

14th Annual

**FLORIDA
REMEDIATION
CONFERENCE**

An NTCC Conference

October 16-17, 2008



Radisson WorldGate Resort

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Casual Atmosphere*

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Thursday, October 16, 2008

8:00 Opening Remarks from the Chair

Conference Chair Nick Albergo, PE, DEE
President and CEO
HSA Engineers & Scientists, Tampa, FL

8:30 Utilizing Enhanced Anaerobic Bioremediation for In-Situ Treatment of Pentachlorophenol and PCE/TCE Co-mingled in Groundwater

Brian Timmons, Director
ETEC LLC, Portland, OR

A six-month demonstration using in-situ enhanced anaerobic bioremediation to remediate pentachlorophenol in groundwater was performed at a former drum handling site in Portland, OR. In addition to PCP, site contaminants of concern included tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, and vinyl chloride. Previously a pump and treat remediation system was operated for five years that provided little remediation benefit. Though the effectiveness of in-situ enhanced anaerobic bioremediation is well documented for chlorinated solvents, documentation of anaerobic bioremediation for in-situ treatment of PCP is limited beyond bench-scale experiments. The demonstration used ETEC's proprietary CarBstrate™ substrate that provided additional carbon and nutrients to enhance anaerobic bioremediation of site COCs. The in-situ delivery and distribution of the substrate/nutrients was performed by the in-situ delivery groundwater recirculation system. Water collected from a central extraction well was amended with approximately 50 pounds of CarBstrate™ per week and reinjected in batches to four injection wells within the treatment area. The empirical data collected shows that PCP in groundwater can be effectively treated in the presence of other chlorinated solvents using enhanced anaerobic bioremediation. A reduction of nitrate and sulfate, an increase in TOC, and increases in ethene and methane concentrations provided evidence of enhanced anaerobic conditions. Greater than 75% reductions in COCs were observed at all source area monitoring wells, including monitoring locations downgradient of the treatment area that historically were unresponsive to previous remediation efforts. PCP concentrations as high as 2,190 ug/L were reduced by 99.6% at the central extraction well, and to below detection limits at source area monitoring wells. The total cost was approximately \$60,000, or \$23 per cubic yard.

9:00 Case Studies of Oil Spill Treatment with a Natural Petroleum Remediation Product

Valentine Nzengung, President/CEO
PLANTECO Environmental Consultants, Athens, GA

Petroleum Remediation Product is a 100% non-toxic natural product prepared from bee wax. PRP consists of tiny spheres of treated wax that encapsulate nutrients at their center. When the wax spheres come in contact with oil, the outer waxy layers "bind" with the hydrocarbons at greater than 20 times their weight. In the presence of water, nutrients within the spheres promote the growth of indigenous petroleum degrading microorganisms. Thus, PRP rapidly absorbs petroleum hydrocarbons while also stimulating petroleum degradation. For diesel spills, 97% of aliphatic hydrocarbons and 76% of aromatic hydrocarbons were removed compared to only 48% aliphatics and 5% aromatics in untreated control sites. We will present data on multiple field case studies from the U.S., Europe and the Middle East. A combination of PRP powder and BioBooms containing PRP are applied to absorb and enhance biodegradation of petroleum hydrocarbons spilled into surface waters. PRP is especially well adapted for moderate to small spills in industrial plant settings, shorelines, railroad tracks, oil wells/oil fields, maintenance facilities, truck rollovers, marshes and wetlands.

9:30 Break

9:45 Full-Scale Bioremediation of a High-Concentration Mixture of Chlorinated Solvents

Brendan Brown, Environmental Scientist
CDM, Maitland

CDM designed and constructed a full-scale enhanced anaerobic bioremediation system at a former industrial manufacturing facility in Orlando. The site is characterized by high concentrations of a mixture of chlorinated solvents in multiple stratigraphic zones of the surficial aquifer. Total volatile organic compound concentrations are commonly greater than 100,000 µg/L and up to 2,300,000 µg/L. The primary contaminants of concern are 1,1-DCE, methylene chloride, 1,1,1-TCA, vinyl chloride, and 1,1-DCA. During pilot testing, potassium lactate was injected into the surficial aquifer as the carbon source. Groundwater circulation was implemented to distribute lactate, facilitate optimal mixing of the carbon source and contaminants, and increase the population of *Dehalococcoides* bacteria. The pilot test resulted in successful enhancement of naturally occurring *Dehalococcoides* bacteria and complete reductive dechlorination via anaerobic biodegradation. The full-scale EAB system consists of horizontal extraction wells, lactate injection well networks and a groundwater treatment plant. Three, 100-foot horizontal well segments were installed in the center of the identified plume cross-cutting multiple surficial aquifer zones. Groundwater is being circulated between the horizontal well segments and the injection well networks, with lactate being metered into the injection lines. To date, distribution of the carbon source has been achieved throughout the surficial aquifer, methanogenic conditions have been established, and complete reductive dechlorination is occurring through each of the chlorinated ethene, ethane, and methane chains. To date, significant reductions in the TVOC concentrations have been realized at the site.

10:15 Titusville Site Reaches GCTLs in Less than One Year

Jerry Kellgren, ChE, Vice President/Engineering
OxyGreen Corp., Longwood

OxyGreen's vertical re-circulation and dissolved oxygen generation cell creates a dissolved oxygen plume in-situ which accelerates bioremediation. OxyGreen's patented in-situ dissolved oxygen generation and vertical re-circulation system provides the following benefits: Operates in gravels, sands, silts, and clays; provides the exact concentration of dissolved oxygen required for biological degradation of contaminants in groundwater; requires neither elaborate treatment systems nor chemicals, thus eliminating these costs, electrical costs amount to only pennies per day; easy to operate and to maintain; is classified as an institutional and/or engineered barrier in Florida, can be operated independently or can be used to increase the efficiency of any currently installed groundwater treatment system by lowering the overall project O&M costs and accelerating free product removal; can be used for polishing to achieve site closure limits; and a single four cell system influences approximately 2,800 square feet. Our presentation will include data and photos from our Titusville site that is designated as DEP Facility 058501118. These will provide the necessary installation and field/laboratory results.

10:45 Break

11:00 Successful Tight Soil Treatment of a Petroleum Spill with a Pulsed Perozone® Injection System

Chuck Brown Senior Project Manager
Advanced Environmental Technologies LLC, Pensacola

Tight soils ($K = 10^{-5}$ cm/sec) have provided difficulties for treating spilled petroleum products. Injection of pulsed peroxide-coated nano- to micro-bubbles (Perozone®) provided superior treatment of alkanes, BTEX, and MTBE from a gasoline spill at a retail outlet in Alford, Jackson County, FL. The predominant soil consisted of cohesive clayey fine sands, resembling concreted sandstones. Removal of volatile organic compounds occurred rapidly. The site work was performed under a Florida Department of Environmental Protection work order for a petroleum cleanup.

11:30 A Safe and Economical Method for Remediating Benzene at a Large-Scale Petrochemical Complex

Anthony Horton, PR, Principal
Rosengarten Smith & Associates Inc., Austin, TX

The need to address a large benzene release at a petrochemical complex in Texas was the driver for evaluating in-situ remediation technologies. Concentrations in excess of 5,000 mg/Kg with free phase product present in some areas at the soil/groundwater interface, obviated the employment of bio-processes. A pilot demonstration, conducted in early 2007, employing controlled in-situ chemical oxidation resulted in reductions in benzene soil concentrations of up to 98.6%. Based upon these results, a full scale application was conducted in February/March 2008. A total area of approximately 59,000 square feet was treated. To ensure complete contact with the entire vertical contaminated zone, a vertical injection interval from ground surface to a depth of ten fbg was employed. In addition to the treatment of the entire unsaturated zone, this design included the top four to six feet of groundwater. Thus, the entire historical groundwater fluctuation interval was addressed. In addition to the destruction of the contaminant, the technology was employed to address two other significant objectives. These were: using the process to precisely locate all contaminant source areas within the injection zone; and secondly, safely treating contaminated soil in and around buried piping and utilities. A large area of the site included piping and equipment either buried in contaminated soil or built on soil that had become contaminated. It was determined that the only safe remedy with respect to anticipated physical damage and corrosion of ferrous metals by conventional ISCO processes, was excavation by hand digging. However, the pilot demonstrated that the Cool-Ox™ Hydro-Dart™ injection method could deliver the reagent without damage to equipment and the

reagent posed no corrosion threat to ferrous piping. Thus, this delivery method was employed. Contaminant source areas were located by observing reactions of the contaminant with the reagent. By using this standard application method it was determined that 13,500 square feet of the area originally intended for treatment, encompassed less impacted groundwater that would be mitigated by appurtenant treatment. Thus, a field modification was made to use the reagent originally intended for that area, to treat three additional areas not slated for injection at this time. Thirty and sixty day post application data indicate significant reductions in contaminant concentrations.

12:00 Day One Luncheon

Sponsored by Jamson Environmental, Thonotosassa

1:30 Surfactant-Enhanced In-Situ Chemical Oxidation Treatment of NAPLs

George Hoag, PhD, Senior Vice President
VeruTEK Technologies Inc., Bloomfield, CT

Traditional ISCO methods have had limited success in degrading non-aqueous phase liquids because mass transfer limitations control the rate of dissolution of NAPL constituents into groundwater. In-situ chemical oxidation reactions alone predominantly take place in the aqueous phase in the subsurface, therefore limiting the effectiveness of ISCO treatment of soils contaminated with NAPLs. In this talk, surfactant enhanced in-situ chemical oxidation technology is presented as a methodology to overcome NAPL solubility limitations associated with the ISCO process. The process uses biodegradable, food-grade co-solvents and surfactants to solubilize immiscible-phase organic compounds coupled with simultaneous chemical oxidation. Results are presented on the extent and rates of solubilization and chemical oxidation for TCE, manufactured gas plant and creosote DNAPLs and No. 6 and No. 2 oil LNAPLs. Solubilized DNAPL and LNAPLs generate emulsified micelles in the 25 nm to 275 nm size range dependent on the type of NAPL and VeruSOL™ cosolvent-surfactant mixture used. Solubilized NAPL compounds are readily oxidized using both activated persulfate and catalyzed hydrogen peroxide. Results from both laboratory and field projects reveal that simultaneous dissolution and oxidation is effective in reducing NAPL, soil and groundwater concentrations for a variety of highly contaminated source areas.

2:00 In-Situ Remediation of Free Product Chlorinated Solvents at Pinellas Park

Sultan Anjum, PE, MASCE, DWRE
Environmental Compliance Services Inc., Tampa
Jerry Lisiecki, PhD, Senior Scientist
Fishbeck, Thompson, Carr & Huber Inc., Grand Rapids, MI
Farsad Fotouhi, VP/Environmental Department
Pall Corporation, Ann Arbor, MI

Five chlorinated solvent plumes originate, typically beneath former degreaser locations, on an inactive industrial site in Pinellas Park, FL. The maximum trichloroethene concentration before remediation began was 470,000 micrograms per liter (ug/L). Four areas of dense non-aqueous phase liquid were suspected based on dissolved phase concentrations. Perchloroethene, cis-1,2-dichloroethene, and vinyl chloride as well as 1,1,1-trichloroethane and its daughter compounds were also present in the subsurface. Remedial work was intended to destroy the suspected DNAPL and reduce dissolved contaminant concentrations below site-specific criteria. A major challenge was the low natural buffering capacity of the groundwater: a major benefit is the high aquifer temperature, which enhances biological activity. Site soils are fine to medium sands to a depth of 10 to 12' below ground surface, overlying silty fine sands, which extend to a silty clay layer at 28 to 30 fgs. Beneath the silty clay is 2-3' of silty sand, similar to above, and then bioclastic sand containing shell fragments (intermediate confining unit or ICU). Groundwater is encountered between 2 and 4' bgs. The groundwater moves approximately 15-25' per year in the fine sand and 2-4' per year in the silty fine sand, depending on the time of year and location on site, the groundwater flows approximately 15-65' per year in the ICU. The low hydraulic conductivity of the soil above the silty clay and the semi-confined nature of the aquifer beneath it limited the rate of solution injection into permanent treatment wells to 0.5 to 1.5 gallons per minute. The highest TCE concentrations were found in the silty sand above the silty clay in four of five plumes. They occur at the interface between the soil layers in the fifth. Different remedial techniques were used in different areas, depending on CVOC concentrations, targeted volume, and other site specific conditions. Fenton's reagent and potassium permanganate chemical oxidation and augmented reductive dechlorination were applied either alone or sequentially. This presentation describes the chemical oxidation treatments and presents the results and lessons learned.

2:30 PCE Source Zone Remediation at the Orlando Events Center Brownfield Site

Dan Bryant, VP/Senior Project Manager
Geo-Cleanse International Inc., Matawan, NJ

A groundwater perchloroethylene source zone in silty sand with an underlying clay aquitard at a depth of 40 feet required rapid remediation to allow construction of the Orlando Events Center. The remediation implemented a limited scope remedial action plan under a brownfields agreement for the site. The remedy consisted of a two-phase in-situ chemical oxidation treatment involving an initial injection of Fenton's reagent for primary mass destruction, followed by sodium permanganate, to reduce or retain VOC concentrations below Florida cleanup target levels and address potential diffusion from the underlying clay. Seventy-two injectors were installed in three depth zones in an 80 x 130 foot area to a depth of 40 feet. The Fenton's reagent treatment completed in 23 days included injection of 85,000 gallons of peroxide solution and catalyst. One week was allowed for reaction of the peroxide before beginning permanganate injection. The permanganate treatment completed in seven days included injection of 21,000 gallons of 4 percent solution. The soil removal completed in two days included a 4-foot deep excavation with off-site disposal of 94 tons of soil. All pre-construction permitting and field work to achieve the CTLs in all media, including LSRAP submittal, regulatory approval, drilling, injection, soil removal, and backfill, was completed by March 7, 2008, approximately 4.5 months after contract execution. Two groundwater sampling events have been completed through June 2008, 73 days post-injection. The PCE concentration has been reduced from a maximum of 14,600 ug/L to non-detectable (<2 ug/L) at all locations in the treatment area. Remediation costs including drilling, injection, soil removal and all documentation, but excluding performance monitoring conducted by an independent consultant for the city of Orlando, totaled \$584,299.

3:00 Break

3:30 VI Update: Results of State Vapor Intrusion Study

Gordon Walters, PE, MBA, Env. Department Manager
HSA Engineers & Scientists, Tampa
Brian Moore, PE, Managing Engineer
HSA Engineers & Scientists, Tampa

4:00 Innovation and Implementation: A Retrospective on Environmental Cleanup Technologies Tested and Deployed at the World's Premier Space Launch Facility

Regina Butler, 45 CES/CEVR Environmental Engineer
Portage Environmental, Patrick Air Force Base
Mark Kershner, Remedial Project Manager
Cape Canaveral Air Force Base

The 45th Space Wing's launch programs at Cape Canaveral Air Force Station and Patrick Air Force Base were molded in the fiery crucible of innovation over the past 60 years. Modern space flight was built upon this legacy of vision and strength, but the storied history of 3,000+ launches has taken a toll on the environment. Past operational practices including "flush and gush" cleaning procedures used extensively at support and launch facilities left a legacy of dense non-aqueous phase liquids that linger in the subsurface. Nearly half a century after the "race to the moon," groundwater contaminant source areas cover nearly 17 acres, with another 1,200 acres of dissolved plumes. Other common contaminants include petroleum products, pesticides and polychlorinated biphenyls. Continuing the space program's legacy of ingenuity, development and testing of innovative cleanup technologies at CCAFS and PAFB provided key data to support remedial decision-making and laid the foundation for full-scale implementation. Through collaborative efforts, stakeholders have shepherded 311 sites through a \$169M investigation and cleanup process since 1991, including 8 major groundwater cleanup actions and over 141 separate soil removals. This talk will summarize site characteristics, risk management considerations, and remedy characteristics, highlighting the wide array of technologies that have been successfully implemented at CCAFS and PAFB, including excavation, bioaugmentation, ex-situ soil flushing, steam and iron enhanced in-situ soil mixing, oxidation, and amendment injection.

4:30 Enhanced Bioremediation for a TCE Source Area Combined with Biosparging for Dissolved Plume Management

Jim Langenbach, PE, Associate Engineer
Geosyntec Consultants, Titusville

A groundwater plume with a trichloroethene source area of approximately ½ acre and a dissolved plume comprised primarily of vinyl chloride in excess of 100 acres was delineated at NASA's Vehicle Assembly Building at the Kennedy Space Center. The remedial strategy for this site was to aggressively treat the source area and protect an adjacent sensitive surface water/wetland area. To accomplish this, a multi-component remedial strategy was designed and implemented, which includes enhanced bioremediation, a biosparge barrier, and natural attenuation with monitoring. Enhanced bioremediation of the source area was implemented via scheduled aquifer dosing with bi-monthly optimization of the electron donor distribution into a network of 45 injection wells. Source area monitoring has revealed TCE concentration reductions from over 30,000 micrograms per liter to less than groundwater cleanup target levels and an overall VOC mass reduction of over 82% during the initial one year of monitoring. The biosparge barrier was installed to create a zone of elevated dissolved oxygen to promote aerobic degradation of VC. The area of the plume impacting the wetland/OFW had VC concentrations ranging from 100 to 1,000 µg/L. The biosparge barrier consists of 25 biosparge wells which are operated on a cycled basis. Monitoring of the biosparge barrier since system startup has revealed the presence of elevated DO throughout the area of the barrier. VC concentrations in monitoring wells on the downgradient side of the biosparge barrier have decreased to less than GCTLs.



Day
2

Friday, October 17, 2008

8:30 Lessons Learned via Ozone, Hydrogen Peroxide and Persulfate Injection Techniques

Charles Whisman, PE, VP Engineering
Groundwater & Environmental Services Inc., Exton, PA

The presentation will focus on the findings of a detailed evaluation of more than 50 chemical oxidation projects conducted in the past two years which focused on some combination of ozone, hydrogen peroxide and sodium persulfate injection. The presentation will discuss the lessons learned from the numerous chemical oxidation projects and explore ways to optimize the oxidation process and will present guidance on when chemical oxidation may or may not be appropriate and some of the important factors to consider as new sites are evaluated for remediation. Developing an effective monitoring program and evaluating the potential for rebound will also be discussed. Most of the case studies evaluated include sites with petroleum hydrocarbon impact in soil and groundwater and where short-term chemical oxidation strategies were utilized. The discussion will review how life-cycle costs compared for the chemical oxidation strategies against typical costs of full-scale conventional remediation technologies and other short-term remediation alternatives. This presentation is meant to provide all of the lessons learned in the site evaluations and determine if general observations can be made on what strategies did or did not work effectively based on various site factors, such as mass of contaminant, soil type, depth to water, active facilities, volume of material injected, etc. Material of construction and compatibility issues will also be discussed.

9:00 ISCO Treatment Using Activated Persulfate on an Industrial Site in Alabama

Ken Summerour, PG, Vice President
ExoTech Inc. Lilburn, GA

In-situ chemical oxidation is a process that involves injecting strong oxidant chemicals for the purpose of breaking the bonds of organic molecules by combining them with oxygen. ISCO using "activated" sodium persulfate involves the creation of aggressive sulfate radicals for the remediation of both chlorinated and non-chlorinated hydrocarbons. Persulfate activation can be accomplished through the use of iron or transition metal catalysts, hydrogen peroxide, pH activation and heat. The ISCO treatment at this facility was performed inside a warehouse building originally constructed as a WWII barracks for German POWs. The facility is located in Eastern Alabama in the Piedmont Province near the "Fall Line" boundary. Subsurface soils consist of heterogeneous silty-sand and sandy-silt saprolites derived from in-place weathering of the bedrock. The dissolved plume inside the facility measured approximately 3.4 acres and consisted of a mixture of VOCs including 1,1-dichloroethane, 1,1-dichloroethene, trichloroethene, and BTEX. Vertical profiling performed using a MIP-EC logger indicated the majority of the VOCs were detected at the top of the water table. DNAPL was not identified during the profiling. After approval of risk-based target levels by ADEM, a total of 915+ injection wells were installed and utilized for the ISCO treatment. A treatability study indicated that an oxidant blend consisting of sodium persulfate activated with sodium hydroxide would effectively treat the target VOCs. A source area pilot injection was initially performed with follow-up confirmatory sample results indicating some reduction was observed. The full-scale injection was then performed across the entire plume. The findings indicated a further reduction in target VOCs; however, additional treatment was required in areas with higher concentrations. Supplemental injection was performed in portions of the plume to complete the site treatment. Quarterly groundwater sampling is currently being performed to verify compliance with RBTLs.

9:30 Destruction of 1,4-Dioxane in Contaminated Groundwater

Lawrence Sims, PG, President/CEO
LS Sims Environmental, Rockledge
Peter Herlihy, Business Unit Manager
Applied Process Technology Inc., Pleasant Hill, CA

In May 2005, a groundwater treatment system was designed for the former Siemens facility in Lake Mary, FL, to treat VOCs including 1,1,1-TCA, 1,1-DCA, TCE, PCE, and 1,1-DCE. Contaminated groundwater was to be collected from seven extraction wells and treated with a shallow tray air stripper, filtered for particulate matter, and re-injected into a shallow recharge gallery on site. Construction of the system began in October 2005. Initial start-up testing was conducted in April to early May 2006. During the time frame between system design and construction, the Florida Department of Environmental Protection established a groundwater cleanup target level of 3.2 ug/L for 1,4-dioxane. In April 2006, DEP mandated that the groundwater treatment system influent and discharge be sampled for 1,4-dioxane. Sampling of the recovery wells, treatment system influent and effluent indicated that the air stripper had little to no impact on the 75-100 ug/L of 1,4-dioxane in the treatment stream. The DEP instructed the plant operator to install an appropriate system to treat 1,4-dioxane to below state levels of 3.2 ug/L. Multiple technologies were evaluated for treatment performance, capital costs and operating costs, including UV/hydrogen peroxide, UV/catalyst, and ozone/hydrogen peroxide. The ozone/hydrogen peroxide "HiPOx" system was chosen and put on-line in January 2007. The HiPOx system was able to treat 1,4-dioxane to non-detect on start-up as well as each of the 5 subsequent quarterly sampling events.

10:00 UST Site Remediation using Kerfoot™ Perozone Technology with ISOC™ Bioremediation of Remote Groundwater Plume

Ed Kellar, Senior Remediation Specialist
MACTEC Engineering and Consulting Inc., Newberry

A former Polk County, FL, UST site release was treated on site with the combined technology of Kerfoot™ Perozone using ozone and hydrogen peroxide. The BTEX plume migrated off-site under a rail line right-of-way and across a pasture to a wetland area. Because a power source was unavailable for the remote area, ISOC™ technology was selected, for bioenhancement remediation of benzene to less than 1 ug/L. ISOC™ gas infusion oxygen delivery technology produces high concentrations of nascent stable dissolved oxygen without bubbling. Twenty-four ISOC™ units were installed in 2-inch infusion wells and arranged in five staggered rows of three to six units, oriented perpendicular to the plume. Each well is 25 feet deep and is screened from 5-25 feet in silty sand. The depth to groundwater is 3 to 8 feet. The units are connected via small-diameter tubing in shallow trench conduits to industrial oxygen cylinder manifolds capable of lasting three months. Monitoring has indicated supersaturated dissolved oxygen concentrations of 57 ppm in the shallow groundwater and rapidly decreased BTEX concentrations. Specialized injection equipment will be demonstrated.

10:30 Break

11:00 Benefits of Auditing Field Activities

Linda Hoffman, Senior Engineer
HSW Engineering Inc., Tampa

Initial and on-going phases of assessment and remediation of contaminated sites often involve taking field measurements, collecting environmental samples, documenting field activities, and analyzing environmental samples. Decisions to implement remediation strategies can involve millions of dollars over the life of a project and are usually based upon field and laboratory data. Data quality is dependent upon the precision and accuracy of laboratory analytical methods and field instruments, sample collection methodology, and collection of appropriate field quality control samples. If a sample is not collected properly, or if a sample is not representative of the sampling environment, then assumptions and decisions involving the data are flawed. The Florida Department of Environmental Protection Standard Operating Procedures for Field Activities are designed so that environmental samples are collected in a specific, methodical manner to assure that samples are representative of the environment from which they are obtained. Unfortunately, some aspects of the SOPs are unclear and consequently difficult to implement. Key elements to obtaining reliable environmental data begins with field staff training, utilizing proper sample collection techniques, conducting periodic field audits, and re-training field staff, as needed. Field auditing includes several factors including sampling plan review, sampling techniques, equipment decontamination procedures, collection of appropriate types and numbers of field QC samples, proper instrument calibration and verifications, and summarizing audit observations and recommendations. Much emphasis is placed on laboratory quality assurance. Labs perform internal audits, the Florida Department of Health audits laboratories for conformance with the National Environmental Laboratory Accreditation Conference standards. However, oversight of field activities is often deemed less important, unnecessary or costly. This is imprudent, as corrective action decisions will be no better than the sample data upon which the decisions are made.

11:30 Field Data Integrity and QC Requirements

Catherine Katsikis, Senior Scientist
Laboratory Data Consultants FL Inc., Royal Palm Beach

This presentation will address the importance of doing things right in the field and meeting regulatory data integrity and quality control requirements. These include field instrumentation calibration and chain-of-custody completeness. Parts of the presentation are interactive where the audience participates in answering true or false questions and

tests their knowledge of field quality control documentation. Examples of real world cases with the consequences of misconduct will be discussed.

12:00 Day Two Luncheon

Sponsored by Zebra Environmental Corp.

1:30 Case Study: Remediation of Large In-Situ MTBE Plume via Chemical Oxidation

Charles Blanchard, Regional Engineering Manager/Western Region
Groundwater and Environmental Services Inc., Concord, CA

Methyl tertiary-butyl ether is a common groundwater contaminant resulting from leaks in underground storage tank systems. Unlike gasoline hydrocarbons, MTBE has a relatively high solubility in water, which can lead to the formation of large, mobile dissolved-phase plumes. Typically, these large plumes are remediated by means of a dedicated remediation system that includes groundwater pump-and-treat as required to maintain hydraulic control of the plume. The cost of installing and operating these pump-and-treat systems can be quite high. In addition, the time required to install and permit these systems may allow continued plume migration. As a case study, GES will present the remediation of an MTBE plume via short-term chemical oxidation events. The plume had a large areal extent and depth down to 50 feet into the aquifer. Short-term chemical oxidation events using GES' mobile HypeAir® injection process to treat the MTBE plume provided an aggressive remedial approach that eliminated the expenses associated with a dedicated treatment system. This case study will discuss site assessment, a life-cycle cost comparison between dedicated remediation systems and short-term chemical injection events, chemical injection methodology, and future planned remedial activities. The presentation will also explore recent advances in GES' patented Six-Phase® chemical oxidation process as a low-cost means to remediate soil and groundwater. The technology combines liquid oxidants and gases for aggressive injection in soil and groundwater to address significant source reduction in all contaminants. The technology uses up to six oxidation species (ozone, hydrogen peroxide, oxygen, persulfate, hydroxyl radicals, and sulfate radicals) to aggressively remediate contaminated soil and groundwater within a short time frame.

2:00 In-Situ Soil and Water Remediation using EN Rx™ Advanced Oxidation Technology

Shannon Smith, Staff Scientist
MACTEC Engineering and Consulting Inc., Newberry

EN Rx™ technology is a State of Florida approved innovative technology that has been used successfully on a number of in-situ remediation sites across the country. Its main advantages over other methods considered are the slow release of hydroxyl radical, with resulting extended oxidation activity and increase in safety, lack of objectionable residual materials from the reactions, and a very effective cost benefit overall. A St. Lucie County, FL, UST release was initially dewatered to about 12 feet and the contamination source soils removed. Subsequent treatment entailed the activation and application of EN Rx™ Advanced Oxidation Technology chemicals to the excavation floor with the additional placement of future horizontal post source removal treatment wells. EN Rx™ was also successfully applied to a UST site on a farm in north Florida which far surpassed the already strict standards required for groundwater. Another UST site, located Branford, FL, just two blocks from a natural limestone spring, possesses added constraints due to the variability of groundwater flow depending on the season, and is located at an active retail vehicle and truck fueling station/fast food restaurant occupying the site. A pilot test was completed with very favorable results, and full-scale remediation is commencing. This innovative new technology has also been successful in treating organochlorine pesticide contaminants. A former termite & pesticide vehicle maintenance facility has been slated for active remediation using this technology later this year.

2:30 A Forensic Autopsy of a Failed ISCO Application

William Lundy, Principal
DeepEarth Technologies Inc., Alsip, IL

To the remedial designers, the urban location of a former service station made it appear that the non-intrusive nature of in-situ chemical oxidation would be ideal for "polishing" the soil to obtain closure as called for in the sale of the property. Although under normal circumstances, the objective of meeting the closure criteria could have been easily achieved, time constraints coupled with the vertical distribution of the contaminant, combined to produce a designed failure. Site contaminant data indicated that only a few soil borings registered contaminant concentrations of > 1,000 mg/Kg and it appeared that the sandy nature of the soil would lend the site to a quick clean-up, thus meeting the 90-day time frame imposed by the terms of the sale of the property. However, the characteristic mechanics of the oxidation process desorbed the contaminants and concentrated them in the capillary fringe, the discrete interval where all samples were collected. Because of this phenomenon, contaminant concentrations spiked in samples collected thirty days after injection of the oxidizer. Although, sixty and ninety day sampling events demonstrated a marked decline, time constraints forced excavation of the site. The paper will walk through the mechanics of the oxidation mechanism and explain the events.

3:00 Break

3:30 Engineered Green Technology for Treatment of Landfill Leachate and Wastewater

Valentine Nzengung, President/CEO
PLANTECO Environmental Consultants, Athens, GA

Constructed microbial mats, BIOMATs, are primarily composed of photoautotrophic microorganisms, primarily cyanobacteria, associated bacteria and other microorganisms organized into a layered structure that is held together with cohesive polysaccharides. Microbial mats are among the fastest growing photosynthetic organisms. They take up carbon dioxide which they use for biomass and oxygen production. Microbial mats have few growth requirements, and will flourish even under harsh environmental conditions. We have demonstrated the use of BIOMATs for treatment of organics, perchlorate, explosives, chlorinated solvents, petrochemicals, landfill leachate, acid mine drainage, radionuclides, oily wastewater, etc. Additionally, BIOMATs will convert greenhouse gases into biomass that can be converted into energy or organic fertilizer. In a recently completed pilot scale test, we used a modular solar-powered "plate and shelf" BIOMAT reactor with a flow capacity of two gallons per minute to treat the landfill leachate at a Department of Defense site. The leachate contained very high concentrations of iron and manganese. Other metals of concern were lead, boron and barium. The residence time for the containerized wetland was 535 minutes. The targeted metals were removed to below the state compliance level. The plate and shelf BIOMAT reactor removed >90% of the influent iron and 20 - 58% of the manganese. The effluent treated water from the microbial mat bioreactor was polished in four small containerized wetlands connected in series. The results of this field study demonstrated the efficacy of constructed microbial mats for cost-effective treatment of landfill leachate to local discharge limits. Other case studies on the use of the mats to effectively treat acid mine drainage, munitions manufacture wastewater, and other wastes will be discussed.

4:00 Addressing land Use Changes of Golf Courses in Florida: On-Site Soil Management as a Cost-Effective Alternative to Soil Disposal

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Owners of many older golf courses in Florida are currently faced with the difficult choice between a costly update and the immediate financial return of selling to land developers. These large, contiguous parcels located within existing communities are prime locations for development in many of the built-out communities of Florida. Florida's regulatory community has become leery of any proposed land use changes involving golf courses due to the prevalence of elevated arsenic concentrations in the soil and groundwater. In order to meet Florida SCTLs for any proposed future land uses, the current process of physical removal of contaminated soil by means of excavation, followed by disposal of the excavated soil and entrained contaminants, is the accepted standard of remediation for these sites. Soil excavation and offsite disposal of arsenic impacted soil, while preferred due to the surety and simplicity of the solution, is often so costly that the choice of remedial processes reduces or eliminates the financial benefit of the proposed land use change. This paper presents an alternative cost-effective solution of on-site soil management activities in concert with specific engineering and institutional controls to achieve compliance with the proposed land use SCTLs. Following an extensive assessment of existing site conditions of a former golf course in Miramar, FL, a soil management plan was submitted to Broward County as an appropriate basis for county approval of proposed land use changes within the property. The SMP contains descriptions of the following elements: the distribution and magnitude of soil contaminants at the site; ICs, primarily land-use restrictions used to reduce potential risks from exposures associated with contaminated soil; and procedures for the identification, management and ultimate onsite disposition of arsenic impacted and non-impacted soils generated during construction activities at the site.