

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
 CENTRAL VALLEY REGION
 MONITORING AND REPORTING PROGRAM NO. R5-2015-0012**

FOR

**IN-SITU GROUNDWATER REMEDIATION
 AND DISCHARGE OF TREATED GROUNDWATER TO LAND**

This Monitoring and Reporting Program (MRP) describes requirements for monitoring a groundwater remediation system for the Former Flyers Energy Station No. 50 located at 2501 Notre Dame Blvd., Chico, California. This MRP is issued pursuant to Water Code Section 13267. The Discharger shall not implement any changes to this MRP unless and until a revised MRP is issued by the Executive Officer. As appropriate, California Regional Water Quality Control Board Central Valley Region (Central Valley Water Board) staff shall approve specific sample station locations prior to implementation of sampling activities.

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

GROUNDWATER MONITORING

As shown on Drawing 4, there are ten (10) groundwater monitor wells (MW-1, MW-3 through MW-5, MW-7 through MW-12), one proposed monitor well (MW-13), and three (3) injection points (IP-1 through IP-3) associated with this site MRP. The groundwater monitoring program for these wells and any treatment system wells installed subsequent to the issuance of this MRP shall follow the schedule below. The new monitor well (MW-13) is anticipated to be installed during Phase I activities following Central Valley Water Board approval of the In-Situ Chemical Oxidation Pilot Scale Testing Interim Corrective Action Plan (ISCO CAP). The volume of extracted groundwater, if applicable, shall also be provided in quarterly monitoring reports. Sample collection and analysis shall follow standard EPA protocol.

The monitor wells shall be sampled according to the schedule in Tables 1A and 1B and the samples analyzed by the methods in Tables 2A and 2B, as follows:

**Table 1A: Sampling Frequency and Constituent Suite
 (Pre- and During Remediation)**

| Well Number ¹ | Constituent ² | Frequency ³ | Monitoring Objective |
|---|---------------------------------|---|---------------------------------------|
| MW-1, -3 thru -5, -7 thru 13 | Table 2A, Suite A | Semi-Annually (1 st /3 rd Quarters) | Ongoing Monitoring Program Compliance |
| MW-13 (GW ⁴ & Soil) MW-1 (GW) | Table 2B | Prior to Pilot Scale Injections | Bench Test |
| MW-1, -3 thru -5, -7 thru 13 | Table 2A, Suite B | Prior to Pilot Scale Injections | Baseline |
| MW-13 | Table 2A, Suite C | Prior to Pilot Scale Injections | Baseline |

Referenced notes provided on next page

**Table 1B: Sampling Frequency and Constituent Suite
 (During Remediation)**

| Well Number ¹ | Constituent ² | Frequency ³ | Monitoring Objective |
|--------------------------|--------------------------|---|------------------------------|
| MW-5, MW-9 | Table 2A, Suite B | 1-week and 1, 3 ⁵ , 6, 9, and 12-month post injection events | Compliance ⁶ |
| MW-7, MW-13 | Table 2A, Suite B | 1-week and 1, 3 ⁴ , 6, 9, and 12-month post injection events | Treatment Zone ⁷ |
| MW-13 | Table 2A, Suite C | 6 and 12-month post injection events | Treatment Zone ⁷ |
| MW-3 | Table 2A, Suite B | 1-week and 1, 3 ⁵ , 6, 9, and 12-month post injection events | Transition Zone ⁸ |
| MW-1 | Table 2A, Suite B | 1-week and 1-month post injection, at 3 ⁵ - and 9- month post-events | Background ⁹ |

1. Well numbers and locations as shown on Figure 1.
2. Constituent analytical methods are listed in Tables 2A and 2B.
3. i.e., weekly, monthly, quarterly, semi-annually, annually, or other.
4. GW – Groundwater sample
5. Based on post 1-month data evaluation, Suite B analyte reduction is anticipated for the 3-month post injection event to include removal of TDS, anions (Br⁻, Cl⁻, NO₃⁻, NO₂⁻, SO₄²⁻), sulfide, alkalinity, hardness, and dissolved metals (As, Ca, Cr, Mg, Mn, Mo, Na, Pb, V).
6. Wells used to determine compliance with groundwater limitations.
7. Wells sampled to evaluate in-situ bioremediation progress inside the treatment zone.
8. Wells sampled to evaluate migration of pollutants within the treatment zone.
9. Wells used to develop background concentrations.

Table 2A: Analytical Methods

| Constituent | Method ¹ | Maximum Practical Quantitation Limit ² |
|---|-------------------------|--|
| Suite A | | |
| GRO ⁵ , BTEX ⁶ , MTBE ⁷ , TBA ⁸ , TAME ⁹ | 8260B | 50 µg/L ¹⁰ (GRO); 5.0 µg/L (TBA); 0.5 µg/L (all others) |
| Suite B | | |
| MTBE, TBA, TAME | EPA 8260B | 5.0 µg/L (TBA); 0.5 µg/L (MTBE) |
| Hexavalent Chromium (Cr ⁺⁶) | EPA 7199 | 1.0 µg/L |
| Total Dissolved Solids (TDS) | SM 2540C | 10 mg/L ¹¹ |
| Sulfate | EPA 300.0 | 0.50 mg/L |
| Sulfide | SM4500-S D or Hach 8131 | 0.1 mg/L |
| Hardness | SM 2340 B | 0.1 mg/L |
| Anions (Br, Cl, NO ₃ ⁻ , NO ₂ ⁻ , SO ₄ ²⁻) | EPA 300 | 2.5 mg/L - 0.5 mg/L |
| Metals, Total and Dissolved (As, Ca, Cr, Mg, Mn, Mo, Na, Pb, V) | EPA 6020/6010 or 200.8 | 0.002 mg/L - 0.5 mg/L |
| Alkalinity | SM2320B | 10 mg/L |
| Suite C | | |
| Phospholipid Fatty Acid (PLFA) | Bligh and Dyer Method | 500 PMOL ³ |

1. Or an equivalent EPA Method that achieves the maximum Practical Quantitation Limit.
2. All concentrations between the Method Detection Limit and the Practical Quantitation Limit shall be reported as an estimated value.
3. PMOL – picomole, an SI unit equal to 10⁻¹² moles.
4. GRO – gasoline range organics
5. BTEX – benzene, toluene, ethylbenzene, xylene
6. MTBE – methyl tert-butyl ether
7. TBA – tert-Butyl Alcohol
8. TAME – tert-Amyl methyl ether
9. µg/L - micrograms per liter
10. mg/L – milligrams per liter

Table 2B: Analytical Methods for Bench-Scale Test

| Constituent | | Method ¹ | Maximum Practical Quantitation Limit ² |
|-------------|---|--|--|
| GW | Alkalinity | EPA 310.1 or SM2320B | 10 mg/L ⁶ |
| | Anions (Br, Cl, NO ₃ ⁻ , NO ₂ ⁻ , SO ₄ ²⁻) | EPA 300 or 353.2 | Br – 0.3 mg/L Cl – 0.5 mg/L NO ₃ ⁻ – 0.45 mg/L NO ₂ ⁻ – 0.01 mg/L SO ₄ ²⁻ – 0.5 mg/L |
| | Hardness (includes Ca and Mg) | SM2340B | 2.5 mg/L |
| | Total Dissolved Solids (TDS) | SM2540C | 10 mg/L |
| | Sulfide | SM4500-S D or Hach 8131 ³ | 0.1 mg/L |
| Soil & GW | Hexavalent Chromium (Cr ⁶⁺) | SM 3500-Cr(water) | 5 µg/L ⁶ |
| | | EPA 3060/7196A (soil) | 0.5 mg/kg |
| | Metals, Total and Dissolved (As, Cr, Mn, Mo, Na, Pb, V) | EPA 200.8 (water) | As, Cr, Mn, & V – 0.5 µg/L Na – 10 µg/L |
| | | EPA 6010B (soil) | As – 8 mg/kg ⁶ Cr – 4 mg/kg Mn – 10 mg/kg Mo – 10 mg/kg Na – 2 mg/kg V – 40 mg/kg |
| | | SOD ⁴ - Residual hydrogen peroxide (HP) | Test Strips |
| | SOD - Residual sodium persulfate (SP) | Titration-FAS ⁵ /KMnO ₄ | Not applicable |
| Soil | Total Organic Carbon (TOC) | Walkley Black (Mod) | 0.1 mg/kg |

1. Or an equivalent EPA Method that achieves the maximum Practical Quantitation Limit.
2. All concentrations between the Method Detection Limit and the Practical Quantitation Limit shall be reported as an estimated value.
3. Hach DR 2800 Spectrophotometer and appropriate Hach kit reagents.
4. SOD – Soil Oxidant Demand
5. FAS – Flame Absorption Spectroscopy
6. µg/L – micrograms per liter; mg/L – milligrams per liter; mg/Kg – milligrams per kilogram

FIELD SAMPLING

In addition to the above sampling and laboratory analyses, field sampling and analysis shall be conducted each time a monitor well or extraction well is sampled. The sampling and analysis of field parameters shall be as specified in Table 3.

Table 3: Field Sampling Requirements

| Parameters | Units | Practical Quantitation Limit | Analytical Method |
|-------------------------------|----------------------|------------------------------|-------------------|
| Groundwater Elevation | Feet, Mean Sea Level | 0.01 feet | Measurement |
| Oxidation-Reduction Potential | Millivolts | 1 millivolts | Field Meter |
| Electrical Conductivity | µS/cm | 0.001 mS/cm | Field Meter |
| Dissolved Oxygen | mg/L | 0.01 mg/L | Field Meter |
| pH | pH Units | 0.01 units | Field Meter |
| Temperature | °F/°C | 0.1 °F/°C | Field Meter |

All wells that are purged shall be purged until pH, temperature, conductivity and dissolved oxygen are within 10% of the previous value.

Field test instruments (such as those used to test pH 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 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 submitted as described in item (b) of the "Reporting" section of this MRP.

IN-SITU DISCHARGE MONITORING

The Discharger shall monitor daily the discharge of water and amendments that are injected into the groundwater according to the requirements specified in Table 4. Each amendment addition shall be recorded individually, along with information regarding the time period over which the amendment was injected into the aquifer.

Table 4: Discharge Monitoring Requirements

| Parameters | Units | Type of Sample |
|---------------------------------|-----------------|----------------|
| Injected Volume (potable water) | gallons per day | Meter |
| Amendment(s) Added | lbs/gal/day | Measured |

AMENDMENT ANALYSIS

Prior to use, amendments shall be analyzed for the constituents listed in Table 5. The analysis will be done on a mixture of the amendment and deionized water at the estimated concentration that would be injected during the pilot project. This analysis will be conducted in addition to the bench-scale test with the injectant.

Table 5: Amendment Analytical Requirements

| Constituent | Method ¹ | Maximum Practical Quantitation Limit ² |
|--|---|--|
| Metals, Total and Dissolved ³ | EPA 6020/6010, 200.8 and SM 3500-Cr | As, Ca, Cr, Mn, & V – 0.5 µg/L ⁴ Na – 10 µg/L Cr ⁺⁶ – 5 µg/L |

1. Or an equivalent EPA Method that achieves the maximum Practical Quantitation Limit.
2. All concentrations between the Method Detection Limit and the Practical Quantitation Limit shall be reported as an estimated value.
3. Metals include arsenic, calcium, chromium, hexavalent chromium, magnesium, manganese, molybdenum, sodium, vanadium.
4. µg/L – micrograms per liter

ESTABLISHMENT OF BACKGROUND CONCENTRATION VALUES

The Discharger has previously developed an extensive dataset of background values for concentrations of contaminants of concern (COCs) including methyl tert-butyl ether (MTBE), tert-Butyl alcohol (TBA), and tert-Amyl methyl ether (TAME) and water quality parameters including dissolved oxygen (DO), temperature, specific conductivity, pH, and oxidation-reduction potential (ORP) in all 12 monitor wells on and off-site. In addition, the Discharger shall develop background values for concentrations of constituents in groundwater following the procedures found in California Code of Regulations (CCR) Title 27 Section 20415(e)(10) (See Table 2A). These will be developed using the baseline/background dataset gathered prior to the pilot scale injections and reported in the ISCO CAP Addendum.

REPORTING

When reporting the data, the Discharger shall arrange the information in tabular form so that the date, the constituents, and the concentrations are readily discernible. The data shall be summarized in such a manner as to illustrate clearly the compliance with this Order. 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 Central Valley Water Board.

As required by the California Business and Professions Code Sections 6735, 7835, and 7835.1, all reports shall be prepared by a registered professional Civil Engineer or Geologist or their subordinate and signed by the registered professional.

The Discharger shall submit quarterly electronic data reports which conform to the requirements of the California Code of Regulations, Title 23, Division 3, Chapter 30. The quarterly reports shall be submitted electronically over the internet to the GeoTracker database system by the 1st day of the second month following the end of each calendar quarter by **1 February, 1 May, 1 August, and 1 November** until such time as the Executive Officer determines that the reports are no longer necessary.

Each quarterly report shall include the following minimum information:

- (a) a description and discussion of the groundwater sampling event and results, including trends in the concentrations of pollutants and groundwater elevations in the wells, how and when samples were collected, and whether the pollutant plume(s) is delineated;
- (b) field logs that contain, at a minimum, water quality parameters measured before, during, and after purging, method of purging, depth of water, volume of water purged, etc.;
- (c) groundwater contour maps for all groundwater zones, if applicable;
- (d) pollutant concentration maps for all groundwater zones, if applicable;
- (e) a table showing well construction details such as well number, groundwater zone being monitored, coordinates (longitude and latitude), ground surface elevation, reference elevation, elevation of screen, elevation of bentonite, elevation of filter pack, and elevation of well bottom;
- (f) a table showing historical lateral and vertical (if applicable) flow directions and gradients;
- (g) cumulative data tables containing the water quality analytical results and depth to groundwater;
- (h) a copy of the laboratory analytical data report; and,
- (i) the status of any ongoing remediation, including an estimate of the cumulative mass of pollutant removed or destroyed from the subsurface.

An Annual Report shall be submitted to the Central Valley Water Board by **1 February (1 November for semi-annual monitoring)** of each year. This report shall contain an evaluation of the effectiveness and progress of the investigation and remediation. The Annual Report may be substituted for the fourth quarter (**or second semi-annual**) monitoring report as long as it contains all of the information required for that report plus that required for the Annual Report. The Annual Report shall contain the following minimum information:

- (a) both tabular and graphical summaries of all data obtained during the year;
- (b) groundwater contour maps and pollutant concentration maps containing all data obtained during the previous year;
- (c) a discussion of the long-term trends in the concentrations of the pollutants in the groundwater monitoring wells;
- (d) an analysis of whether the pollutant plume is being effectively treated;
- (e) a description of all remedial activities conducted during the year, an analysis of their effectiveness in removing the pollutants, and plans to improve remediation system effectiveness;
- (f) an identification of any data gaps and potential deficiencies/redundancies in the monitoring system or reporting program; and
- (g) if desired, a proposal and rationale for any revisions to the groundwater sampling plan frequency and/or list of analytes.

A letter transmitting the 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 on the first day of the month following adoption of this Order.

Ordered by:

PATRICK PULUPA, Incoming Executive Officer
for PAMELA C. CREEDON, Executive Officer

(Date)