

ATTACHMENT C

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
CENTRAL VALLEY REGION

MONITORING AND REPORTING PROGRAM NO. R5-2015-XXXX

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

**NOTE: THIS MONITORING AND REPORTING PROGRAM SHALL BE CUSTOMIZED TO FIT THE SITE-SPECIFIC NEEDS OF THE PROJECT. CONSTITUENTS TO BE SAMPLED, SAMPLING FREQUENCY AND REPORTING FREQUENCY NEED TO BE SPECIFIED FOR THE PROJECT. THE TABLES PROVIDE TEMPLATES AND LIKELY CONSTITUENT LISTS THAT NEED TO BE MODIFIED TO MEET THE SITE-SPECIFIC NEEDS.**

This Monitoring and Reporting Program (MRP) describes requirements for monitoring a groundwater remediation system for **NAME OF SITE AND LOCATION**. 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 Figure x, there are xx monitor wells, xx extraction wells, and xx injection wells/trenches associated with this site. 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. Monitor wells with free phase petroleum product or visible sheen shall be monitored, at a minimum, for product thickness and depth to water. 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, extraction wells and/or injection wells shall be sampled according to the schedule in Table 1 and the samples analyzed by the methods in Table 2, as follows:

**Table 1: Sampling Frequency and Constituent Suite**

Well Number <sup>1</sup>	Constituent <sup>2</sup>	Frequency <sup>3</sup>	Monitoring Objective
			Compliance <sup>4</sup>
			Treatment Zone <sup>5</sup>
			Transition Zone <sup>6</sup>
			Background <sup>7</sup>

<sup>1</sup> Well numbers and locations as shown on Figure X.

- <sup>2</sup> Constituent analytical methods are listed in Table 2.  
<sup>3</sup> i.e., weekly, monthly, quarterly, semi-annually, annually, other. Semi-annual sampling occurs 1<sup>st</sup> and 3<sup>rd</sup> quarters, annual sampling occurs in the 1<sup>st</sup> quarter, biennial sampling occurs every two years in the 1<sup>st</sup> quarter, with the first sample during year two.  
<sup>4</sup> Wells used to determine compliance with water groundwater limitations.  
<sup>5</sup> Wells sampled to evaluate in-situ bioremediation progress inside the treatment zone.  
<sup>6</sup> Wells sampled to evaluate migration of pollutants within the treatment zone.  
<sup>7</sup> Wells used to develop background concentrations.

**NOTE: ADD OR DELETE CONSTITUENTS AND METHODS AS NEEDED IN TABLES 2 THROUGH 6. TABLE 2 PROVIDES THE GENERAL LIST OF CONSTITUENTS THAT ARE MOST LIKELY TO BE SAMPLED FOR AT AN INSITU REMEDIATION SITE**

**Table 2: Analytical Methods**

Constituent	Method <sup>1</sup>	Maximum Practical Quantitation Limit (µg/L) <sup>2</sup>
Volatile Organic Compounds	EPA 8020 or 8260B	0.5
Sodium	EPA 200.7	100
Potassium	EPA Method 300	20
Volatile Organic Acids	EPA 6500	1,000
Orthophosphate	Hach Method 8131	30
Ethane	Modified EPA 602	0.1
Ethene	Modified EPA 602	0.1
Methane	Modified EPA 602	0.1
Total Dissolved Solids	EPA 160.1	10,000
Total Organic Carbon	EPA 415	300
Chloride	EPA 6500	300
Nitrate	EPA 6500	300
Sulfate	EPA 6500	200
Sulfide	Hach Method 8131	30
Iron, Total and Dissolved	EPA 200.7	100
Ferrous and Ferric Iron	EPA 200, 6020 or SM3000	100
Hexavalent Chromium	EPA 7199	1
Phosphorous	EPA 200.7, 365	1,000
Metals, Total and Dissolved <sup>3</sup>	EPA 200.7, 200.8	Various
1,2,3-Trichloropropane <sup>4</sup>	EPA 8260B <sup>4</sup>	0.5 µg/L <sup>4</sup>

- <sup>1</sup> Or an equivalent EPA Method that achieves the maximum Practical Quantitation Limit.  
<sup>2</sup> All concentrations between the Method Detection Limit and the Practical Quantitation Limit shall be reported as an estimated value.  
<sup>3</sup> Metals include barium cadmium, calcium, total chromium, copper, lead, magnesium, manganese, mercury, molybdenum, nickel and silica.  
<sup>4</sup> If 1,2,3-TCP in a monitor well is expected to exceed 0.5 µg/L, then Method 8260B may be used. If the concentration is expected to exceed 0.02 µg/L, then EPA Method 504.1 is to be used. If 1,2,3-TCP is not detected greater than 0.02 µg/L, then SRL 524M-TCP must be used in the next regularly scheduled sampling event.

### 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	10 millivolts	Field Meter
Electrical Conductivity	uhmos/cm	50 $\mu\text{S}/\text{cm}^2$	Field Meter
Dissolved Oxygen	mg/L	0.2 mg/L	Field Meter
pH	pH Units (to 0.1 units)	0.1 units	Field Meter
Temperature	$^{\circ}\text{F}/^{\circ}\text{C}$	0.1 $^{\circ}\text{F}/^{\circ}\text{C}$	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.

### TREATMENT PLANT EFFLUENT MONITORING

**NOTE: ADD OR DELETE CONSTITUENTS AND METHODS AS NEEDED IN TABLE 4. TABLE 4 PROVIDES THE GENERAL LIST OF CONSTITUENTS THAT ARE MOST LIKELY TO BE SAMPLED FOR AT AN IN-SITU REMEDIATION SITE**

The effluent from the groundwater treatment system shall be sampled on a monthly basis as follows in Table 4: **NOTE: FREQUENCY CAN BE ADJUSTED AS WARRANTED**

**Table 4: Treatment Plant Effluent Sampling Requirements**

Parameters	Units	Type of Sample
Volatile Organics	$\mu\text{g}/\text{L}$	Grab
Metals	$\mu\text{g}/\text{L}$	Grab
Pesticides	$\mu\text{g}/\text{L}$	Grab
Cyanide	$\mu\text{g}/\text{L}$	Grab
Petroleum Hydrocarbons	$\mu\text{g}/\text{L}$	Grab
Total Dissolved Solids	mg/L	Grab

Parameters	Units	Type of Sample
Electrical Conductivity	µmhos/cm	Grab
Dissolved Oxygen	mg/L	Grab
pH	pH Units (to 0.1 units)	Grab

### 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 5. Each amendment addition shall be recorded individually, along with information regarding the time period over which the amendment was injected into the aquifer.

**Table 5: Discharge Monitoring Requirements**

Parameters	Units	Type of Sample
Injected Volume	gallons per day	Meter
Amendment(s) Added	pounds per day	Measured
Biocide Added	pounds per day	Measured

### AMENDMENT ANALYSIS

Prior to use, amendments shall be analyzed for the constituents listed in Table 6. The analysis should be done on a mixture of the amendment and deionized water at the estimated concentration that would be injected during the pilot project.

**SOME CONSTITUENTS CAN BE ELIMINATED DEPENDING ON THE AMENDMENT**

**Table 6: Amendment Analytical Requirements**

Constituent	Method <sup>1</sup>	Maximum Practical Quantitation Limit (µg/L) <sup>2</sup>
Volatile Organic Compounds	EPA 8020 or 8260B	0.5
General Minerals <sup>3</sup>		
Metals, Total and Dissolved <sup>4</sup>	EPA 200.7, 200.8	Various
Semi-Volatile Organic Compounds	EPA Method 8270	5.0
Total Dissolved Solids	EPA 160.1	10,000
pH	meter	NA
Electrical Conductivity	meter	NA

<sup>1</sup> Or an equivalent EPA Method that achieves the maximum Practical Quantitation Limit.

<sup>2</sup> All concentrations between the Method Detection Limit and the Practical Quantitation Limit shall be reported as an estimated value.

<sup>3</sup> General Minerals include: alkalinity, bicarbonate, potassium, chloride, sulfate, total hardness, nitrate, nitrite, ammonia.

- <sup>4</sup> Metals include arsenic, barium, cadmium, calcium, total chromium, copper, iron, lead, manganese, magnesium, mercury, molybdenum, nickel, selenium and silica.

### **ESTABLISHMENT OF BACKGROUND CONCENTRATION VALUES**

**NOTE: SPECIFIC BACKGROUND CONSTITUENTS DEPEND UPON THE NATURE OF THE AMENDMENTS, TREATMENT PROCESSES, AND ANTICIPATED INSITU REACTIONS.**

The Discharger shall develop background values for concentrations of constituents such as dissolved iron, dissolved manganese, metal xxx, total dissolved solids and electrical conductivity in groundwater following the procedures found in CCR Section 20415(e)(10). The Discharger shall submit a proposal to develop the background concentrations by **XX XXXXX XXXX**.

### **REPORTING**

**NOTE: CUSTOMIZE THE REPORTING FREQUENCY. QUARTERLY REPORTS ARE RECOMMENDED AND THIS SECTION IS DEVELOPED AROUND THAT CONCEPT**

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. In addition, the Discharger shall notify the Central Valley Water Board within 48 hours of any unscheduled shutdown of any soil vapor and/or groundwater extraction system. 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;
- (i) the status of any ongoing remediation, including an estimate of the cumulative mass of pollutant removed from the subsurface, system operating time, the effectiveness of the remediation system, and any field notes pertaining to the operation and maintenance of the system; and
- (j) if applicable, the reasons for and duration of all interruptions in the operation of any remediation system, and actions planned or taken to correct and prevent interruptions.

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:

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PAMELA C. CREEDON Executive Officer

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XX XXXXXXXX XXXX

(Date)