IN-SITU APPLICATIONS OF REMEDIATION PRODUCTS

Jennifer L. Rogers, P.E.
Division of Waste Management / Petroleum Restoration Program
Florida Department of Environmental Protection

Tallahassee, Florida | April 28-30, 2026

APPLICATIONS OF REMEDIATION PRODUCTS

AGENDA

In-Situ Applications of Remediation Products:

- Types of Remediation Products.
- Remediation Product Acceptance.
- Methods of Application.
- Approval Orders.
- Underground Injection Control (UIC).
- Reviewing Remedial Action Plans (RAPs).
- Remediation Product Application Monitoring.
- Closure.

In this presentation, Remedial Action Plan (RAP) includes RAPs, RAP Modifications (RAP Mods), Interim Source Removal Proposals (ISRPs), and Pilot Test Plans (PTPs).

APPLICATIONS OF REMEDIATION PRODUCTS

REFERENCES

- Rule – Chapter 62-780 – Contaminated Site Cleanup Criteria.
- Rule – Chapter 62-520 – Ground Water Classes, Standards, and Exemptions.
- Rule – Chapter 62-528 – Underground Injection Control.
- Rule – Chapter 62-550 – Drinking Water Standards, Monitoring, and Reporting.
- Guidance: BPSS-10, In Situ Chemical Additives.
- Innovative Technology Acceptance Program – Accepted Products.
- Guidance for Comparing Background and Site Chemical Concentrations in Groundwater.

APPLICATIONS OF REMEDIATION PRODUCTS

TYPES OF PRODUCTS

Oxidizers:

- Chemical reaction.
  - May be rapid.
- In-Situ Chemical Oxidation (ISCO).
- Examples:
  - Hydrogen Peroxide.
  - Persulfate & activator.
  - Proprietary oxidizers.
  - Ozone.

Bio-Augmentation:

- Microbial consortium.
- Electron acceptor blends.
  - Sulfate.
  - Nitrate.
  - Manganese.
- Controlled release oxygen.
  - Proprietary remediation products.
  - Ozone.

APPLICATIONS OF REMEDIATION PRODUCTS

TYPES OF PRODUCTS

Activated Carbon

- Colloidal carbon.
  - Adsorption.
- May be paired with bio-augmentation.

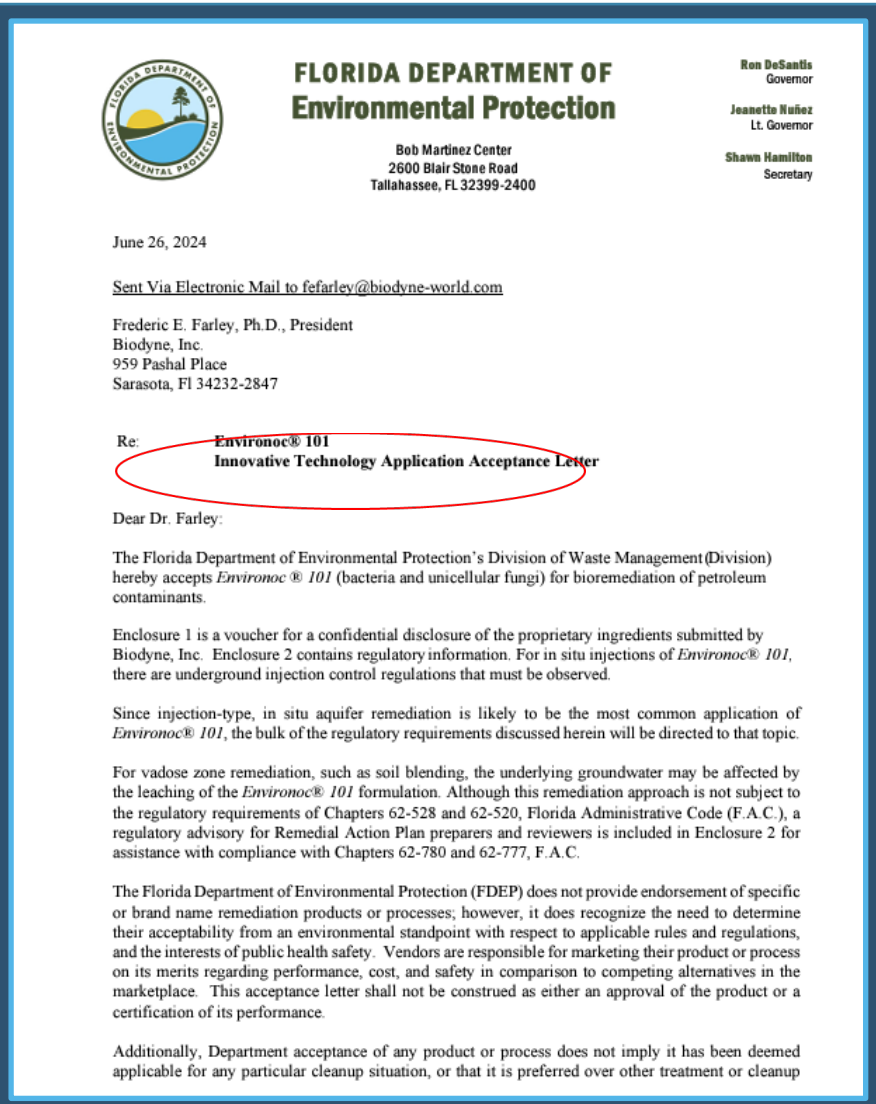
Surfactants:

- Also known as foaming agents.
- Contaminants of Concern (COCs). desorbed from soils.
- May be paired with bio-augmentation.
- Care is needed to prevent plume migration.

APPLICATIONS OF REMEDIATION PRODUCTS
INNOVATIVE TECHNOLOGIES

Accepted Remediation Products:

- Remediation products are accepted through the Innovative Technology Acceptance Program (ITAP).
- Division of Waste: DWM Listing.
- ITAP issues Acceptance Letters.
  - Clips on this and next seven slides are portions of example letters.



FLORIDA DEPARTMENT OF
Environmental Protection

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

Ron DeSantis
Governor

Jeanette Nuñez
Lt. Governor

Shawn Hamilton
Secretary

June 26, 2024

Sent Via Electronic Mail to fefarley@biodyne-world.com

Frederic E. Farley, Ph.D., President
Biodyne, Inc.
959 Pashal Place
Sarasota, Fl 34232-2847

Re: **Environoc® 101**
Innovative Technology Application Acceptance Letter

Dear Dr. Farley:

The Florida Department of Environmental Protection's Division of Waste Management (Division) hereby accepts *Environoc ® 101* (bacteria and unicellular fungi) for bioremediation of petroleum contaminants.

Enclosure 1 is a voucher for a confidential disclosure of the proprietary ingredients submitted by Biodyne, Inc. Enclosure 2 contains regulatory information. For in situ injections of *Environoc® 101*, there are underground injection control regulations that must be observed.

Since injection-type, in situ aquifer remediation is likely to be the most common application of *Environoc® 101*, the bulk of the regulatory requirements discussed herein will be directed to that topic.

For vadose zone remediation, such as soil blending, the underlying groundwater may be affected by the leaching of the *Environoc® 101* formulation. Although this remediation approach is not subject to the regulatory requirements of Chapters 62-528 and 62-520, Florida Administrative Code (F.A.C.), a regulatory advisory for Remedial Action Plan preparers and reviewers is included in Enclosure 2 for assistance with compliance with Chapters 62-780 and 62-777, F.A.C.

The Florida Department of Environmental Protection (FDEP) does not provide endorsement of specific or brand name remediation products or processes; however, 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. Vendors are responsible for marketing their product or process on its merits regarding performance, cost, and safety in comparison to competing alternatives in the marketplace. This acceptance letter shall not be construed as either an approval of the product or a certification of its performance.

Additionally, Department acceptance of any product or process does not imply it has been deemed applicable for any particular cleanup situation, or that it is preferred over other treatment or cleanup

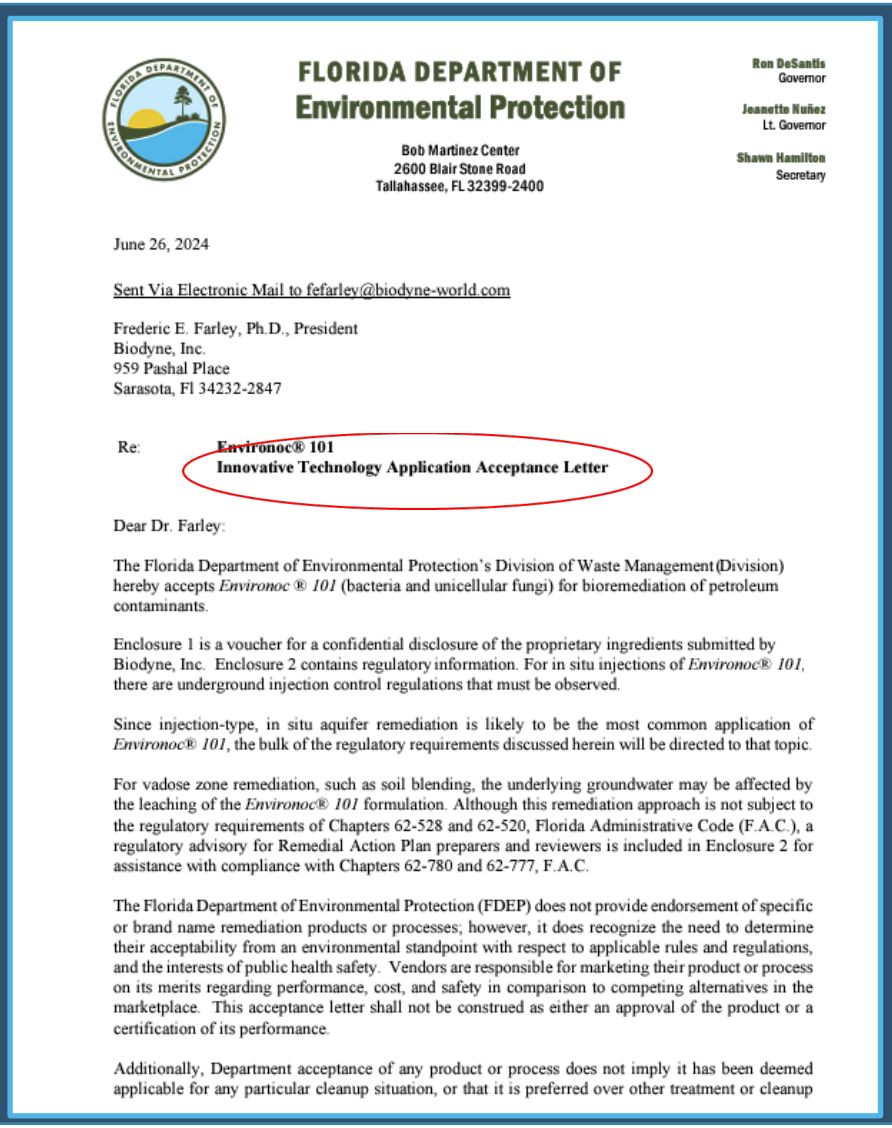
APPLICATIONS OF REMEDIATION PRODUCTS
INNOVATIVE TECHNOLOGIES

Accepted Remediation Products

ITAP Acceptance Letters are:

- Acceptances; not approvals.
  - The approval of the RAP is the approval to use the product(s) at site.
- Vendor/applicant specific.

- Acceptance within 10 years.
- Every ITAP Acceptance Letter varies.



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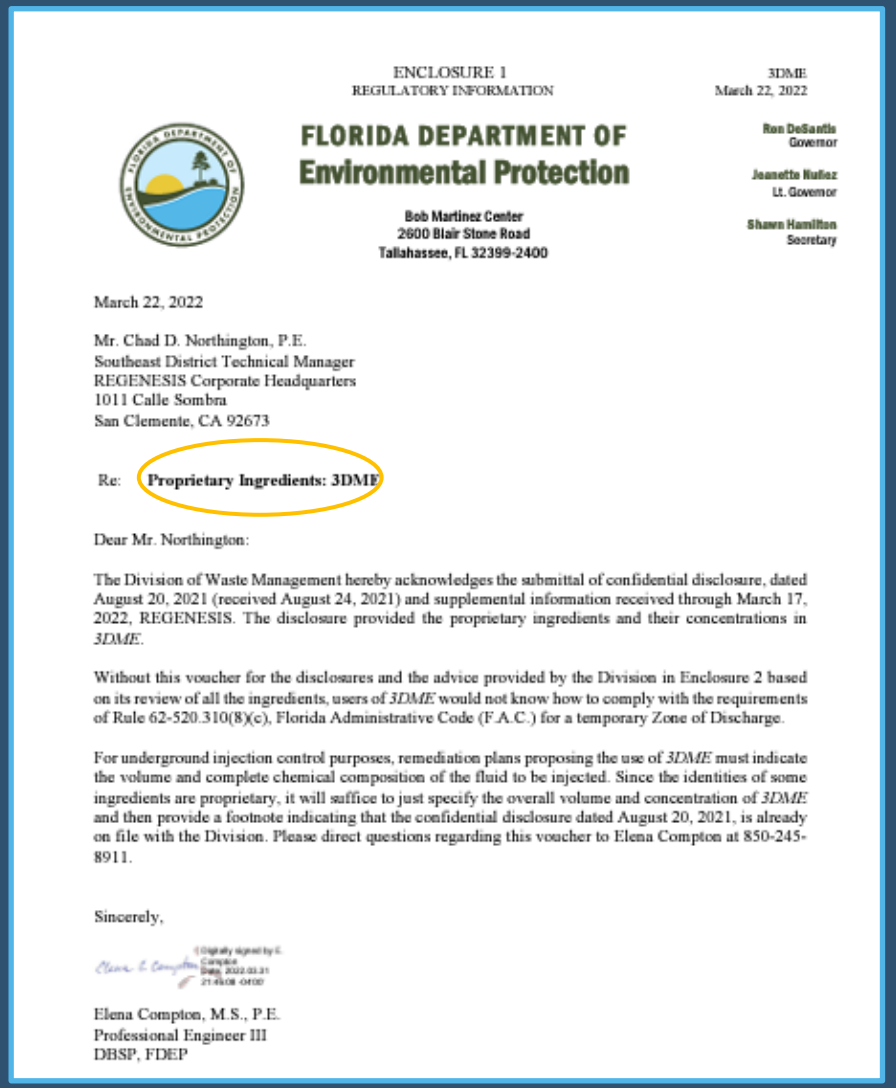
APPLICATIONS OF REMEDIATION PRODUCTS
INNOVATIVE TECHNOLOGIES

Accepted Remediation Products:

- ITAP Acceptance Letters may include:
  - Proprietary Ingredient Letter.



ENCLOSURE 1
REGULATORY INFORMATION

3DME
March 22, 2022

FLORIDA DEPARTMENT OF Environmental Protection

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

Ron DeSantis
Governor

Jeanette Nuñez
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Shawn Hamilton
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March 22, 2022

Mr. Chad D. Northington, P.E.
Southeast District Technical Manager
REGENESIS Corporate Headquarters
1011 Calle Sombra
San Clemente, CA 92673

Re: **Proprietary Ingredients: 3DME**

Dear Mr. Northington:

The Division of Waste Management hereby acknowledges the submittal of confidential disclosure, dated August 20, 2021 (received August 24, 2021) and supplemental information received through March 17, 2022, REGENESIS. The disclosure provided the proprietary ingredients and their concentrations in *3DME*.

Without this voucher for the disclosures and the advice provided by the Division in Enclosure 2 based on its review of all the ingredients, users of *3DME* would not know how to comply with the requirements of Rule 62-520.310(8)(c), Florida Administrative Code (F.A.C.) for a temporary Zone of Discharge.

For underground injection control purposes, remediation plans proposing the use of *3DME* must indicate the volume and complete chemical composition of the fluid to be injected. Since the identities of some ingredients are proprietary, it will suffice to just specify the overall volume and concentration of *3DME* and then provide a footnote indicating that the confidential disclosure dated August 20, 2021, is already on file with the Division. Please direct questions regarding this voucher to Elena Compton at 850-245-8911.

Sincerely,

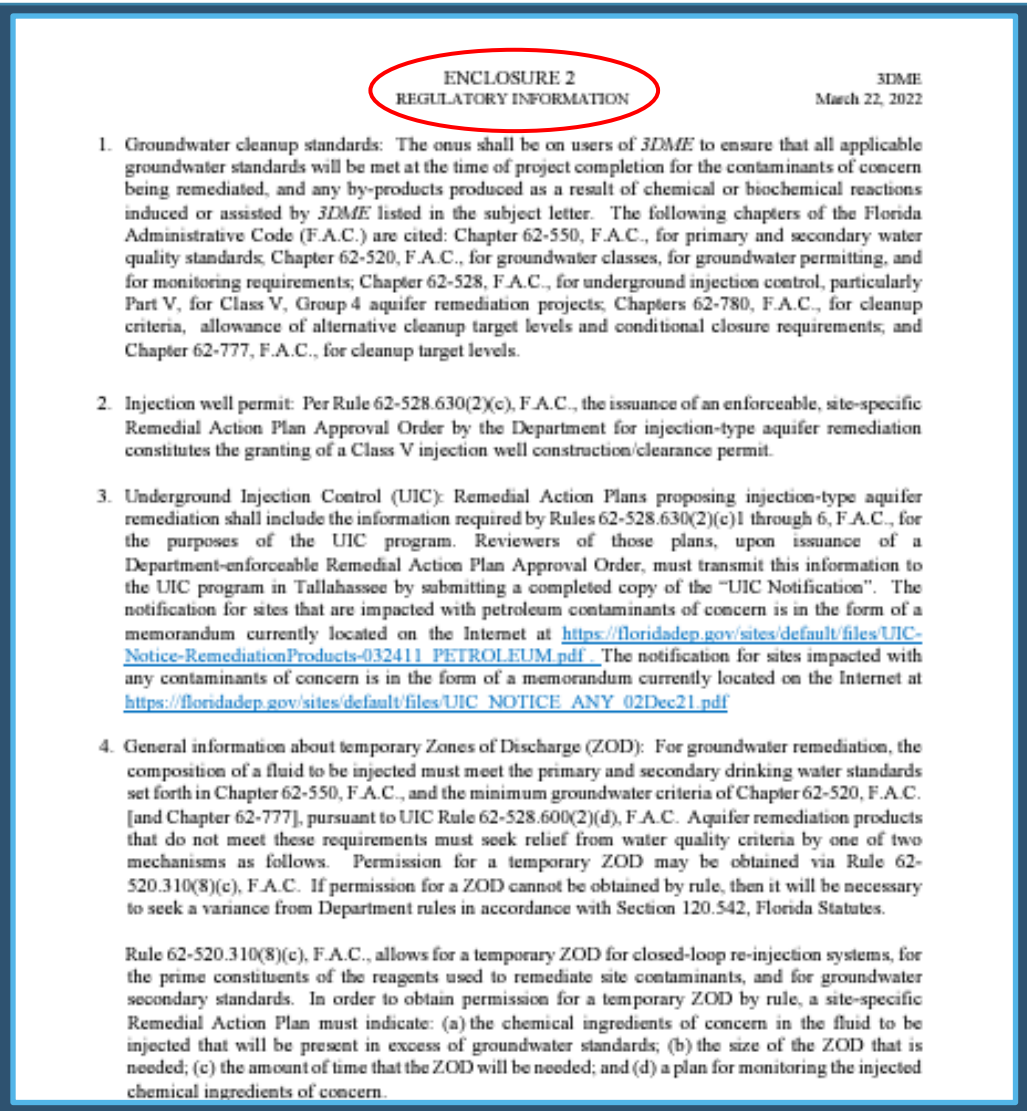
Elena Compton, M.S., P.E.
Professional Engineer III
DBSP, FDEP

APPLICATIONS OF REMEDIATION PRODUCTS
INNOVATIVE TECHNOLOGIES

Accepted Remediation Products:

- ITAP Acceptance Letters may include:
  - Regulatory Information.
    - Establishment of temporary Zone of Discharge (ZOD).
      - Radius of Influence (ROI).

The size of the temporary ZOD will usually be the injection well radius of influence when the treatment system is a single injection point. For a multiple point system, the ZOD can usually be expressed and illustrated as the total area covered by all the injection points, located side-by-side with overlapping radii of influence.



ENCLOSURE 2
REGULATORY INFORMATION

3DME
March 22, 2022

1. Groundwater cleanup standards: The onus shall be on users of *3DME* to ensure that all applicable groundwater standards will be met at the time of project completion for the contaminants of concern being remediated, and any by-products produced as a result of chemical or biochemical reactions induced or assisted by *3DME* listed in the subject letter. 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, for groundwater permitting, and for monitoring requirements; Chapter 62-528, F.A.C., for underground injection control, particularly Part V, for Class V, Group 4 aquifer remediation projects; Chapters 62-780, F.A.C., for cleanup criteria, allowance of alternative cleanup target levels and conditional closure requirements; and Chapter 62-777, F.A.C., for cleanup target levels.

2. Injection well permit: 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.

3. Underground Injection Control (UIC): Remedial Action Plans proposing injection-type aquifer remediation shall include the information required by Rules 62-528.630(2)(c)1 through 6, F.A.C., for the purposes of the UIC program. Reviewers of those plans, upon issuance of a Department-enforceable Remedial Action Plan Approval Order, must transmit this information to the UIC program in Tallahassee by submitting a completed copy of the "UIC Notification". The notification for sites that are impacted with petroleum contaminants of concern is in the form of a memorandum currently located on the Internet at https://floridadep.gov/sites/default/files/UIC-Notice-RemediationProducts-032411_PETROLEUM.pdf . The notification for sites impacted with any contaminants of concern is in the form of a memorandum currently located on the Internet at https://floridadep.gov/sites/default/files/UIC_NOTICE_ANY_02Dec21.pdf

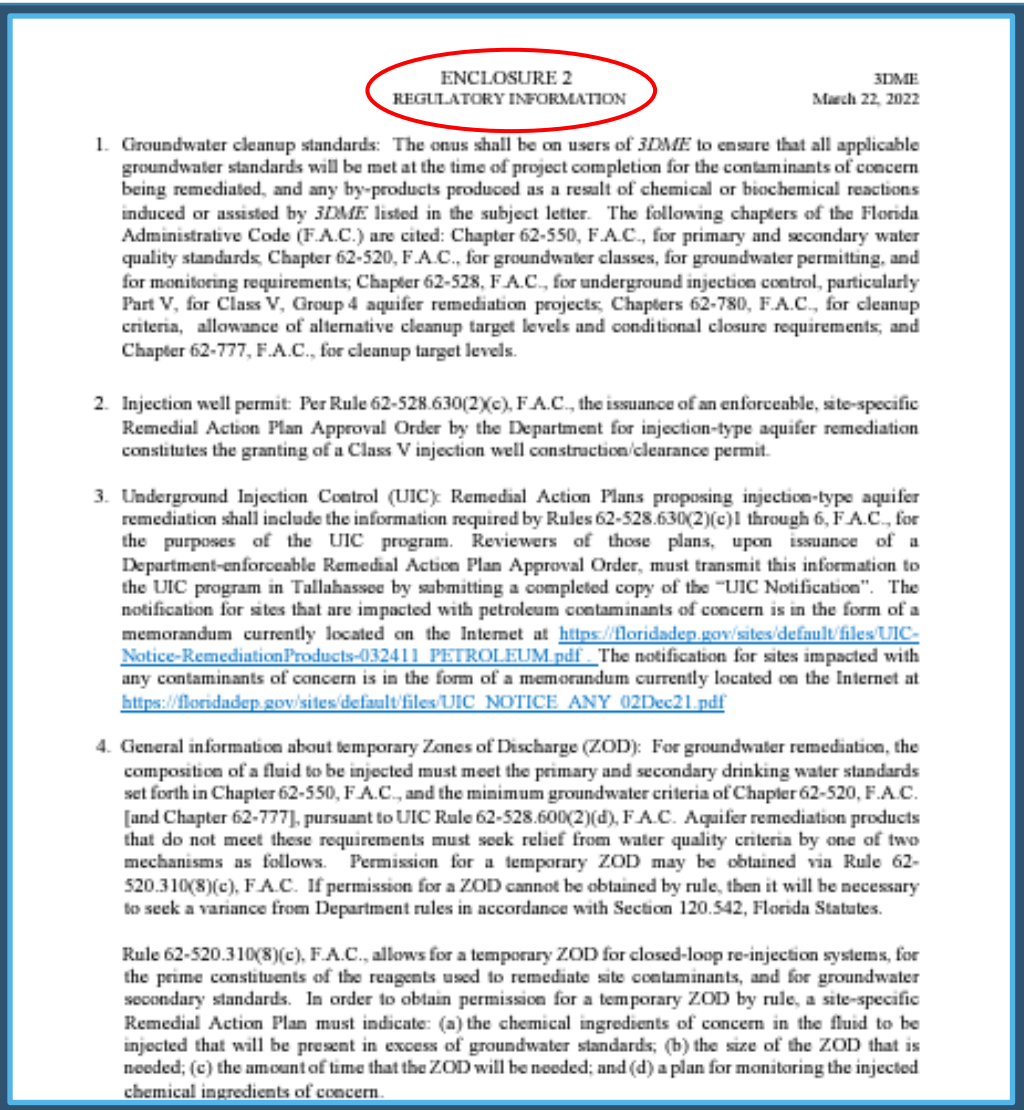
4. General information about temporary Zones of Discharge (ZOD): For groundwater remediation, the composition of a fluid to be injected must meet the primary and secondary drinking water standards set forth in Chapter 62-550, F.A.C., and the minimum groundwater criteria of Chapter 62-520, F.A.C. [and Chapter 62-777], pursuant to UIC Rule 62-528.600(2)(d), F.A.C. Aquifer remediation products that do not meet these requirements must seek relief from water quality criteria by one of two mechanisms as follows. Permission for a temporary ZOD may be obtained via Rule 62-520.310(8)(c), F.A.C. If permission for a ZOD cannot be obtained by rule, then it will be necessary to seek a variance from Department rules in accordance with Section 120.542, Florida Statutes.

   Rule 62-520.310(8)(c), F.A.C., allows for a temporary ZOD for closed-loop re-injection systems, for the prime constituents of the reagents used to remediate site contaminants, and for groundwater secondary standards. In order to obtain permission for a temporary ZOD by rule, a site-specific Remedial Action Plan must indicate: (a) the chemical ingredients of concern in the fluid to be injected that will be present in excess of groundwater standards; (b) the size of the ZOD that is needed; (c) the amount of time that the ZOD will be needed; and (d) a plan for monitoring the injected chemical ingredients of concern.

APPLICATIONS OF REMEDIATION PRODUCTS
INNOVATIVE TECHNOLOGIES

Accepted Remediation Products

- ITAP Acceptance Letters may include:
  - Regulatory Information.
    - Groundwater Monitoring.
      - ZOD Monitoring.
      - Baseline Monitoring.
      - For Injection and Excavation applications.
        - Explicitly or implicitly
      - Minimum requirements
        - Professionals may add as applicable (e.g., color)



ENCLOSURE 2
REGULATORY INFORMATION

3DME
March 22, 2022

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APPLICATIONS OF REMEDIATION PRODUCTS
INNOVATIVE TECHNOLOGIES

Accepted Remediation Products

- ITAP Acceptance Letters may include:
  - Requirements for ZOD monitoring (e.g., parameters and frequency).
    - Parameters may include aluminum, fluoride, foaming agents, iron, sulfate, nitrates, pH, Total Dissolved Solids (TDS), etc.
      - Example clip from ITAP Acceptance Letter:

> c. For the ZOD parameters: aluminum, ammonia, arsenic, chromium, fluoride, lead, nickel, nitrate, nitrite, sodium, sulfate, and TDS shall be monitored. Reviewers of Remedial Action Plans should check the box as shown below when filling out the UIC Notification memorandum:
>
> "☑ *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. ...".

  - Specific laboratory analytical methods may also be specified.
  - ZOD permission by Rule.

APPLICATIONS OF REMEDIATION PRODUCTS
INNOVATIVE TECHNOLOGIES

Accepted Remediation Products

- ITAP Acceptance Letters may include:
  - Monitoring in addition to ZOD parameters.
    - Additional monitoring parameters may include:
      - Antimony, thallium, 1,4-dioxane, ethylene glycol, etc.
    - Example acceptance letter requirement (clip from ITAP Acceptance Letter below), “these parameters are not ZOD monitoring parameters but should be included in the baseline sampling and then annually following treatment to demonstrate and verify compliance with Chapter 62-528, F.A.C.”


iii. These parameters are not ZOD monitoring parameters but should be included in the baseline sampling and then annually following treatment to demonstrate and verify compliance with Chapter 62-528, F.A.C.

    - If exceedances of applicable standards (e.g., primary drinking water standards), remediation product may not have been properly diluted.

APPLICATIONS OF REMEDIATION PRODUCTS
INNOVATIVE TECHNOLOGIES

Accepted Remediation Products

- ITAP Acceptance Letters may include:
  - Application Requirements (e.g., avoidance of migration, dilution requirements).
    - Examples clips from ITAP Acceptance Letters:

a. The pre-injection concentrations of MicroFUEL must not exceed 0.75 lbs per four (4) gallons of water.

a. Per Innovative Remedial Solutions, Inc., the recommended pre-injection concentration is 5 gallons of PetroBloom diluted with 200 gallons of water. A ZOD is not needed for PetroBloom at the recommended injection concentration. The pre-injection concentration may not exceed 1:4 (1 part of PetroBloom to 4 parts of water).

d. Required UIC ZOD compliance for *PersulfOx*® to comply with paragraph 62-520.310(8)(c), F.A.C.: pre-injection dilution at least to 20% by weight.

a. The concentration of PetroFix in pre-injection fluids must not exceed 160 grams per liter (160 g/L). Since PetroFix is delivered as colloidal suspension at a concentration of 320 grams of PetroFix per liter of the total volume of the suspension, it must be at least 50 % diluted (1 part of the PetroFix colloidal suspension to 1 part of water) prior to injection into the subsurface.

b. The concentration of Electron Acceptor Blend – Regular in pre-injection fluids must not exceed 4 grams per liter (4 g/L), or 0.4 % diluted (4 parts of electron acceptor diluted in approximately 1,000 parts of water) prior to injection into the subsurface.

APPLICATIONS OF REMEDIATION PRODUCTS
METHODS OF APPLICATION

INJECTION

Remediation products may be applied by injection through:

- Wells (photo).
  - Vertical wells including wells installed using Horizontal Directional Drill (HDD) methods.
- Direct Push Technology (DPT) points.
  - Permitting may be required for each DPT point.
- Large Diameter Auger (LDA) boring.
  - Considered an injection point.

Source: James Russel, Orange County.

APPLICATIONS OF REMEDIATION PRODUCTS

METHODS OF APPLICATION

Open Pits – Excavations

Remediation products may be applied to open pits or excavations (photo).

- Proper Mixing.
  - Injections.
  - Excavations.
- Proper Order.
  - Injections.
  - Excavations.

Source: Environmental Risk Management (ERMI)

APPLICATIONS OF REMEDIATION PRODUCTS

METHODS OF APPLICATION

Injections, including LDA borings, and Open Pit Excavations

- Guidance:
  - BPSS-10, In Situ Chemical Additives.
- Per BPSS-10, Paragraph 14:
  - An open pit is considered a "subsurface fluid distribution system".
  - Requirements for injections apply to open pit applications.
    - Establishment of ZOD.
    - Monitoring.
    - Enforceable Order.

BPSS-10 clips:

Petroleum Cleanup Program

REMEDIAL ACTION PLAN GUIDELINES

BUREAU OF PETROLEUM STORAGE SYSTEMS

History: New 5/1/98, Revised 11/4/98, 3/16/00, 1/22/02, 7/16/05, 3/14/11

Identification No.: BPSS-10
Topic of Guideline: In Situ Chemical Additives

Thomas W. Conaway 3/11/11
Signature and Date
CHIEF ENGINEER

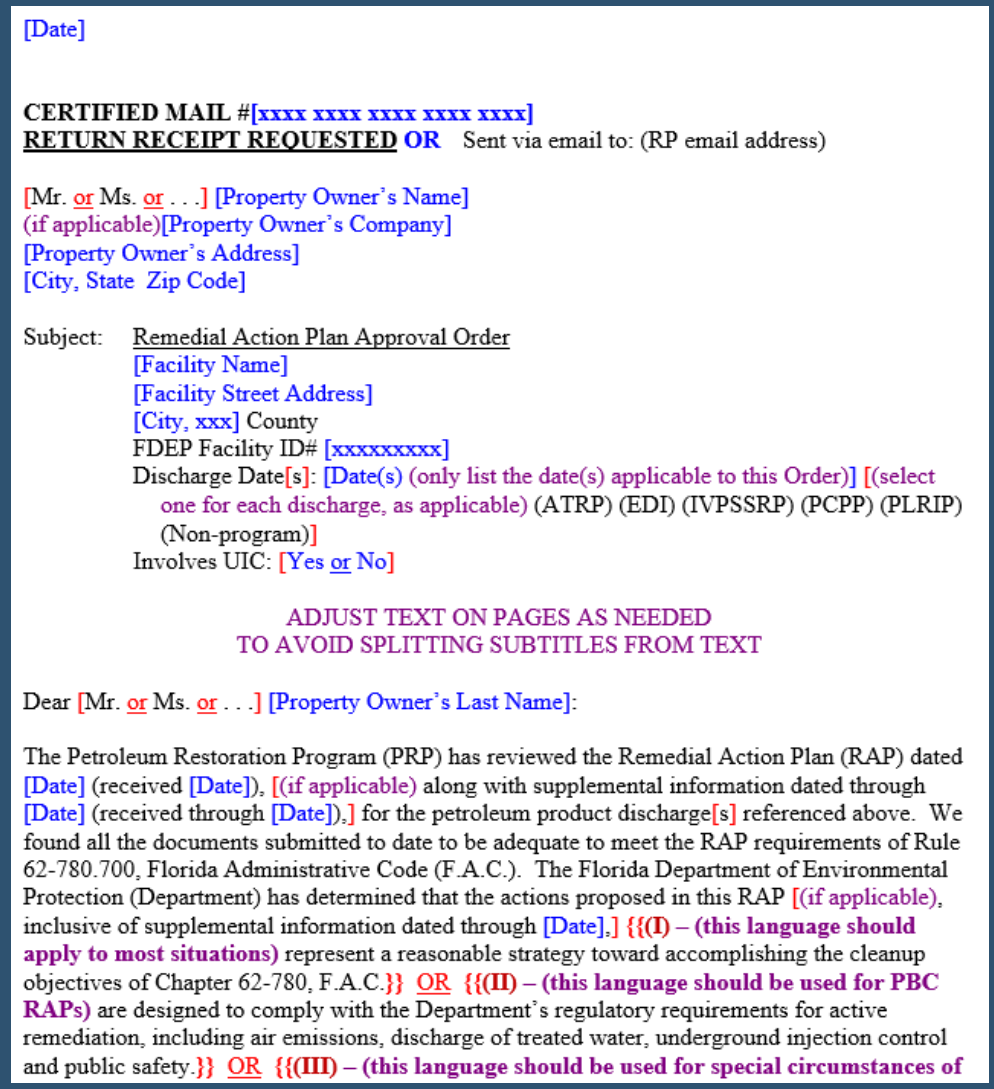
Charles T. Williams 3/11/11
Signature and Date
(ACTING) BUREAU CHIEF

14. **Open pit applications.** When used for beneficial cleanup of a contaminated site undergoing site rehabilitation under Department cleanup rules, application of remediation products to an excavation is considered to be a "subsurface fluid distribution system" and therefore may be authorized under the procedures of this guidance, including the need for prior authorization of the application of the product with an enforceable FDEP Order, establishing a zone of discharge, and post application monitoring of the residual effects of the remediation product. However, at this time these applications do not need to be reported by the cleanup programs to the Department's UIC Section.

APPLICATIONS OF REMEDIATION PRODUCTS
APPROVAL ORDERS

Enforceable Approval Orders:

- Per BPSS-10, remediation product applications require an enforceable Approval Order.
  - For a RAP that includes remediation product application, the RAP Approval Order is the applicable enforceable Approval Order.
  - For an ISRP, the ISRP Approval Order is the applicable enforceable Approval Order.
  - Use applicable Approval Order template.
    - Clip is a portion of the RAP Approval Order template.



[Date]

CERTIFIED MAIL #[xxxx xxxx xxxx xxxx xxxx]
RETURN RECEIPT REQUESTED OR Sent via email to: (RP email address)

[Mr. or Ms. or . . .] [Property Owner's Name]
(if applicable)[Property Owner's Company]
[Property Owner's Address]
[City, State Zip Code]

Subject: Remedial Action Plan Approval Order
[Facility Name]
[Facility Street Address]
[City, xxx] County
FDEP Facility ID# [xxxxxxxxx]
Discharge Date[s]: [Date(s) (only list the date(s) applicable to this Order)] [(select one for each discharge, as applicable) (ATRP) (EDI) (IVPSSRP) (PCPP) (PLRIP) (Non-program)]
Involves UIC: [Yes or No]

ADJUST TEXT ON PAGES AS NEEDED
TO AVOID SPLITTING SUBTITLES FROM TEXT

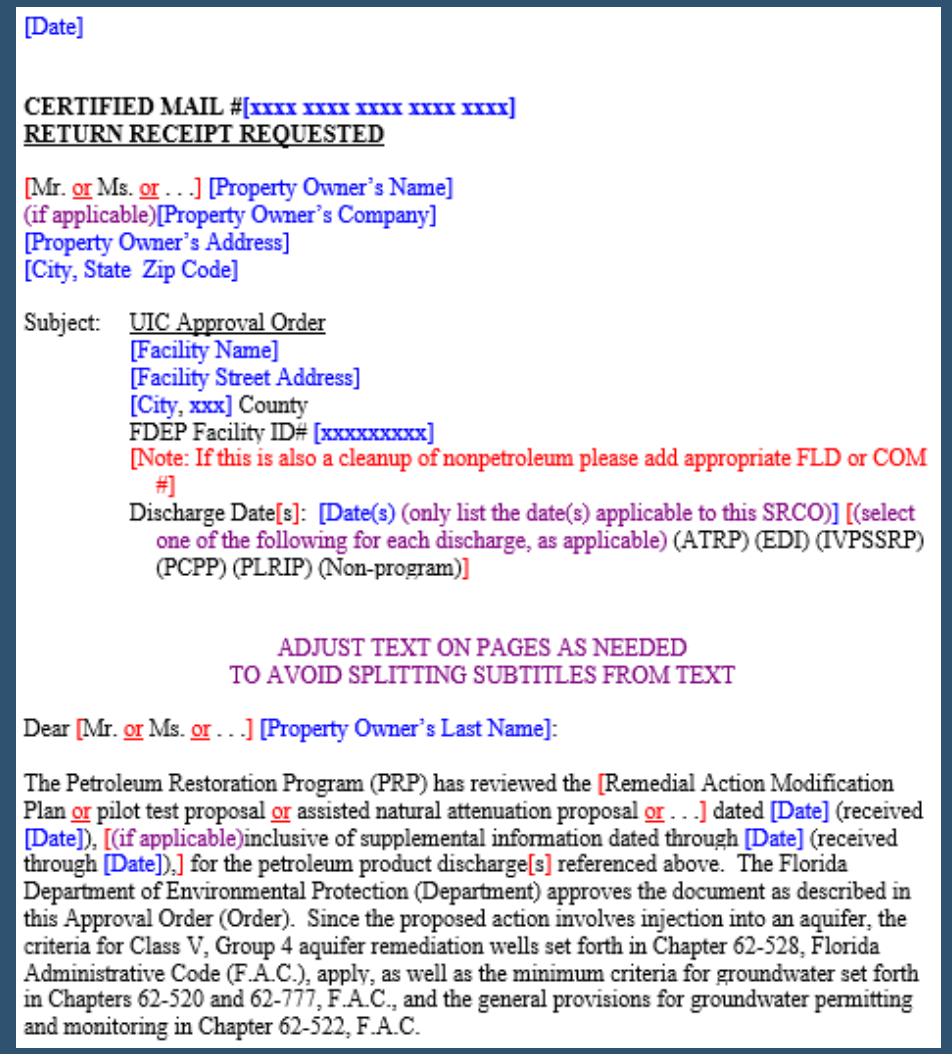
Dear [Mr. or Ms. or . . .] [Property Owner's Last Name]:

The Petroleum Restoration Program (PRP) has reviewed the Remedial Action Plan (RAP) dated [Date] (received [Date]), [(if applicable) along with supplemental information dated through [Date] (received through [Date]),] for the petroleum product discharge[s] referenced above. We found all the documents submitted to date to be adequate to meet the RAP requirements of Rule 62-780.700, Florida Administrative Code (F.A.C.). The Florida Department of Environmental Protection (Department) has determined that the actions proposed in this RAP [(if applicable), inclusive of supplemental information dated through [Date],] **{{(I) – (this language should apply to most situations)** represent a reasonable strategy toward accomplishing the cleanup objectives of Chapter 62-780, F.A.C.**}}** OR **{{(II) – (this language should be used for PBC RAPs)** are designed to comply with the Department's regulatory requirements for active remediation, including air emissions, discharge of treated water, underground injection control and public safety.**}}** OR **{{(III) – (this language should be used for special circumstances of**

APPLICATIONS OF REMEDIATION PRODUCTS
APPROVAL ORDERS

Enforceable Approval Orders:

- Per BPSS-10, remediation product applications require an enforceable Approval Order.
  - For RAP Modifications (RAP Mods) or Pilot Test Plans (PTPs), for which RAP Approval Orders are typically not issued, an Underground Injection Control (UIC) Approval Order is the applicable enforceable Approval Order.
  - Use applicable Approval Order template.
    - Clip is a portion of the UIC Approval Order template.



[Date]

CERTIFIED MAIL #[xxxx xxxx xxxx xxxx xxxx]
RETURN RECEIPT REQUESTED

[Mr. or Ms. or . . .] [Property Owner's Name]
(if applicable)[Property Owner's Company]
[Property Owner's Address]
[City, State Zip Code]

Subject: UIC Approval Order
[Facility Name]
[Facility Street Address]
[City, xxx] County
FDEP Facility ID# [xxxxxxxxx]
[Note: If this is also a cleanup of nonpetroleum please add appropriate FLD or COM #]
Discharge Date[s]: [Date(s) (only list the date(s) applicable to this SRCO)] [(select one of the following for each discharge, as applicable) (ATRP) (EDI) (IVPSSRP) (PCPP) (PLRIP) (Non-program)]

ADJUST TEXT ON PAGES AS NEEDED
TO AVOID SPLITTING SUBTITLES FROM TEXT

Dear [Mr. or Ms. or . . .] [Property Owner's Last Name]:

The Petroleum Restoration Program (PRP) has reviewed the [Remedial Action Modification Plan or pilot test proposal or assisted natural attenuation proposal or . . .] dated [Date] (received [Date]), [(if applicable)inclusive of supplemental information dated through [Date] (received through [Date]),] for the petroleum product discharge[s] referenced above. The Florida Department of Environmental Protection (Department) approves the document as described in this Approval Order (Order). Since the proposed action involves injection into an aquifer, the criteria for Class V, Group 4 aquifer remediation wells set forth in Chapter 62-528, Florida Administrative Code (F.A.C.), apply, as well as the minimum criteria for groundwater set forth in Chapters 62-520 and 62-777, F.A.C., and the general provisions for groundwater permitting and monitoring in Chapter 62-522, F.A.C.

APPLICATIONS OF REMEDIATION PRODUCTS
APPROVAL ORDERS

RAP Approval Orders:

- The Petroleum Restoration Program (PRP) typically only issues one (1) RAP Approval Order per discharge (or discharges).
- Subsequent RAPs, whether scoped as RAPs or RAP Modifications, are considered modifications to the original RAP.
  - Unless revoked, modified or amended (all in writing), original RAP Approval Order remains enforceable until closure is achieved.
  - After one RAP Approval Order has been issued for the applicable discharge(s), subsequent plans proposing remediation product application need to be approved using a UIC Approval Order.

APPLICATIONS OF REMEDIATION PRODUCTS
APPROVAL ORDERS

UIC Approval Orders:

- Discharge(s) may have multiple UIC Approval Orders.
- Each UIC Approval Order applies to a specific plan proposing defined:
  - Remediation product(s) to be applied,
  - Application location(s),
  - Application methodology, and
  - Application volume(s).
- Any remediation product application proposed to vary from or beyond the approved defined plan (e.g., greater volume, additional points, etc.) requires an applicable RAP Modification and UIC Approval Order.

APPLICATIONS OF REMEDIATION PRODUCTS

APPROVAL ORDERS

RAP/ISRP/UIC Approval Order Package:

- Submit request for RAP, ISRP, or UIC Approval Order to the Program Administrator's Office (PAO).
  - Submittal shall include:
    - RAP, ISRP, or UIC Approval Order template, as applicable, as a word document, edited with site-specific information.
    - Professional Recommendation Memo.
      - All requests for Orders require the Professional Recommendation Memo.
    - UIC Notification Memorandum and applicable attachments, unless not required (see next slides).

UIC Approval Order Template:

[Date]

CERTIFIED MAIL #[xxxx xxxx xxxx xxxx xxxx]
RETURN RECEIPT REQUESTED

[Mr. or Ms. or . . .] [Property Owner's Name]
(if applicable)[Property Owner's Company]
[Property Owner's Address]
[City, State Zip Code]

Subject: UIC Approval Order
[Facility Name]
[Facility Street Address]
[City, xxx] County
FDEP Facility ID# [xxxxxxxxx]
[Note: If this is also a cleanup of nonpetroleum please add appropriate FLD or COM #]
Discharge Date[s]: [Date(s) (only list the date(s) applicable to this SRCO)] [(select one of the following for each discharge, as applicable) (ATRP) (EDI) (IVPSSRP) (PCPP) (PLRIP) (Non-program)]

ADJUST TEXT ON PAGES AS NEEDED
TO AVOID SPLITTING SUBTITLES FROM TEXT

Dear [Mr. or Ms. or . . .] [Property Owner's Last Name]:

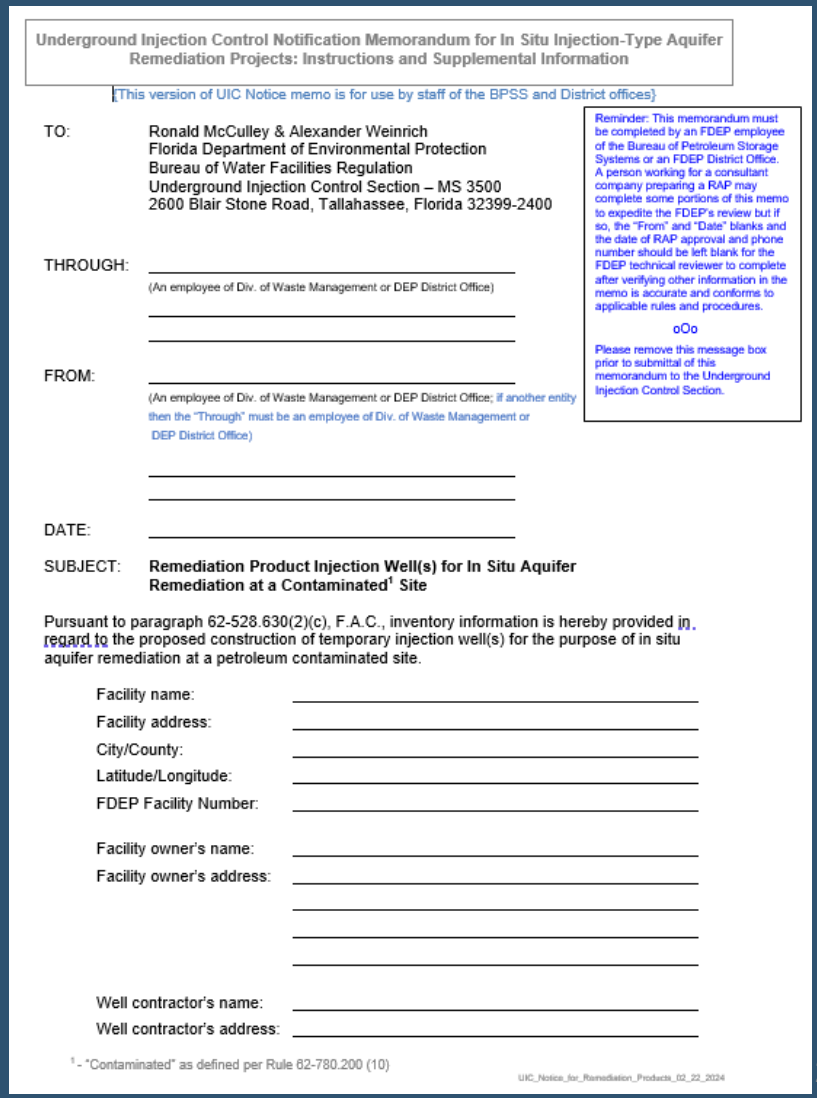
The Petroleum Restoration Program (PRP) has reviewed the [Remedial Action Modification Plan or pilot test proposal or assisted natural attenuation proposal or . . .] dated [Date] (received [Date]), [(if applicable)inclusive of supplemental information dated through [Date] (received through [Date]),] for the petroleum product discharge[s] referenced above. The Florida Department of Environmental Protection (Department) approves the document as described in this Approval Order (Order). Since the proposed action involves injection into an aquifer, the criteria for Class V, Group 4 aquifer remediation wells set forth in Chapter 62-528, Florida Administrative Code (F.A.C.), apply, as well as the minimum criteria for groundwater set forth in Chapters 62-520 and 62-777, F.A.C., and the general provisions for groundwater permitting and monitoring in Chapter 62-522, F.A.C.

APPLICATIONS OF REMEDIATION PRODUCTS

UNDERGROUND INJECTION CONTROL (UIC)

UIC Notification Memorandum:

- There are two UIC Notification Memorandums:
  - 1) For Remediation Products; and,
  - 2) For Air Sparging.
- This presentation focuses on the use of remediation products and associated UIC Notification Memo.
- Clip is from UIC Notification Memo for remediation products.



Underground Injection Control Notification Memorandum for In Situ Injection-Type Aquifer Remediation Projects: Instructions and Supplemental Information

{This version of UIC Notice memo is for use by staff of the BPSS and District offices}

TO: Ronald McCulley & Alexander Weinrich
Florida Department of Environmental Protection
Bureau of Water Facilities Regulation
Underground Injection Control Section – MS 3500
2600 Blair Stone Road, Tallahassee, Florida 32399-2400

THROUGH: _____
(An employee of Div. of Waste Management or DEP District Office)

FROM: _____
(An employee of Div. of Waste Management or DEP District Office; if another entity then the "Through" must be an employee of Div. of Waste Management or DEP District Office)

DATE: _____

SUBJECT: **Remediation Product Injection Well(s) for In Situ Aquifer Remediation at a Contaminated[1] Site**

Reminder: This memorandum must be completed by an FDEP employee of the Bureau of Petroleum Storage Systems or an FDEP District Office. A person working for a consultant company preparing a RAP may complete some portions of this memo to expedite the FDEP's review but if so, the "From" and "Date" blanks and the date of RAP approval and phone number should be left blank for the FDEP technical reviewer to complete after verifying other information in the memo is accurate and conforms to applicable rules and procedures.

oOo

Please remove this message box prior to submittal of this memorandum to the Underground Injection Control Section.

Pursuant to paragraph 62-528.630(2)(c), F.A.C., inventory information is hereby provided in regard to the proposed construction of temporary injection well(s) for the purpose of in situ aquifer remediation at a petroleum 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: _____
Well contractor's address: _____

[1] - "Contaminated" as defined per Rule 62-780.200 (10)

UIC_Notice_for_Remediation_Products_02_22_2024

APPLICATIONS OF REMEDIATION PRODUCTS
UNDERGROUND INJECTION CONTROL (UIC)

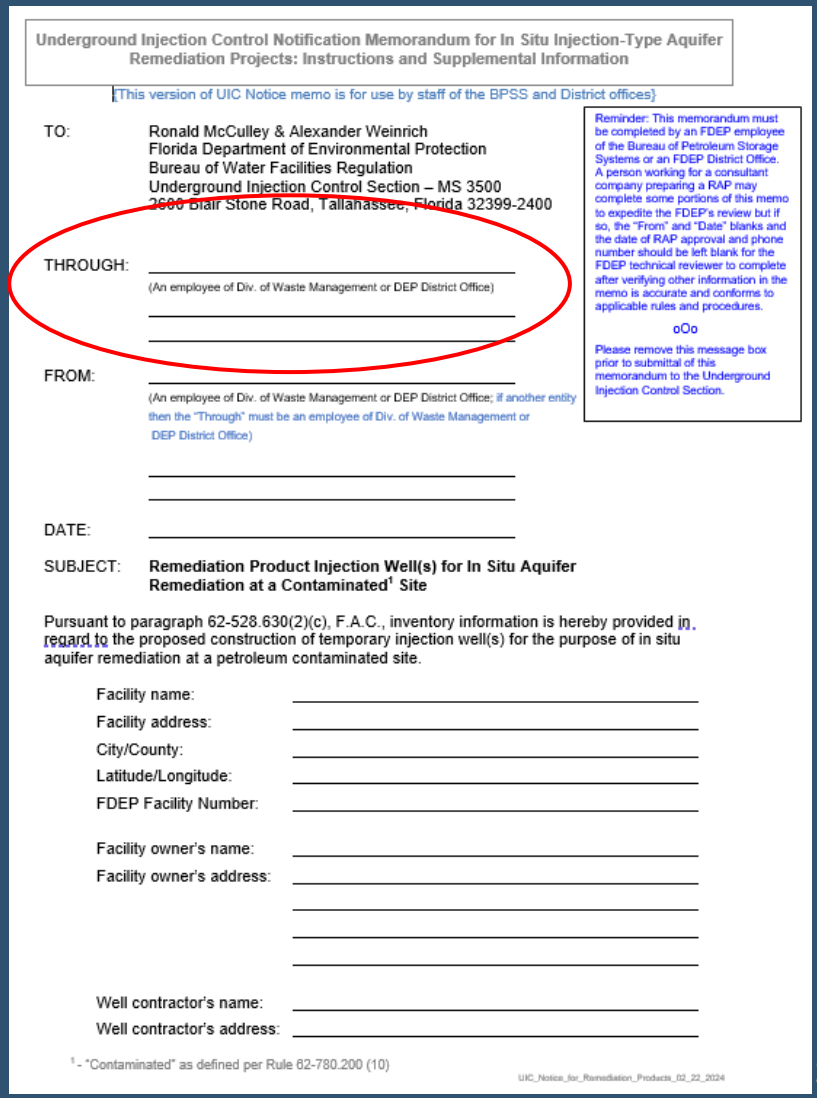
UIC Notification Memorandum:

- UIC Notification Memorandums are required for:
  - Injections (e.g., wells, DPT points); and,
  - Applications to LDA borings.
- UIC Notification Memorandums are not required for remediation product applications to:
  - Open pits/excavations;
  - Infiltration galleries; or,
  - Trenches.

APPLICATIONS OF REMEDIATION PRODUCTS
UNDERGROUND INJECTION CONTROL (UIC)

UIC Notification Memorandum:

- When required, Contractor or Site Manager complete the UIC Notification Memo based on information in RAP.
  - Memo should be through a DEP employee.
    - See clip.



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Facility owner's address: _____

Well contractor's name: _____
Well contractor's address: _____

[1] - "Contaminated" as defined per Rule 62-780.200 (10)

UIC_Notice_for_Remediation_Products_02_22_2024

APPLICATIONS OF REMEDIATION PRODUCTS
UNDERGROUND INJECTION CONTROL (UIC)

UIC Notification Memorandum:

- Temporary ZOD Section (clip from UIC Notification Memorandum).
  - Select ZOD permission by Rule as applicable (see ITAP Acceptance Letter).
  - List ZOD monitoring parameters to match ITAP Acceptance Letter.

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 chemical species and parameters for which the approved Remedial Action Plan identifies zone size and duration, and addresses groundwater monitoring are summarized below.

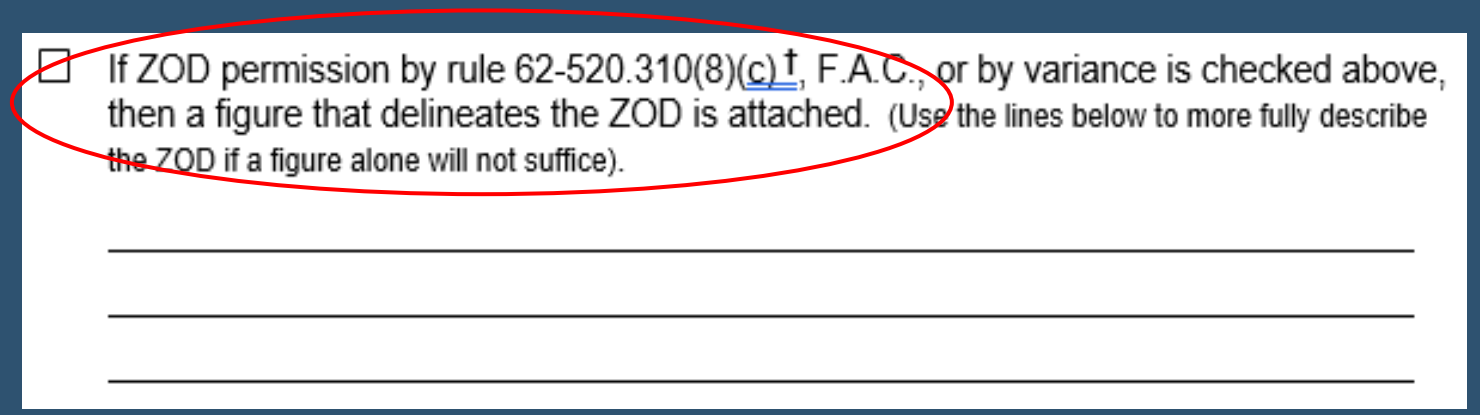
Chemical species & parameters: aluminum, ammonia, arsenic, chromium, fluoride, lead, nickel, sulfate, and TDS.

Zone size (sq. ft.) 400 Duration (mos.) 12 Yes, monitoring addressed. ☒

APPLICATIONS OF REMEDIATION PRODUCTS
UNDERGROUND INJECTION CONTROL (UIC)

UIC Notification Memorandum:

- If ZOD permission by Rule (clip from UIC Notification Memorandum).
  - Attach a figure depicting the ZOD.
    - Recommend also depicting the extents of groundwater impacts (plume).



☐ 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. (Use the lines below to more fully describe the ZOD if a figure alone will not suffice).

_____

_____

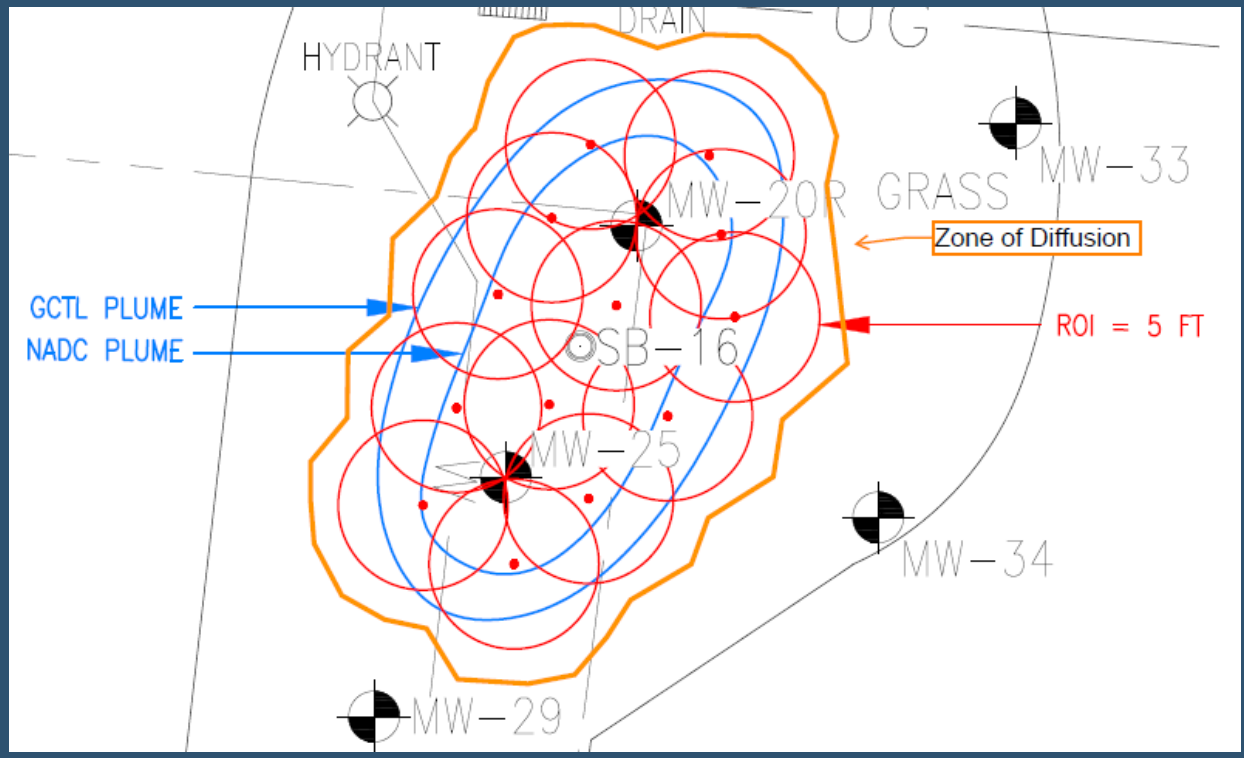
_____

APPLICATIONS OF REMEDIATION PRODUCTS
UNDERGROUND INJECTION CONTROL (UIC)

UIC Notification Memorandum:

- Example Figure depicting ZOD:
  - ZOD for different aspects of remediation product.
    - Colloidal carbon ~ 5 feet
    - Electron acceptor blend a few feet beyond.
  - ZOD extends beyond source property boundaries.
    - Temporary Points of Compliance (e.g., TPOC wells) are needed.

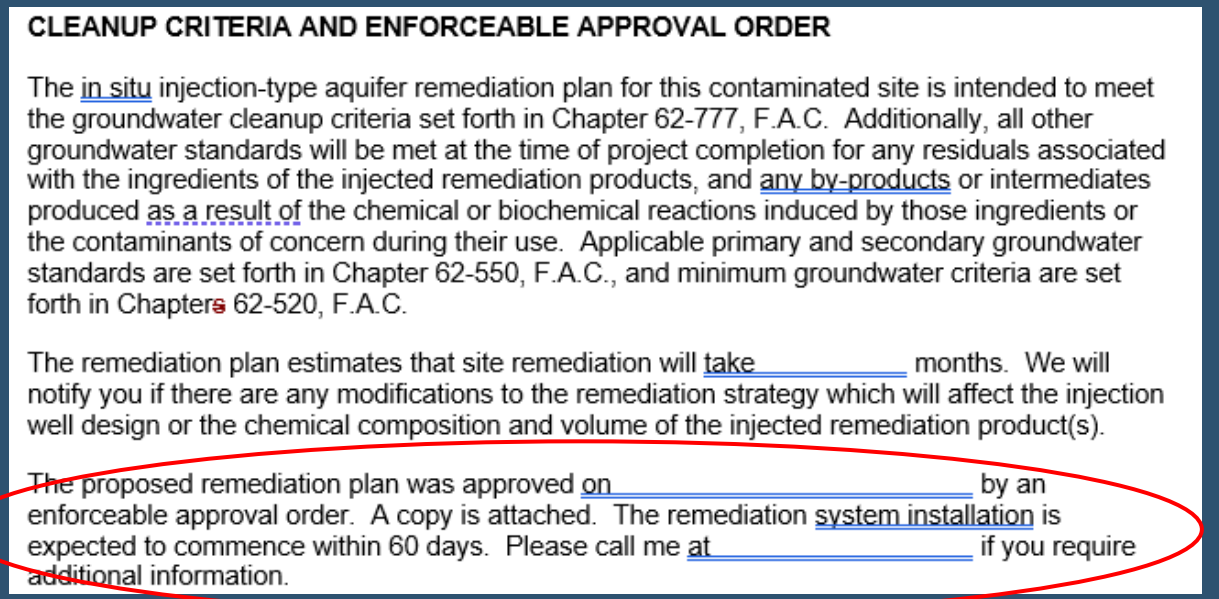
Clip of example ZOD depiction:



APPLICATIONS OF REMEDIATION PRODUCTS
UNDERGROUND INJECTION CONTROL (UIC)

UIC Notification Memorandum:

- Once applicable Approval Order is issued, the PAO submits the UIC Notification Memorandum to the Bureau of Water Facilities Regulation.
- On the last page of the memorandum the PAO will input the date of the applicable Approval Order.
  - Date of enforceable Approval Order may not be the same date the deliverable was approved.
  - See clip from UIC Memo:



CLEANUP CRITERIA AND ENFORCEABLE APPROVAL ORDER

The in situ injection-type aquifer remediation plan for this contaminated site is intended to meet the groundwater cleanup criteria set forth in Chapter 62-777, 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 reactions induced by those ingredients or the contaminants of concern during their use. Applicable primary and secondary groundwater standards are set forth in Chapter 62-550, F.A.C., and minimum groundwater criteria are set forth in Chapters 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.

APPLICATIONS OF REMEDIATION PRODUCTS

REVIEWING RAPs

Reviewing RAPs

- RAPs should include:
  - Copy of ITAP Acceptance Letter(s) and all enclosures.
  - Monitoring requirements per ITAP Acceptance Letter(s).
  - Proposed application methodology (e.g., dilution) in accordance with ITAP Acceptance Letter(s).
  - Draft UIC Notification Memorandum.
    - For application by injection including LDA boring applications.

APPLICATIONS OF REMEDIATION PRODUCTS
MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Establish either background concentrations or baseline concentrations.
  - Baseline concentrations may not be background concentrations.
  - Background concentrations.
    - Per subsection 62-780.200(3), F.A.C., “Background concentrations” means concentrations of contaminants that are naturally occurring or resulting from anthropogenic impacts unrelated to the discharge of pollutants or hazardous substances at a contaminated site undergoing site rehabilitation, in the groundwater, surface water, soil, or sediment in the vicinity of the site.

APPLICATIONS OF REMEDIATION PRODUCTS
MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Establish either background concentrations or baseline concentrations.
  - Background concentrations.
    - Guidance for Comparing Background and Site Chemical Concentrations in Groundwater.
    - Establishment of background concentrations can require a substantial effort.
    - For example, “A minimum of three groundwater wells sampled quarterly for one year per impacted aquifer zone is a good rule-of-thumb for background sampling.”

APPLICATIONS OF REMEDIATION PRODUCTS

MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Establish either background concentrations or baseline concentrations.
  - Background concentrations:
    - Guidance for Comparing Background and Site Chemical Concentrations in Soil.
    - Although the title of the guidance document is specific to soils, this guidance has a lot of great general information with respect to establishment of background concentrations.
    - Establishment of background concentrations can require a substantial effort.
    - For example, for direct comparison method, “a minimum of seven background samples is needed.” That is, seven different locations.

APPLICATIONS OF REMEDIATION PRODUCTS

MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Establish either background concentrations or baseline concentrations.
  - Baseline concentrations.
    - May be easier to establish than background concentrations.
    - Based on a sampling event performed prior to active remediation; i.e., conducted prior to application of remediation product(s).
  - Not required – strongly recommended.
    - Clip from ITAP letter:

> 10. Baseline Sampling: Baseline sampling (prior to any injection) for the ZOD monitoring parameters (and the impurities) is not required but is strongly recommended. The baseline sampling data is very useful for evaluating when the aquifer has returned to the pre-injection conditions.

APPLICATIONS OF REMEDIATION PRODUCTS

MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Baseline Sampling – Recommendations:
  - Develop based on plans for Active Remediation Monitoring (ARM), Post Active Remediation Monitoring (PARM), and, as applicable, Natural Attenuation Monitoring (NAM).
  - Review history of site to determine if any prior remediation products were applied.
    - If yes, examine associated sampling and analytical results.
  - More than one baseline sampling event may be beneficial for establishing baseline concentrations.
    - Some typical parameters used to monitor ZODs tend to vary across a site, including short distances.
    - For example, iron, salinity, TDS, etc.

APPLICATIONS OF REMEDIATION PRODUCTS

MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Baseline Sampling – Recommendations:
  - If remediation product to be applied includes electron acceptors, and site-specific concentrations of electron acceptors have not yet been evaluated, baseline sampling may be beneficial for confirming formulation of product.
    - For example, nitrate, manganese, iron, sulfate, etc. may not be a limiting factor to bioremediation at the site.
    - Allow time between baseline sampling and product application to assess.
    - Include site-specific electron acceptor assessment and confirmation of remediation product formulation in RAP, if not done previously.

APPLICATIONS OF REMEDIATION PRODUCTS

MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Active Remediation Monitoring (ARM).
  - Portion of applied remediation product remains active.
  - Active portion of remediation product may be:
    - Surfactants, electron acceptors, etc.
    - Active for minutes, days, months, etc. after application.

APPLICATIONS OF REMEDIATION PRODUCTS
MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Active Remediation Monitoring (ARM):
  - RAP shall present the conditions used to determine when the remediation product is no longer active and when PARM will begin.
    - Active portion of product (e.g., electron acceptors) exhausted/expended.
  - May be followed by either PARM or NAM.
    - Bio-augmentation (e.g., addition of an electron acceptor blend) is an active remedial strategy that is not equivalent to NAM, which is a passive remedial strategy.

APPLICATIONS OF REMEDIATION PRODUCTS

MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Post Active Remediation Monitoring (PARM).
  - PARM is used to verify that active remediation has effectively remediated a site to achieve closure goals.
    - COCs are typically below Cleanup Target Levels (CTLs) for the site.
  - PARM shall be implemented per Rule 62-780.750, F.A.C.

APPLICATIONS OF REMEDIATION PRODUCTS

MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Natural Attenuation Monitoring (NAM)
  - NAM is a passive remedial strategy.
    - COCs may remain above CTLs for the site.
  - NAM shall be implemented per Rule 62-780.690, F.A.C.

APPLICATIONS OF REMEDIATION PRODUCTS
MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- For either PARM or NAM:
  - No residual effects of active portion of remediation product remain.
    - Active portions have been exhausted/expended.
  - First PARM (or NAM) event shall be 90+ days after there are no longer any residual effects from the remediation product application.
    - First PARM/NAM is not necessarily 90 days after injection/application.
    - Consider: point at which no residual effects of active portion of remediation product remain as equivalent to a system shut-down.
  - Non-active by-products (e.g., chromium, fluoride, TDS, etc.) may remain above respective groundwater standards or site-specific background values.

APPLICATIONS OF REMEDIATION PRODUCTS

MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- ARM, PARM, and/or NAM:
  - Minimum of two (2) wells:
    - At least one well downgradient.
    - At least one well located in the area(s) of highest groundwater impacts.
  - Temporary Point of Compliance (TPOC) well(s), as applicable
  - Designated representative monitoring wells as needed for monitoring or establishing:
    - Progress of active remediation (ARM); and/or,
    - Progress of passive remediation (NAM); and/or,
    - Closure documentation (ARM/PARM/NAM), as applicable
    - Use professional judgement.
  - See ITAP Acceptance Letters and guidance.

APPLICATIONS OF REMEDIATION PRODUCTS
MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Monitoring Wells:
  - No well used for remediation product application may be used to track remediation progress (i.e., may not be or become a designated well for monitoring COCs).
    - Analytical results for concentrations of COCs may be skewed.

APPLICATIONS OF REMEDIATION PRODUCTS

MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Monitoring Wells:
  - Per Guidance: BPSS-10, In Situ Chemical Additives, maintain representative monitoring wells during remediation product application:
    - Do not install injection points (or apply remediation product to open pits/excavations) too close to monitoring wells.
      - Too close: analytical results for concentrations of COCs may be skewed.
    - Use site-specific ROIs or minimum 10-foot distance.

APPLICATIONS OF REMEDIATION PRODUCTS
MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Monitoring Wells:
  - Pilot Tests may include wells within proximity to injection points to determine ROI (e.g., Observation Wells); however, those observation wells may become compromised with respect to providing groundwater samples representative of groundwater conditions.
    - It may be beneficial to differentiate an observation well used to assess ROIs from a groundwater monitoring well used to assess groundwater conditions (e.g., concentrations of COCs).
  - For additional guidance, see BPSS-10, In Situ Chemical Additives.

APPLICATIONS OF REMEDIATION PRODUCTS

MONITORING REMEDIATION PRODUCT APPLICATIONS

Remediation Product Applications – Monitoring:

- Scoping Monitoring:
  - Active Remediation Monitoring (ARM).
    - Remedial Action Interim Reports (RAIRs).
    - RAIR with PE/PG review pay item when transition from ARM to either PARM or NAM is proposed.
  - Post Active Remediation Monitoring (PARM).
    - PARM Reports.
  - Natural Attenuation Monitoring (NAM).
    - NAM Reports.

APPLICATIONS OF REMEDIATION PRODUCTS

REMEDIATION PRODUCT APPLICATIONS - CLOSURE

Remediation Product Applications – Closure:

- For Closure:
  - Applicable closure criteria have been met.
  - Concentrations of monitoring parameters set by ITAP Acceptance Letter meet their respective groundwater standards or return to their site-specific baseline or background concentrations, whichever is less stringent.

THANK YOU

Jennifer L. Rogers, P.E.
Division of Waste Management / Petroleum Restoration Program
Florida Department of Environmental Protection

Contact Information:
(850) 245-8919
Jennifer.L.Rogers@FloridaDEP.gov