



Department of Environmental Protection

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

Colleen M. Castille
Secretary

September 9, 2005

Isaac Aboulafia
MECX LLC
6300 West Loop South, Suite 500
Bellaire, Texas 77401

Re: MECX ISCO

Dear Mr. Aboulafia:

The Florida Department of Environmental Protection (Department) hereby accepts MECX ISCO for the remediation of petroleum, chlorinated solvents and other suitable organic contaminants in groundwater and soil, in situ and ex situ, via chemical oxidation. As MECX LLC has indicated, MECX ISCO uses hydrogen peroxide, an iron-based catalyst, and an acid to create a Fenton-type reaction that generates hydroxyl radicals, which in turn oxidize the petroleum hydrocarbon contaminants to carbon dioxide and water end products. When chlorinated hydrocarbons are the targeted contaminants for destruction, the end products also include chloride.

The MECX ISCO remediation process, formerly known as CleanOx, was originally accepted by the Department on May 7, 1999. The acceptance was issued to ManTech Environmental Corporation, Chantilly, Virginia, now known as MECX LLC, Houston, Texas. In regard to the process, only the name has been changed, while all other aspects of it remain the same. This letter therefore reaffirms the Department's acceptance of the process, but supersedes the original May 7, 1999 acceptance letter.

This superseding acceptance letter is also a regulatory update: Rule 62-522.300(2)(c), Florida Administrative Code (F.A.C.), effective August 27, 2001, now permits a temporary injection zone of discharge (ZOD) by rule for the iron, pH, sulfate, and total dissolved solids associated with MECX ISCO reagents. However, an August 12, 1998 variance granting a ZOD for those same parameters, to ManTech for CleanOx, is still valid since the process itself remains unchanged.

This acceptance applies only to the regulatory jurisdiction of the Florida Department of Environmental Protection. Other state agencies and local governments may choose to recognize it if their needs and regulations are similar. The Department, however, is not responsible for applications beyond its jurisdiction.

For soil remediation in which the underlying groundwater will not be affected by the leaching of MECX ISCO reagents, there are no underground injection control concerns. However, for injection-type, in situ groundwater remediation, via direct injection of MECX ISCO reagents

into an aquifer, or injections into soil that could leach or percolate to the water table, there are underground injection control regulations that must be observed. Since injection-type, in situ remediation is likely to be the most common application of MECX ISCO, the regulatory requirements discussed in Enclosure 1 are focused on that topic.

The Department recognizes MECX ISCO as a viable process for the remediation of contaminated sites in Florida. There are no objections to its use provided: (a) the considerations of this letter are taken into account; (b) a site-specific Remedial Action Plan is approved by the Department for each site where the use of MECX ISCO is proposed; and (c) the Remedial Action Plan specifies the size and duration of a temporary injection zone of discharge for iron, pH, sulfate, and total dissolved solids, and addresses groundwater monitoring of them pursuant to Rule 62-522.300(2)(c), Florida Administrative Code (F.A.C.), or the Remedial Action Plan indicates that the terms of the August 12, 1998 variance granting a temporary ZOD will be observed, and addresses the groundwater monitoring of iron, pH, sulfate and total dissolved solids. It may be necessary to add chloride to this list when chlorinated hydrocarbons are a contaminant of concern if there is a possibility that the chloride by-products of the oxidation process will be produced in significant concentrations.

While the Florida 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 and safety. 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" letters and an approval. Products and processes are accepted but they are not approved.

Also, 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. 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 pertaining to underground injection control.

Those who prepare Remedial Action Plans are advised to include a copy of this letter in the appendix, and call attention to it in the text of their document. In this way, technical reviewers will be informed that you have contacted the Department of Environmental Protection to inquire about the environmental acceptability of MECX ISCO. To aid those reviewers, supplemental information is provided as Enclosure 2.

The Department reserves the right to revoke its acceptance of a product or process if it 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 Rick Ruscito at (850) 877-1133, extension 29, if there are any questions.

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

History:

Inn_030.doc
5/7/1999

ppl #281
Inn_030a.doc
9/9/2005

REGULATORY INFORMATION

- a. Groundwater cleanup standards: The onus shall be on users of MECX ISCO to ensure that all applicable groundwater standards will be met at the time of project completion, for petroleum and other contaminants that may be present, any residuals associated with the ingredients of MECX ISCO, and any by-products produced as a result of chemical or biochemical reactions involving those ingredients. The following chapters of the Florida Administrative Code (F.A.C.) 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 cleanup and 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 that 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, Bureau of Waste Cleanup, or any other bureau or district office of the Florida Department of Environmental Protection, for remediation via injection of MECX ISCO into an aquifer, constitutes the granting of a Class V injection well permit. [62-528.630(2)(c) and 62-528.640(1)(c), F.A.C.]
- 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., and the minimum groundwater criteria of Chapter 62-520, F.A.C., pursuant to underground injection control Rule 62-528.600(2)(d), F.A.C. Aquifer remediation fluids that do not meet these requirements must seek permission for a temporary injection zone of discharge.
- d. Zone of discharge (ZOD): For MECX ISCO, rule 62-522.300(2)(c), F.A.C., effective August 27, 2001, can now be used to obtain permission for a temporary injection zone of discharge. However, since the process has only changed in name, the August 12, 1998 order granting a variance for a temporary injection ZOD is still valid, so the user has a choice in this case: the necessary permission can be obtained either by way of the rule or the existing variance. Regardless of whether the rule or the variance is used, the requirements are the same in that they both require the groundwater to be monitored for iron, pH, sulfate and total dissolved solids. The only difference is that the variance is limited to a zone size of not more than 20 feet radially from each point of injection, and a duration of not more than 1 year, whereas the rule allows the Remedial Action Plan to tailor the zone size and duration to the specific needs of the site. Still, the Department would like to indicate that zone sizes and durations should be kept within reason, and suggests that those who seek a temporary

injection ZOD for MECX ISCO via rule attempt to limit their requests to not more than 1 year and not more than 50 feet.

In order to obtain permission for a temporary injection ZOD via rule 62-522.300(2)(c), F.A.C., a site-specific Remedial Action Plan proposing MECX ISCO must: (a) indicate that the concentrations of iron, sulfate, and total dissolved solids in the fluid to be injected will be in excess of their groundwater injection standards, and that the pH of the fluid may not be within the required range; (b) specify a temporary zone of discharge size; (c) specify the period of time for which the temporary zone of discharge will be needed; and (d) propose groundwater monitoring of iron, pH, sulfate, and total dissolved solids. The current maximum allowable groundwater concentrations for these parameters, and the allowable range for pH are as follows: iron, 0.3 milligrams per liter (mg/L); pH; range 6.5 to 8.5; sulfate, 250 mg/L; and total dissolved solids, 500 mg/L. If a significant amount of chloride by-product could be produced during the course of a chlorinated solvent cleanup project, then the residual concentration of chloride in the groundwater by the time the project is completed should meet its 250 mg/L secondary groundwater standard. And if the groundwater's natural-occurring background level for any of these parameters at a specific remediation site does not already meet the established standard, then the residual level of that parameter by the time remedial action ends shall be no worse than the pre-existing, pre-injection, natural-occurring background level.

- 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 for the application of MECX ISCO. However, no "designated" monitoring well, dedicated to the tracking of remediation progress (by sampling) shall be used to apply MECX ISCO reagents. 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. Groundwater monitoring:
 - 1. Active remediation petroleum monitoring: For petroleum remediation projects, 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., for the petroleum contaminants of concern. For non-petroleum cleanup projects, the contaminants of concern should be monitored in accordance with the provisions of an approved Remedial Action Plan.
 - 2. Post remediation petroleum monitoring: For petroleum remediation projects, at least one (1) year of quarterly post remediation groundwater monitoring for the petroleum contaminants of concern 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. For non-petroleum cleanup projects, the post remediation monitoring of the contaminants of concern should be conducted in accordance with the provisions of an approved Remedial Action Plan.

3. Underground injection control monitoring: Regardless of whether a cleanup project is for petroleum or non-petroleum contaminants, for Underground Injection Control purposes, when MECX ISCO is injected, the groundwater must be monitored for iron, pH, sulfate, and total dissolved solids pursuant to Rule 62-522.300(2)(c), F.A.C., as discussed above in paragraph *d*.
- g. Underground injection control inventory: Remedial Action Plans proposing injection-type, in situ aquifer 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 3. Only 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 2.
- h. Operation:
 1. Avoidance of migration: For injection-type, in situ aquifer remediation projects, injection of the MECX ISCO reagents shall be performed in such a way, and at such a rate and volume, that no undesirable migration of either the reagents 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 treatment process, the Department suggests 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 the MECX ISCO reagents that will be injected. It is not necessary, however, for the Remedial Action Plan to include the chemical composition of the reagents, since a confidential disclosure of the original CleanOx reagents submitted to the Department on July 17, 1998 is still valid. In lieu, it will suffice in the Remedial Action Plan to only make reference to that original disclosure.
- i. 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.

- j. Open-pit applications: While open-pit application of MECX ISCO reagents is not an injection-type application, and notification of the Underground Injection Control Section therefore not required, the user of MECX ISCO must still be mindful of groundwater quality. For open-pit applications, the Department suggests that groundwater in the application area be monitored for the same parameters that would be monitored had the application been an injection.

SUPPLEMENTAL INFORMATION

- a. Department of Environmental Protection reviewers of injection-type, in situ aquifer remediation plans, regardless of whether in Tallahassee or district offices, must fill in the blanks on the Enclosure 3 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 (Mail Station 3530).

Only the Department and its district offices may approve injection-type, in situ 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: Per rule 62-770.700(2), Florida Administrative Code (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.
- c. Safety reminders: Safety considerations to keep in mind include but are not necessarily limited to the items below.
- Use of proper protective clothing.
 - Proper handling and storage of MECX ISCO reagents, and consideration for their compatibility with other chemicals that they may be placed alongside in storage facilities.
 - Use of containers, tanks and piping constructed from materials that are compatible with the oxidizer and catalyst being used.
 - Proper disposal of unused or unwanted MECX ISCO reagents.

Additional safety items to consider for chemical oxidation-type remediation processes at petroleum cleanup sites are listed in the Bureau of Petroleum Storage Systems' Remedial Action Plan Checklist. A similar checklist exists for non-petroleum cleanup sites.

ENCLOSURE 3

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 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.