

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
LOS ANGELES REGION**

ORDER NO. R4-2006-0038

**WASTE DISCHARGE REQUIREMENTS
FOR**

**EXXON MOBIL CORPORATION
(20310 Madrona Avenue, Torrance)
(PILOT INJECTION TEST OF CALCIUM POLYSULFIDE AND SUBSEQUENT FULL-
SCALE REMEDIATION OF CHROMIUM VI
IN GROUNDWATER AND SOIL)
(FILE NO. 05-045)**

The California Regional Water Quality Control Board, Los Angeles Region, (hereafter Regional Board) finds that:

PURPOSE OF ORDER

1. This remediation is part of an ongoing investigation, monitoring and remediation program on the 750 acre Exxon Mobil Torrance refinery which includes areas of contamination other than hexavalent chromium. Future Regional Board actions will continue to ensure the management and cleanup of those contaminants on other parts of the site. However, their presence in this small area will not affect the proposed action or their future remediation.
2. On January 26, 2005, Exxon Mobil Corporation (hereafter Discharger) filed a Report of Waste Discharge (ROWD) and applied for Waste Discharge Requirements to inject calcium polysulfide solution (CPS) into soil and groundwater to remediate a limited area of hexavalent chromium (CrVI) contamination.
3. The proposed remediation area (Site) is located adjacent to Del Amo Boulevard in Torrance, California, as shown on Figure 1. The Site measures approximately 350 feet long by 150 feet wide, and includes two properties:
 - a. Property located at 20310 Madrona Avenue and owned by Exxon Mobil Oil Corporation; and
 - b. Property owned by Exxon Mobil Oil Corporation, but with a transportation easement granted to the City of Torrance in 1977 (on Figure 2 north of fence line).

The Site is currently vacant. Adjacent Exxon Mobil-owned parcels to the north and south are also vacant except for horse stables maintained by the Torrance Mounted Posse and two oil production wells and associated storage equipment operated by Power Run Oil Company.

SITE HYDROGEOLOGY

4. The Site is located on the Torrance Plain of the West Coast Groundwater Basin, in the southwestern part of the Los Angeles Coastal Plain (Latitude 33° 50' 53", Longitude 118° 20' 35") as shown in Figure 1. A zone of shallow groundwater is

March 9, 2006

- present at a depth of approximately 70 feet below ground surface (bgs) beneath the Site. Shallow groundwater is supported by low permeability silts and clays of the Bellflower Aquitard. The shallow groundwater zone is generally less than 5 feet thick and was not observed to be present between 1991 and 1993 or in late 2002. When present, shallow groundwater flow direction is locally variable and controlled primarily by the stratigraphy of the underlying silt/clay layers. No shallow groundwater or potential perching layers have been observed to the south or southeast of the Site. The injection and monitoring wells are shown in Figure 2.
5. Underlying the shallow groundwater zone are the deeper Gage-Gardena, Lynwood, and Silverado aquifers. The Gage-Gardena Aquifer is present at a depth of approximately 110 feet bgs and flows towards the east-southeast beneath the Site. There is one active water supply well screened in the Gage-Gardena Aquifer located 4,200 feet north of the Site. This well operated by Southern California Edison extracts less than 5 acre-feet per month.
 6. Three active municipal water supply wells are located within one-half mile south of the Site. These wells are all screened in the deeper Lynwood and Silverado aquifers, more than 200 feet below the zone of shallow groundwater. Groundwater flow in the deeper Lynwood and Silverado aquifers is from west to east in this area.

FACILITY DESCRIPTION

7. Groundwater investigation, monitoring, and remediation activities at the adjacent Exxon Mobil Oil Torrance Refinery are currently conducted under Cleanup and Abatement Order (CAO) 85-17, 89-136 and 95-116, issued by the Regional Board in 1989. The Discharger samples monitoring wells semi-annually at and in the vicinity of the Site in April and October as part of the approved sampling plan.
8. Hexavalent chromium (CrVI) was first detected in the groundwater zone underlying the Site in October 2000, during the Refinery's routine groundwater monitoring activities conducted under CAO 89-136 and 95-116.
9. Subsequent investigations were conducted between 2000 to 2004 on a voluntary basis by the Discharger, including the installation of 19 cone penetrometer test (CPT) boreholes, 24 hollow-stem-auger boreholes for soil and groundwater grab sampling, 15 hand-auger boreholes for shallow soil sampling, and 8 perched zone groundwater monitoring wells.
10. The results of the subsurface investigations indicated the presence of CrVI concentrations in soil and groundwater beneath the Site. Concentrations of CrVI in soil range from non-detectable to 95.5 milligrams per kilogram (mg/kg), with concentrations exceeding 1 mg/kg limited to an area approximately 50 feet by 30 feet in size and within 50 feet above the groundwater. Detected concentrations of CrVI in shallow groundwater have been as high as 200 milligrams per liter (mg/L), and are limited to an area measuring approximately 150 feet by 50 feet. No CrVI has been detected in the underlying Gage-Gardena or Lynwood aquifers beneath or downgradient of the Site. Investigation results were summarized in ERM-West, Inc.'s (ERM's) October 8, 2004 Remedial Action Workplan (Workplan), which was submitted to the Regional Board.

11. The sources of CrVI have not been fully delineated, but further investigation will occur during the long-term clean-up of the Exxon Mobil Refinery under future revisions of the cleanup and abatement order.

TREATMENT PROCESS DESCRIPTION

12. Bench-scale tests for Exxon Mobil show that electrochemical reduction of CrVI to trivalent chromium can be accomplished through injection of a chemical reducing agent, CPS (also known as lime sulfur). The chemical reaction of CPS with CrVI generates chromium hydroxide (hydrolyzed trivalent chromium), elemental sulfur, and calcium salts. CPS is used as an agricultural soil amendment, an insecticide-fungicide for fruit crops and for removal of metals in water treatment systems.
13. The bench-scale pilot study conducted in October 2003 measured the effectiveness of CPS in reducing CrVI to trivalent chromium. The results of the study indicated that CPS was able to significantly reduce CrVI concentrations in soil and groundwater samples from the Site, in both sandy and silty soils. The mass of CrVI in soil-groundwater slurry samples was reduced nearly 100 percent following 30 minutes of treatment. Soil column studies indicated successful reduction of chromium concentrations in soil leachate samples following infiltration with CPS, to below the State of California Maximum Contaminant Level of 0.050 mg/L.
14. In January 2002, the Regional Board adopted General WDRs for Groundwater Remediation at Petroleum Hydrocarbon Fuel and/or Volatile Organic Compound Impacted Sites (Order No. R4-2002-0030). These General WDRs permit the injection of CPS, but insufficient information was available to permit its use to remediate CrVI. Therefore, these individual waste discharge requirements have been developed for the remediation of CrVI at the Site.
15. Injection of CPS solution into groundwater is a discharge of waste as defined by the California Water Code. However, the discharge of CPS is intended to lower the concentrations of CrVI in soil and groundwater, and is an acceptable remediation approach available for this site.
16. In October 2004, the Discharger submitted a Workplan to the Regional Board, proposing the injection of CPS into vadose zone soil and shallow groundwater to electrochemically reduce CrVI to trivalent chromium. The Workplan presents the rationale and field methods for pilot testing and subsequent full-scale implementation of in situ CrVI remediation at the Site. The Workplan and January 26, 2005 ROWD present the procedures for monitoring the remediation program and evaluating the injection volume and concentrations. The frequency of injection will be adjusted based on the results of field monitoring. There is an existing network of groundwater monitoring wells located upgradient/cross-gradient, within, and downgradient of the planned injection area. Groundwater conditions will be monitored during the operation to determine the efficiency of the injection. The Discharger proposes to inject up to 60,000 gallons of solution through injection wells into the vadose zone soil and up to 140,000 gallons of solution directly into the shallow groundwater zone at the Site. The Discharger will obtain written approval from the Regional Board before exceeding these injection volumes.

17. Within 60 days of completion of the field-scale pilot test and evaluation of the data, a report of the test and a specific plan for the full-scale injection program incorporating those results and meeting the terms of this Order will be submitted to the Regional Board for approval by the Regional Water Quality Control Board Executive Officer (Executive Officer). Modifications of the monitoring and reporting plan may also be required to ensure compliance with the Order.

APPLICABLE LAWS, PLANS, POLICIES AND REGULATIONS

18. On June 13, 1994, the Regional Board adopted a revised *Water Quality Control Plan for Coastal Watersheds of Los Angeles and Ventura Counties* (Basin Plan) which was amended on January 27, 1997 by Regional Board Resolution No. 97-02. The Basin Plan (i) designates beneficial uses for surface waters and groundwater, (ii) sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to the State anti-degradation policy (*Statement of Policy with Respect to Maintaining High Quality Waters in California*, State Water Resources Control Board (State Board) Resolution No. 68-16, October 28, 1968), and (iii) describes implementation programs to protect all waters in the Region. In addition, the Basin Plan incorporates by reference applicable State and Regional Board plans and policies and other pertinent water quality policies and regulations. The Regional Board prepared the 1994 update of the Basin Plan to be consistent with previously adopted State and Regional Board plans and policies. This Order implements the plans, policies and provisions of the Regional Board's Basin Plan.
19. The beneficial uses for the West Coast Groundwater Basin are municipal and domestic water supply, industrial service supply, industrial process supply, and agricultural supply.
20. The requirements contained in this Order are based on the *Basin Plan*, and, as they are met, will be in conformance with the goals of the aforementioned water quality control plans and will protect and maintain existing beneficial uses of the groundwater.
21. The permitted discharge is consistent with the anti-degradation provisions of State Water Resources Control Board Resolution No. 68-16 (Anti-degradation Policy). The discharge may result in some localized temporary changes in the background levels of TDS, pH, conductivity, oxidation-reduction potential, sulfates, sulfides, dissolved arsenic, dissolved manganese, and dissolved iron. However, any parameter change resulting from the discharge:
 - a. Will be consistent with maximum benefit to the people of the State;
 - b. Will not unreasonably affect present and anticipated beneficial uses of such waters; and
 - c. Will not result in water quality less than that prescribed in the Water Quality Control Plan for West Coast Groundwater Basin.

Monitoring will be conducted before, during and after injection of CPS from a network of wells located upgradient, within, and downgradient of the planned injection area.

22. This Regional Board has assumed lead-agency role for this project under the California Environmental Quality Act (Public Resources Code section 21000 et seq.) and has conducted an Initial Study in accordance with section 15063 of the "State CEQA Guidelines" at California Code of Regulations, title 14, section 15000 et seq. Based upon the Initial Study, the Regional Board staff prepared a Mitigated Negative Declaration that the project, as mitigated, will not have a significant adverse effect on the environment. The Regional Board is adopting the Mitigated Negative Declaration concurrently with its adoption of this Order.
23. The Regional Board has notified the Exxon Mobil and interested agencies and persons of its intent to prescribe Waste Discharge Requirements for this discharge and has provided them with an opportunity to submit their written views and recommendations. The Regional Board, in a public meeting, heard and considered all comments pertaining to the discharge and to the tentative requirements.

IT IS HEREBY ORDERED that the Discharger (Exxon Mobil Corporation), in order to meet the provisions contained in Division 7 of the California Water Code and regulations and guidelines adopted there under, shall comply with the following:

A. Discharge Specifications

1. The discharge (injection) of calcium polysulfide(CPS) into groundwater and soil shall be performed in accordance with the procedures described in the October 2004 work plan, January 2005 ROWD, August 2005 Addendum to the ROWD and Staff's February 2006 work plan comment letter.
2. During this remediation, the total injection volume of CPS shall not exceed 200,000 gallons, unless approved by this Regional Board through the Executive Officer.
3. Discharge duration shall not exceed more than two years, unless approved by the Executive Officer.
4. Solution shall be limited to potable water and calcium polysulfide. The maximum concentration of Solution shall not exceed 12% CPS by weight, unless approved by this Regional Board through the Executive Officer.
5. The Discharger shall provide hydraulic control and complete containment of injected chemicals and any by-products of the chemical reduction process if any by-products or CPS are observed to be migrating outside of the remediation area.
6. In the event that additional CPS discharge is needed, written approval by the Executive Officer shall be obtained before such discharge is carried out.

B. Discharge Prohibitions

1. The Discharger shall not cause the by-products of the chemical reduction process to migrate outside of the CPS remediation area established by the Discharger and approved by the Executive Officer.
2. The Discharger shall not cause the groundwater outside of the remediation area to exceed the background concentrations of total dissolved solids established prior to the start of remediation.
3. The discharge of CPS or any by-products into any surface water or surface water drainage course is prohibited.
4. The Discharger shall not cause the groundwater to contain taste, color, or odor producing substances in concentrations that cause nuisance or adversely affect beneficial uses outside the treatment area.
5. The Discharger shall not cause the groundwater to contain concentrations of chemical constituents, including CPS and its by-products, in amounts that may adversely affect municipal, domestic, industrial or agricultural uses.

C. Provisions

1. This Order includes the attached Monitoring and Reporting Program No. CI-9053 which is incorporated herein by reference. If there is any conflict between provisions stated in the Monitoring and Reporting Program No. CI-9053 and the Standard Provisions, those provisions stated in the Monitoring and Reporting Program prevail.
2. A copy of this Order shall be maintained at an on-site office and be available at all times to operating personnel.
3. In the event of any change in name, ownership, or control of this facility, the Discharger shall notify this Regional Board in writing and shall notify any succeeding owner or operator of the existence of this Order by letter, a copy of which shall be forwarded to this Regional Board.
4. The Discharger shall file with the Regional Board technical reports on self-monitoring work performed according to the detailed specifications contained in Monitoring and Reporting Program No. CI-9053 as directed by the Regional Board Executive Officer (Executive Officer). The results of any monitoring done more frequently than required at the location and/or times specified in the Monitoring and Reporting Program shall also be reported to the Regional Board.
5. In accordance with section 13260(c) of the California Water Code, the Discharger shall file a report of any material change or proposed change in the character, location, or volume of the discharge.
6. Discharge of wastes to any point other than specifically described in this Order is prohibited and constitutes a violation thereof.

7. This Order includes the attached *Standard Provisions Applicable to Waste Discharge Requirements*, which are incorporated herein by reference. If there is any conflict between provisions stated herein and the *Standard Provisions Applicable to Waste Discharge Requirements*, the provisions stated herein will prevail.
8. The Discharger shall notify Regional Board staff by telephone within 24 hours, followed by written notification within one week, in the event it is unable to comply with any of the conditions of this Order due to:
 - a) Breakdown of equipment,
 - b) Accident caused by human error or negligence, or other causes such as acts of nature, and
 - c) Site construction or development operations.
9. The Regional Board considers the property operator to have continuing responsibility for correcting any problem that may arise in the future as a result of this discharge.
10. The Discharger shall submit a Summary Report detailing the results of the remediation six months after injection has been completed. The report should include an evaluation of the effectiveness of using CPS to remediate CrVI in groundwater at the Site, the impact of any by-products on the receiving groundwater quality, and any other effects the in-situ treatment may have.
11. All work must be performed by or under the direction of a California registered civil engineer, registered geologist, or certified engineering geologist, as provided in sections 6762, 7850, and 7842, respectively, of the California Business and Professional Code. A statement is required in all technical submittals that the registered professional in direct responsible charge actually supervised or personally conducted all the work associated with the project.
12. The injection of CPS to shallow groundwater may result in unintended adverse impacts to groundwater quality. Any potential adverse water quality impacts that may result shall be localized or short-term duration, and shall not impact any existing or prospective uses of groundwater. Groundwater quality shall be monitored before injection of CPS, during treatment, and after treatment is completed to verify no long-term adverse impact to water quality.
13. The Discharger shall cleanup and abate the effects of injecting CPS, including extraction of any by-products, which adversely affect beneficial uses, and shall provide an alternate water supply source for municipal, domestic or other water use wells that become contaminated in exceedance of water quality objectives as a result of using CPS.
14. These requirements do not exempt the Discharger from compliance with any other laws, regulations, or ordinances, which may be applicable. They leave unaffected any further restraints on the site that may be contained in other statutes of and/or required by other agencies.

15. This Order does not relieve the Discharger from responsibility to obtain other necessary local, state, and federal permits to construct facilities necessary for compliance with this Order; nor does this Order prevent imposition of additional standards, requirements, or conditions by any other regulatory agency.
16. The Discharger shall furnish, within a reasonable time, any information the Regional Board may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this Order. The Discharger shall also furnish to the Regional Board, upon request, copies of records required to be kept by this Order.
17. After notice and opportunity for a hearing, this Order may be terminated or modified for cause including, but not limited to:
 - a) Violation of any term or condition contained in this Order;
 - b) Obtaining this Order by misrepresentation, or failure to disclose all relevant facts;
 - c) A change in any condition that requires either a temporary or permanent reduction or elimination of authorized discharge.
18. In accordance with California Water Code section 13263(g), these requirements shall not create a vested right to continue to discharge and are subject to rescission or modification. All discharges of waste into the waters of the State are privileges, not rights.
19. The discharger shall allow the Regional Board, or an authorized representative upon the presentation of credentials and other documents as may be required by law, to:
 - (a) Enter upon the Discharger's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Order;
 - (b) Have access to and copy, at reasonable times, any records that must 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 purposes of assuring compliance with this Order, or as otherwise authorized by the California Water Code, any substances or parameters at any location [CWC Section 13267].

D. Expiration Date

This Order expires on March 9, 2011.

The Discharger must file a Report of Waste Discharge in accordance with sections 13260 and 13264 of the California Water Code not later than 180 days

in advance of such date as application for issuance of new waste discharge requirements.

I, Jonathan S. Bishop, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Los Angeles Region, on March 9, 2006.

Jonathan S. Bishop,
Executive Officer