

ATTACHMENT E
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LAHONTAN REGION

MONITORING AND REPORTING PROGRAM
NO. R6V-2014-TENTATIVE

FOR

PACIFIC GAS AND ELECTRIC COMPANY
GROUNDWATER REMEDIATION PROJECT

AGRICULTURAL TREATMENT UNITS

WDID NO. 6B360303001

_____ San Bernardino County _____

California Water Code section 13267 authorizes the Regional Water Quality Control Board (Water Board) to require technical and monitoring reports. This Monitoring and Reporting Program (MRP) establishes monitoring and reporting requirements consistent with the California Water Code. This MRP applies to all agricultural treatment units (ATUs) covered under this Board Order. It includes monitoring and reporting as described in the California Environmental Quality Act (CEQA) Environmental Impact Report prepared for the PG&E Hinkley groundwater remediation project (State Clearinghouse No. 2008011097), as well as other monitoring required by this Order. Pursuant to Water California Water Code section 13223, this MRP may be amended by the Water Board Executive Officer.

I. MONITORING

1. Environmental Impact Report (EIR) Monitoring

Table E-1 describes the monitoring (or modeling) constituents, monitoring areas, frequency of monitoring, and frequency of reporting. These requirements are needed to monitor the mitigation measures for water resources impacts described in the Project's EIR. Specific monitoring areas and wells will also be proposed by the Discharger in individual Reports of Waste Discharge, and accepted by the Water Board Executive Officer in writing.

Details on all EIR mitigation measures, including implementation timing, responsibility, and standards for compliance, are included in Attachment F. Certain EIR mitigation measures are not within the Water Board's authority to require (for example, those mitigation measures related to air quality, cultural resources and biological resources); however, as CEQA lead agency the Water Board is responsible for monitoring that the Discharger has or will implement those mitigation measures that another agency should require.

Therefore, as a condition of this Order, the Discharger must submit an annual report to the Water Board documenting implementation of and compliance with all applicable mitigation measures for agricultural treatment units.

Table E-1. EIR Mitigation Monitoring for Water Resources Impacts

A. Pre-remedial Reference Level Monitoring for Water Supply Wells (WTR-MM-2b and 2c)				
Parameter/Constituent	Timing	Monitoring Area	Frequency/Duration	Reporting
<ul style="list-style-type: none"> • TDS • Nitrate as N • Uranium • Other Radionuclides 	One year prior to or concurrent with operation of new ATUs.	Water supply wells one mile downgradient and cross-gradient of any proposed new agricultural treatment unit.	Quarterly for one year.	Quarterly
<ul style="list-style-type: none"> • Groundwater Elevations and wetted screen depth 	One year prior to or concurrent with operation of new ATUs.	Water supply wells one-half mile downgradient and cross-gradient of any proposed new agricultural treatment unit.	Quarterly for one year, including monitoring in March and October.	Quarterly
<ul style="list-style-type: none"> • Total Chromium • Hexavalent Chromium 	One year prior to or concurrent with operation of new ATUs.	Water supply wells one-half mile downgradient and cross-gradient of any proposed new agricultural treatment unit, <u>when Cr data is not available for a water supply well.</u>	Quarterly for one year.	Quarterly
B. ATU Operations Monitoring for Water Supply Wells (WTR-MM-2a, 2b, 2c)				
Parameter/Constituent	Timing	Monitoring Area	Frequency/Duration	Reporting
<ul style="list-style-type: none"> • TDS • Nitrate as N • Uranium • Other Radionuclides 	Concurrent with ATU operation.	Water supply wells one-half mile downgradient and one-quarter mile cross-gradient of any proposed new ATU.	Twice yearly for duration of operation of ATU.	Twice yearly
<ul style="list-style-type: none"> • TDS • Nitrate as N • Uranium • Other Radionuclides 	If water supply well is "actually affected" (see WDRs section I.E.1 for criteria to determine affected wells).	Actually affected water supply well.	Once per month, until alternate water supply is provided to the satisfaction of the Water Board. Then, twice yearly if nearby monitoring wells exist.	Monthly, or twice yearly
<ul style="list-style-type: none"> • TDS • Nitrate as N • Uranium • Other Radionuclides 	If water supply well is "actually affected" (see WDRs section I.E.1).	Water supply wells within one-half mile downgradient and one-quarter mile cross-gradient of "actually affected" well.	Quarterly for the following two years of identification of actually affected well.	Quarterly

Total and Hexavalent Chromium	Concurrent with remediation activities.	Water supply wells one mile downgradient and cross-gradient of previously defined chromium plume boundary.	Quarterly for duration of remediation project.	Quarterly
Groundwater Elevations	Concurrent with ATU operations in monitoring area.	Water supply wells one-quarter mile from any ATU extraction point. If groundwater levels cannot be measured in water supply wells, monitoring wells between supply wells and area of remedial action may be substituted.	Twice yearly including monitoring in March and October. Continuing for duration of remedial pumping until groundwater levels have stabilized for a minimum of two years following commencement of groundwater extraction.	Twice yearly
Uranium and Gross alpha	If well is actually or potentially affected by drawdown (loss of greater than 25% of wetted screen depth, see WDRs section I.E.1).	Affected well, and water supply wells within one-quarter mile of affected well.	Twice yearly in October and March until groundwater levels have stabilized for a minimum of two years following commencement of groundwater extraction.	Twice yearly

C. Groundwater Flow, Drawdown and Contaminant Transport Modeling (WTR-MM-2a, 2b, 2c)

Parameter/Constituent	Timing	Monitoring Area	Frequency/Duration	Reporting
Chromium and remediation byproduct plume movement for the following three years.	Concurrent with remediation.	Project area.	Annually for duration of remediation project.	Annually Report due Jan 31
Groundwater levels in water supply wells for the following three years.	Concurrent with remediation.	Project area. Modeling based on month with greatest well water use.	Annually for duration of remediation project.	Annually Report due Jan 31

D. ATU Byproduct Investigation (WTR-MM-5)				
Parameter/Constituent	Timing	Monitoring Area	Frequency/Duration	Reporting
<ul style="list-style-type: none"> • TDS • Uranium • Other Radionuclides • Nitrate as N 	Complete investigation within one year of WDRs approval.	<p>Monitoring wells associated with existing ATUs. See Table E-2 for specific monitoring wells.</p> <p>Extraction wells associated with existing ATUs. Grab sample of combined extracted groundwater to characterize quarterly water quality for each constituent at each ATU.</p>	<p>At a minimum, quarterly sampling data collected for one year.</p> <p>Any existing data that has been collected at least quarterly for a minimum of one year may be used for investigation purposes.</p>	<p>Within three months of investigation completion.</p> <p>Report must provide an analysis of the effects of existing ATUs on concentrations of byproducts in groundwater.</p>
E. Water Rights Documentation (WTR-MM-1)				
Parameter/Constituent	Timing	Monitoring Area	Frequency/Duration	Reporting
<p>Water rights: Discharger-owned Free Production Allowance meets or exceeds annual net remedial use.</p> <p>Estimated annual net remedial use and discharger-owned FPA.</p>	Upon expansion of ATUs over 2013 acreages.	Centro subarea, Mojave Groundwater Basin.	Annually for duration of remedial activities that involve groundwater extraction.	Annually: December 31

2. Groundwater Monitoring Well Sampling

a. Existing ATUs

- i. For existing ATUs, monitoring wells listed in Table E-2 shall be sampled quarterly. Constituents to be monitored are total and hexavalent chromium, nitrate (as N), and TDS. Uranium and other radionuclides may be required pending results of the investigation described in Table E-1, row D. Locations of existing ATUs are shown in Attachment B.
- ii. For the purposes of the investigation required by EIR mitigation measure **WTR-MM-5** (described in Table E-1, row D, above), where uranium and other radionuclide data do not exist for the monitoring wells in Table E-2, those data shall be collected quarterly for a minimum of one year, and reported as specified in Table E-1, row D.
- iii. For the North and South Gorman ATUs, two new monitoring wells are required by this Order at the locations described in Table E-2. These wells shall be installed and sampled **no later than 3 months** following the date of this Order.
- iv. When new monitoring wells are installed to evaluate the effects upon water quality from the existing ATUs, they will be added to this monitoring program.

Table E-2. Quarterly Groundwater Monitoring for Existing ATUs

Desert View Dairy		North & South Gorman		Cottrell		Yang		Ranch	
Well ID#	Location	Well ID#	Location	Well ID#	Location	Well ID#	Location	Well ID#	Location
DW-02	Downgradient	MW-69S/D	Cross gradient	MW-68S/D	Downgradient	MW-21A/B1	Cross gradient	MW-09	Upgradient
DW-03	Downgradient	MW-70S	Mid-field	MW-55A/B	Downgradient	MW-32B1/B2	Downgradient	MW-14A/B/S	Upgradient
MW-29	DVD	MW-84S	Downgradient					MW-22A/B	Downgradient
MW-31	DVD	MW-85S/D	Downgradient					MW-24A/B	Downgradient
MW-42B1/B2	Upgradient	New well north of MW-85 and Thompson Rd	Downgradient					MW-56	Downgradient
MW-43	DVD	New well between MW-84 & MW-85 on Thompson Rd	Downgradient						
MW-62A	Downgradient								
MW-63	DVD								
MW-71S	Downgradient								
MW-83S	Downgradient								
MW-89S	Downgradient								
MW-127S1/S2	Downgradient								
MW-170S	Downgradient								

b. New ATUs

- i. Groundwater monitoring locations for new ATUs shall be proposed by the Discharger in its Report of Waste Discharge. Groundwater monitoring well locations shall be proposed to characterize water quality mid-field and in the downgradient flow direction of new ATUs.
- ii. Monitoring constituents shall be total and hexavalent chromium, nitrate (as N), TDS, uranium and other radionuclides.

3. Monitoring of Irrigation Water Applied to ATUs

- i. Irrigation water applied to ATUs shall be monitored monthly or quarterly, as specified in Table E-3. Samples shall be collected as grab samples of combined extracted groundwater to characterize monthly or quarterly concentrations of constituents applied to ATUs.
- ii. Groundwater volumes shall be recorded in a permanent log book at the frequency and duration specified in Table E-3, and reported quarterly.

Table E-3. ATU Irrigation Water Monitoring				
Parameter/Constituent	Timing	Monitoring Area	Frequency/Duration	Reporting
<ul style="list-style-type: none"> • Total Hexavalent and Chromium 	Concurrent with remediation.	All ATUs. Grab sample of combined extracted groundwater to characterize monthly chromium concentration applied at each ATU.	Monthly	Quarterly
<ul style="list-style-type: none"> • Arsenic • Iron • Manganese • Total Organic Carbon 	Concurrent with remediation.	ATUs in OU1 where irrigation water is extracted from within footprint of IRZ byproduct plumes. Grab sample of combined extracted	Quarterly	Quarterly

Table E-3. ATU Irrigation Water Monitoring

Parameter/Constituent	Timing	Monitoring Area	Frequency/Duration	Reporting
		groundwater to characterize quarterly water quality applied at each ATU.		
<ul style="list-style-type: none"> • Uranium • Total Dissolved Solids • Nitrate as N 	Concurrent with remediation.	All ATUs. Grab sample of combined extracted groundwater to characterize quarterly water quality applied at each ATU.	Quarterly	Quarterly
Volume of Extracted Groundwater: Tabulate: <ul style="list-style-type: none"> • Monthly and quarterly volumes in gallons per minute per extraction well • Cumulative quarterly volumes in gpm for each ATU • Total yearly volumes of extracted groundwater in acre-feet per year. 	Concurrent with remediation.	All ATUs, for each extraction well and ATU as specified.	As specified (quarterly, monthly, yearly)/Project duration	Quarterly

4. Soil Monitoring

- i. Soil monitoring is required for existing and new ATUs, as specified in Table E-4. For existing fields, sample collection shall be at a rate of one sample per every 20 acres or less. For new ATUs, the Discharger shall propose soil sampling locations and numbers of samples sufficient to establish background concentrations of the constituents in Table E-4, and to investigate the accumulation (loading) of constituents in ATU soils. Sample analysis methods shall be proposed in the Report of Waste Discharge.

Table E-4. ATU Soil Monitoring

Parameter/Constituent	Timing	Monitoring Area	Frequency/Duration	Reporting
<ul style="list-style-type: none"> • Trivalent Chromium (insoluble salts) • Hexavalent Chromium 	Prior to application of irrigation water to ATUs in OU1 for new ATUs, and concurrent with remediation for new and existing ATUs.	One-half foot and five feet below surface in existing and new ATUs in OU1 .	Yearly	Yearly
<ul style="list-style-type: none"> • Trivalent Chromium (insoluble salts) • Hexavalent Chromium 	Prior to application of irrigation water to ATUs in OU2 for new ATUs, and concurrent with remediation for new and existing ATUs.	One-half foot and five feet below surface in existing and new ATUs in OU2 .	Once every two years	Once every two years.
<ul style="list-style-type: none"> • Arsenic, inorganic • Manganese 	Prior to application of irrigation water to ATUs in OU1 , and concurrent with remediation.	One-half foot below surface in ATUs in OU1 where irrigation water is extracted from within footprint of IRZ byproduct plumes.	Yearly	Yearly
<ul style="list-style-type: none"> • Uranium (soluble salts) 	Prior to application of irrigation water to ATUs, and concurrent with remediation.	One-half foot below surface in all ATUs where uranium exceeds 20 pico curies per liter (state MCL) in irrigation water based on results of quarterly sampling.	Yearly	Yearly

5. Plant Tissue Monitoring.

- i. Representative samples of plant or crop tissue irrigated by extracted groundwater shall be collected and analyzed as described below. For existing fields, sample collection shall be at a rate of one sample per every 20 acres or less. A sufficient number of samples shall be proposed for new ATUs to characterize plant uptake of constituents of listed in Table E-5.
- ii. Plant tissue sampling results shall be reported in milligrams per kilogram (mg/kg) dry weight of plant tissue.

Table E-5. ATU Plant Tissue Monitoring

Parameter/Constituent	Timing	Monitoring Area	Frequency/Duration	Reporting
<ul style="list-style-type: none"> • Trivalent Chromium • Hexavalent Chromium 	Concurrent with remediation.	All ATUs in OU1.	Twice Yearly	Twice Yearly
<ul style="list-style-type: none"> • Uranium • Arsenic 	Concurrent with remediation.	ATUs where quarterly U or As exceeds MCLs in irrigation water.	Twice Yearly	Twice Yearly
<ul style="list-style-type: none"> • Nitrate as N 	Concurrent with remediation.	All ATUs	Yearly	Yearly

6. Aquifer Characteristics

For each groundwater monitoring well sampled pursuant to this Order, the following data shall be collected and reported quarterly.

Table E-6. Aquifer Characteristics				
Parameter/Constituent	Timing	Monitoring Area	Frequency/Duration	Reporting
<ul style="list-style-type: none"> • Static groundwater level (feet above mean sea level) • Depth to groundwater (feet below ground surface) • Specific Conductance (micro Siemens per centimeter) • pH • Eh/ORP (millivolts) • Temperature (degrees C) 	Concurrent with remediation.	Monitoring wells in project area, as specified in Table E-2 and to be determined by annual workplans and modeling.	Quarterly.	Quarterly

7. ATU Condition Monitoring

On a twice-weekly basis, each ATU shall be visually inspected and the following information recorded in a permanent log book.

Table E-7. ATU Condition Monitoring				
Parameter/Constituent	Timing	Monitoring Area	Frequency/Duration	Reporting
<ul style="list-style-type: none">• Runoff/drainage control facilities• Perimeter site fencing• Signs of runoff leaving ATU• Presence of ponded water	Concurrent with remediation.	All ATUs.	Twice weekly for duration of ATU operation.	Twice yearly, include a summary of issues noted, and description of actions taken to address.

II. AUTHORIZED WELL REHABILITATION CHEMICALS, COMPOUNDS AND TRACERS

a) Well Chemicals and Compounds

- i. Acetic acid
- ii. Citric acid
- iii. Hydrochloric acid
- iv. Hydrogen peroxide
- v. Sodium hydroxide
- vi. Phosphoric acid
- vii. Carbon dioxide (Aqua Gard and Aqua Freed are technologies for applying carbon dioxide for well rehabilitation)
- viii. Chemicals or compounds which result in similar or less effects on water quality as compared to those previously approved. A pilot study or additional monitoring may be required for chemicals or compounds that do not have a previous history of use under similar conditions to demonstrate viii, above.
- ix. Commercial mixtures of rehabilitation compounds that carry the following certifications/registrations valid in the state of California by the NSF may be used:
 - NSF/ANSI 60-2005 (Drinking Water Treatment Chemicals – Health Effects): compounds with this certification are routinely used for rehabilitation of drinking water wells in California under the California Waterworks Standard (California Code of Regulations Title 22, Section 64590: Direct Additives).
 - NSF Nonfood Registered Compound: Compounds on this registry are acceptable for use as an ingredient in cleaning products to be used in and around food processes where not intended for direct food contact.

The Material Safety Data Sheet must be provided for any proposed chemical or compound.

Monitoring

- i. Monitoring for well rehabilitation chemicals and compounds is required for the appropriate marker constituent for any chemical or compound used.
- ii. Monitoring wells shall be sampled for the marker constituent if they are located within 500 feet cross gradient or downgradient of a well where rehabilitation chemicals or compounds have been injected.
- iii. If the marker constituent is not detected in two consecutive quarterly sampling events, sampling for that constituent is no longer required.

- b) Groundwater Flow Tracers
- i. Bromide
 - ii. Fluorescein
 - iii. Eosine
 - iv. Additional fluorescent tracers

Monitoring

Specific monitoring for groundwater flow tracers shall be proposed in any tracer study plan submitted by the Discharger.

III. NUTRIENT AND IRRIGATION WATER APPLICATION AT AGRONOMIC RATES

This Order requires application of irrigation water to ATUs at an "agronomic rate". Agronomic rate refers to a rate of irrigation water applied that provides the needed amount of water and nutrient loading which grasses/crops require while minimizing excess water or nutrients percolating beyond the root zone.

Demonstration of agronomic rate application shall include the following considerations for each ATU:

- i. Irrigation Water
 - Maximizing irrigation system efficiency (for example, maximizing distribution uniformity to reach 0.85 or higher)
 - Scheduling of irrigation (amount and timing, both daily and seasonally)
 - Soil moisture and root zone water holding capacity
 - Evapotranspiration rates
- ii. Nutrients
 - Soil and irrigation water nutrient testing to determine amount of fertilizer needed
 - Plant tissue testing for nutrient uptake

IV. NOTIFICATIONS

The Discharger shall notify the Water Board of any significant change in remedial operations within 14 days of such change. Significant change means when more than 50 percent of the extraction and discharge locations are shut down, or when the total system flow rate is decreased by greater than 50 percent, or when data shows that an ATU is not being maintained by at least 50 percent in area.

A significant change in operations also includes changes which trigger ATU contingency planning to maintain hydraulic containment, in case extreme weather, crop disease, or other unforeseen events prevent groundwater extraction and irrigation of fields for an extended period such that hydraulic containment of the plume cannot be maintained.

V. REPORTING

1. General Requirements

- a. All reports shall include a transmittal letter summarizing the essential points in each report. The letter shall include a discussion of any requirement violations found since the last report was submitted, and shall describe actions taken or planned for correcting those violations. The transmittal letter shall also include a discussion of any violations of the WDRs and a description of action(s) taken to correct those violations. If no violations have occurred since the last report, this shall be stated in the transmittal letter.
- b. The results of any analysis taken more frequently than required for the parameters and locations specified in this monitoring and reporting program shall be submitted to the Water Board in the next monitoring report.
- c. All reports shall include the signature and stamp of a California licensed professional geologist or civil engineer verifying statements in the report, laboratory and other sampling results, and work conducted at the site.

2. Reports

Annual Reports

The Discharger shall submit the following reports annually:

a. EIR Mitigation Measures Compliance Report

A report documenting compliance with all applicable EIR mitigation measures described in Attachment F. It is recognized that not all mitigation measures contained in Attachment F will apply to discharges or activities covered under this Order.

Compliance with the following mitigation measures must be documented in the annual report as described in Attachment F for each mitigation measure listed below. Documentation may include separate, stand-alone memoranda or reports of verification from responsible agencies, in which case the agency's receipt of those reports can be documented.

Table E-8. Applicable EIR Mitigation Measures			
Water Resources	Hazardous Materials	Air Quality	Noise
WTR-MM-1	HAZ-MM-1	AIR-MM-1	NOI-MM-1
WTR-MM-2	HAZ-MM-2	AIR-MM-2	
WTR-MM-2a, 2b, 2c	HAZ-MM-3	AIR-MM-3	Traffic
WTR-MM-5		AIR-MM-4	TRA-MM-1
WTR-MM-6		AIR-MM-5	
		AIR-MM-6	
		AIR-MM-7	
Geology/Soils	Land Use	Socioeconomics	Aesthetics
GEO-MM-2	LU-MM-1	SE-MM-1	AES-MM-1
	LU-MM-2		AES-MM-2
			AES-MM-3
Biological Resources	Biological Resources	Biological Resources	Cultural Resources
BIO-MM-1a	BIO-MM-1i	BIO-MM-2	CUL-MM-1
BIO-MM-1b	BIO-MM-1j	BIO-MM-3	CUL-MM-2
BIO-MM-1c	BIO-MM-1k	BIO-MM-4	CUL-MM-3
BIO-MM-1d	BIO-MM-1l		CUL-MM-4
BIO-MM-1e	BIO-MM-1m		CUL-MM-5
BIO-MM-1f	BIO-MM-1n		CUL-MM-6
BIO-MM-1g	BIO-MM-1o		CUL-MM-7
BIO-MM-1h	BIO-MM-1p		CUL-MM-8

b. Agronomic Rate Performance Report

An agronomic rate performance report, containing, at a minimum, the information outlined in section III, above.

Monthly, Quarterly, and Twice-yearly Reports

1. Groundwater monitoring for existing and new ATUs shall be reported quarterly. Refer to Tables E-1, E-2 and E-4 through E-8 for reporting frequencies for those monitoring requirements.

The reports shall contain, at a minimum, the following information:

- a. Description of and as-built maps and designs for new fields, structures, etc. Describe acreage, number of extraction wells, and manner and method of irrigation. Describe when irrigation began and rate of application. State whether ponding occurred on fields and, if so, length of time of ponding.

- b. Overall description of all operating fields. Provide the range and total volume of effluent discharged as irrigation.
- c. Description of aquifer characteristics and state changes or variations from the previous monitoring event.
- d. Description of and tabulation of monthly discharge volume for each agricultural treatment units for that quarter and over the previous 12 months. The new information shall be added to a table of historical data. Cite changes or variations from previous monitoring event. If fields operated at less than 50 percent of normal, provide reasoning and corrective measures. State how reduced operation affected effective of chromium plume containment and chromium remediation.
- e. Description of other discharges to agricultural treatment units, such as tracers or well rehabilitation chemicals. Provide the volume, duration, and location of discharge, and manner of application.
- f. Description of sampling conducted and laboratory analytical results of samples collected from the agricultural treatment units during the reporting period. The results of sample analysis of monitoring parameters for the effluent water samples shall be described and reported in tabular and graphic form. Each graph prepared for ground water data shall be plotted with raw data at a scale appropriate to show trends or variations in water quality. For graphs showing the trends of similar constituents, the scale shall be the same.
- g. The results of soil and plant tissue sampling conducted at the frequency and in accordance with Tables E-4 and E-5, above. Describe analytical results, whether results are changes from the previous monitoring event, and comparison to historical data. The new information shall be added to a table of historical data.
- h. The table containing analytical results for groundwater monitoring wells shall show the range and average concentrations of total chromium, hexavalent chromium, nitrate (as N), and TDS from all required groundwater monitoring wells for that quarter and over the previous 12 months. The new information shall be added to a table of historical data.
- i. All site maps shall have a font size of no less than 9 points and show the following information: scale, legend, field names, all well locations (monitoring, extraction, domestic, etc.), other sampling locations, street names, and chromium plume lines for hexavalent and total chromium out to 3.1/3.2 µg/L, 10 µg/L, 50 µg/L, 100 µg/L, and 1,000 µg/L. The following maps shall be included in each report:
 - Potentiometric map for upper aquifer.
 - Groundwater sampling results from monitoring and other wells. Draw isoconcentration lines for nitrate (as N), TDS, and uranium.
 - Soil sampling locations (when soil samples are collected).

Ordered by:

Patty Z. Kouyoumdjian
EXECUTIVE OFFICER

Date

TENTATIVE