disposed in a proper manner. Geo Resources has provided the results of Toxic Characteristic Leachate Procedure (TCLP) tests performed on used absorbent, showing that it passes the TCLP test for benzene and chlorinated hydrocarbons. It has also been indicated that spent absorbent, if rendered hazardous as a result of a particular application, will be disposed by a licensed hazardous waste disposal company under the appropriate manifest.
5. Polishing step: The effluent polishing step of the Polymeric Zorption/Oxidation process is ozonation. The system generates its own ozone from a supply of bottled oxygen. The flow rate and concentration at which ozone is generated and used in the process was not disclosed, although it was indicated that the duration of the ozonation polishing step, which is performed in tanks, is approximately 4 hours. The Department suggests that Remedial Action Plans, for the sake of thoroughness, include the flow rate and concentration.
6. Treatment rates: The Geo Resources Polymeric Zorption/Oxidation system can treat contaminated water at a rate of 5 to 150 gallons per minute.
7. Performance: The overall performance of the Polymeric Zorption/Oxidation process during tests, using contaminated water from actual petroleum storage facilities, was always greater than 99.9% removal of contaminants. The total benzene, ethylbenzene, toluene, and xylene (BETX) concentrations of the

influent during the tests ranged from 9,956 parts per billion (ppb) to 51,538 ppb BETX. The performance of the polymer absorbent step, which is the first step in the process, ranged from 92-99.2% BTEX removal (although one test only achieved a 28% reduction). In all cases, including the 28% reduction test, the ozonation polishing step always completed contaminant removal to 99.9% or greater. A separate test of the polymer alone on an influent containing 6 ppb perchloroethylene resulted in a 91.7% removal rate, producing an effluent concentration of 0.5 ppb. Based on the results of these tests, the Department believes that the Polymeric Zorption/Oxidation process can be a viable method for the remediation of petroleum and other types of contaminated sites in Florida.

8. Total organic carbon (TOC): Like other processes that involve absorption and/or oxidation, the Department believes naturally-occurring total organic carbon must be taken into account when designing such a treatment system, or estimating the usage of absorbent and oxidation reagents for such a system for a given job site. If TOC is of concern, then it is suggested that the groundwater from a monitoring well located outside the groundwater contamination plume at the site be sampled and analyzed for background TOC. In this way, the additional burden placed on the system by the naturally-occurring TOC can be taken into account.
9. Effluent disposal: Like any other petroleum remediation system constructed pursuant to Chapter 62-770, F.A.C., the effluent must meet the cleanup criteria for the petroleum contaminants of concern and/or the criteria for the selected method of effluent disposal, whichever is more stringent. Effluent disposal may be accomplished via on site infiltration, storm sewer, sanitary sewer, or transport to a licensed industrial water treatment facility.
10. Pretreatment: At sites where free product may be present in the influent to the Polymer Zorption/Oxidation system, it is recommended that a phase separation device such as an oil/water separator be used to pretreat the influent. And at sites where the total suspended solids loading is high, it may be beneficial to filter the influent before it is fed to the process.
11. Inorganics: Geo Resources indicates that there is some flexibility in the configuration of the process equipment train for the Polymer Zorption/Oxidation system, and that additional items can be installed if it is necessary to also remove inorganics such as heavy metals from a feed stream. For example, the process can be tailored to include an ion exchange unit or a precipitation unit should the influent contain heavy metals.