



Department of Environmental Protection

Jeb Bush
Governor

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

David B. Struhs
Secretary

June 13, 2002

Mr. Robert Gaudet
Bio-Tech 2000
861 Jupiter Park Drive, Unit A
Jupiter, Florida 33458

Re: **Hydrocarbon Degradation Formula (HDF-2)**

Dear Mr. Gaudet:

The Bureau of Petroleum Storage Systems hereby accepts HDF-2 as a product for in situ and ex situ bioremediation of petroleum and other suitable contaminants in groundwater and soil. It is a proprietary mixture of natural-occurring, non-pathogenic, aerobic microorganisms. It also contains macro- and micro- nutrients that are necessary for the growth of microorganisms. The product is shipped as a dry powder that is rehydrated by the user prior to application at a remediation site. Enclosure 1 is a chemical analysis of rehydrated HDF-2.

Although this acceptance applies only to the jurisdiction of this bureau, other bureaus within the Department of Environmental Protection, or other state agencies and local governments may choose to recognize it if their needs and regulations are similar. This bureau, however, is not responsible for applications beyond its jurisdiction.

For vadose remediation where the underlying groundwater will not be affected by the leaching of HDF-2, there are no special concerns beyond those which would normally need to be addressed in preparing a Remedial Action Plan and conducting a cleanup in accordance with the petroleum cleanup requirements of Chapter 62-770, Florida Administrative Code (F.A.C.). For ex situ groundwater treatment, where an aboveground treatment system produces effluent meeting the petroleum cleanup criteria of Chapter 62-770, F.A.C., and the drinking water standards of Chapter 62-550, F.A.C., for disposal via recharge gallery or NPDES permit, there are no special concerns. But for in situ groundwater remediation, via direct injection of HDF-2 into an aquifer, there are underground injection control (UIC) regulations that must be observed. Since in situ aquifer remediation via injection is likely to be the most common application of this product, the bulk of the regulatory requirements discussed herein will be directed to that topic.

The bureau recognizes HDF-2 as a viable product for the bioremediation of 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 prepared in accordance with Chapter 62-770 and Rule 62-522.300(2)(c), F.A.C., for approval by the Department; and (c) the terms of a May 7, 2002 variance granted by the Department to Bio-Tech 2000 are observed. The terms of the variance - which temporarily allows a zone of discharge where the minimum groundwater criteria for ammonia and boron may be exceeded - are summarized in enclosure 2. The May 7, 2002 variance applies to

these two (2) minimum groundwater parameters. Rule 62-522.300(2)(c), F.A.C., applies to the following five (5) drinking water standards: copper, iron, nitrate, nitrite, and total dissolved solids.

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. In no way, however, shall this regulatory acceptance letter be construed as Department certification of performance. Additionally, the Department emphasizes a distinction between its regulatory "acceptance" and approval. Products and processes are accepted but they are not approved.

It is also 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. The plan, however, must contain sufficient information about the product or process to show that it meets all applicable and appropriate rules and regulations, especially those of the Florida Administrative Code.

Those who prepare Remedial Action Plans are advised to include a copy of this letter in the appendix of plans they submit, and call attention to it in the text of their document. In this way, technical reviewers throughout the state will be informed that you have contacted the Department of Environmental Protection to inquire about the environmental acceptability of HDF-2. To aid those reviewers, the Bureau of Petroleum Storage Systems provides supplemental information as enclosure 3.

The Department reserves the right to revoke its acceptance of a product or process if its nature or 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 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

c: T. Conrardy - FDEP/Tallahassee

HDF-2 CHEMICAL ANALYSIS *

CHEMICAL SPECIES OR PARAMETER

	<u>AMOUNT</u>	<u>UNITS</u>
<u>Primary Drinking Water Contaminants</u>		
Nitrate (as N) **	320	mg/L ‡
Nitrite (as N) **	1.05	mg/L
Sodium §	75	mg/
<u>Secondary Drinking Water Contaminants</u>		
Copper **	1.65	mg/L
Iron **	8.05	mg/L
pH	7.61	pH units
Total Dissolved Solids **	2010	mg/L
Zinc	1.70	mg/L
<u>Minimum Groundwater Criteria Contaminants of Chapter 62-777, F.A.C.</u>		
Ammonia † (as N)	491	mg/L
Boron †	0.97	mg/L
Molybdenum	0.02	mg/L
<u>Other Parameters and Measurements</u>		
Calcium	270	mg/L
Magnesium	16.4	mg/L
Nitrogen (Kjeldahl) Ⓐ	597	mg/L
Nitrogen (Total)	917	mg/L
Total Phosphorus (as P)	207	mg/L
Potassium	353	mg/L
Sulfur	.03	%

* Analysis of the aqueous HDF-2 fluid to be injected.

‡ mg/L denotes milligrams per liter.

§ Sodium is a State of Florida primary drinking water contaminant with a maximum contaminant level (MCL) of 160 mg/L set forth in Chapter 62-550, F.A.C., but not a federal primary drinking water contaminant.

** Rule 62-522.300(2)(c), F.A.C., applies to these parameters of the HDF-2 injection fluid that do not meet their respective standards, all of which are expressed in mg/L as follows: nitrate, 10; nitrite, 1; copper, 1; iron, 0.3; and total dissolved solids, 500.

Ⓐ Total Kjeldahl Nitrogen (TKN) is the sum of free ammonia and organic nitrogen compounds, expressed as elemental nitrogen.

† Variance granted May 7, 2002 applies to these minimum groundwater criteria contaminants that exceed their respective standards, in mg/L, as follows: ammonia, 2.8; and boron, 0.63.

ENCLOSURE 2

HDF-2: ENVIRONMENTAL AND REGULATORY CONSIDERATIONS

For HDF-2 applications, the major environmental and regulatory considerations are listed below.

- a. Groundwater cleanup standards: The onus shall be on users of HDF-2 to ensure that all applicable groundwater contaminant standards will be met at the time of project completion, for petroleum, other contaminants that may be present, any residuals associated with the ingredients of HDF-2, and any byproducts produced as a result of chemical or biochemical reactions involving those ingredients. The following chapters of the Florida Administrative Code are cited: Chapter 62-550, F.A.C., for primary and secondary water quality standards; Chapter 62-520, F.A.C. for groundwater classes and standards, and minimum criteria; 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; Chapter 62-770, F.A.C., for petroleum cleanup criteria; and Chapter 62-777, F.A.C., also for minimum groundwater criteria.

A noteworthy aspect of the minimum criteria set forth in Chapter 62-520, F.A.C., is that it requires groundwater to be free from substances which are harmful to plants, animals, and organisms, and free from substances that are carcinogenic, mutagenic, teratogenic or toxic to human beings. In effect, these "free from" requirements form a catchall. They close what would otherwise be a loophole in the regulations by preventing injection of a potentially harmful product in the event that any of its ingredients is not regulated as a specific primary or secondary drinking water contaminant.

- b. Injection well permit: 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, for remediation via injection of HDF-2 into an aquifer, constitutes the granting of a Class V injection well permit.
- c. Groundwater injection standards: For in situ aquifer remediation, the composition of an 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.
- d. Variance summary: A May 7, 2002 variance granted to Bio-Tech 2000 is for a temporary exemption from Rule 62-522.300(3), F.A.C., in order to create a 35-foot zone of discharge in the aquifer around each injection point. Within this zone of discharge, for a period of time not to exceed one (1) year, a temporary departure from the minimum groundwater criteria for ammonia and boron set forth in Chapters 62-520 and 62-777, F.A.C., will be tolerated when HDF-2 is injected for remediation purposes. By the end of the 1-year period, the groundwater must meet the required values for these parameters, or the natural-occurring background value for each of them at a given remediation site, whichever is less stringent. The current minimum groundwater criteria, per Chapter 62-777, F.A.C. for each of these parameters is as follows: ammonia, 2.8 milligrams per liter (mg/L); and boron, 0.63 mg/L.

The variance granted by the Department is a general variance, which may be applied to each site-specific HDF-2 Remedial Action Plan submitted hereafter. Bio-Tech 2000 does not have to petition for a new variance

each time HDF-2 is proposed for the remediation of a site, provided there is no deviation from the terms of the variance.

Additionally, rule 62-522.300(2)(c), F.A.C., effective August 27, 2001, requires each Remedial Action Plan to address groundwater monitoring for the five (5) drinking water contaminants, listed as follows, along with their respective standards: copper, 1 milligram per liter (mg/L); iron, 0.3 mg/L; nitrate, 10 mg/L; nitrite, 1 mg/L; and total dissolved solids 500 mg/L.

- e. Utilization of wells: If a remediation site happens to have an abundance of monitoring wells, then the Department has no objection to the use of some wells for the application of HDF-2. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply HDF-2. This will avoid premature conclusions that the entire site meets cleanup goals. By making sure that designated tracking wells are not also used for treatment, there will be more assurance that the treatment process has permeated the entire site and that it did not remain localized to the area immediately surrounding each injection well.
- f. Additional nutrients: If, in the future, either Bio-Tech 2000 or a user of HDF-2 decides to augment it with other nutrients and/or chemicals, the injection of such nutrients and other chemicals into an aquifer must also be in accordance with the underground injection control requirements of Chapter 62-528, F.A.C., which requires that substances injected meet the drinking water standards set forth Chapter 62-550, F.A.C., and the minimum groundwater criteria of Chapter 62-520, F.A.C.
- g. Groundwater monitoring:
 - 1. Active remediation petroleum monitoring: During the period of active remediation, groundwater shall be monitored in accordance with the requirements set forth in Section 62-770.700, F.A.C. Two noteworthy rules within that section are 62-770.700(3)(i), F.A.C., for frequency of sampling, and 62-770.700(5)(f), F.A.C., which requires a sampling schedule for bioremediation.
 - 2. Post remediation petroleum monitoring: At least one (1) year of quarterly post remediation groundwater monitoring shall be conducted at a minimum of two (2) wells, one located in the area of maximum petroleum contamination, the other downgradient of the area of maximum petroleum contamination, pursuant to Section 62-770.750, F.A.C.
 - 3. Underground injection control monitoring: The terms of the May 7, 2002 variance require that the background levels of ammonia and boron be measured before injection, and the concentration of those two minimum groundwater criteria contaminants be monitored after injection. Additionally, per rule 62-522.300(2)(c), F.A.C., groundwater monitoring must be addressed in a Department-approved Remedial Action Plan for the primary and secondary drinking water contaminants in HDF-2 that do not meet the standards set for them in Chapter 62-550, F.A.C. In the case of HDF-2, those drinking water contaminants that must be monitored in the groundwater are copper, iron, nitrate, nitrite, and total dissolved solids.

The purpose of monitoring the two (2) minimum groundwater criteria and the five (5) drinking water parameters of concern for HDF-2 before injection is to establish their naturally occurring background

concentrations at the site. The purpose of groundwater monitoring after injection is to demonstrate that they either meet their respective groundwater criteria or do not exceed their natural-occurring background levels, whichever is less stringent.

- h. Underground injection control inventory: Remedial Action Plans prescribing in situ aquifer injection-type remediation shall include information pursuant to Rule 62-528.630(2)(c)1 through 6, F.A.C., for the inventory purposes of underground injection control. Per Rule 62-528.630(2)(c), F.A.C., aquifer remediation projects involving injection wells may be authorized under the provisions of a Remedial Action Plan, provided the construction, operation, and monitoring requirements of Chapter 62-528, F.A.C., are met. A memorandum outlining the inventory information about injection type aquifer remediation plans to be transmitted by Department reviewers to the Underground Injection Control Section is provided as enclosure 4. Only reviewers within the Department, including its district offices, may approve in situ injection-type remediation plans in which the approval constitutes a Class V injection permit; local programs are not authorized to grant such approvals. See enclosure 3.
- i. Operation:
 - 1. Avoidance of migration: For in situ injection-type aquifer remediation projects, injection of HDF-2 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 petroleum 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 petroleum contamination plume is expected to accompany the HDF-2 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 volume of HDF-2 that will be injected.
 - 3. Operating parameter measurements: Rule 62-770.700(9)(h), F.A.C., sets forth frequency requirements for the measurement of bioremediation operating parameters such as dissolved oxygen levels, rates of nutrient addition, temperature, etc. It also includes an option for reduction in the frequency or discontinuation of some measurements in situations when appropriate.
- j. Abandonment of wells: Upon issuance of a petroleum 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

HDF-2: SUPPLEMENTAL INFORMATION

The information below, compiled from several sources, may be helpful to reviewers of Remedial Action Plans prescribing bioremediation.

- a. Department of Environmental Protection reviewers of in situ injection-type aquifer remediation plans, regardless of whether in Tallahassee or district offices, must fill in the blanks on the enclosure 4 memorandum, whose subject is "Proposed Injection Well(s) for In Situ Aquifer Remediation at a Petroleum Remedial Action Site". The completed form must be submitted to the Underground Injection Control Section at 2600 Blair Stone Road, Tallahassee, Florida 32399-2400.

Only reviewers within the Department and its district offices may approve in situ injection type remediation plans in which the approval constitutes the issuance of a Class V injection permit; local programs are not authorized to grant such approvals. Reason: Although an arrangement between the Environmental Protection Agency and the Department delegates underground injection control authority to the Department, it does not allow the Department to delegate that authority any further. This includes delegation to the Department's contracted remediation review agencies such as those operated by the counties and other local governments.

- b. Pilot study: For bioremediation, per rule 62-770.700(2), F.A.C., a pilot study proposal shall be submitted for review, and a pilot test shall be performed prior to designing a treatment system. If conditions or the situation at a site do not warrant a pilot study, then a proposal explaining the rationale for the decision not to perform a pilot study shall be submitted for review. For state funded projects, reviewers are encouraged to use judgment in balancing cost and the need for technical information to be obtained from a pilot study.
- c. Dosage and application rate: The Bureau of Petroleum Storage Systems recommends that users consult Bio-Tech 2000 regarding the dosage and application rate of HDF-2 to treat contaminated soil or aquifer.
- d. Oxygen and other operating parameters: Bio-Tech 2000 indicates that its microorganisms are microaerophilic but that they should have at least 1 mg/L of dissolved oxygen made available to them. The Bureau of Petroleum Storage Systems suggests that users contact Bio-Tech 2000 to determine whether or not it would be beneficial to add oxygen at a site, based on site-specific conditions. Bio-Tech 2000 has indicated that the temperature range for HDF-2 is 35 to 120 degrees Fahrenheit, and the pH range is 5 to 10.
- e. Degradation products: Carbon dioxide and water are the ultimate products of aerobic and most anaerobic biodegradations of petroleum hydrocarbons. The intermediate products may include simple acids, alcohols, and fatty acids. Aerobic processes use oxygen as an electron acceptor to produce the carbon dioxide and water.
- f. Parameters: The following parameters may be useful in determining the potential for bioremediation at a site, or whether bioremediation is already occurring. They were selected from a list that appears in the publication "In Situ Treatment Technology" by E. Nyer et al., Lewis Publishers, 1996. The parameters are: dissolved oxygen; redox potential;

pH; temperature; specific conductance; volatile organic compounds; nitrate; nitrite; ammonia nitrogen; manganese (total and dissolved); iron (total, dissolved, and ferrous); sulfate; sulfide; and total organic carbon. Gaseous parameters include: carbon dioxide, oxygen, nitrogen, and methane. Other parameters that may be helpful are chemical oxygen demand, biochemical oxygen demand, and total organic carbon. Preparers of bioremediation plans and their reviewers should determine which parameters, if any, should be investigated on a site specific basis.

- g. Operating samples schedule: The sampling schedule for the petroleum contaminants of concern when using HDF-2 to remediate a site are usually 45 days after initial treatment, 60 days after initial treatment, and every 30 days thereafter for the duration of the project. For the first year of operation, this is a total of 10 samplings, which does not differ much from the 8 samples that would have otherwise been taken for the recovery wells during the first year for a conventional pump and treat system pursuant to Rule 62-770.700(10)(e), F.A.C. The Bureau of Petroleum Storage Systems suggests to its technical reviewers throughout the state that this may be reasonable for the first year. However, after the first year of operation, it may be more appropriate to reduce the frequency to quarterly, especially if by that point in time it becomes obvious that the project will need more than a year to reach cleanup target levels. Both the state's technical reviewers and Bio-Tech 2000 may need to exercise some judgment on a site-specific basis to strike a reasonable balance between the frequency of sampling needed for HDF-2, and the intent of Section 62-770.700, F.A.C., to prevent sampling frequencies from becoming needlessly excessive.

Memorandum**Florida Department of
Environmental Protection**

TO: Richard Deuerling, Mail Station 3530
Division of Water Facilities
Underground Injection Control Section
Florida Department of Environmental Protection
2600 Blair Stone Road, Tallahassee, FL 32399-2400

FROM: _____ (Note 1.)

DATE: _____

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

Pursuant to Rule 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 petroleum-contaminated site.

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

Site owner's name: _____
Site owner's address: _____

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

Brief description of the in situ injection-type aquifer remediation project:

Summary of major design considerations and features of the project:

Areal extent of contamination (square feet): _____
Number of injection wells: _____
Composition of injected fluid (Note 3)
(ingredient, wt. %): _____

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

Richard Deuerling
Page Two
Date: _____

Site name: _____
FDEP facility no.: _____

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

The following is a summary description of the affected aquifer:

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

The injection well(s) features are summarized below, and/or a schematic of the injection well(s) is attached.

Direct-push or Conventional (*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 surface
Grouted interval: _____ to _____ feet below surface
Casing diameter, if applicable (inches): _____
Cased depth, if applic.: _____ to _____ feet below surface
Casing material, if applic.: _____

The in situ injection-type aquifer remediation plan for this petroleum contaminated site is 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 by-products 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 groundwater quality criteria are set forth in Chapter 62-520, 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. 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 a March 16, 2000 memorandum to arrange for Department headquarters' execution of an approval order, and then complete this form. This form is primarily for use by state and local program technical reviewers, but petroleum remediation contractors may fill in all blanks except those labeled "FROM", "DATE", and "approval date", and "telephone number" blanks in the last paragraph. Those blanks should be completed only by a state or local program reviewer.

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 injected fluid is required by Chapter 62-528, Florida Administrative Code. 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.