



Department of Environmental Protection

Jeb Bush
Governor

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

David B. Struhs
Secretary

July 9, 2001

Mr. Zachary A. Smith, P.E.
Environmental H2O
14998 West Sixth Avenue, Suite 800
Golden, Colorado 80401

Re: **Iso-Gen[®] Technology**

Dear Mr. Smith:

The Bureau of Petroleum Storage Systems hereby accepts Iso-Gen[™] Technology as an innovative technology for remediation of groundwater at petroleum-contaminated sites. This technology is not only effective in reducing petroleum contaminants of concern in source areas of groundwater contamination, but is particularly effective in "polishing" residual contamination in groundwater. Additionally, the technology may be utilized as a downgradient oxygen barrier at the leading edge of contaminant plumes. The Iso-Gen[™] technology is also applicable for remediation of non-petroleum contaminants, although the review and approval of site-specific Remedial Action Plans in this area does not fall within the regulatory jurisdiction of this bureau.

As you indicated in your literature, the Iso-Gen[™] technology generates dissolved oxygen (DO) enriched groundwater with a downhole unit that may easily be utilized in two-inch or larger diameter groundwater monitor wells. An aboveground controller powers the downwell unit by converting standard 110V AC power to low voltage DC current (three to five amps). The downwell unit consists of a vertical assembly that draws in water with a recirculation pump at the base of the well and pushes it upward through an electrolytic cell to a screened pipe that allows the release of the DO enriched water back into the aquifer. The electrolytic cell dissociates water into hydrogen and oxygen. The hydrogen is off-gassed and the oxygen that is generated goes into solution as DO in groundwater. The chemical diffusion of the DO aids in making oxygen available to the microbes in the aquifer. Enclosure 1 contains additional information about the Iso-Gen[™] technology that the bureau would like to pass along to the readers of this letter.

For any type of product or process, it is not required that an acceptance letter be obtained in order to propose its use in a site-specific RAP. However the RAP must contain adequate design details and information to show that the proposed product or process meets all applicable and appropriate rules and regulations.

While the bureau does not endorse 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.

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Vendors must then market the products and processes on their own merits regarding performance, cost, and safety in comparison to competing alternatives in the marketplace. In no way, however, shall this letter by this bureau, stating regulatory acceptance (or the conditions of regulatory acceptance) be construed as certification of product or process performance.

A copy of this letter should be provided in the appendix of site-specific RAPs proposing the Iso-Gen™ technology, so that technical reviewers throughout the state will be informed that you have contacted the bureau to inquire about its acceptability from a regulatory standpoint.

The bureau reserves the right to revoke its acceptance of a product or process if any aspect of its nature, components, constituents, or performance 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 Remedial Action Plans prescribing the product or process. You may contact Donna M. Cline, P.E., at (850) 222-6446 ext. 257 or the undersigned at (850) 487-3299 if there are any questions.

Sincerely,

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

c: Donna M. Cline, PCS5, Tallahassee

T. Conrardy, PCS3, Tallahassee

ENCLOSURE 1

ADDITIONAL INFORMATION ABOUT ISO-GEN™ TECHNOLOGY

1. Configuration: The downhole unit consists of a small pump and an electrolytic cell. The unit is controlled with an aboveground controller that operates on standard 110/220 voltage.
2. Downhole Electrolytic Unit: The downwell unit consists of a vertical assembly that draws in water with a recirculation pump at the base of the well that pushes the water upward through an electrolytic cell to a screened pipe that allows the release of the DO enriched water back into the aquifer. The electrolytic cell dissociates water into hydrogen and oxygen. The hydrogen is off-gassed and the oxygen that is generated goes into solution as dissolved oxygen in groundwater.
3. Controller: The controller converts the current from AC to DC. Each cell operates at constant amperage that can be adjusted from three to five amps at a voltage between two and forty-eight volts. A power consumption of approximately 200 watts per downhole unit is utilized. The electrolytic cell typically cycles for 10 minutes on and 39 minutes off, while the circulation pump typically runs 13 minutes and 36 minutes off.
4. Oxygen Generation: High concentration of DO were measured above 20 parts per million (ppm) in the Iso-Gen™ application wells and elevated concentrations were measured in wells more than 30 feet away from the treatment well.
5. Microbes: Indigenous microbial population counts increased along the perimeter of the application well and decrease within the application well. The microbes are essentially inert under high DO concentrations. This phenomena is highly advantageous to the Iso-Gen™ process as biofouling (or aquifer clogging) within the application well does not occur which ensures that the DO is readily transmitted.
6. Vadose and Smear Zone Applicability: Studies on the effectiveness of this technology within the vadose and smear zone are underway but have not been evaluated.
7. Applicability: Iso-Gen™ technology performs best under the following set of conditions: (1) an indigenous population of petroleum degrading microbes favorable to biostimulation; (2) moderate water quality (details provided in notation number 8); (3) a groundwater aquifer thickness of 10 feet or greater.
8. Water Quality Conditions: The following water quality conditions are required to ensure that a sufficient DO saturation of the groundwater is attained and to prevent scaling and corrosion on the electrolytic cell and pump:
 - (1) Silica < 10 mg/l;
 - (2) Iron < 50 mg/l;
 - (3) Total dissolved solids (TDS) < 2000 mg/l;
 - (4) Chemical oxygen demand (COD) < 500 mg/l;
 - (5) Sulfate < 1000 mg/l;
 - (6) Chloride < 300 mg/l; and

(7) Hardness < 600 mg/l.

9. Safety: The National Electrical Code should be observed to ensure that electrical components are appropriately rated when used in hazardous Class I, Group D, Division 1, or Class I, Group D, Division 2 areas, to prevent fires. Appropriate instrumented shutdown features and/or pressure relieves to prevent over pressurization should be included, as applicable, to maintain a safe working environment. With respect to hydrogen generation, the literature provided by Iso-Gen™ specifies that very little hydrogen is generated per well. As a safety precaution a Raney nickel filter cap is placed on the well casing for the purposes of absorbing the hydrogen gases. These nickel filter caps are routinely recycled every ninety or more day by Environmental H2O's certified technicians. The bureau provides a reminder that the onus shall be on the user regarding the safety precautions utilized when the Iso-Gen™ technology is used at remediation sites in Florida.