

# MEMO

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TO: Mr. Richard Duerling - FDEP  
3530 Division of Water Facilities  
Underground Injection Control Section  
Florida Department of Environmental Protection  
2600 Blair Stone Road, Tallahassee, FL 32399-2400

CC: Ms. Kelsey Helton – FDEP  
Mr. Greg Council - GeoTrans  
Mr. S. Miller – U.S. EPA  
Mr. J. Mousa – ACEPD  
Mr. M. Slenska – Beazer  
Mr. M. Brouman – Beazer  
Ms. P. Salisbury – KI  
Ms. L. Paul – KI  
Mr. J. Mueller - Adventus

FROM: Neale Misquitta  
Key Environmental, Inc.  
200 Third Avenue  
Carnegie, PA 15106 (Note 1)

DATE: February 5, 2008

SUBJ: **FINAL Summary Memo**  
**UIC Application – Catalyzed Permanganate Injection into Surficial Aquifer**  
**DNAPL *In Situ* Stabilization Pilot Testing Activities**  
**Koppers Gainesville Facility**

This UIC Application summary memo is a revision of the September 27, 2007 submittal. These revisions reflect the integration of FDEP HWCS response comments dated January 12, 2008.

Pursuant to Rule 62-528.630 (2) (c), F. A. C., inventory information is hereby provided regarding the proposed construction of nine direct injection points and two temporary injection points for the purpose of short-term, pilot-scale field testing of an in situ aquifer remediation technology at a contaminated site. Please note that the Revised Field Activity Plan detailing the proposed events summarized herein was submitted to FDEP and the U.S. EPA on September 8, 2006 and was approved by the US EPA for implementation via email dated May 25, 2007. A FINAL (Revision 3) Field Activity Plan (dated February 5, 2008) has been prepared to reflect the FDEP HWCS response comments dated January 12, 2008 that demonstrate compliance with the UIC Rule and Variance requirements.

|                            |   |
|----------------------------|---|
| Site Name:                 | Koppers Inc.  |
| Site Address:              | 200 NW 23rd Boulevard   |
| City/County:               | Gainesville, Florida 32607  |
| Latitude/Longitude:        | N-2658641/E253626   |
| FDEP Facility Number:      | FLD 004 057 535   |
| Site Owner's Name:         | Koppers Inc.  |
| Site Owner's Address:      | 200 N.W. 23 <sup>rd</sup> Avenue, Gainesville, Florida                  |
| Well Contractor's Name:    | GeoTrans, Inc. (Note 2)   |
| Well Contractor's Address: | 1080 Holcomb Bridge Rd,<br>Building 100, Suite 190<br>Roswell, GA 30076 |



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

The purpose of the pilot test is to evaluate in situ biogeochemical stabilization (ISBS) of Dense Non Aqueous Phase Liquid (DNAPL) residuals present in the Surficial Aquifer and concomitant flux reduction via addition of catalyzed sodium permanganate (RemOx EC Stabilization Reagent – Carus Chemical Company, Peru/LaSalle, Illinois). The ISBS technology employs specially modified solutions of buffered, catalyzed permanganate that are flushed through a targeted source zone suspected to contain residual hydrocarbons. As relatively small amounts of reagents migrate through the targeted source area, various biogeochemical reactions occur between the DNAPL constituents of interest (COI) and the oxidant/catalysts. Initially, these reactions cause the removal of COI residuals via a two step process: i) oxidation and ii) dissolution. The chemical/biological oxidation processes destroy COI present in the dissolved phase. This, in turn, increases the release of COI from NAPLs into the aqueous phase. The more water soluble, lower-molecular-weight constituents are dissolved and treated/removed at a proportionally higher rate, thus leading to a “hardening” or “chemical weathering” of the DNAPL as it steadily loses its more labile components. This causes a net increase in viscosity of the organic material, which yields a more stable, recalcitrant residual mass. As such, the flux of COI released into the dissolved phase is much reduced, and natural attenuation processes are more easily capable of managing associated plumes.

In addition to mass removal, the catalyzed permanganate serves to physically stabilize DNAPL residuals by coating them with precipitated (X)MnO<sub>2</sub> complexes. The MnO<sub>2</sub> precipitate is insoluble, has high surface area, is a good coagulant, and has high sorptive capacity for divalent cations). The catalyzed (X)MnO<sub>2</sub> precipitate will form along the DNAPL interface, physically coating or entombing it thereby further reducing the flux of dissolved-phase constituents into the groundwater.

The following is a summary description of the targeted aquifer:

|                              |  |
|------------------------------|--|
| Name of aquifer:             | Surficial Aquifer (fine grained sand to clayey sand) |
| Depth to groundwater (feet): | 10 feet to groundwater                               |
| Aquifer thickness (feet):    | 28 feet of the unconsolidated surficial soil         |

Summary of major design considerations and features of the project:

Field-scale pilot testing of the ISBS technology will yield site-specific data necessary to validate full-scale technology efficacy at the Koppers Site. The field test will determine: i) ability to introduce the ISBS reagents in a safe and effective manner, and, once applied, ii) the ability of the ISBS reagents to stabilize DNAPL and ultimately accelerate natural attenuation of dissolved phase COI.

The pilot study will occur within two plots in an onsite source area (Former North Lagoon) positioned approximately 150 ft south of existing monitoring well HG-10S (**Figure 1**). The DNAPL Stabilization Pilot Test Areas occur within an already impacted portion of the Surficial Aquifer. Groundwater in this area is impacted with petroleum hydrocarbon constituents, principally polycyclic aromatic hydrocarbons (PAHs) and also phenolic compounds.

In the Direct Injection Point (DIP) test plot, approximately 620 USG of a pre-mixed RemOx EC solution containing 4.5% sodium permanganate + catalysts (**Appendices A and B**) will be added to 9 (or 10) direct push points over a 5 to 7 day period. The material will be injected in a top-down or bottom-up manner from a depth of about 8 to 28 ft bgs. This will result in the addition of ca. 6,200 USG or ca. 62,850 lbs of aqueous solution throughout a plot area measuring about 45 ft wide x 45 ft long x 20 ft deep (from 8 to 28 ft bgs). One objective of the pilot program is to optimize the process of adding liquid reagents to the subsurface. It is our intent to introduce the reagents under low



pressure (< 50 psi) and low flow rate (< 5 gpm). Numerical modeling of injecting 3.5 gpm over a 7 hr period showed that this total injected volume is incapable of inducing DNAPL migration whether the material is in residual or pooled form. Upon completion each DIP will be sealed with pelletized bentonite hole plug. Reagent injections will be conducted by Innovative Environmental Technologies, Inc (IET) Pipersville PA.

In the Temporary Injection Point (TIP) test plot, approximately 250 to 300 USG of a specially prepared RemOx L-D solution containing 10% sodium permanganate; the ISBS catalysts will be provided in individual containers and mixed on site (**Appendices C, D and E**) because at this concentration the reagents “settle out” hence the materials are not amenable to shipping and storage. The more concentrated RemOx EC solution will be added initially to two TIPs. The material will be added over a 1 to 2 day period under low flow (< 5 gpm) and low pressure (<25 psi). This will result in the addition of ca. 500 USG or ca. 4,800 lbs of solution. Numerical modeling showed that the total injected volume is incapable of inducing DNAPL migration whether the material is in residual or pooled form. Installation details regarding the construction of the TIP are discussed below in more detail.

As discussed in the FINAL Revised Field Activity Plan (February 5, 2008), a soil coring program will generate the primary performance monitoring data. Replicate (6) soil cores will be acquired for Baseline (pre treatment), 8 weeks post-treatment and an optional 16 weeks post treatment. Soil cores will be analyzed for total COI, leachable COI/permeability and inorganic ions. Soil “crust” will be geochemically analyzed for composition, structure and thickness. In addition, two newly installed NAPL monitoring wells N-ISBS1 and N-ISBS2 (see below) will be installed within the DIP and the TIP test areas, respectively (Figure 1). These wells will be monitored weekly for groundwater level monitoring and the presence of NAPL.

The TIP injection well features are summarized below:

The TIP well will be drilled utilizing a Rotasonic drill rig. A nominal borehole diameter of 4 inches will extend down to the Upper Hawthorn Group (maximum depth of 28 feet). Schedule 80 PVC with 1-inch male NTP threaded to grade and 15 ft of 20-slot screen positioned from ca. 10 to 25 ft bgs. The well will be completed with 10/20 silica sand filter pack followed by a 2-ft bentonite seal and grouted to the surface (no pad required). Upon completion of the field pilot test, the TIPs will be removed and abandoned in a proper manner.

The NAPL monitoring well features are summarized below:

The NAPL monitoring well will be drilled utilizing a Rotasonic drill rig. The well casing will be a two-inch diameter 304 stainless steel casing with 15 ft of stainless steel well screen (20 slot) positioned from about 13 to 28 ft bgs (base of the surficial aquifer). The borehole annulus will be a minimum of 4 inches. The screened interval will be covered with 10/20 silica sand filter pack followed by a 2-ft bentonite seal and grouted to the surface. The wells will be encased in 3 ft x 3 ft concrete pads with stick-up protective casings and bollards.

In accordance with DEP State UIC rules, Chapter 62-522.300(2)(c), for DEP approved aquifer remediation projects using UIC wells as described in 62-528.600(2)(d) it is noted that catalyzed permanganate will be introduced into the DIPs and TIPs. There will be no injection of untreated groundwater. As part of this project, a site-specific Variance from Rule 62-522.300(3), F.A.C was filed on January 16, 2008. The sampling, analysis and monitoring requirements associated with this Variance are outlined in the FINAL (Revision 3) Field Activity Plan (February 5, 2008).



The injection activities will take place over a 5 to 7 day period and they will be closely governed so as to not result in exacerbation or migration of DNAPL or the existing contaminant plume, which will be confirmed by groundwater monitoring.

The remediation system installation is expected to commence in January 2008 after completion and evaluation of baseline soil coring within the study area. The intended duration of the filed pilot test is 8 to 16 weeks. FDEP will be notified if the pilot test duration will exceed 16 weeks. Approximately 10 weeks after the pilot test is initiated, an interim report will be submitted. After approximately 20 weeks, a final report will present a detailed evaluation of the technology efficacy. 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).

Please do not hesitate to contact me 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 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, FAC., unless an exemption or variance has been granted.



Figure 1  
Plan View of ISBS Test Plots

