
Colorado River Basin Regional Water Quality Control Board

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION**

**INVESTIGATIVE ORDER R7-2017-0031
TO PROVIDE
A TECHNICAL OR MONITORING REPORT**

**FOR
R.D. BROWN COMPANY, INC
307 & 321 NORTH IMPERIAL AVENUE
CITY OF IMPERIAL – IMPERIAL COUNTY**

The California Regional Water Quality Control Board, Colorado River Basin Region (Colorado River Basin Water Board), finds that:

Background

1. R.D. Brown Company, Inc. (Discharger) is the current property owner of 307 and 321 North Imperial Avenue in Imperial, California (Site).
2. The Site consists of 0.9 acres of unpaved land enclosed by a chain-linked fence. The Site was a commercial petroleum fueling facility from 1959 to 1973. An office and warehouse building were located to the north, and a concrete-paved parking lot to the east, both subsequently demolished in early 2015.
3. An unauthorized release of petroleum hydrocarbon fuel occurred at the Site following the removal of one gasoline underground storage tank (UST) on July 26, 2013. The petroleum release is limited to soil and shallow groundwater. A plume extending approximately 1.4 acres occurs on-site and off-site primarily to the north, the direction of groundwater flow. There are no known public or private supply wells, or surface water bodies within 1,000 feet of the projected plume boundary.
4. SCS Engineers (SCS) conducted several assessments and remedial actions at the Site beginning in June 2013. Source area excavation occurred in April 2015 removing 3,360 tons of petroleum impacted soil from 10 to 13 feet below the ground surface in an area 30 feet east of the former UST. Impacted soils were transported to Soil Safe in Adelanto, California for treatment. A high vacuum dual phase extraction (HVDPE) pilot test was conducted in March and April 2016 removing roughly 400 pounds of petroleum hydrocarbons, and 15,000 gallons of contaminated groundwater.
5. Groundwater monitoring and sampling activities have been ongoing since February 2014. Fifteen groundwater monitoring wells and four remediation wells have been installed and monitored regularly. Two monitoring wells were destroyed during soil excavation, and two monitoring wells were properly abandoned.

6. The Site is proposed for development as an assisted senior living, affordable housing facility. The development will consist of sixty-one units designed to house active seniors aged 55 and up, and to provide non-medical quality of life care. The proposed building will also house a community center that will be shared with the City of Imperial.
7. On October 31, 2016, the Discharger requested partial closure of the Site under the State Low-Threat Underground Storage Tank Case Closure Policy (Policy) to facilitate development of the Site into affordable senior housing.
8. On December 2, 2016, the State Water Resources Control Board (State Water Board) issued a letter titled "Review Summary Report – Additional Work Second Review – November 2016" indicating that the Site failed to meet all media specific criteria required by the Policy for groundwater, vapor intrusion, and direct contact and outdoor exposure, stating:
 - a) "Groundwater Specific Criteria: The case does not meet Policy groundwater specific criteria. The projected groundwater plume is greater than 250 feet in length and benzene concentrations are greater than 1,000 micrograms per liter ($\mu\text{g/L}$) beneath the street and sidewalk immediately downgradient of the source area. In addition, benzene concentrations are increasing in downgradient well MW-5."
 - b) "Vapor Intrusion to Indoor Air: The case meets Policy Criterion 2a by Scenario 4 with a bioattenuation zone."
 - c) "Direct Contact and Outdoor Air Exposure: The case meets Policy Criterion 3a. Maximum concentrations in soil are less than those in Policy Table 1 for Residential use, and the concentration limits for a utility worker are not exceeded."

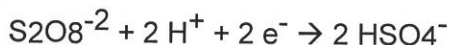
The State Water Board further recommended the Discharger conduct additional soil and groundwater remediation north of the source area, and continue groundwater monitoring until Policy criteria for groundwater are satisfied. Colorado River Basin Water Board staff concurred with the State Water Board's recommendation.

9. The objective of remediating soil and groundwater north of the source area is to reduce the sorbed-phase contaminant mass and dissolved-phase plume of benzene and gasoline-range petroleum hydrocarbons (TPH-gas) in the shallow subsurface, estimated to cover approximately 1.4 acres at the Site and off-site to the north.
10. On March 28, 2017, SCS submitted an Interim Remedial Action (IRA) Workplan on behalf of the Discharger that proposed a Pilot Study to test in situ chemical oxidation (ISCO) injection to remediate residual hydrocarbon contaminants at the Site. ISCO injection appears suitable because impacted groundwater occurs in a relatively permeable and shallow unconfined setting.
11. The Pilot Study proposes to test ISCO injection in two treatment zones: one treatment zone around groundwater monitoring well four (MW-4) located immediately down-gradient of the Source Zone within the sorbed-phase contaminant mass, and a second treatment zone around groundwater monitoring well five (MW-5), situated cross gradient of the Source Zone within the dissolved-phase plume. A groundwater well location map is provided in Attachment 1 of this Order.

Potential Impacts to Groundwater Quality

12. The Water Quality Control Plan for the Colorado River Basin Region (Basin Plan), adopted on November 17, 1993 and amended on March 17, 2017 designates beneficial uses, establishes water quality objectives, and contains implementation plans and policies to achieve those objectives for all waters addressed in the plan (including amendments adopted by the Colorado River Basin Water Board to date).

13. The Site is located within the Imperial Hydrologic Unit. The designated Beneficial Uses for groundwater in the Imperial Hydrologic Unit are:
 - a. Municipal supply (MUN)
 - b. Industrial supply (IND)
14. The Discharger reports first encountered groundwater at the Site is very poor quality ranging up to 39,000 milligrams per liter (mg/l) Total Dissolved Solids (TDS), well above the Water Quality Objective (up to 3000 mg/l TDS) set by the Basin Plan to support the municipal (MUN) supply beneficial use.
15. The proposed remedial technology employs direct-push ISCO injection of a groundwater amendment consisting of sodium persulfate oxidant mixed with sodium hydroxide activator to utilize oxidative, reductive, and nucleophilic pathways to destroy dissolved-phase contaminants. SCS will attempt to inject the sodium persulfate oxidant amendment known as Klozur SP® (an engineered sodium persulfate produced by PeroxyChem), into the downgradient plume concurrently with a high pH sodium hydroxide activator. The sodium persulfate oxidant (Klozur SP®) will destroy dissolved-phase VOCs while the sodium hydroxide activator will convert Klozur SP® into highly reactive radicals that neutralize the generation of hydrogen sulfate from persulfate decomposition, by raising the pH in soil and groundwater to greater than 10.5.
16. Potential byproducts from direct-push ISCO injection of the proposed groundwater amendment (sodium persulfate oxidant mixed with sodium hydroxide activator) include sulfate due to the depletion of persulfate, as given in the equation below:



17. The United States Environmental Protection Agency (US EPA) has a secondary maximum contaminant level for sulfate in drinking water of 250 mg/l, based on taste and odor. PeroxyChem studies indicate sulfate concentrations at persulfate injection sites may be elevated up to six months after oxidant application, and may temporarily exceed the secondary maximum contaminant level for drinking water.
18. Other concerns with ISCO injection involve applying more oxidant than needed to destroy contaminants, resulting in metal precipitation. However, effects are usually transient. Metals of concern to monitor due to their redox potential or likelihood of occurrence at contaminated sites include chromium, manganese, lead, and arsenic.
19. Academic studies suggest long-term groundwater impacts associated with ISCO injection may be limited¹. The groundwater monitoring program established in this Order will be used in part to validate these findings.

Pilot Study - Injection Dosing and Locations

20. The Pilot Study will require two days of direct-push drilling and injection activities in up to ten borings (depending on injection success and final boring locations), completed in the immediate vicinity of monitoring wells MW-4, OW-1, OW-2, and MW-5 (Attachment 1).

¹ For example, at least one study has shown that Chromium levels return to pre-ISCO injection conditions within one year regardless of site and design conditions and that parameter impacts are generally localized to the target treatment zone, except at sites where groundwater flow velocities exceed 1.51 feet/day. (See e.g., Moore, *Geochemical Impacts of ISCO: A Field-Scale Assessment* (2008).)

21. The table below provides information for wells and injection points within sorbed-phase and dissolved-phase treatment zones, and recommended dosages for each treatment zone and injection boring.

Table 1. Dosing and Injection Locations

	Sorbed-Phase Treatment Zone	Dissolved-Phase Treatment Zone
Treatment Zone Wells	MW-4	MW-5
Transition Zone Wells (To Evaluate Migration)	MW-4, OW-1, OW-2, MW-6, MW-7	MW-5
Baseline Zone Wells	MW-3R, MW-8, MW-10, MW-11, MW-12	
Area of Treatment Zone	1,600 square feet	200 square feet
Number of Injection Points	8	2
Klozur SP® Demand in Total	9,163 pounds	775 pounds
Klozur SP® Demand for each Injection Boring	1,145.4 pounds	387.5 pounds
25% Sodium Hydroxide Activator Solution in Total	1,360 gallons	123 gallons
25% Sodium Hydroxide Activator Solution for each Injection Boring	170 gallons	61.5 gallons

22. Injection at the areas proposed for treatment will begin eight feet below grade, and generally proceed downward to a depth of thirteen feet below grade (i.e., the vertical extent of the area proposed for treatment), and will be repeated until injection within a given injection point area is complete. The following parameters will be observed in each injection boring, and recorded during the Pilot Study:
- Initial and average injection pressures;
 - Flow rate; and
 - Achieved injection volume.
23. If the Pilot Study finds direct-push ISCO injection feasible for full-scale remediation of the down-gradient plume, SCS will submit an IRA Work Plan addendum proposing to implement this technology to the Colorado River Basin Water Board.

Legal Authority

24. This Order is issued pursuant to CWC Section 13267, which states in relevant part:

“(b)(1) In conducting an investigation . . . , 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 waste within its region . . . shall furnish, under penalty of perjury, technical or monitoring program reports which the regional board requires. The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report 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 reports required under this Order are necessary to assure protection of waters of the state, and to protect public health and the environment. The monitoring reports required under this Order are necessary to provide the Colorado River Basin Water Board information about the potential impacts to groundwater from wastes associated with ISCO injection and about the efficacy of ISCO injection for a full scale remediation. Because the Discharger is proposing to develop a senior assisted living facility at the Site, the Colorado River Basin Water Board requires this information to determine whether the Site is compatible with the proposed use. Therefore, in light of the need for the reports and the benefits to be obtained from them, the burden, including costs, of these reports is reasonable.

25. The California Code of Regulations (CCRs), Title 23, Section 2720, defines a Responsible Party as:

“[A]ny person who owns or operates an underground storage tank used for the storage of a hazardous substance... any person who owned or operated the underground storage tank immediately before the discontinuation of its use... any owner of property where an unauthorized release of a hazardous substance from an underground storage tank has occurred, and any person who had or has control over a underground storage tank at the time of or following an unauthorized release of a hazardous substance.”

A Responsible Party has a legal obligation to investigate and remediate contamination. The Discharger is subject to this Section 13267 Order because it is a Responsible Party. The Discharger currently owns the Site where an unauthorized release of a hazardous substance from an underground storage tank has occurred.

26. Issuance of this Order is exempt from the provisions of the California Environmental Quality Act (CEQA) (Pub. Resources Code § 21000 et seq.) pursuant to CCRs, Title 14, Section 15308, action by a regulatory agency for the protection of the environment, CCRs, Title 14, Section 13306 for information collection; and CCRs, Title 14, Section 15330 for minor actions to prevent, minimize, stabilize, mitigate or eliminate the release of a hazardous waste or hazardous substances which cost one million dollars or less.

REQUIRED ACTIONS

IT IS HEREBY ORDERED that, pursuant to CWC Section 13267, the Discharger shall submit monitoring reports according to the following requirements:

A. MONITORING REQUIREMENTS

1. To establish baseline conditions, groundwater monitoring wells **MW-3R, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9R, MW-10, MW-11, MW-12, OW-1, OW-2, OW-3, MW-13** and **MW-14** (Attachment 1) shall be monitored at least once *prior to ISCO injection*, and *quarterly* thereafter, for the following parameters:

<u>Parameter/Constituent</u>	<u>Unit</u>	<u>Sample</u>	<u>Frequency</u>
TPH (EPA 8015)	mg/l	grab	quarterly
BTEX (EPA 8260)	ug/l	grab	quarterly
MTBE (EPA 8260)	ug/l	grab	quarterly

2. In addition to "A.1." above, to establish baseline conditions groundwater monitoring wells **MW-4, MW-9R, and MW-11** shall be monitored at least once *prior to ISCO injection*, and *quarterly* thereafter, for the following parameters:

<u>Parameter/Constituent</u>	<u>Unit</u>	<u>Sample</u>	<u>Frequency</u>
Groundwater elevation	USGS Datum	field	quarterly
Depth to groundwater	feet	field	quarterly
Temperature	°F	field	quarterly
pH	pH unit	field	quarterly
oxidation-reduction potential	mV	field	quarterly
DO	mg/l	field	quarterly
EC	uS/cm	field	quarterly
Turbidity	NTU	field	quarterly
<u>Parameter/Constituent</u>	<u>Unit</u>	<u>Sample</u>	<u>Frequency</u>

California Title 22 metals (EPA Method 200.7 and 7196A)	ug/l	grab	quarterly
Hexavalent Chromium (EPA Method 7196A)	ug/l	grab	quarterly
Dissolved methane and carbon dioxide (AM20GAX)	ug/l	grab	quarterly
Nitrite, nitrate, and sulfate (EPA Method 9056)	mg/l	grab	quarterly

3. The collection, preservation, and holding times of all samples shall be in accordance with US EPA approved procedures. All analyses shall be conducted by a laboratory certified by the State Water Board's Division of Drinking Water to perform the required analysis.

B. REPORTING REQUIREMENTS

1. The Discharger shall arrange monitoring data in tabular form so that the date, sample type, and reported analytical result for each sample are readily discernible. The data shall be summarized in such a manner to clearly illustrate compliance with this Order, and spatial or temporal trends, as applicable. The results of any additional monitoring, other than that required in "Monitoring Requirements Section A" above, shall be reported to the Colorado River Basin Water Board.
2. As required by the California Business and Professions Code Sections 6735, 7835, and 7835.1, all reports shall be prepared under the direct supervision of a Registered Engineer or Geologist, and signed by the registered professional.
3. Pursuant to the requirements of CCRs, Title 23, Division 3, Chapter 30, all well and analytical data included in reports shall be submitted electronically into the State Water Board's Geotracker database system.
4. Monitoring reports shall be certified under penalty of perjury to be true and correct, and must contain the following statement:

"I declare under the penalty of law that I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of a fine and imprisonment for knowing violations."

5. **Noncompliance Report:** The Discharger shall notify the Colorado River Basin Water Board by telephone within 24-hours after the Discharger has knowledge of an incident of noncompliance, and shall confirm this notification in writing within two weeks of the telephone notification. The written notification shall include pertinent information explaining the reasons for the noncompliance, shall indicate the steps taken to correct the problem and the dates thereof, and shall indicate the preventive measures proposed to prevent the problem from recurring.

C. REPORTING SCHEDULE

1. Reporting for the dissolved-phase plume ISCO remediation Pilot Study shall be detailed in the regularly scheduled groundwater monitoring and sampling reports. The reports shall be prepared and submitted to the Colorado River Basin Water Board according to the following schedule:

Quarter	Months	Report Due Date
1 st (2018)	January, February, March	June 1 st
2 nd	April, May, June	September 1 st
3 rd	July, August, September	December 1 st
4 th	October, November, December	March 1 st

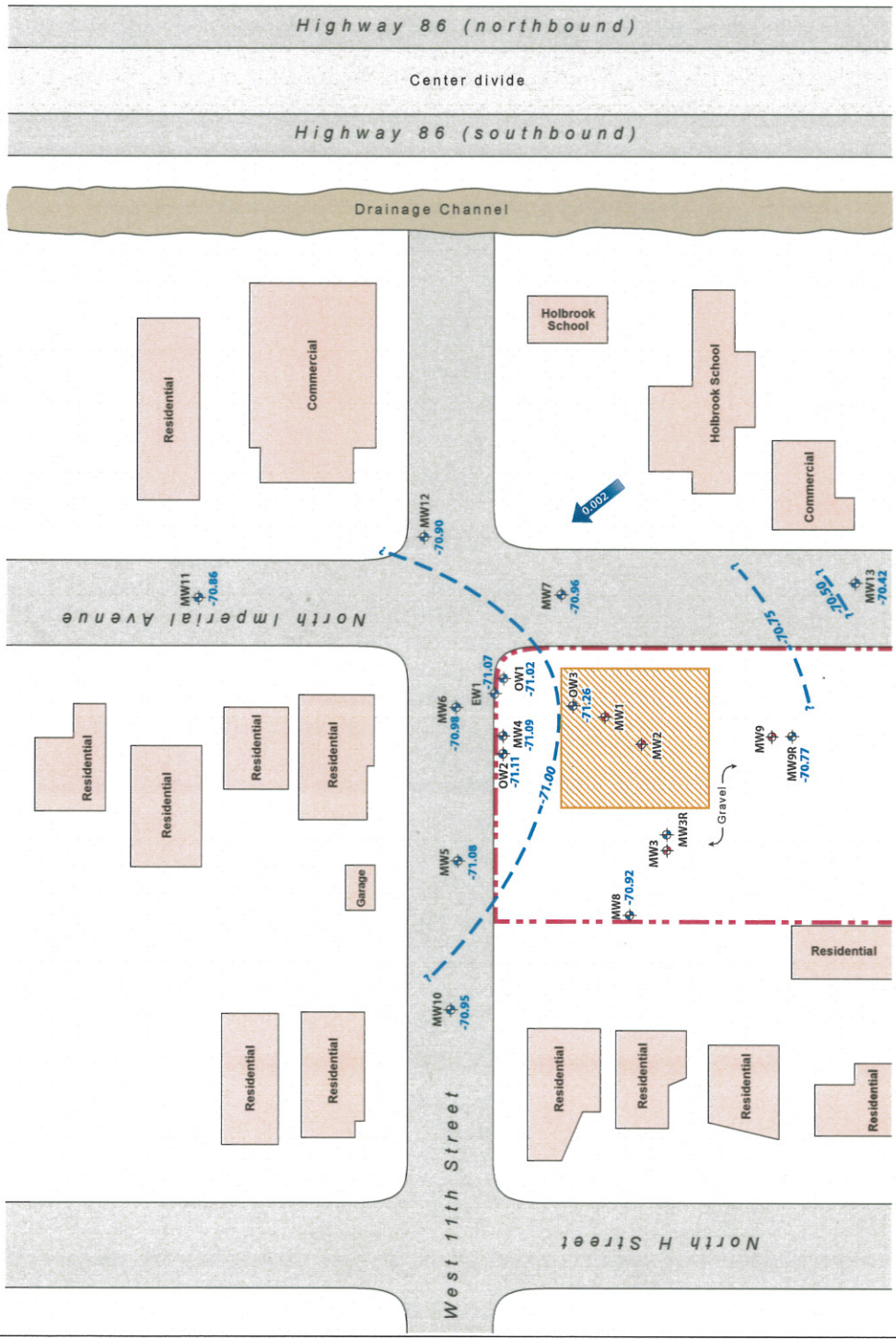
The reports shall include a detailed description of work performed, discussion of the results, and SCS's conclusions and recommendations, as appropriate.

D. PETITION FOR STATE WATER BOARD REVIEW

Any person aggrieved by this action of the Colorado River Basin Water Board may petition the State Water Board to review the action in accordance with CWC Section 13320 and CCRs, Title 23, Sections 2050 and following. The State Water Board must receive the petition by 5:00 p.m., 30 days after the date of this Order, except that if the thirtieth day following the date of this Order falls on a Saturday, Sunday, or state holiday (or mandatory furlough day), the petition must be received by the State Water Board by 5:00 p.m. on the next business day. Copies of the law and regulations applicable to filing petitions may be found on the Internet at: http://www.waterboards.ca.gov/public_notices/petitions/water_quality/ or shall be provided upon request.

LEGEND

- Approximate Site boundary
- Groundwater monitoring well location
- Abandoned groundwater monitoring well location
- Approximate location of excavated soil conducted by SCS Engineers in April 2015
- Interpreted direction of groundwater flow and estimated groundwater gradient
- Estimated groundwater contour in feet above mean sea level
- Groundwater elevation in feet above mean sea level. Measured by SCS Engineers on December 28, 2016



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GROUNDWATER CONTOUR MAP
DECEMBER 2016
 RD Brown Company
 307 and 321 North Imperial Avenue
 Imperial, California

Project No.: 01213171.01
Figure 3
 Date Drafted: 2/6/17

Disclaimer: This figure is based on available data. Actual conditions may differ. All locations and dimensions are approximate.