

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
ORDER NO. R5-2003-0164
WASTE DISCHARGE REQUIREMENTS
FOR
ATLANTIC RICHFIELD COMPANY
STOCKTON TERMINAL #40T
ENHANCED BIOREMEDIATION PILOT STUDY
SAN JOAQUIN COUNTY

The California Regional Water Quality Control Board, Central Valley Region (hereafter Regional Board), finds that:

1. The Atlantic Richfield Company (hereafter Discharger) submitted a Report of Waste Discharge on 22 July 2003 and supplemental information on 1 August 2003 for a sulfate and nitrate injection pilot study for enhanced bioremediation. The Discharger owns the ARCO/BP bulk fuel terminal #40T at 2700 Washington Street in Stockton, Assessor's Parcel Number 145-030-09, at township 1N, range 6E, section 8, Mount Diablo Base and Meridian. The general location of the facility is shown on Attachment A, which is attached hereto and made part of this Order by reference.
2. The Discharger, along with three other bulk fuel terminal companies on the same parcel, formed the Stockton Terminals Technical Committee (STTC) to address groundwater pollution across the entire parcel. Site groundwater monitoring is performed by the STTC as required by Monitoring and Reporting Program (MRP) No. 5-01-819. The Discharger's site currently has 31 on-site monitoring wells, three on-site wells installed for an In-Situ Stable Oxygen Generation (ISO-GEN) pilot study, and six off-site monitoring wells.
3. There are four identified groundwater bearing zones. A majority of the mass of petroleum hydrocarbon pollution is in the A water bearing zone, which is from about 5 to 20 feet below ground surface. Groundwater contains total petroleum hydrocarbons (TPH) as gasoline up to 240,000 micrograms per liter ($\mu\text{g/l}$), TPH as diesel up to 140,000 $\mu\text{g/l}$, benzene up to 27,000 $\mu\text{g/l}$, toluene up to 22,000 $\mu\text{g/l}$, ethylbenzene up to 3,500 $\mu\text{g/l}$, xylenes up to 15,000 $\mu\text{g/l}$, methyl tertiary butyl ether (MTBE) up to 290,000 $\mu\text{g/l}$, and tertiary butyl alcohol up to 2,800 $\mu\text{g/l}$.
4. The Discharger proposes a pilot study to evaluate injection of nitrate and sulfate to bioremediate petroleum hydrocarbon pollution. The Discharger will do weekly slug injections of nitrate and sulfate substrates for three months with groundwater monitoring until concentrations of nitrate, sulfate, and any byproducts therefrom return to baseline levels. Each slug injection will be about 18 hours. If analytical data show that the microorganisms have used up the injected nitrate and sulfate before the end of one year, the Discharger may propose additional sulfate and nitrate injections for up to three months. The pilot study will be concluded when the amendments and byproducts do not exceed baseline levels.

5. The Discharger proposes to inject substrates into wells IS-1, IS-2, and IS-3, which were previously used for the ISO-GEN pilot study. The Discharger proposes the injection of nitrate and sulfate to stimulate anaerobic biodegradation of the petroleum hydrocarbon pollution. The ISO-GEN wells were selected based on location within the plume, spacing of the wells, and screened interval.
6. The remedial process for hydrocarbon plumes depends upon stimulating growth of indigenous microorganisms. The microorganisms obtain energy by oxidizing one compound and reducing another compound. Different amounts of energy can be obtained from different compounds. The first compounds to be utilized are those that provide the most energy. Microorganisms will consume carbon (i.e., petroleum hydrocarbons) first using oxygen as the electron acceptor until it is depleted, since oxygen provides the most energy. After oxygen depletion, a succession of anaerobic microorganisms becomes dominant, oxidizing (consuming) carbon and reducing the specific compounds, such as nitrate and sulfate, upon which their metabolism depends. In general, nitrate and sulfate are the next compounds to be reduced after oxygen. Iron also is reduced, but is not proposed for injection at the site based on potential for clogging the water bearing zone.
7. The plume at the site is anaerobic. The Discharger proposes to inject a sodium nitrate solution at a concentration of 137 milligrams per liter (mg/l) and a sodium sulfate solution at a concentration of 400 mg/l. A total of about 8,900 gallons of the sodium nitrate and sodium sulfate solution will be injected into each of the three injection wells at a rate of about 0.22 gallons per minute during each of the weekly slug injections. There should not be an excess of nitrate or sulfate in the subsurface because the proposed injection volume is set at about half of the calculated uptake rate by the microorganisms.
8. The Discharger anticipates nitrogen and phosphorous depletion within the plume because the microorganisms will take up these nutrients as the nitrate and sulfate is injected and used by the microorganisms. In order to provide balanced nutrients to promote growth of the microorganisms, nitrogen and phosphorous supplements are proposed in the form of an ammonium phosphate injection (Miracle-Gro). The Discharger proposes injecting 0.186 grams of Miracle-Gro for each liter of the nitrate and sulfate solution. No nutrient concentrations will remain in the subsurface because the nutrient addition rate will match the microorganism nutrient uptake rate.
9. Using a pneumatic pump system, the Discharger will inject the nitrate/sulfate/ ammonium phosphate solution via above ground piping at a rate of 0.22 gallons per minute per well. Natural groundwater flow velocity and direction will distribute the solution into the plume. The solution will be prepared by mixing dry sodium sulfate, sodium nitrate, and ammonium phosphate with potable water.

10. Bench-scale testing has not been performed because nitrate and sulfate have both been used at numerous sites and the anaerobic biodegradation process of petroleum hydrocarbons by naturally-occurring microorganisms has been well documented. Microorganisms degrade petroleum hydrocarbons through natural biological processes and do not create reaction products. There is potential for aquifer clogging from the reduction of sulfate to sulfide and nitrate to ammonium. Therefore, the Discharger will monitor for these constituents and total dissolved solids.
11. The Discharger will monitor 10 downgradient monitoring wells (AR/MW-1A, AR/MW-3A, AR/MW-5A, AR/MW-5B, AR/MW-5C, AR/MW-5O, AR/MW-8A, AR/MW-10A, AR/MW-11A, and AR/MW-12A) and one upgradient well (PS-P29). Samples will be collected weekly during the first month, monthly during the first six months, and quarterly thereafter during the pilot test for the parameters outlined in the attached MRP No. R5-2003-0164. In addition, the Discharger will collect baseline samples from AR/MW-1A to determine natural variation of nitrate, sulfate, sulfide, nitrogen, sodium, ammonium, phosphate, and phosphorous. The Discharger will conduct three sampling events to monitor for these constituents and propose baseline concentrations for Executive Officer approval prior to injection.
12. If the levels of nitrate and sulfate in AR/MW-3A drop below baseline levels and upon written Executive Officer approval, the Discharger may begin another three-month cycle of the injection with up to double the original injection volumes (i.e., the level the Discharger calculated as the actual uptake rate of the microorganisms).
13. In the event that concentrations of nitrate, sulfate, nitrogen, sodium, ammonium, sulfide, phosphate, and/or phosphorous in downgradient well AR/MW-1A exceed approved baseline concentrations by more than 20 percent, injections will cease and the Discharger will collect a confirmation sample. If the exceedance is confirmed, the Discharger will cease the sulfate and nitrate injection and continue monthly monitoring of well AR/MW-1A. Monthly monitoring will continue for three months so there are enough data to establish a trend. If the levels, based on the concentration trend, are more than 20 percent above baseline levels, the Discharger will install a groundwater extraction and treatment system. The Discharger will extract groundwater from one to three extraction wells, treat it, and then discharge it to the sanitary sewer or haul it off-site for disposal. The Discharger will also monitor well AR/MW-1A every other week until the levels decrease to baseline levels and then monthly for six months to confirm concentrations remain below baseline levels.
14. Groundwater consistently flows in an easterly direction at an average gradient of 0.0064 feet per foot. AR/MW-1A was selected as the well to evaluate for exceedences because it is about 450 east of the proposed injection wells.

15. The injection into waters of the State is subject to regulation under the California Water Code. This Order authorizes the Discharger to inject sodium sulfate, sodium nitrate, and ammonium phosphate into groundwater subject to specific discharge requirements.
16. The *Water Quality Control Plan for the Sacramento River and San Joaquin River Basins, Fourth Edition*, (hereafter Basin Plan) designates beneficial uses, establishes water quality objectives, contains implementation plans and policies for protecting waters of the basin, and incorporates by reference plans and policies adopted by the State Water Resources Control Board (State Board). Pursuant to Section 13263(a) of the California Water Code, waste discharge requirements must implement the Basin Plan.
17. Surface water drainage is to the San Joaquin River within the legal boundaries of the Sacramento - San Joaquin Delta. The beneficial uses of the Sacramento - San Joaquin Delta are municipal and domestic supply; agricultural supply; process and service industrial supply; water contact recreation; noncontact water recreation; warm and cold freshwater habitat, warm and cold water migration, warm water spawning, wildlife habitat and navigation.
18. The beneficial uses of underlying groundwater are municipal and domestic, agricultural, and industrial service and process water supply.
19. Surrounding land uses are residential, commercial, and industrial.
20. State Board Resolution No. 68-16 (hereafter Resolution 68-16 or the "Antidegradation Policy") requires the Board in regulating discharges to maintain high quality waters of the state until it is demonstrated that any change in quality will be consistent with maximum benefit to the people of the State, will not unreasonably affect beneficial uses, and will not result in water quality less than that described in plans and policies (e.g., quality that exceeds water quality objectives). Temporal degradation of groundwater at this site due to the nitrate, sulfate, and ammonium phosphate injection may occur. This temporary degradation allowed by this Order is consistent with Resolution 68-16 since (1) the purpose is to accelerate and enhance remediation of unacceptable concentrations of several waste constituents and such remediation will benefit the people of the state; (2) the discharge facilitates a pilot project to evaluate the effectiveness of cleanup technology in accord with SWRCB Resolution 92-49 and is limited in scope and duration; (3) best practicable treatment, including adequate monitoring and contingency plans to assure protection of water quality, are required; and (4) the injection will not cause water quality objectives to be exceeded beyond the project target area or the duration of the project as specified in Finding 4.

21. Section 13267(b) of California Water Code provides that:

In conducting an investigation specified in subdivision (a), the regional board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste outside of its region that could affect the quality of the waters of the state within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the board requires. The burden, including costs of these reports, shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports. In requiring those reports, the regional board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports.

The technical reports required by this Order and the attached MRP No. R5-2003-0164 are necessary to assure compliance with these waste discharge requirements. The Discharger operates the facility that discharges the waste subject to this Order.

22. The California Department of Water Resources sets standards for the construction and destruction of groundwater wells, as described in *California Well Standards Bulletin 74-90* (June 1991) and *Water Well Standards: State of California Bulletin 74-81* (December 1981). These standards, and any more stringent standards adopted by the State or County pursuant to California Water Code Section 13801, apply to all monitoring wells.
23. Issuance of this Order is an action to assure the restoration of the environment and is, therefore, exempt from the provisions of the California Environmental Quality Act (Public Resources Code, Section 21000, et seq.), in accordance with Section 15308 and 15330, Title 14, California Code of Regulations (CCR).
24. This discharge is exempt from the requirements of *Consolidated Regulations for Treatment, Storage, Processing, or Disposal of Solid Waste*, as set forth in Title 27, CCR, Section 20005, et seq., (hereafter Title 27). The exemption pursuant to Section 20090(d), is based on the following:
- a. The Board is issuing waste discharge requirements,
 - b. The discharge complies with the Basin Plan, and
 - c. The wastewater does not need to be managed according to Title 22 CCR, Division 4.5, and Chapter 11, as a hazardous waste.

25. Pursuant to California Water Code Section 13263(g), discharge is a privilege, not a right, and adoption of this Order does not create a vested right to continue the discharge.
26. All the above and the supplemental data and information and details in the attached Information Sheet, which is incorporated by reference herein, were considered in establishing the following conditions of discharge. The Discharger and interested agencies and persons were notified of intent to prescribe waste discharge requirements for this discharge and provided with an opportunity for a public hearing and an opportunity to submit written views and recommendations. In a public meeting, all comments pertaining to the discharger were heard and considered.

IT IS HEREBY ORDERED that pursuant to Sections 13263 and 13267 of the California Water Code, Atlantic Richfield Company, its agents, successors, and assigns, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder, shall comply with the following while conducting the above-described pilot study:

[Note: Other prohibitions, conditions, definitions, and some methods of determining compliance are contained in the attached "Standard Provisions and Reporting Requirements for Waste Discharge Requirements" dated 1 March 1991, incorporated herein.]

A. Discharge Prohibitions

1. Discharge of wastes to surface waters or surface water drainage courses is prohibited.
2. The injection of other than sodium sulfate, sodium nitrate, and/or ammonium phosphate into groundwater is prohibited.
3. Discharge of waste classified as 'hazardous' under Section 2521 of Title 23, CCR, or as 'designated' under Section 13173 of California Water Code is prohibited.
4. Discharge of groundwater, sodium sulfate, sodium nitrate, and/or ammonium phosphate at a location or in a manner different from that described in Findings 4, 5, 7, 8 and 9 is prohibited.

B. Discharge Specifications

1. No waste constituent shall be released or discharged, or placed where it will be released or discharged, in a concentration or in a mass that causes violation of the Groundwater Limitations.

2. This Order allows injection of sodium sulfate, sodium nitrate, and ammonium phosphate under the conditions defined in Findings 4, 5, 7, 8 and 9. No other products shall be discharged.
3. The sulfate/nitrate/ammonium phosphate injection shall only be injected through IS-1, IS-2, and/or IS-3 as described in Finding 5.

C. Groundwater Limitations

1. During the pilot study, the Discharger shall not cause an increase in amendments or byproducts including but not limited to nitrate, sulfate, ammonium, and sulfide above 20 percent of the baseline concentration in downgradient well AR/MW-1A, as described in Finding 11.
2. When the pilot study is completed, the amendments and byproducts shall not exceed baseline levels.

D. Provisions

1. The Discharger shall notify Board staff a minimum of one week prior to the initial injection.
2. The Discharger shall comply with the attached MRP No. R5-2003-0164, which is part of this Order, and any revisions thereto as ordered by the Executive Officer.
3. The Discharger shall comply with the “Standard Provisions and Reporting Requirements for Waste Discharge Requirements,” dated 1 March 1991, which are attached hereto and by reference a part of this Order. This attachment and its individual paragraphs are commonly referenced as “Standard Provision(s).”
4. All of the following reports shall be submitted pursuant to Section 13267 of the California Water Code. All technical reports required herein that involve planning, investigation, evaluation, or design, or other work requiring interpretation and proper application of engineering or geologic sciences, shall be prepared by or under the direction of persons registered to practice in California pursuant to California Business and Professions Code sections 6735, 7835, and 7835.1. To demonstrate compliance with sections 415 and 3065 of Title 16, CCR, all technical reports must contain a statement of the qualifications of the responsible registered professional(s). As required by these laws, completed technical reports must bear the signature(s) and seal(s) of the registered professional(s) in a manner such that all work can be clearly attributed to the professional responsible for the work.

- a. The Discharger shall submit a Baseline Summary Report due no later than **60 Days** after the collection of the third proposed sampling event to evaluate the natural variation and propose baseline numbers for the amendments and byproducts. The Discharger shall not begin injection until receiving written Executive Officer approval of baseline concentrations.
 - b. The Discharger shall submit a Pilot Study Implementation Report due no later than **60 days** after startup of the enhanced bioremediation pilot study. The Pilot Study Implementation Report shall include a description of the injection system and results of the first month of operation including analytical results.
 - c. If the Discharger proposes a second three-month sulfate and nitrate injection period, the Discharger shall submit an Evaluation Report, which shall include analytical results to show the fate and transport of the initial sulfate and nitrate injection and proposed injection details including volume, rate, and concentration for the second injection. The Discharger shall not begin the second injection period before obtaining written Executive Officer approval.
 - d. The Discharger shall submit a Pilot Study Evaluation Report no later than **one year** after the final injection ends, which shall include a summary of analytical results, an evaluation of injection effectiveness, and discussion of feasibility for full-scale remediation.
5. If groundwater samples from monitoring well AR/MW-1A are 20 percent above baseline concentrations of nitrate, sulfate, nitrogen, sodium, ammonium phosphate, and/or phosphorous, the Discharger shall immediately notify Regional Board staff of the exceedance(s) and obtain a confirmation sample within **7 days** of receiving the results. Within **48 hours** of receiving the confirmation sample results, the Discharger shall notify Regional Board staff of the results followed by written notification within **7 days**.
 6. **Within 30 days** of confirming that baseline concentrations have been exceeded by 20 percent in monitoring well AR/MW-1A, the Discharger shall implement the contingency plan as described in Finding 13 and submit a Contingency Plan Implementation Report **90 days** thereafter.
 7. The Discharger shall comply with all conditions of this Order, including timely submittal of technical and monitoring reports as directed by the Executive Officer. Violations may result in enforcement action, including Regional Board or court order requiring corrective action or imposing civil monetary liability, or in revision or rescission of this Order.

8. The Discharger shall maintain records of all monitoring information including all calibration and maintenance records, copies of all reports required by this Order, and records of all data used to complete the application for this Order. Records shall be maintained for a minimum of three years from the date of the sample, measurement, or report. This period may be extended during the course of any unresolved litigation regarding this discharge or when requested by the Executive Officer.
9. The Discharger shall at all times properly operate and maintain all facilities and systems of treatment and control that are installed or used by the Discharger to achieve compliance with this Order. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems, which are to be installed by the Discharger only when necessary to achieve compliance with the conditions of this Order.
10. The Discharger shall report any non-compliance, and/or accidental spill or release of liquid or material verbally to the Regional Board within 24 hours of the spill or release, and follow-up the verbal notification with written documentation of the spill or release and remedial actions taken or proposed to contain and clean up the spill within 14 calendar days of the incident.
11. A copy of this Order shall be kept at the discharge facility for reference by operating personnel. Key operating personnel shall be familiar with its contents.
12. As described in the Standard Provisions, the Discharger shall report promptly to the Regional Board any material change or proposed change in the character, location, or volume of the discharge.
13. While this Order is in effect, and prior to any change in ownership of the site or management of this operation, the Discharger shall transmit a copy of this Order to the succeeding Owner/Operator, and forward a copy of the transmittal letter and proof of transmittal to the Board.
14. The Discharger shall allow the Regional Board, or an authorized representative, upon presentation of credentials and other documents as may be required by law, to:
 - a. Enter upon the premises regulated by the Regional Board, or the place where records must be kept under the conditions of this Order;
 - b. Have access to and copy, at reasonable times, any records that shall be kept under the conditions of this Order;
 - c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order; and

- d. Sample or monitor, at reasonable times, for the purpose of assuring compliance with this Order or as otherwise authorized by the California Water Code, any substances or parameters at this Site.
15. The Regional Board will review this Order periodically and will revise requirements when necessary.

I, THOMAS R. PINKOS, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region, on 17 October 2003.

THOMAS R. PINKOS, Executive Officer

Attachments

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

MONITORING AND REPORTING PROGRAM NO. R5-2003-0164
FOR
ATLANTIC RICHFIELD COMPANY
STOCKTON TERMINAL #40T
ENHANCED BIOREMEDIATION PILOT STUDY
SAN JOAQUIN COUNTY

This Monitoring and Reporting Program (MRP) incorporates requirements for monitoring the progress of the bioremediation pilot study. This MRP is issued pursuant to California Water Code Section 13267. Atlantic Richfield Company (Discharger) is required to comply with this MRP. The Discharger shall not implement any changes to this MRP unless and until a revised MRP is issued by the Executive Officer. In addition to this MRP, groundwater sampling and reporting outlined in MRP No. 5-01-819 is still required.

All samples shall be representative of the volume and the nature of the discharge and matrix of the sampled medium. The time, date, and location of each grab sample shall be recorded on the sample chain of custody form.

REMEDIATION PILOT STUDY MONITORING

A. LABORATORY PARAMETERS

Monitoring of the bioremediation pilot study shall consist of collecting groundwater samples from downgradient wells AR/MW-1A, AR/MW-3A, AR/MW-5A, AR/MW-5B, AR/MW-5C, AR/MW-5O, AR/MW-8A, AR/MW-10A, AR/MW-11A, and ARMW-12A and upgradient well PS-P29. Monitoring wells with free phase petroleum product or visible sheen shall be monitored, at a minimum, for product thickness and depth to water. Monitoring well samples shall be analyzed for the following constituents. These analyses shall be completed by a State certified laboratory and shall follow standard EPA protocol.

Constituents	EPA Method	Maximum Quantitation Limit ¹	Frequency
Depth to Groundwater	---	0.01 ft	A
Total Petroleum Hydrocarbons as Diesel	8015M	50 µg/l	B
Total Petroleum Hydrocarbons as Gasoline	8015M	50 µg/l	B
Benzene	8260B	0.5 µg/l	B
Toluene	8260B	0.5 µg/l	B
Ethylbenzene	8260B	0.5 µg/l	B
Xylenes	8260B	0.5 µg/l	B
Methyl Tertiary Butyl Ether	8260B	0.5 µg/l	B
Tertiary Butyl Alcohol	8260B	5 µg/l	B
Ferrous Iron (dissolved) ²	SM 3500FeD	0.1 mg/l	C
Sulfide ²	376.2	0.1 mg/l	C

Table continued on the next page.

Constituents	EPA Method	Maximum Quantitation Limit ¹	Frequency
Nitrate (as NO ₃) and Sulfate ²	300.0	1 mg/l	C
Ammonia plus Ammonium (as NH ₃) ²	350.1	0.5 mg/l	C
General Minerals ^{2,3}	various	various	C

- 1 For nondetectable results.
 2 Baseline samples shall be collected a minimum of two weeks prior to injection. Three sampling events to determine baseline for AR/MW-1A are required.
 3 General Minerals include: alkalinity, hardness, total dissolved solids, nitrogen, sodium, phosphate, and phosphorous.
 A Every time a well is sampled.
 B Monthly while injection is occurring and quarterly after injection has ceased.
 C After injection, weekly during the first month of injection, monthly for the first six months after initiation of injection, and quarterly thereafter.
 mg/l Milligrams per liter
 µg/l Micrograms per liter

B. FIELD MEASURED PARAMETERS

Monitoring of the bioremediation pilot study shall include field measured parameters recorded from downgradient wells AR/MW-1A, AR/MW-3A, AR/MW-5A, AR/MW-5B, AR/MW-5C, AR/MW-5O, AR/MW-8A, AR/MW-10A, AR/MW-11A, and ARMW-12A and upgradient well PS-P29 every time these wells are sampled. The field measured parameters to be recorded are listed in the following table.

<u>Constituents</u>	<u>Units</u>
Electrical conductivity	µmhos/cm
pH	pH units
Oxidation-reduction potential	millivolts
Dissolved oxygen	mg/l
Temperature	°F/°C
Groundwater elevation	Feet and hundredths, mean sea level

Field testing instruments (such as those used to test oxidation-reduction potential and dissolved oxygen) may be used provided that:

1. The operator is trained in proper use and maintenance of the instruments;
2. The instruments are field calibrated prior to each monitoring event;
3. Instruments are serviced and/or calibrated by the manufacturer at the recommended frequency; and
4. Field calibration reports are provided with the appropriate monitoring report.

REPORTING

In reporting monitoring data, the Discharger shall arrange the data in tabular form so that the date, sample type (e.g., influent, effluent, groundwater, etc.), and reported analytical result for

each sample are readily discernible. The data shall be summarized in such a manner to clearly illustrate compliance with waste discharge requirements and spatial or temporal trends, as applicable. The results of any monitoring done more frequently than required at the locations specified in the Monitoring and Reporting Program shall also be reported to the Regional Board. In addition, the Discharger shall notify the Board within 24 hours of any unscheduled shutdown of the enhanced bioremediation system.

As required by the California Business and Professions Code Sections 6735, 7835, and 7835.1, all Groundwater Monitoring Reports shall be prepared under the direct supervision of a Registered Engineer or Geologist and signed by the registered professional.

Quarterly reports shall be submitted to the Board by the **1st day of the second month following the end of each calendar quarter (i.e., by 1 February, 1 May, 1 August, and 1 November)**. The reports shall be submitted separately from the quarterly monitoring reports required by MRP No. 5-01-819. At a minimum, the reports shall include:

1. A narrative description of all preparatory, monitoring, sampling, and analytical testing activities for the groundwater monitoring. The narrative shall be sufficiently detailed to verify compliance with the WDR, this MRP, and the Standard Provisions and Reporting Requirements. The narrative shall be supported by field logs for each well documenting depth to groundwater; parameters measured before, during, and after purging; calculation of casing volume; total volume of water purged, etc.;
2. Copies of all laboratory analytical report(s);
3. Cumulative data tables containing the water quality analytical results and depth to groundwater;
4. An evaluation of the performance of the bioremediation pilot study including an analysis of its effectiveness in destroying the pollutants, and a discussion of the potential for field scale application;
5. A discussion of compliance and the corrective action taken, if any, as well as any planned or proposed actions needed to bring the discharge into full compliance with the waste discharge requirements; and
6. A discussion of any data gaps, potential deficiencies/redundancies in the monitoring system or reporting program and the anticipated date for an effectiveness evaluation of the pilot study.

A letter transmitting the self-monitoring reports shall accompany each report. Such a letter shall include a discussion of requirement violations found during the reporting period, and actions taken or planned for correcting noted violations, such as operation or facility modifications. If the Discharger has previously submitted a report describing corrective actions and/or a time

schedule for implementing the corrective actions, reference to the previous correspondence will be satisfactory. The transmittal letter shall contain the penalty of perjury statement by the Discharger, or the Discharger's authorized agent, as described in the Standard Provisions General Reporting Requirements Section B.3.

The Discharger shall implement the above monitoring program as of the date of the Order.

Ordered by: _____
THOMAS R. PINKOS, Executive Officer

17 October 2003

DLL

INFORMATION SHEET

ORDER NO. R5-2003-0164
ATLANTIC RICHFIELD COMPANY
STOCKTON TERMINAL #40T
ENHANCED BIOREMEDIATION PILOT STUDY
SAN JOAQUIN COUNTY

Atlantic Richfield Company (ARCO) owns the bulk fuel terminal at 2700 Washington Street in Stockton (site). ARCO is a member of the Stockton Terminals Technical Committee, which was formed with three other bulk fuel terminal companies on the same assessor's parcel to address site wide groundwater pollution. A majority of the mass of petroleum pollution is in the A water bearing zone which is about 5 to 20 feet below ground surface.

ARCO proposes to inject sulfate, nitrate, and ammonium phosphate into the A water bearing zone through three wells to enhance anaerobic biodegradation. The remedial process for hydrocarbon plumes depends upon stimulating growth of indigenous microorganisms. The microorganisms obtain energy by oxidizing one compound and reducing another compound. Different amounts of energy can be obtained from different compounds. The first compounds to be utilized are those that provide the most energy. Microorganisms will consume carbon (i.e., petroleum hydrocarbons) first using oxygen as the electron acceptor until it is depleted, as oxygen provides the most energy. After oxygen depletion, a succession of anaerobic microorganisms becomes dominant, oxidizing (consuming) carbon and reducing the specific compounds, such as nitrate and sulfate, upon which their metabolism depends. In general, nitrate and sulfate are the next compounds to be reduced after oxygen. Iron is also reduced, but is not proposed for injection at the site based on potential for clogging the water bearing zone. A nitrogen and phosphorous injection (Miracle-Gro) is also proposed to aid in the growth of the microorganisms.

ARCO proposes weekly slug injections of ammonium phosphate, nitrate and sulfate substrates for three months into three wells. Groundwater samples from 10 downgradient wells and one upgradient well will be collected weekly during the first month, monthly for the first six months and quarterly thereafter to evaluate the effectiveness of the injection.

As part of the monitoring, baseline levels will be determined for monitoring well AR/MW-1A. If concentrations of nitrate, sulfate, nitrogen, or phosphorous increase to 20 percent or more above the baseline levels, ARCO will cease the injection and collect a confirmation sample within seven days of receiving results of exceedence. If the exceedence is confirmed, ARCO will implement a contingency plan within 30 days of sampling confirmation.

The purpose of the pilot study is to evaluate the effectiveness of the injection of sulfate and nitrate to enhance anaerobic biodegradation.

DLL 9/24/03