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Interim Corrective Action Plan For ORC and RegenOx Injection

Former Fiesta Beverages Facility
966 89th Avenue
Oakland, California 94621
ACDEH Fuel Leak Site # RO0000314

February 7, 2007
BEI Job No. 203004

Prepared for:

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1.0 Introduction

1.1 Background

In August 1990, one 500-gallon and one 1,000-gallon gasoline underground storage tanks (USTs) were removed from the subject site (Figures 1 and 2). Soil and groundwater were reported to be impacted from releases from one or both USTs. Overexcavation of the former UST basins occurred in January 1991. The excavations were reported to have reached approximately 15 feet by 8 feet by 14 feet deep and 12 feet by 7 feet by 14 feet deep, respectively, on January 14, 1991. Beginning in April 1991, aeration of the soil occurred onsite. In April 1993, 74.28 tons of soil was transported to the REMCO recycling facility.

In June 1993, groundwater monitoring wells MW-1, MW-2, and MW-3 were installed by Tank Protect Engineering (*Preliminary Site Assessment Report*, December 15, 1993). In general, the wells encountered black to grey to light brown clay to a depth of approximately 15 feet below ground surface (bgs). At 15 feet bgs, the three bores encountered 0.5- to 2.0-foot-thick clayey sand. Below this unit, a light brown to grey clay was present to a depth of 18 to 21 feet bgs. Underneath this unit, 1- to 3-foot-thick sand was encountered in bores MW-1 and MW-2, while clayey silt was encountered in bore MW-3. Below approximately 21 feet bgs, green-grey or black clay was encountered to the full explored depth of 26.5 feet bgs in bore MW-1 and to 25 feet bgs in bores MW-2 and MW-3. Saturated soil was encountered below a depth of approximately 13 feet bgs (in clay overlaying the uppermost sand unit). The wells were installed with a screened interval between 10 and 25 feet bgs. Groundwater from the three wells was sampled six times between August 1993 and December 1998.

In November 1999, after obtaining appropriate permits, All Cal Property Services, Inc. (All Cal) installed four Geoprobe[7] soil bores (SB-1 through SB-4, Figure 2) downgradient (north-northwest) from the former location of the two USTs (*Offsite Groundwater Investigation*, December 20, 1999). The bores were installed in the public right-of-way across 89th Avenue from the subject site, in an unpaved portion of the roadway. Soil bores SB-1 and SB-2 were logged to a depth of 16 feet bgs. Silty clay was encountered to a depth of approximately 13 to 14 feet bgs. Below that depth, soil consisted of clayey silt that alternated between moist and saturated for several vertical feet. Bore SB-1 also encountered poorly graded sand at 16 feet bgs. Hydrocarbon odors were present in both bores at a depth of approximately 6 feet bgs and green discolored soil was present at 10 feet bgs in bore SB-1. Discolored soil and gasoline odors were noted in both bores throughout the clayey silt, while brownish colored clay was present in both bores just above the silt. The groundwater interface appears to have been encountered at an approximate depth of 16 feet bgs in the sand. Sheen was noted at that depth in SB-1. Groundwater samples were obtained from bores SB-1 and SB-2 after pushing the Geoprobe^7 system to a total depth of 18 feet bgs. Soil bores SB-3 and SB-4 were directly pushed to a total depth of 18 feet bgs in order to obtain grab groundwater samples. Groundwater samples from bores SB-1 and SB-2 contained elevated concentrations of Total Petroleum Hydrocarbons as Gasoline (TPH as gasoline), and benzene, toluene, ethylbenzene, and total xylenes (BTEX). Significantly lower concentrations of TPH as gasoline and total xylenes were encountered in the groundwater sample from soil bore SB-3, while all analytes were nondetectable in groundwater collected from soil bore SB-4. No soil samples were submitted for laboratory analysis from the four Geoprobe**7** bores.

After the review of the January 2001 groundwater monitoring report, the Alameda County Department of Environmental Health (ACDEH) approved the application of a 7% solution of hydrogen peroxide to the wells in an attempt to remediate dissolved constituents. On March 7, 2001, the solution was applied by All Cal and on April 25, 2001, a groundwater monitoring event was conducted to determine if a reduction in dissolved constituents had occurred (*Application of Hydrogen Peroxide into Wells and Second Quarter 2001 Groundwater Monitoring Event*, May 10, 2001). Based on the analytical data, a reduction was seen in wells MW-1 and MW-2, with some reductions also seen in well MW-3. This sampling event and subsequent interpretation were complicated by the presumed mismarking of samples from wells MW-1 and MW-3. No further work at the site is known to have occurred between April 2001 and the March 2003 groundwater monitoring event. Blymyer Engineers was retained in mid-January 2003 to resume groundwater monitoring, to redevelop well MW-1, and to review appropriate future actions for the site at that time.

A review of the groundwater analytical data collected prior to and after the application of a 7% solution of hydrogen peroxide (March 2001) suggest that a rebound of contaminant concentrations in groundwater appears to have occurred since that time (see Tables I through V). If this assumption is correct, the data appear to indicate that the peroxide application did suppress groundwater concentrations for some period of time; however, it also appears to indicate that the residual contaminant concentrations in soil are an adequate source for the continued degradation of vicinity groundwater. It is likely that the extent of soil removal from the UST basins at the time of the removal of the USTs (August 1990) and at the time of overexcavation (January 1991) was laterally limited due to the immediate proximity of the buildings to the southeast (See Tables VI, VII, and VIII).

On January 16, 2003, a new case manager, Mr. Amir Gholami, was assigned by the ACDEH. On September 17, 2003, a workplan for a Geoprobe^{7} investigation of the site was submitted to the ACDEH by Blymyer Engineers. The intent was to attempt to determine the lateral and vertical extent of impacted soil and groundwater in order to better target the residual contamination in future remedial actions to be determined. Due to the lack of a response from the ACDEH, on February 17, 2004, Blymyer Engineers issued a *Letter of Intent to Proceed: Geoprobe*^{7} *Investigation*.

The *Fourth Quarter 2003 Groundwater Monitoring Event* report, dated January 6, 2004, recommended that analysis for fuel oxygenates by EPA Method 8260B be eliminated from the analytical program. It was reasoned that the data generated to date had been very consistent, and further quantification would not significantly add to the level of understanding at the site. Additionally, the concentration of methyl *tert*-butyl ether (MTBE) can be monitored using EPA Method 8021B for no additional cost and the resultant concentration of MTBE can be used as a proxy for the approximate concentration of the remaining fuel oxygenates. As no response from the ACDEH was received within the 90-day comment and review period, Blymyer Engineers' recommendations were deemed acceptable.

On March 15, 2004, Blymyer Engineers issued a letter entitled *Recommendation for Reduction of Groundwater Monitoring* that provided additional rationale for decreasing the groundwater sampling interval from quarterly to semi-annually. It was reasoned that generation of quarterly analytical data would not significantly improve the level of understanding of impacts to the subsurface at the site, and recommended a reduction of the sampling interval to semi-annual. As no response from the ACDEH was received within the 90-day comment and review period, Blymyer Engineers' recommendations were deemed acceptable.

On December 14, 2004, Blymyer Engineers issued to the ACDEH the *Report on a Geoprobe® Subsurface Investigation* which documented the installation of nine Geoprobe® soil bores (GP-1 through GP-9, Figure 2) at the site. The work further refined the known lateral and vertical extent of soil impacted by the petroleum release at the site. Grab groundwater samples in the upgradient and the eastern cross-gradient directions defined all petroleum compounds in groundwater to concentrations below the San Francisco Bay Regional Water Quality Control Board (RWQCB) Environmental Screening Levels (ESLs). Grab groundwater samples in the downgradient and western cross-gradient directions were unable to define most petroleum compounds to concentrations below the RWQCB ESLs. The installation of additional permanent groundwater monitoring wells was recommended as appropriate at the site in order to allow for groundwater sampling from a "repeatedly accessible location". It was reasoned that data generated from these locations will assist in determining appropriate remedial actions, and in monitoring remedial progress.

On July 6, 2005, the new case manager for the ACDEH, Mr. Barney Chan, issued the letter *Fuel Leak Case RO0000314* commenting on the December 14, 2004 report. The ACDEH determined that the collection of additional data was needed to progress the site towards closure. The letter requested a workplan to clear well MW-1 of several feet of sediment due to the potential for groundwater gradient biasing, requested further definition of the groundwater and soil plumes through the installation of additional wells and soil bores, requested a conduit study, and requested a Feasibility Study and Remedial Action Plan.

Blymyer Engineers submitted the *Workplan for Remedial Investigation / Feasibility Study*, on October 10, 2005. The Workplan detailed the procedures for the collection of Remediation by Natural Attenuation (RNA) analytical parameters from existing wells as an initial phase of a Remedial Investigation / Feasibility Study (RI/FS), as well as the installation of four additional groundwater monitoring wells, and the destruction and reinstallation of groundwater monitoring well MW-1. On November 18, 2005, the ACDEH issued the letter

Fuel Leak Case RO0000314 commenting on the Workplan. The ACDEH requested the following:

- The addition of two wells at specified locations for further plume characterization,
- Use of a maximum of 10 feet of screen in the wells,
- Confirmation of the presence of MTBE by EPA Method 8260 if MTBE concentrations rose significantly, and
- Collection of the RNA parameters.

The ACDEH requested confirmation that the additional wells would be added by December 19, 2005, and that a RI/FS report would be submitted by February 19, 2006. Confirmation that the additional wells would be included was provided by telephone in December 2005; however, permitting issues delayed installation of the wells. The *Remedial Investigation / Feasibility Study Report* (RI/FS Report), dated September 8, 2006, was submitted to ACDEH on October 6, 2006.

The RI/FS report documented the destruction of well MW-1, the installation of replacement well MW-1R, and the installation of wells MW-4 through MW-9. The soil and groundwater data collected in the effort achieved vertical delineation, as well as upgradient, lateral, and downgradient delineation of all hydrocarbon compounds in soil and groundwater, with the exception of MTBE in groundwater. MTBE was delineated to below the MCL and the *non-drinking water* ESL goal for the compound, but was slightly above the *drinking water* goal. Because the site is in an area that is not known to extensively use groundwater as a drinking water source, the numeric remedial goals were predominantly compared to the *non-drinking water* ESL goals; however, the ACDEH may ultimately apply *drinking water* ESL goals to remedial efforts at the site.

Higher concentrations of TPH as gasoline appear to be relatively isolated near the former source (MW-1, MW-1R, GP-5, and GP-2; the latter based on PID results only). The presence of slightly higher concentrations at GP-6 or GP-8 likely indicate lateral migration through the clay units in the vadose zone in very thin, interbedded coarser grained deposits with more permeability and porosity. A conduit survey indicated that, due to depth of burial, the utility corridors do not appear to be acting as significant conduits in the site vicinity for groundwater movement and therefore contaminant migration. A notable decrease in analyte concentrations in soil is apparent with increasing depth. Generic *non-drinking water* ESL goals for soil were not exceeded for any compound beneath approximately 12 feet bgs.

The distribution of nitrate, methane and dissolved oxygen indicate that the TPH as gasoline groundwater plume is undergoing anaerobic degradation. Specifically, the elevated concentrations of nitrate observed in perimeter wells MW-4 through MW-9, in comparison to the concentration of nitrate in plume core wells MW-1/1R, MW-2 and MW-3, where the concentration is reduced to essentially one-half of its perimeter levels, and the correspondingly high methane concentrations in the plume core area suggest that active anaerobic degradation is occurring. The source of nitrate is likely leaking sewer lines located along 89th Avenue.

For the site as a whole, the limited area of hydrocarbon degradation suggested by the RNA data, collectively with the laboratory notes indicating relatively unmodified gasoline range hydrocarbons are present in soil and groundwater samples, and the continued recontamination of groundwater documented by graphs depicted on Figures 10 through 13 of the *RI/FS Report*, appear to document a release that is undergoing anaerobic microbial degradation, that RNA is oxygen limited, has reached stability with the surrounding area, and will not progress significantly further without remedial efforts.

Six potential remedial options were evaluated for appropriateness at the site; monitored natural attenuation (MNA), groundwater pump and treat, enhanced insitu bioremediation (EIB), air sparging-vapor recovery (ASVR), dual phase extraction, and insitu chemical oxidation (ISCO). A combination of EIB and ISCO was selected as the most appropriate remedial technology for the site due to multiple factors. ISCO was selected for the vicinity of the former tank excavation and would consist of the injection of the commercial oxidation product RegenOx. Chemical oxidation of residual source soil and groundwater containing higher hydrocarbon concentrations is anticipated to eliminate potential residual free-phase hydrocarbons in the tank vicinity. EIB using Oxygen Releasing Compound Advanced (ORC

Advanced) was selected for the larger area around and downgradient of the former tank location. Petroleum hydrocarbon compounds are recognized to degrade favorably and rapidly under aerobic (oxygen rich) conditions. To stimulate aerobic bacterial activity and increase the rate of biodegradation within the hydrocarbon plume, non-toxic inorganic chemicals (bionutrients) can be added to the groundwater that release oxygen, nitrogen and phosphate, such as ORC Advanced and bionutrient compounds (typically, nitrogen/phosphorus/potassium (NPK) fertilizer). At sites where stagnant hydrocarbon plumes are present, one or more of the essential bio-nutrient elements is commonly depleted, and natural attenuation of the hydrocarbon plume due to microbial activity ceases. By determining a site's "bio-needs," the missing elements can be injected into the hydrocarbon plume to boost bioactivity.

At the site, dissolved oxygen in groundwater is depleted to less than 1 mg/L, and based on available information, the lack of dissolved oxygen is the limiting factor retarding current biological activity. For EIB, the supply of bio-nutrients is assessed prior to and during remediation. During the course of remediation, if nutrient concentrations are found to be inadequate, then further nutrient addition is performed.

On December 18, 2006, the ACDEH issued a letter indicating that it was in agreement with the proposed plan of action, namely EIB with localized ISCO, using a combination of ORC Advanced and RegenOx, respectively. The December 18, 2006 letter requested an interim corrective action plan (ICAP) by January 19, 2007, and quarterly monitoring reports by January 30, and April 30, 2007.

1.2 Site Conditions

The subject site consists of two buildings (960 and 966 89th Avenue) on the southeast side of 89th Avenue in the city of Oakland, Alameda County, California (Figures 1 and 2). The site is situated in an industrial district of the city, and is bounded on the north by 89th Avenue, on the west and east by small warehouses and industrial buildings, and on the south by an older residential community. Across 89th Avenue are additional small warehouses and industrial facilities. The site is currently leased by two occupants, Best Equipment (966 89th Avenue), a custom builder of towing equipment, and an importer of Chinese food goods (960 89th

Avenue), a warehouser. The current study area is located at the front of both addresses, in and just outside the area normally reserved as sidewalk. The investigation area is paved with asphalt, except the interior of the buildings, which consist of slab-on-grade concrete.

Based on existing evidence and the comments of Ted Walbey of Fiesta Beverages, the former UST system was a suction system with a single dispenser located approximately 5 feet inside the roll-up door closest to the former tank system. A vent line remains fastened to the northern wall of the building at 966 89th Avenue.

2.0 Interim Corrective Action Plan

The following ICAP provides details to implement interim corrective actions in order to treat hydrocarbon-impacted unsaturated and saturated soil as recommended in the RI/FS Report dated September 8, 2006, and as requested by the ACDEH in a letter dated December 18, 2006. The *RI/FS* Report documented that a principal limiting factor for bioremediation was lack of sufficient dissolved oxygen in subsurface groundwater. The RI/FS Report identified EIB using an injected slurry of ORC Advanced and bionutrients, combined with ISCO using an injected slurry of RegenOx in the vicinity of the former UST location. The previous use of hydrogen peroxide showed that TPH as gasoline impacted groundwater at the site can be chemically oxidized with positive results. Thirty-nine Geoprobe bores are proposed for ORC injection, and ten Geoprobe bores are proposed for the injection of RegenOx, at the approximate locations indicated in Figure 2. These locations have been selected in order to provide full coverage of the known extent of hydrocarbon impacted soil and groundwater in the area of investigation.

The contaminants of concern at the site include TPH as gasoline, BTEX, and MTBE in groundwater. Methyl tert-amyl ether (TAME) is also in groundwater and is a secondary contaminant of concern. The implementation of the ICAP should significantly reduce hydrocarbon impacts at the site. The ICAP should provide both the fastest method and the most cost-effective approach to alleviate environmental conditions at the site.

2.1 Project Planning

The ICAP will be implemented upon approval of this plan by the ACDEH, and Blymyer Engineers ability to secure all necessary permits. An outline of the tasks required to implement this ICAP are provided in the following sections.

2.1.1 Secure all required permits

Upon approval of this ICAP, a drilling permit will be obtained from Alameda County Public Works Agency (ACPWA). Additionally, an excavation permit and a traffic control plan will be obtained from the city of Oakland. A city of Oakland encroachment permit is not required for bore installation. All locations are planned to be installed on property owned by Fiesta

Beverages or in the public right-of-way. Any additional remobilizations will also obtain permits from these agencies and jurisdictions, when appropriate.

2.1.2 Revise the site-specific health and safety plan

The health and safety plan will be revised in order to outline potentially hazardous work conditions and contingencies for an emergency.

2.1.3 Locate utilities and conduct conduit survey

Offsite utilities will be marked for location by Underground Service Alert (USA) a minimum of 48-hours prior to initiation of the work. Additionally, proposed onsite Geoprobe bore locations will be marked for clearance by a private utility location service.

2.2 Install RegenOx Injection Bores

To induce accelerated destruction of hydrocarbons within the core of the soil and groundwater plume, RegenOx has been proposed for placement at locations proximal to the former location of the USTs. Earlier field work produced limited indications of free phase product (sheen at most) at the site. As a consequence, RegenOx has been proposed to initially treat the remaining soil and groundwater source. The goals for chemical oxidation projects are to rapidly reduce the contaminant mass and to stabilize or reduce the size of the plume. Ten Geoprobe locations have been identified for the purpose of injecting RegenOx (Figure 2). As recommended by Regenesis, Inc., the RegenOx will be injected in two rounds separated by approximately 2 weeks. The injection grid will be on approximately 10-foot centers, with the second round of injection points to be offset approximately 5 feet from the first set of injection points. A C-57 licensed drilling contractor will be retained to drill and inject the RegenOx. Approximately 18.8 pounds per foot of RegenOx will be injected into each borehole under pressure from approximately 4 to 16 feet bgs. The remaining portion of the borehole to ground surface will be backfilled with neat cement grout.

Typically two to three rounds of RegenOx injection are required at a site to effectively remediate residual soil and groundwater contamination. Two rounds have been calculated by Regenesis to be appropriate for this site. The rounds will be injected approximately 2 weeks apart. Injection of RegenOx rapidly reduces dissolved-phase contaminants in groundwater; however, as contaminants sorbed on subsurface soil re-enter (re-dissolve) into groundwater in response to the initial decrease in groundwater concentrations, groundwater concentrations typically rebound. Reinjection of RegenOx with ORC Advanced helps assure continued long-term treatment of residual contaminants in the project vicinity. The half-life of RegenOx is dependant on the contaminant concentration and the total oxygen demand, but typically averages 5 to 20 days.

2.3 Install ORC Injection Bores

To stimulate bacterial activity outside the vicinity of the former tank excavations, a mixture of ORC Advanced and bionutrients will be injected in a series of strategically placed boreholes (Figure 2) approximately 2 to 4 weeks after the final RegenOx injection. A drilling contractor will be retained to drill and pressure-inject the ORC Advanced into approximately 58 boreholes after the final injection of RegenOx in the plume core. Approximately 5 pounds per foot of ORC Advanced will be injected into each borehole under pressure from approximately 4 to 16 feet bgs. The remaining portion of the borehole will be backfilled with neat cement grout to ground surface. ORC Advanced will typically provide between 6 and 12 months of increased oxygen concentrations in groundwater. An additional round of ORC Advanced injection bores may be required and should be determined by field measurements of DO and hydrocarbon levels monitored in the plume core monitoring wells.

Site-specific bionutrient calculations indicate that NPK fertilizer will not be required (Appendix A). The NPK calculations were generated using the principles detailed in the article *Bionutrient Modeling for Design of Insitu Bioremediation*, from *Pollution Engineering*, April 2003 (Appendix B). These calculations indicate that sufficient nitrogen (as nitrate) is present in groundwater beneath the site vicinity. It was surmised in the RI/FS Report that the source of the nitrate is likely leaking sewer lines located along 89th Avenue. These bionutrient calculations also indicate approximately 0.18 pounds of phosphorous would be required by the subsurface microbes. It is likely that this bionutrient is either naturally present in site vicinity groundwater but may also be present due to the leaky sewer lines with a clothing wash-water source.

2.4 Interim Groundwater and Soil Monitoring

Two rounds of interim groundwater monitoring and sampling of plume core wells (MW-1R, MW-2, and MW-3) will be conducted to help determine the timing of or need for additional RegenOx applications. The first round will be collected approximately 15 days after the initial application of the RegenOx, and the second will be collected approximately 30 days after the final application in an attempt to determine the magnitude of a contaminant rebound, if any. Groundwater from the wells will be submitted for analysis of TPH as gasoline, BTEX, MTBE, pH, DO, and oxidation-reduction potential (ORP) by standard analytical methods.

Additionally a round of bio-monitoring will occur immediately after the second round of interim groundwater monitoring and sampling. Chemical oxidation is known to disinfect (kill-off) bacterial populations; however, this disinfection is not reported as significant with the use of RegenOx. However, post-injection testing of groundwater from plume core wells MW-1R, MW-2, and MW-3, and two background locations (upgradient MW-6 and downgradient MW-9) for aerobic bacteria plate counts and speciation for hydrocarbon degraders will be undertaken. If post-injection monitoring indicates a "sterile zone" then, portions of the subsurface may be bio-augmented with a bacterial culture to populate soil and groundwater with hydrocarbon degrading bacteria. The bacterial culture for bio-augmentation may be obtained from a commercially available product or if viable hydrocarbon degraders are found in the groundwater samples from background wells; then purge waters from background wells may provide a source of native "site-adapted" bacteria. Bio-augmentation through existing monitoring wells (MW-1R, MW-2 and MW-3) should be performed when well conditions indicate groundwater has returned to near neutral conditions, that is, groundwater is no longer highly oxidative.

Interim soil monitoring will be conducted at the time the Geoprobe bores are installed for the purpose of injecting ORC Advanced. Regenesis recommends collection of soil samples for the contaminants of concern approximately four weeks after the final round of RegenOx injection. One to two soil samples will be collected from two of the injection bore sites in close proximity to wells MW-1 and MW-1R, where elevated soil concentrations have previously been documented. Soil from the bores will be submitted for analysis of TPH as gasoline, BTEX, and MTBE by standard analytical methods.

2.5 Reporting

After completion of field activities a report will be prepared for submission to ACDEH. The report will include a description of all field activities, a scaled site plan showing the Geoprobe bore locations, and conclusions and recommendations for additional investigatory work, if appropriate, based on the findings from the implementation of the ICAP. Copies of appropriate documentation, including field data sheets, manifests or bills of lading, and permits, will be included.

3.0 Quarterly Groundwater Monitoring

Groundwater monitoring will return to a quarterly basis from the current semi-annual basis beginning with the first quarter of 2007. Progress of the ICAP will be provided in quarterly reports. Positive progress will be judged by a reduction in hydrocarbon concentrations in groundwater and the maintenance of subsurface conditions favorable for aerobic biodegradation of remaining hydrocarbons in groundwater.

Groundwater from all wells will be submitted for analysis of TPH as gasoline, BTEX, and MTBE by standard analytical methods during each quarterly groundwater monitoring and sampling event. An abbreviated RNA chemical parameter suite will be additionally analyzed each quarter and will consist of DO, pH, and ORP. This will help to determine if an oxygen-rich environment conducive to microbial growth is present in the subsurface.

To achieve final site closure, a period of groundwater monitoring, typically a minimum of four quarters after completion of remedial activities, will likely be required. Should contaminant concentrations be reduced below regulatory acceptable levels or show a declining trend, then site closure may be achieved through the risk-based corrective action (RBCA) approach. Blymyer Engineers recommends that the RBCA analysis be performed concurrently with post-remedial groundwater monitoring to expedite closure proceedings.

Tables

Table I, Summary of Groundwater Elevation Measurements
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Date	TOC Elevation (feet)	Depth to Water (feet)	Water Surface Elevation (feet)
MW-1	8/6/1993	18.72	8.96	9.76
	1/12/1996		8.55	10.17
	4/16/1996		7.65	11.07
	7/15/1996		8.76	9.96
	10/16/1996		9.04	9.68
	12/15/1998		8.38	10.34
	1/18/2001		8.49	10.23
	4/25/2001		8.24	10.48
	3/17/03*		8.08	10.64
	6/23/2003		8.63	10.09
	9/18/2003		8.90	9.82
	12/15/2003		8.15	10.57
	6/15/2004		8.67	10.05
	12/15/2004		7.99	10.73
	6/29/2005		7.88	10.84
	5/8/2006	21.70	Destroyed	Destroyed

Table I, Summary of Groundwater Elevation Measurements BEI Job No. 203004, Former Fiesta Beverage 966 89th Avenue, Oakland, California				
Well ID	Date	TOC Elevation (feet)	Depth to Water (feet)	Water Surface Elevation (feet)
MW-2	8/6/1993	18.44	8.68	9.76
	1/12/1996		8.24	10.20
	4/16/1996		7.41	11.03
	7/15/1996		8.45	9.99
	10/16/1996		8.73	9.71
	12/15/1998		8.05	10.39
	1/18/2001		8.24	10.20
	4/25/2001		7.88	10.56
	3/17/03*		7.08	11.36
	6/23/2003		8.90	9.54
	9/18/2003		8.61	9.83
	12/15/2003		7.97	10.47
	6/15/2004		8.42	10.02
	12/15/2004		8.00	10.44
	6/29/2005		9.51	8.93
	6/12/2006	21.45	8.25	13.20

Table I, Summary of Groundwater Elevation Measurements
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Date	TOC Elevation (feet)	Depth to Water (feet)	Water Surface Elevation (feet)
MW-3	8/6/1993	19.01	9.07	9.94
	1/12/1996		8.65	10.36
	4/16/1996		7.82	11.19
	7/15/1996		8.88	10.13
	10/16/1996		9.16	9.85
	12/15/1998		8.45	10.56
	1/18/2001		8.57	10.44
	4/25/2001		8.29	10.72
	3/17/03*		8.50	10.51
	6/23/2003		9.05	9.96
	9/18/2003		9.11	9.90
	12/15/2003		8.03	10.98
	6/15/2004		8.85	10.16
	12/15/2004		8.84	10.17
	6/29/2005		9.00	10.01
	6/12/2006	22.02	8.62	13.40

Table I, Summary of Groundwater Elevation Measurements BEI Job No. 203004, Former Fiesta Beverage 966 89th Avenue, Oakland, California				
Well ID	Date	TOC Elevation (feet)	Depth to Water (feet)	Water Surface Elevation (feet)
MW-1R	6/12/2006	21.73	8.49	13.24
MW-4	6/12/2006	21.34	8.37	12.97
MW-5	6/12/2006	22.53	8.75	13.78
MW-6	6/12/2006	21.97	8.59	13.38
MW-7	6/12/2006	21.21	8.31	12.90
MW-8	6/12/2006	20.97	8.37	12.60
MW-9	6/12/2006	20.98	8.50	12.48

Notes:

TOC = Top of Casing
* = Initial data set collected under direction of Blymyer Engineers, Inc.
NM = Not measured
[1] = Resurveyed on February 7, or June 22, 2006 by CSS Environmental Services, Ir

Elevations in feet above mean sea level

Table II, Summary of Groundwater Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Sample Date	Modified EPA Method 8015 (µg/L)	EPA Method 8020 or 8021B (µg/L)				
		TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
MCL		N/A	1	150	700	1,750	13
Drinking Water Source [1]		100	1	40	30	20	5
Non-Drinking Water Source [2]		500	46	130	290	100	1,800
MW-1	8/6/1993	**17,000**	**7.1**	**8.4**	**9.2**	**53**	NA
	1/12/1996	**12,000**	**1,900**	**840**	**370**	**1,100**	NA
	4/16/1996	**3,500**	**700**	**55**	**100**	**180**	NA
	7/15/1996	**11,000**	**2,300**	**450**	**350**	**910**	NA
	10/16/1996	**21,000**	**4,200**	**2,200**	**650**	**2,600**	NA
	12/15/1998	**10,000**	**1,800**	**520**	**270**	**1,100**	<350
	1/18/2001	**11,000** [a]	**2,000**	**320**	**320**	**1,100**	<120
	4/25/2001	**2,100** [a, c]	**270**	**46**	**59**	**130**	<5.0
	3/17/2003*	**2,200** [a]	**260**	**19**	**36**	**54**	NA [d]
	6/23/2003	**6,100** [a]	**930**	**53**	**99**	**200**	NA
	9/18/2003	**3,800** [a]	**660**	**13**	**24**	**34**	NA
	12/15/2003	**260** [a]	**19**	**1.1**	<0.5	**1.5**	NA
	6/15/2004	**5,200** [a]	**520**	**13**	**38**	**39**	<50
	12/15/2004	**2,400** [a]	**370**	**8.2**	**13**	**14**	<15
	6/29/2005	**5,500** [a]	**750**	**27**	**94**	**140**	<100
	5/8/2006	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed

Table II, Summary of Groundwater Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Sample Date	Modified EPA Method 8015 (µg/L)	EPA Method 8020 or 8021B (µg/L)				
		TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
MCL		N/A	1	150	700	1,750	13
Drinking Water Source[1]		100	1	40	30	20	5
Non-Drinking Water Source[2]		500	46	130	290	100	1,800
MW-2	8/6/1993	**2,700**	**1**	**2**	**2**	**8**	NA
	1/12/1996	**2,700**	**600**	**310**	**94**	**220**	NA
	4/16/1996	**190**	**39**	**11**	**10**	**14**	NA
	7/15/1996	**700**	**160**	**33**	**34**	**48**	NA
	10/16/1996	**190**	**48**	**8**	**10**	**13**	NA
	12/15/1998	**200**	**62**	**17**	**5**	**14**	**4.4 b**
	1/18/2001	**300**[a]	**74**	**26**	**7**	**21**	**7.3**
	4/25/2001	<50[c]	**5**	**2**	**1**	**2**	<5.0
	3/17/2003*	**78**[a]	**26**	**3**	**2**	**4**	NA[d]
	6/23/2003	**160**[a]	**51**	**2**	**1**	**2**	**NA**
	9/18/2003	<50	**2**	**<0.5**	**<0.5**	**<0.5**	NA
	12/15/2003	<50	**12**	<0.5	**<0.5**	**<0.5**	NA
	6/15/2004	**95**[a]	**15**	**1.3**	**2**	**1**	<30
	12/15/2004	**<50**	**11**	**0.97**	**1**	**1**	**7.8**
	6/29/2005	**130**	**29**	**2**	**3**	**3**	**6.7**
	6/13/2006	**150**[a]	**59**	**3**	**3.4**	**2.7**	**11**

Table II, Summary of Groundwater Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Sample Date	Modified EPA Method 8015 (µg/L)	EPA Method 8020 or 8021B (µg/L)				
		TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
MCL		N/A	1	150	700	1,750	13
Drinking Water Source [1]		100	1	40	30	20	5
Non-Drinking Water Source [2]		500	46	130	290	100	1,800
MW-3	8/6/1993	**5,200**	**2.1**	**2.9**	**3.6**	**17**	NA
	1/12/1996	**4,500**	**280**	**180**	**120**	**470**	NA
	4/16/1996	**5,400**	**370**	**340**	**160**	**580**	NA
	7/15/1996	**1,800**	**200**	**220**	**66**	**250**	NA
	10/16/1996	**2,000**	**340**	**140**	**100**	**300**	NA
	12/15/1998	**1,400**	**200**	**39**	**72**	**150**	<22
	1/18/2001	**1,800** [a]	**240**	**41**	**86**	**120**	<10
	4/25/2001	**8,300** [a, c]	**300**	**330**	**200**	**1,100**	<20
	3/17/2003*	**2,100** [a]	**240**	**78**	**10**	**280**	NA [d]
	6/23/2003	<50	**2.5**	**0.6**	**0.69**	**1.4**	NA
	9/18/2003	<50	<0.5	<0.5	<0.5	<0.5	NA
	12/15/2003	**2,400**	**300**	**120**	**140**	**260**	NA
	6/15/2004	<50	**1.1**	<0.5	<0.5	<0.5	**6.2**
	12/15/2004	**1,600** [a]	**140**	**83**	**83**	**230**	<15
	6/29/2005	**230** [a]	**27**	**6.1**	**7.2**	**15**	<15
	6/13/2006	**68** [a]	**3.1**	**1.8**	<0.5	<0.5	<5.0

Table II, Summary of Groundwater Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Sample Date	Modified EPA Method 8015 (µg/L)	EPA Method 8020 or 8021B (µg/L)				
		TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
MCL		N/A	1	150	700	1,750	13
Drinking Water Source [1]		100	1	40	30	20	5
Non-Drinking Water Source [2]		500	46	130	290	100	1,800
MW-1R	6/13/2006	**90** [a]	**24**	<0.5	<0.5	**1.9**	**7.0**
MW-4	6/12/2006	<50	<0.5	<0.5	<0.5	<0.5	**5.7**
MW-5	6/12/2006	<50	<0.5	<0.5	<0.5	<0.5	<5.0
MW-6	6/13/2006	<50	<0.5	<0.5	<0.5	<0.5	<5.0
MW-7	6/12/2006	<50	<0.5	<0.5	<0.5	<0.5	<5.0
MW-8	6/12/2006	<50	<0.5	<0.5	<0.5	<0.5	<5.0
MW-9	6/12/2006	<50	<0.5	<0.5	<0.5	<0.5	**5.6**

Notes:
ug/L = micrograms per liter
TPH = Total Petroleum Hydrocarbons
EPA = Environmental Protection Agency
MTBE = Methyl *tert*-Butyl Ether
[1] = From Table A; RWQCB Environmental Screening Levels (ESLs); Groundwater IS a Current or Potential Source of Drinking Water
[2] = From Table B; RWQCB Environmental Screening Levels (ESLs); Groundwater IS NOT a Current or Potential Source of Drinking Water
RWQCB = California Regional Water Quality Control Board, San Francisco Bay Region
ESL = Environmental Screening Level
N/A = Not applicable
NA = Not analyzed
RBSL = Risk Based Screening Level
<*x* = Analyte not detected at reporting limit *x*
* = Initial data set collected under direction of Blymyer Engineers, Inc.
[a] = Laboratory note indicates the unmodified or weakly modified gasoline is significant.
[b] = Confirmed with EPA Method 8260.
[c] = Groundwater samples for MW-1 and MW-3 suspected to have been switched (mismarked) in field. First collection of groundwater samples after application of Hydrogen Peroxide on March 7, 2001.
[d] = Analysis conducted by EPA Method 8260. See Table III.

Bold results indicate detectable analyte concentrations.
Note: Shaded cell indicates that detected concentration exceeds ESL

Table III, Summary of Groundwater Sample Fuel Oxygenate Analytical Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Sample Date	EPA Method 8260B (ug/L)								
		TAME	TBA	EBD	1,2-DCA	DIPE	Ethanol	ETBE	Methanol	MTBE
Drinking Water Source [1]		NV	12	0.05	0.5	NV	50,000	NV	NV	5
Non-Drinking Water Source [2]		NV	18,000	152	204	NV	50,000	NV	NV	1,800
MW-1	3/17/2003	**8.3**	<5.0	NA	NA	<0.50	NA	<0.50	NA	**10.0**
	6/23/2003	**6.4**	<25	NA	NA	<2.5	NA	<2.5	NA	**8.0**
	9/18/2003	**5.3**	<25	NA	NA	<2.5	NA	<2.5	NA	**8.5**
	12/15/03[3]	**9.0**	<5.0	NA	NA	<0.5	NA	<0.5	NA	**12.0**
MW-2	3/17/2003	**2.1**	**6.0**	NA	NA	<0.50	NA	<0.50	NA	**13.0**
	6/23/2003	**4.5**	<5.0	NA	NA	<0.50	NA	<0.50	NA	**11.0**
	9/18/2003	**0.7**	<25	NA	NA	<2.5	NA	<2.5	NA	**5.0**
	12/15/03[3]	**3.2**	**5.2**	NA	NA	<0.5	NA	<0.5	NA	**13.0**
	6/13/2006	**4.5**	**6.5**	<5.0	<5.0	<5.0	<50	<0.5	<500	**7.6**
MW-3	3/17/2003	**4.3**	**8.6**	NA	NA	<0.50	NA	<0.50	NA	**10.0**
	6/23/2003	**2.6**	<5.0	NA	NA	<0.50	NA	<0.50	NA	**5.6**
	9/18/2003	**3.6**	<25	NA	NA	<2.5	NA	<2.5	NA	**10.0**
	12/15/03[3]	**2.7**	<5.0	NA	NA	<0.5	NA	<0.5	NA	**13.0**
MW-4	6/12/2006	NA	NA	NA	NA	NA	NA	NA	NA	**6.1**

Table III, Summary of Groundwater Sample Fuel Oxygenate Analytical Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Sample Date	EPA Method 8260B (ug/L)								
		TAME	TBA	EBD	1,2-DCA	DIPE	Ethanol	ETBE	Methanol	MTBE
Drinking Water Source [1]		NV	12	0.05	0.5	NV	50,000	NV	NV	5
Non-Drinking Water Source [2]		NV	18,000	152	204	NV	50,000	NV	NV	1,800

Notes:

TAME = Methyl tert-Amyl Ether
TBA = tert-Butyl Alcohol
EDB = 1,2-Dibromoethane
1,2-DCA = 1,2-Dichloroethane
DIPE = Di-isopropyl ether
ETBE = Ethyl tert-butyl ether
MTBE = Methly tert-butyl ether
(µg/L) = Micrograms per liter
NV = No value
NA = Not analyzed

[1] = From Table A; Environmental Screening Levels (ESLs); Groundwater IS a Current or Potential Source of Drinking Water

[2] = From Table B; RWQCB Environmental Screening Levels (ESLs); Groundwater IS NOT a Current or Potential Source of Drinking Water

[3] = In general after this date, fuel oxygenates were monitored using MTBE detected by EPA Method 8020B, as a proxy for the approximate concentration of the remaining fuel oxygenates.

Bold results indicate detectable analyte concentrations.
Note: Shaded cell indicates that detected concentration exceeds ESL

Table IV, Summary of Groundwater Intrinsic Bioremediation Field Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Sample Date	Field Meter	Field Meter	Field Test Kit	Field Meter	Field Meter
		Dissoved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	Ferrous Iron (Fe 2+)	Field Temperature (o F / o C)	Field pH pH units
MW-1	3/17/2003	NA	NA	NA	60.4 / 60.0 *	7.1 / 7.3
	6/23/2003	0.4	NA	NA	61.0 / 61.0 *	6.9 / 6.9
	9/18/2003	0.4	NA	NA	65.1 / 62.9 *	7.1 / 6.9
	12/15/2003	1.1	NA	NA	13.1 / 13.4	6.8 / 6.7
	6/15/2004	0.1	NA	NA	64.5 / 63.4 *	6.9 / 7.0
	12/15/2004	NA	NA	NA	15.4 / 17.5	7.0 / 6.9
	6/29/2005	0.24 / 0.17	1.0	4.5	19.78 / 21.63	7.15 / 7.08
	5/8/2006	Destroyed	Destroyed	Destroyed	Destroyed	Destroyed
MW-2	3/17/2003	NA	NA	NA	66.0 / 64.2 *	7.4 / 7.9
	6/23/2003	0.6	NA	NA	62.1 / 61.8 *	6.8 / 7.1
	9/18/2003	1.3	NA	NA	66.7 / 63.7 *	6.7 / 6.9
	12/15/2003	1.6	NA	NA	13.2 / 13.4	6.6 / 6.6
	6/15/2004	0.1	NA	NA	64.5 / 65.0 *	6.3 / 7.1
	12/15/2004	NA	NA	NA	16.9 / 17.0	7.1 / 7.1
	6/29/2005	0.19 / 0.24	0.7	0.7	18.58 / 21.18	7.12 / 7.13
	6/13/2006	0.80 / 0.42	168.0 / 168.0	0 / 0	17.49 / 17.70	6.97 / 6.98
MW-3	3/17/2003	NA	NA	NA	63.3 / 60.9 *	7.4 / 7.6
	6/23/2003	0.7	NA	NA	66.4 / 66.9 *	7.3 / 7.2
	9/18/2003	0.4	NA	NA	63.7 / 62.6 *	7.1 / 7.1
	12/15/2003	1.6	NA	NA	14.7 / 15.1	6.5 / 6.4
	6/15/2004	0.0	NA	NA	63.1 / 62.3 *	7.5 / 7.1
	12/15/2004	NA	NA	NA	15.4 / 16.7	7.2 / 7.0
	6/29/2005	0.72 / 0.78	141.7 / -67.6	0.9	17.65 / 18.79	6.94 / 7.02
	6/13/2006	1.01 / 0.41	170.0 / 168.5	0 / 0	17.30 / 17.15	7.02 / 6.98

Table IV, Summary of Groundwater Intrinsic Bioremediation Field Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Sample Date	Field Meter	Field Meter	Field Test Kit	Field Meter	Field Meter
		Dissoved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	Ferrous Iron (Fe 2+)	Field Temperature (o F / o C)	Field pH pH units
MW-1R	6/13/2006	0.87 / 0.37	172.9 / 172.9	0 / 0	17.31 / 17.36	6.90 / 6.92
MW-4	6/12/2006	0.67 / 0.33	164.3 / 161.0	0.5 / 0	16.90 / 16.79	6.82 / 6.79
MW-5	6/12/2006	0.61 / 0.31	175.2 / 169.0	0 / 0	18.40 / 18.01	7.01 / 6.94
MW-6	6/13/2006	3.10 / 0.81	181.2 / 174.8	0 / 0	17.25 / 17.32	6.94 / 6.83
MW-7	6/12/2006	0.59 / 0.27	172.5 / 171.8	0.5 / 0.2	18.14 / 18.00	6.90 / 6.87
MW-8	6/12/2006	0.37 / 0.33	186.1 / 180.4	0 / 0	18.55 / 18.39	6.85 / 6.85
MW-9	6/12/2006	2.01 / 1.87	206.0 / 191.0	0 / 0	16.88 / 16.91	6.63 / 6.66

Notes:
mV = Millivolts
mg/L = Milligrams per liter
^{o} F / ^{o} C = degrees Fahrenheit / degrees Centigrade
* = degrees Fahrenheit
2.6 / 2.2 = Initial reading (pre-purge) / Final reading (post-purge)
Na = Not available

Table V, Summary of Groundwater Intrinsic Bioremediation Analytical Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Sample Date	Method SM 5310B	Method E300.1		Method RSK 174
		CO_2	Nitrate (as N)	Sulfate	Methane
		mg/L			µg/L
MW-1	6/29/2005	490	<0.1	5	5,900
	5/8/2006	Destroyed	Destroyed	Destroyed	Destroyed
MW-2	6/29/2005	250	4.1	42	68
	6/13/2006	290	3.2	44	45
MW-3	6/29/2005	230	3.5	33	370
	6/13/2006	220	3.5	33	55
MW-1R	6/13/2006	290	4.3	46	24
MW-4	6/12/2006	260	8.6	44	1.1
MW-5	6/12/2006	240	6.8	45	1.5
MW-6	6/13/2006	290	7.2	50	<0.5
MW-7	6/12/2006	260	6	51	<0.5
MW-8	6/12/2006	330	7.3	46	<0.5
MW-9	6/12/2006	240	8.3	44	1.1

Notes:
SM = Standard Method
mg/L = Milligrams per liter
µg/L = Micrograms per liter
CO_2 = Carbon Dioxide

Table VI, Summary of Grab Groundwater Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Sample Date	Modified EPA Method 8015 (µg/L)	EPA Method 8020 or 8021B (µg/L)				
		TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
MCL		N/A	1	150	700	1,750	13
Drinking Water Source [1]		100	1	40	30	20	5
Non-Drinking Water Source [2]		500	46	130	290	100	1,800
W1*	1/15/1991	**25,000**	**3,100**	**2,900**	**380**	**2,800**	NA
W2*	1/15/1991	**36,000**	**3,700**	**4,300**	**840**	**4,900**	NA
B-1	11/30/1999	**850 a, b**	**0.94**	**3**	**0.7**	**5.7**	<5.0
B-2	11/30/1999	**3,200 a, c**	**94**	**210**	**79**	**370**	<10
B-3	11/30/1999	**90 b**	**<0.5**	**<0.5**	**<0.5**	**1**	<5.0
B-4	11/30/1999	**<50**	**<0.5**	**<0.5**	**<0.5**	**<0.5**	<5.0
GP1-W	9/27/2004	**14,000 c**	**210**	**190**	**84**	**420**	<50
GP2-W	9/27/2004	**790 c**	**28**	**59**	**25**	**110**	<10
GP3-W	9/27/2004	**<50**	**<0.5**	**1.3**	**<0.5**	**0.53**	8.7
GP4-W	9/27/2004	**7,200 c**	**5**	**<5**	**46**	**110**	<50
GP5-W	9/27/2004	**14,000 c**	**94**	**25**	**380**	**1,300**	<50
GP6-W	9/27/2004	**12,000 c**	**99**	**60**	320	**1,200**	<50
GP7-W	9/27/2004	**<50**	**1.4**	**<0.5**	**<0.5**	**0.88**	12
GP8-W	9/27/2004	**1,300 c**	**73**	**180**	**37**	**150**	<15

Notes:
ug/L = micrograms per liter
TPH = Total Petroleum Hydrocarbons
EPA = Environmental Protection Agency
MTBE = Methyl *tert* -Butyl Ether
[1] = From Table A; RWQCB Environmental Screening Levels (ESLs); Groundwater IS a Current or Potential Source of Drinking Water
[2] = From Table B; RWQCB Environmental Screening Levels (ESLs); Groundwater IS NOT a Current or Potential Source of Drinking Water
RWQCB = California Regional Water Quality Control Board, San Francisco Bay Region
ESL = Environmental Screening Level
N/A = Not applicable
NA = Not analyzed
RBSL = Risk Based Screening Level
<*x* = Analyte not detected at reporting limit *x*
* = Pit water collected at a depth of 14 feet below grade surface.
[a] = Laboratory note indicates that heavier gasoline range compounds are significant (aged gasoline?).
[b] = Laboratory note indicates no recognizable pattern..
[c] = Laboratory note indicates unmodified or weakly modified gasoline is significant.

Bold results indicate detectable analyte concentrations.
Note: Shaded cell indicates that detected concentration exceeds ESL

Table VII, Summary of Soil Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Depth (ft)	Sample Date	Modified EPA Method 8015	EPA Method 8020 or 8021B (mg/Kg)				
			TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
Drinking Water ESL, Shallow or Deep Soil [1]			100	0.044	2.9	3.3	2.3	0.023
Non-Drinking Water ESL, Shallow Soil [2]			400	0.38	9.3	32	11	5.6
Non-Drinking Water ESL, Deep Soil [3]			400	0.51	9.3	32	11	5.6
1	9*	8/24/1990	**350**	**3.5**	**15**	**4.5**	**28**	NA
2	9*	8/24/1990	**4900**	**59**	**260**	**100**	**500**	NA
3	9*	8/24/1990	**780**	**13**	**41**	**13**	**67**	NA
4	9*	8/24/1990	**810**	**16**	**52**	**17**	**87**	NA
Composite 1	N/A	8/24/1990	**1000**	**0.16**	**1.8**	**0.57**	**22**	NA
Composite 2	N/A	8/24/1990	**10**	**0.0071**	**0.032**	**0.037**	**1.1**	NA
Composite 3	N/A	8/24/1990	**440**	**0.1**	**0.59**	**1.7**	**13**	NA
S1	14**	1/15/1991	<0.5	<0.005	**0.0068**	<0.005	**0.0077**	NA
S2	14**	1/15/1991	**2.2**	**0.081**	**0.013**	<0.005	**0.0092**	NA
MW-1	6	6/24/1993	**43**	**0.9**	**0.71**	**0.7**	**3.8**	NA
MW-1	11	6/24/1993	**60**	**2.8**	**2.3**	**3.5**	**10**	NA
MW-2	6	6/24/1993	**260**	**7.9**	**30**	**6.3**	**49**	NA
MW-2	11	6/24/1993	**11**	**0.097**	**0.34**	**0.44**	**1.6**	NA
MW-3	6	6/24/1993	**5**	**0.15**	**0.16**	**0.18**	**0.48**	NA
MW-3	11	6/24/1993	**22**	**0.29**	**2.2**	**0.29**	**5.6**	NA
GP1-6	6	9/27/2004	**2.1** [c]	**0.027**	**0.009**	<0.005	<0.005	<5.0
GP1-15.5	15.5	9/27/2004	**23** [d]	**0.0056**	<0.005	<0.005	**0.07**	<5.0
GP2-11.5	11.5	9/27/2004	**140** [c]	**1.4**	**2**	**2.3**	**6.4**	<0.50
GP3-14.5	14.5	9/27/2004	<1.0	<0.005	<0.005	<0.005	<0.005	<5.0

Table VII, Summary of Soil Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Depth (ft)	Sample Date	Modified EPA Method 8015	EPA Method 8020 or 8021B (mg/Kg)				
			TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
Drinking Water ESL, Shallow or Deep Soil [1]			100	0.044	2.9	3.3	2.3	0.023
Non-Drinking Water ESL, Shallow Soil [2]			400	0.38	9.3	32	11	5.6
Non-Drinking Water ESL, Deep Soil [3]			400	0.51	9.3	32	11	5.6
GP4-11.5	11.5	9/27/2004	**310**[c]	**0.28**	**0.4**	**1.4**	**2.1**	<1.0
GP5-11	11	9/27/2004	**540**[c]	**1.1**	**0.22**	**8.3**	**12**	<0.50
GP5-12.5	12.5	9/27/2004	**23**[c]	**0.13**	**0.03**	**0.24**	**0.62**	<5.0
GP6-6	6	9/27/2004	**200**[c]	**0.63**	**0.83**	**3.3**	**12**	<1.0
GP6-11.5	11.5	9/27/2004	**390**[c]	**0.63**	**0.56**	**4.5**	**18**	<1.0
GP7-2.5	2.5	9/27/2004	**2.7**[c]	**0.028**	<0.005	<0.005	**0.018**	<5.0
GP7-11.5	11.5	9/27/2004	<1.0	<0.005	<0.005	<0.005	<0.005	<5.0
GP8-6.5	6.5	9/27/2004	**170**[c]	**1.8**	**2.5**	**3.2**	**10**	<0.50
GP8-11.5	11.5	9/27/2004	**32**[c]	**0.27**	**1.1**	**0.44**	**2.2**	<0.50
GP9-11.5	11.5	9/27/2004	**120**[c]	**0.2**	**0.32**	**1.3**	**5.3**	<0.50
GP9-15.5	15.5	9/27/2004	**40**[d]	**0.011**	**0.037**	**0.066**	**0.3**	<5.0
MW5-10.5	10.5	5/8/2006	<1.0	<0.005	<0.005	<0.005	<0.005	<0.05
MW6-5.5	5.5	5/8/2006	<1.0	<0.005	<0.005	<0.005	<0.005	<0.05
MW6-13.5	13.5	5/8/2006	<1.0	<0.005	<0.005	<0.005	<0.005	<0.05
MW1R-7	7	5/9/2006	**450**[c]	**4.8**	**18**	**8.2**	**45**	**<10**
MW1R-13.5	13.5	5/9/2006	**60**[c, d]	**0.34**	**1.8**	**0.73**	**3.3**	<0.35
MW4-14.5	14.5	5/9/2006	<1.0	<0.005	<0.005	<0.005	<0.005	<0.05
MW7-14	14	6/2/2006	<1.0	<0.005	<0.005	<0.005	<0.005	<0.05
MW8-15	15	6/2/2006	<1.0	<0.005	<0.005	<0.005	<0.005	<0.05
MW-9-16	16	6/2/2006	<1.0	<0.005	<0.005	<0.005	<0.005	<0.05

Table VII, Summary of Soil Sample Hydrocarbon Analytical Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Well ID	Depth (ft)	Sample Date	Modified EPA Method 8015	EPA Method 8020 or 8021B (mg/Kg)				
			TPH as Gasoline	Benzene	Toluene	Ethylbenzene	Total Xylenes	MTBE
Drinking Water ESL, Shallow or Deep Soil [1]			100	0.044	2.9	3.3	2.3	0.023
Non-Drinking Water ESL, Shallow Soil [2]			400	0.38	9.3	32	11	5.6
Non-Drinking Water ESL, Deep Soil [3]			400	0.51	9.3	32	11	5.6

Notes:

ft = feet
mg/Kg = Milligrams per kilogram
TPH = Total Petroleum Hydrocarbons
MTBE = Methyl *tert* -Butyl Ether
RWQCB = California Regional Water Quality Control Board, San Francisco Bay Region
ESL = Environmental Screening Level

[1] = From Table A or C; RWQCB Environmental Screening Levels (ESLs); **Shallow or Deep Soils (<3m)**; Commercial/Industrial Land Use; Groundwater IS a Current or Potential Source of Drinking Water

[2] = From Table B; RWQCB Environmental Screening Levels (ESLs); **Shallow Soils (<3m)**; Commercial/Industrial Land Use; Groundwater IS NOT a Current or Potential Source of Drinking Water

[3] = From Table D; RWQCB Environmental Screening Levels (ESLs); **Deep Soils (>3m)**; Commercial/Industrial Land Use; Groundwater IS NOT a Current or Potential Source of Drinking Water

NA = Not analyzed
RBSL = Risk Based Screening Level
<*x* = Analyte not detected at reporting limit *x*
* = Assumed to be bottom samples.
** = Bottom samples (per Tank Protect Engineering Preliminary Site Assessment Report, dated December 15, 1993).
[a] = Laboratory note indicates the result is a hydrocarbon within the diesel range but that it appears to be the less volatile constituents of gasoline.
[b] = Also detected “High Point Hydrocarbons” calculated as oil at 300 mg/kg, and Oil and Grease at 80 mg/kg.
[c] = Laboratory note indicates unmodified or weakly modified gasoline is significant.
[d] = Laboratory note indicates no recognizable pattern..

Bold results indicate detectable analyte concentrations.
Note: Shaded cell indicates that detected concentration exceeds ESL

Table VIII, Summary of Miscellaneous Soil Sample Analytical Results
BEI Job No. 203004, Former Fiesta Beverage
966 89th Avenue, Oakland, California

Sample ID	Sample Date	Method SW 7010 (mg/Kg)
		Total Lead
Drinking Water ESL, Shallow or Deep Soil [1]		750
Non-Drinking Water ESL, Shallow Soil [2]		750
Non-Drinking Water ESL, Deep Soil [3]		750
GP2-11.5	9/27/2004	**10**
GP5-11.0	9/27/2004	**11**
GP9-11.5	9/27/2004	**12**

Notes: mg/Kg = milligram per kilogram

[1] = From Table A or C; RWQCB Environmental Screening Levels (ESLs); **Shallow or Deep Soils (<3m)**; Commercial/Industrial Land Use; Groundwater IS a Current or Potential Source of Drinking Water

[2] = From Table B; RWQCB Environmental Screening Levels (ESLs); **Shallow Soils (<3m)**; Commercial/Industrial Land Use; Groundwater IS NOT a Current or Potential Source of Drinking Water

[3] = From Table D; RWQCB Environmental Screening Levels (ESLs); **Deep Soils (>3m)**; Commercial/Industrial Land Use; Groundwater IS NOT a Current or Potential Source of Drinking Water

Bold results indicate detectable analyte concentrations.

Note: Shaded cell indicates that detected concentration exceeds ESL

Figures

UNITED STATES GEOLOGICAL SURVEY 7.5' QUADS. "OAKLAND EAST, CA & SAN LEANDRO, CA", BOTH PHOTOREVISED 1981.


QUADRANGLE LOCATION

BLYMYER
ENGINEERS, INC.

BEI JOB NO. 203004

DATE 3-19-03

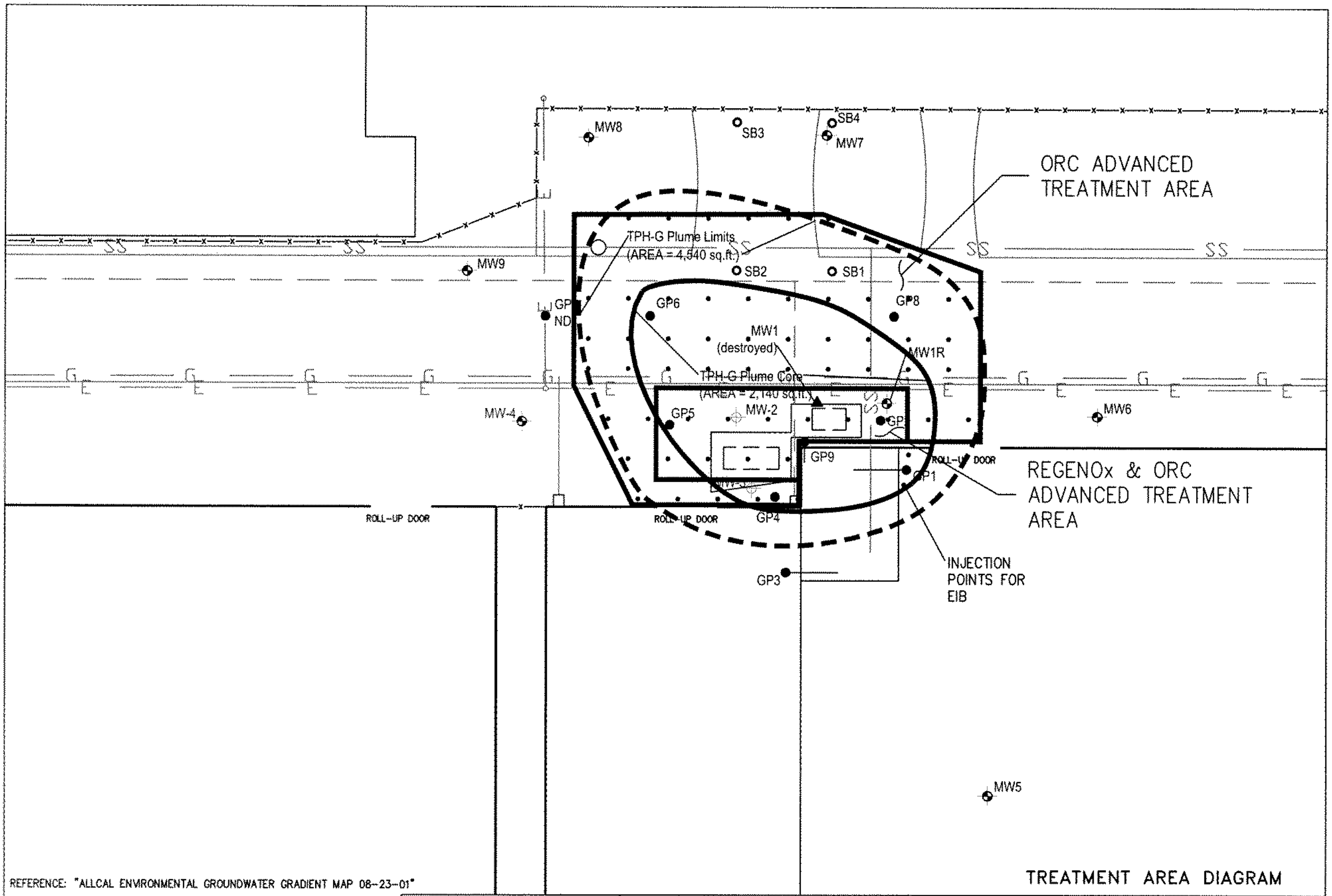
0 1000 2000
SCALE IN FEET

N

SITE LOCATION MAP

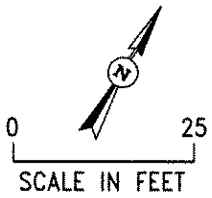
FORMER FIESTA BEVERAGE
966 89TH AVE.
OAKLAND, CA

FIGURE
1



REFERENCE: "ALLCAL ENVIRONMENTAL GROUNDWATER GRADIENT MAP 08-23-01"

TREATMENT AREA DIAGRAM



BLYMYER ENGINEERS, INC.

BEI JOB NO.	DATE
203004	02-08-07

LEGEND

UST	UNDERGROUND STORAGE TANK
NS	NOT SAMPLED
ND	NOT DETECTED
⌖	GROUNDWATER MONITORING WELL
○ SB4	SOIL BORE (INSTALLED BY ALLCAL)
● GP1	SOIL BORE
●—	SOIL BORE-ANGLED
⊕	GROUNDWATER MONITORING WELL
▲	DESTROYED GW MONITORING WELL

TPH-G PLUME CORE AND
LIMITS WITH ESTIMATED
INJECTION POINTS

FORMER FIESTA BEVERAGE
966 89TH AVE.
OAKLAND, CA

FIGURE

2

L:\Acad\2003dwg\203004\203004fig2L.dwg February 08, 2007 - 10:19AM lwittstock

Appendix A

Bionutrient Estimation for ORC Injection Bores

Bionutrient Calculations for
Former Fiesta Beverage Facility
966 89th Avenue, Oakland, CA
Fule Leak Case RO000314
Aerobic Conditions

Mass Ratios ($C_{106}H_{263}N_{16}P_1$) From Strumm and Morgan (1991)

	Carbon	Nitrogen	Phosphorous
Moles	106	16	1
MW	12	14	31
Mass Ratio	1272	224	31
Per gram of Carbon	1	0.176	0.024

	Carbon (mg/L)	Nitrogen (mg/L)	Phosphorous (mg/L)
C:N:P	1	0.176	0.024
C:N:P Required	6.1	1.0736	0.1464
C:N:P Present	6.1	6.0	0.0
Nutrient Deficiency	0.0	0.0	0.1464

Volume of Saturated Treatment Area: 75 ft x 75 ft x 10 ft x 0.3 = 16,875 feet^3

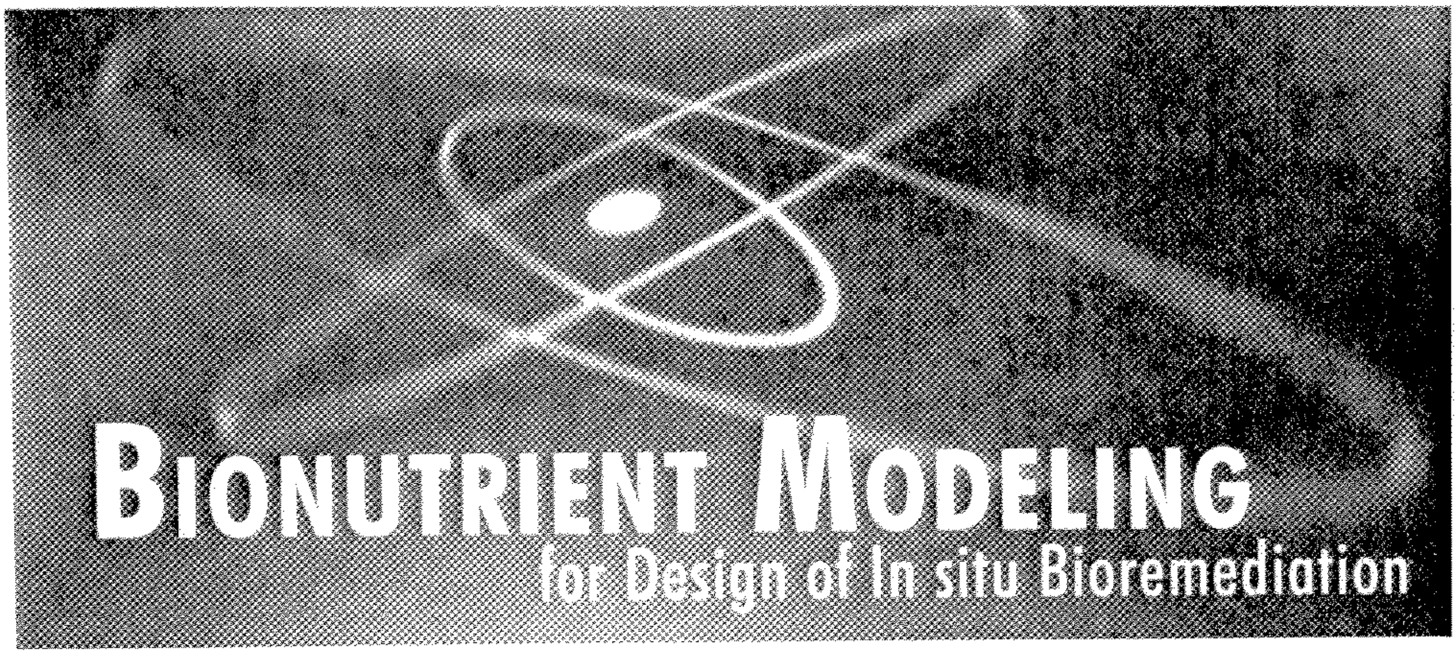
16,875 ft^3 x 28.3168 L/ft^3 = 477,847 Liter

	Nitrogen	Phosphorous
Pounds Required	0.0	0.054

	Nitrate	Ortho P
Pounds Required as	0.0	0.18

Appendix B

Bionutrient Modeling for Design of Insitu Bioremediation, Pollution Engineering, April 2003



BIONUTRIENT MODELING
for Design of In situ Bioremediation

by Warren B. Chamberlain, R.G., C.H.G, P.E.

Enhanced bioremediation is a remediation technology that involves the stimulation of natural microbial activity to address specific environmental contamination. In the "natural" state, microbial activity that is capable of degrading organic compounds can stall for lack of one or more of the elements necessary to promote bacterial activity — most often oxygen or hydrogen depending on the need for oxic or anoxic subsurface conditions. It is also commonly found that macronutrient compounds of nitrogen and/or phosphorous are also depleted. In biological terms, the missing or depleted nutrients are known as the Limiting Factor to microbial growth.

This article presents an anabolic design approach to quantifying macronutrient additions for in situ bioremediation projects.

Background

With the exception of methane, most organic solutes encountered in natural waters are not in thermodynamic equilibrium with their environment (Strumm and Morgan, 1981). Nonphotosynthetic organisms such as heterotrophic bacteria tend to restore thermodynamic equilibrium by decomposing "unstable" organic compounds through energy yielding oxidation-reduction reactions; in so doing, the bacteria obtain a source of energy for their metabolic needs. As such, bacteria play an active role in the breakdown process of complex organic compounds to more environmentally inert chemical compounds such as carbon dioxide, ethanol, or methane.

However, the traditional design approach for the degradation of say, benzene, is viewed as a simple redox reaction, with the following stoichiometric relationship for the breakdown of benzene (C6H6):

$$C_6H_6 + 7.5O_2 \xrightarrow{bacteria} 6CO_2 + 3H_2O$$

In this design approach, only the addition of oxygen (as a terminal electron acceptor) is deemed necessary, and the bacteria are viewed as mere catalysts.

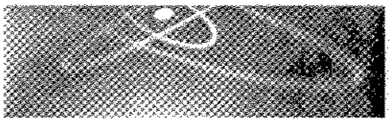
Essentially, the traditional bioremediation design considers only those paths of the bacteria's metabolic process that are catabolic (reaction processes that liberate free energy due to the breakdown of complex molecules to simpler molecules). While this design approach is valid, it presents only a partial picture of the bacteria's role and the processes involved in contaminant degradation. While designers of the catabolic (or terminal electron acceptor) approach often state the need to consider macro and micronutrients, a method or procedure to quantify the macro and micronutrient requirements has not been established. Collectively termed bionutrients, macronutrients are usually nitrogen, sulfur, phosphorous, and potassium compounds, and micronutrients are usually trace metal compounds.

The addition of macronutrient compounds to groundwater is of particular concern to regulators, as the fate of added bionutrients is not usually well described in the bioremediation design. Because of this, regulators will typically permit the addition of (non-toxic) oxygen and hydrogen releasing compounds to groundwater but will not allow bionutrient compounds (for example, NPK fertilizers). This restriction can lead to less than optimum conditions for promoting bacterial metabolic activity and colony growth. However, when regulators are presented with more explicit quantification of the fate of macronutrients that will be added, they can be less restrictive.

In the bionutrient design approach, an additional element is considered in the design: the anabolic process, that is, the nutritional requirements for growing bacterial cells. The bacteria's nutritional/reproductive needs are estimated based on the stoichiometric make-up of a microbial cell. The bionutrient approach considers the quantity of the contaminant as a carbon source, and what macronutrients (and trace elements) are essential to grow new cells and increase the bacterial colony. As such, the bionutrient approach represents an extension of traditional catabolic bioremediation design; it presents a method to quantify the amount of macronutrients needed to facilitate bioremediation.

Stoichiometric design for bioremediation

Microbial organisms are the product of inorganic matter and have a relatively constant stoichiometric composition of



$C_{106}H_{263}O_{110}N_{16}P_1$ plus species-specific trace elements. For contaminants to increase and promote bacterial growth, organisms also require a supply of inorganic chemicals to support the growth of new cellular structures and produce life-functioning proteins and enzymes (nitrogen based amino acids, and phosphorus based phospholipids and nucleic acids) for the expanding colony.

From a purely stoichiometric view, Strumm and Morgan (1981) provide the following reaction equation for the make-up of algal protoplasm (noting that the composition of simple organisms such as bacteria, yeast and algae are very similar) as an example of microbial elemental composition:

$$106CO_2 + 16NO_3^- + HPO_4^{2-} + 122H_2O + 18H^+ + \text{trace elements} + \text{energy} \xrightarrow{dR \,\uparrow\!\downarrow\, dP} \underbrace{\{C_{106}H_{263}O_{110}N_{16}P_1\}}_{\text{algal protoplasm}} + 138O_2$$

where:

C = Carbon, O = Oxygen, H = Hydrogen, N = Nitrogen, and P = Phosphorus.

dP = rate of production of cellular organic matter (for bioremediation projects this means an increase in the microbial population while consuming contaminants).

dR = rate of destruction of cellular organic matter.

For comparison with the above example, Metcalf and Eddy (1991), in the design of anaerobic digesters, use the stoichiometric relationship of $C_{60}H_{87}O_{23}N_{12}P_1$, to represent the cellular composition of anaerobic bacteria.

Furthermore, the composition of the algal protoplasm may be conveniently expressed in terms of a basic carbon unit and inorganic compounds, ammonia (NH_3) and orthophosphate (H_3PO_4) as:

$$\{(CH_2O)_{106}(NH_3)_{16}(H_3PO_4)\}$$

where:

(CH_2O) represents the carbohydrate unit (as basic sugar)

(NH_3) represents the base nitrogen unit (as ammonia)

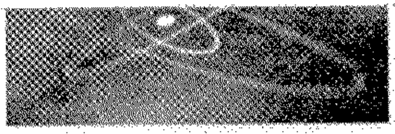
(H_3PO_4) represents the base phosphorus unit (as orthophosphate)

These macronutrient molecules are readily soluble and electrochemically active, and therefore readily dispersed in the natural environment for uptake by microorganisms.

For a biological system as indicated above, biomass will continue to form as long as there exists a continuous supply of carbon (organic or inorganic) and bionutrient compounds. Only when one or more nutrients become a limiting factor will the production of biomass cease. However, the reverse destruction of biomass is typically very slow compared to the rate of production, as the biomass produced is predominantly composed of large macromolecules (that is, proteins, etc.).

Application of the stoichiometric design approach

Using the preceding formulation to represent bacterial cells, it can be seen that there exists a molar ratio of carbon to nitrogen to phosphorus (C: N: P) of (106: 16: 1). On this premise, the bionutrient design approach seeks to create a subsurface condi-



tion where macronutrient chemical elements are present and available for microbial uptake at ratios similar to the compositional make-up of the bacterial cell, with the contaminant of concern being the design limiting factor nutrient.

The mass ratio of the macronutrients (nitrogen and phosphorus) with respect to carbon can be found by multiplying the molecular weight of each element by its respective molar ratio to get equivalent mass. To express nutrient mass requirements in terms of per gram of carbon, divide the mass of each element by the total mass of carbon. These calculation steps are summarized in **Table 1**.

Thus, for every gram of carbon used to grow new cells, 0.176 grams of nitrogen, and 0.024 grams of phosphorus are required, that is (C: N: P) = (1: 0.176: 0.024). The above design procedure can be readily expanded to consider other essential macronutrients and trace metals as needed based on the knowledge of a specific bacteria's nutrient requirements.

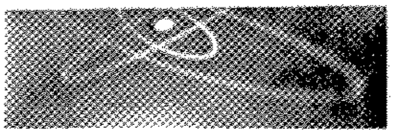
Example application

The following is an (applied) example of how the stoichiometric-bionutrient design approach is evaluated to determine macronutrient requirements for the aerobic degradation of a hydrocarbon plume:

Consider a (dissolved) gasoline plume with an average mass concentration of six milligrams per liter (mg/L). Assume that the gasoline consists primarily of hydrocarbon molecules, with the carbon to hydrogen ratio consistent with a mid-range gasoline compound such as toluene (C_7H_9). For aerobic degradation to occur, a source of dissolved oxygen (DO) will typically be required, and DO concentrations should be maintained at two mg/L to preserve aerobic conditions within the plume. Typically, the total DO requirements are taken as three to four times the average hydrocarbon concentration (see Suthersan, 1997) based on performing a mass balance of the hydrocarbon constituent

Table 1 - Equivalent Mass Calculation of Microorganism Stoichiometry

Element	Carbon	Nitrogen	Phosphorus
Molar ratio (moles)	106	16	1
Molecular Weight (grams per mole)	12	14	31
Mass ratio (grams)	1272	224	31
Per gram of carbon	1	.176	.024



redox reactions similar to the one presented for benzene.

Now to determine the quantity of macronutrients required:

- Step 1: Determine the carbon mass concentration within the plume; in this example carbon (represented as toluene) accounts for 90 percent of the contaminant mass or 5.4 mg/L.
- Step 2: Determine the mass ratio of the macronutrients (nitrogen and phosphorus) with respect to carbon. That is, 5.4 times (1: 0.176: 0.024).
- Step 3: Suppose groundwater analyses determined that dissolved nitrogen and phosphorus were present in the aquifer at concentrations of 0.2 and 0.03 mg/L, respectively.
- Step 4: Perform a mass balance of the gasoline plume zone to determine the quantity of macronutrients required to utilize all the contaminant mass to grow new cells. These steps are summarized in **Table 2**.

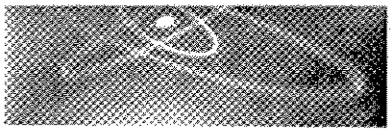
Based on the above calculations, nitrogen and phosphorus should be added to the system until the plume volume contains a concentration of nitrogen and phosphorus of at least 0.95 mg/L and 0.13 mg/L, respectively. That is, a sufficient volume of nitrogen and phosphorous compounds should be added to the aquifer to amend the lacking nitrogen (0.75 mg/L) and phosphorus (0.10 mg/L) within the area of contamination. If indicated by site characterization testing, consideration should also be given to non-contaminant sources of carbon in determining nutrient requirements.

The molecular ratios presented in **Table 1** may be used to determine nutrient requirements for the bacteria. The author has found that the use of the molecular formula for algal protoplasm to determine macronutrient requirements in conjunction with the addition of oxygen release compounds has worked well for the design of in situ biodegradation of petroleum hydrocarbon plumes. In cases where anaerobic conditions prevail and halorespirators, nitrogen, sulfate, or methane reducing bacteria are the active remediating organisms, these bacteria will have cellular composition similar to that stated above.

The ability of these bacteria to degrade contaminants is a function of their active (degrading) enzymes, and the bacteria are best able to

Table 2 - Sample Mass Balance Calculation to Determine Nutritional Needs

Calculation Step	Carbon	Nitrogen	Phosphorus
(1) Mass of carbon present	5.4		
(2) Mass of carbon present to bionutrients required (mg/L)	5.4	.95	.13
(3) Nutrients present (mg/L)	5.4	.2	.03
(4) Bionutrient deficiency (mg/L), Step (2)-(3)	0	.75	.1



(re)produce the required degrading enzymes in an environment that has sufficient macro and micronutrients.

Role of added nutrient compounds

For sites where contaminated groundwater has the potential for use as a drinking water source, regulatory standards require the specific conductance of the groundwater to be less than 900 micromhos per centimeter. The addition of macronutrients (nitrate, sulfate, or orthophosphate) will increase the specific conductance of the groundwater due to their ionic nature (that is, macronutrient compounds are generally composed of soluble cations and anions). As such, a drinking water aquifer could be affected by the addition of excessive quantities of macronutrient compounds.

The federal government has determined Maximum Contaminant Levels (MCLs) for specific compounds in drinking water; if any one of the listed compounds exceeds its MCL in potable groundwater, consumption of the groundwater is considered to be potentially toxic. Nitrogen compounds have listed MCLs. However, the MCLs for the macronutrient compounds are usually 1,000 times higher than those established for organic or metal contaminants, as indicated in **Table 3**.

Table 3 - Comparison of typical MCL values for Pollutant Types

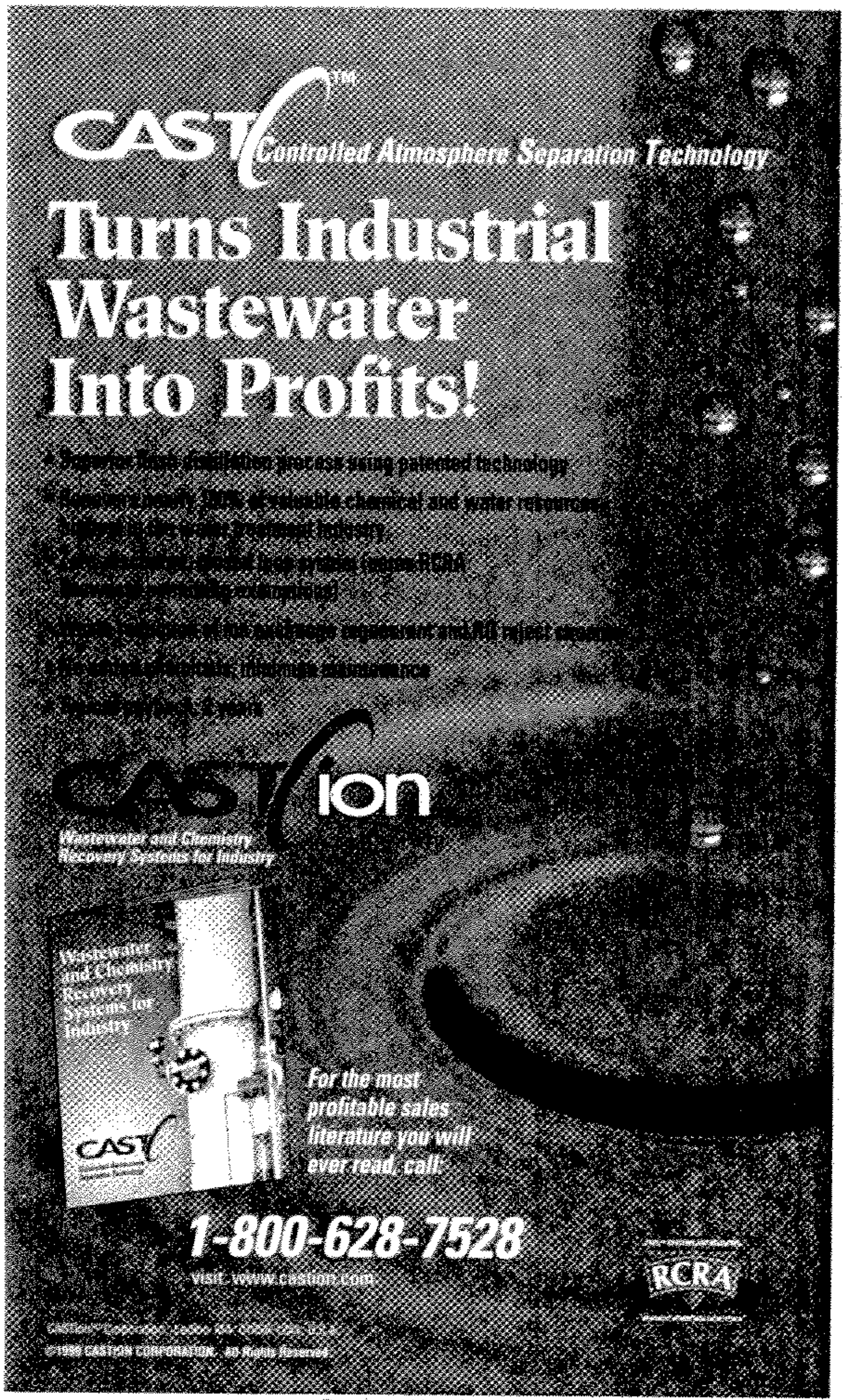
Contaminant	Pollutant	MCL
Benzene	Hydrocarbon	.001
PCE	Chlorinated Solvent	.005
Mercury	Metal	.002
DDT	Insecticide	.001
Nitrate	Inorganic	45

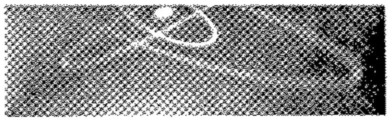
As shown in the example application presented above, the amount of macronutrient additions required to foster optimal contaminant biodegradation is significantly less than the mass of the contaminant of concern, and significantly less than the nitrate MCL. Therefore, if found to be lacking, macronutrients should be added only in amounts that do not exceed respective MCLs.

Furthermore, if the bioremediation is observed to be progressing, it may be reasonably assumed that the macronutrients are being assimilated by the bacteria and transformed into biomass (that is, used to synthesize complex biomolecules). The breakdown of biomass (organic proteins, etc.) to more fundamental compounds will take a significant amount of time.

Concluding remarks

The bionutrient (or anabolic) design approach focuses on how to expand a bacterial colony while considering the contaminant of concern as a limiting factor nutrient. The design approach provides a means





to quantify macronutrient (nitrogen and phosphorous compounds) additions to groundwater, making the addition of bionutrients justifiable to regulators. When used in combination with the traditional terminal electron acceptor (or catabolic) bioremediation design approach, the bionutrient design approach completes the microorganism metabolic cycle. Considering both metabolic pathways in bioremediation design leads to procedures that optimize subsurface conditions, fosters bacterial activity, and achieves remedial goals at the site. PE

For more information regarding this article, contact Warren Chamberlain, R.G., CHG, P.E., at 925-462-2665 or by e-mail at wchamberlain@claytongrp.com.

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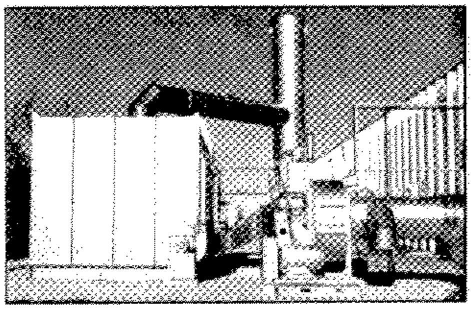

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