

**STATE OF CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION**

**STAFF REPORT FOR REGULAR MEETING OF JULY 7-8, 2005
Prepared June 16, 2005**

ITEM: 20

SUBJECT: Revised Waste Discharge Requirements and Termination of NPDES Permit, Order No. R3-2005-0070 for Chevron Texaco Produced Water Management Facility, San Ardo Oil Field, Monterey County

KEY INFORMATION

Discharger: ChevronTexaco Exploration and Production Company (formerly *Texaco Exploration and Production Inc.*)
Location: San Ardo Oil Field in Monterey County
Discharge Type: Produced water extracted during gas and oil production operations
Design: Oil and solids removal, degasification, warm lime softening, multi-media filtration, ion exchange softening, two-pass reverse osmosis, sodium adsorption adjustment, neutralization, constructed post-treatment wetlands
Disposal: Recharge basins
Capacity: 2.1 MGD average daily flow, 6.3 MGD maximum daily flow
Present Flow: None
Recycling: Treated produced water will recharge shallow aquifer
Existing Orders: Waste Discharge Requirements Order No. 99-81, NPDES Permit No. CA004983

SUMMARY

ChevronTexaco Exploration and Production Company (formerly *Texaco Exploration and Production Inc.*, hereafter *ChevronTexaco*) extracts gas, oil, and "produced water" from Monterey County's San Ardo Oil Field. Rock units that host accumulations of oil and gas usually host water as well - a lot of water. Oil and gas production operations typically view "produced" water as a nuisance that must be managed. Historically ChevronTexaco planned for, and permitted (under Order No. 99-81 and NPDES Permit No. CA0049832), a water management facility that would treat produced water and then either discharge the water to 1) the Salinas River, or 2) recharge the Salinas groundwater basin. By developing that system, ChevronTexaco could expand its current area of steam-enhanced production into an idled, previously developed portion of the field known as the Lombardi zone. However, ChevronTexaco did not construct the previously proposed water management facility and has not expanded the Lombardi development. Instead, ChevronTexaco re-injected the produced

water back into the oil-producing zone. NPDES Permit No. CA0049832 expired on September 10, 2004.

ChevronTexaco decided against pursuing an NPDES permit renewal. However, ChevronTexaco still wishes to discharge highly treated produced water to land. Treatment will include filtering, water softening (for steam only), reverse osmosis, and neutralization. Following treatment, the produced water will flow through constructed post-treatment surface wetlands to percolation basins. The constructed wetlands and percolation basins are located within the 100-year flood plain. Should a 100-year flood occur, ChevronTexaco can route flows away from the constructed post-treatment wetlands and percolation basins, instead discharging to existing class II disposal wells, which re-inject water into the oil-bearing formation. The discharge removes a relatively large amount of water from the deep oilfield formation and introduces it into the Upper Valley Subarea of the Salinas Valley Groundwater Basin,

where the water can augment freshwater supplies at an average daily flow of 2.1 MGD (6.45 acre-feet per day).

The proposed waste discharge requirements terminate the existing NPDES permit and regulate the San Ardo Oil Field's treated produced water discharge to recharge basins. Regulations applicable to the land discharge are unchanged since adoption of the existing permit. Staff redrafted the proposed order maintaining the previous order's land disposal requirements.

DISCUSSION

Facility Description

ChevronTexaco (formerly *Texaco Exploration and Production Inc.*) extracts gas and oil from the San Ardo Oil Field. The San Ardo oil field is approximately 2,500 acres, and is located:

- About 6 miles south of San Ardo
- Between Sargent Road and U.S. 101, and
- East of the Salinas River.

The project site is identified with Monterey County Assessor's Parcel Number of 237-101-002-000. The location of the project site is illustrated on Attachment A - Location Map. Adjacent property uses include agricultural fields located north of the project site, San Ardo oil field properties east and south of the project site, and the Salinas River and additional oil field properties west of the project site. The project site is currently zoned for heavy industrial uses.

Waste streams of concern

The quality of produced water is determined by geochemical reactions between the water and rock, hydrology, and geologic history. The untreated San Ardo Oilfield produced water exhibits the following notable characteristics:

Characteristic	Rating	Value (mg/L)
Alkalinity as CaCO ₃	High	550
Hardness as CaCO ₃	Hard	170
Chloride	Very high	3,700
Sodium	Very high	2,100
TDS	Very high	6,200
Various petroleum hydrocarbons	Some above MCLs	

Treatment operations description

The proposed water treatment facility will process an average daily flow of 2.1 million gallons per day (6.45 acre-feet per day; an acre-foot is equivalent to 326,000 gallons and is enough to serve two families for one year) and a maximum capacity of 6.3 MGD using the following processes:

- Oil and solids removal
- Degasification
- Warm lime softening
- Multi-media filtration
- Ion exchange softening
- Two-pass reverse osmosis (RO)
- Sodium adsorption ratio (SAR) adjustment

ChevronTexaco would construct post-treatment wetland areas as part of the proposed project. The constructed post-treatment wetlands would be built on an approximately 32-acre area, initially segmented into three 5-acre areas. The remaining area would be set aside for future expansion, if necessary. The constructed post-treatment wetland areas would be built with approximately five-foot high earthen berms around the perimeter of each pond. The constructed post-treatment wetland areas could accommodate approximately 50,000 barrels of water per day (2.1 MGD).

The constructed post-treatment wetland areas would provide hydraulic equalization and quality assurance of the water prior to discharge. The ponds would be constructed as a surface flow system and would consist of shallow basins with emergent and sub-emergent wetlands plants. The constructed post-treatment wetland areas would have a free-water surface design with water flowing above the surface of the soil at an average operating water depth of 6 to 12 inches. The constructed post-treatment wetland areas would use native plants, such as cattail (*Typha* spp.) and bulrush (*Schoenoplectus* spp.), and locally excavated topsoil underlain by a bentonite-amended soil liner that would prevent percolation of water into the aquifer.

The water flowing through the wetland would be enhanced through several mechanisms, including sedimentation, microbial degradation, precipitation, and plant uptake.

Disposal operations description

Recharge Basins - ChevronTexaco will use recharge basins to discharge treated water to the shallow aquifer. The recharge basins will consist of two 7.5-acre ponds (totaling 15 acres). The basins would be approximately six feet deep. The basins would be created through excavation of the project site and construction of earthen berms around the perimeter of each basin. The sand and gravelly soils located at the project site would provide sufficient hydraulic conductivity to allow percolation of the total outfall of the water reclamation facility, totaling approximately 50,000 barrels per day (2.1 MGD) of treated water. The percolation of the treated water would recharge the groundwater basin with approximately 2,300 acre-feet per year. Approximately 160,000 cubic yards of grading would be required to construct the recharge basins.

Regional Geology

The project area is located in the Salinas Valley, a 120-mile long northwest trending tectonic basin extending from the mountain regions in San Luis Obispo County near Santa Margarita to Monterey Bay in Monterey County. Along its length in Monterey County, the Valley varies in width from approximately 3 miles near Bradley to 10 miles at the Monterey Bay coast. The Valley is bounded on the east by the Gabilan and Diablo ranges, and on the west by the Sierra de Salinas and Santa Lucia Range.

Bedrock in the area adjacent to the Salinas Valley is composed of granite intrusives and metamorphic rocks. The metamorphic rocks consist primarily of gneisses, schists, and quartzites, and together the granitics and metamorphics are referred to as the Salinian basement complex. The Salinian basement complex is bounded on the northeast by the San Andreas Fault, and it extends southwestward to the Sur-Nacimiento Fault.

In the Santa Lucia Range, the Salinian basement is overlain primarily by deformed late Tertiary marine and continental sediments. The relatively level, shallow sediments beneath the Salinas Valley were deposited during the late Pleistocene and Holocene, and the distribution of these sediments is influenced by sea level fluctuations resulting from glaciation and deglaciation during the late Pleistocene. The Pleistocene sea level fluctuations influenced sediment distribution most

strongly in the area from just southeast of the city of Salinas northwestward to the coast, and as a result the Pleistocene stratigraphy from the vicinity of Salinas northwestward is different from that found to the southeast. Pleistocene sediments in the southern part of the Salinas Valley consist predominantly of sand and gravel.

Hydrogeologic Conditions

ChevronTexaco will discharge to the Salinas Valley Groundwater Basin's Upper Valley Subarea, which is in the southernmost part of the Salinas Valley and extends to the southern end of Monterey County, near Bradley. The aquifer layer in this area is in one unit. The majority of wells in this area are relatively shallow, and lie along the course of Salinas River. The shallowest groundwater in the San Ardo area occurs in Quaternary river deposits of the Salinas Valley.

Sediments younger than the Paso Robles Formation are classified as alluvium and include alluvium in recent streambeds as well as paleofluvial deposits. Alluvium covers most valley bottoms and terraces along major streams in the Salinas Valley. It is sometimes difficult to establish the thickness of alluvium in the Salinas River Valley because the material is difficult to distinguish from the Paso Robles Formation in well logs. The transition from recent alluvium to that of the older Paso Robles is typically gradational. Recent alluvium consists of gravel, sand, and silt and is generally unconsolidated. The gravel is sandy, poorly sorted, and ranges in color from yellowish gray to pale yellowish brown and dark reddish brown. It is massive to crudely bedded and commonly includes channels and cross strata. Sand units are interbedded with gravel and silt and locally make up the bulk of alluvium. Sands are pale yellowish orange, massive, and friable, they can be calcareous locally. The alluvium unconformably overlies the Paso Robles Formation and older strata. Fossils are scarce in the alluvium. The alluvium is mainly of fluvial origin, deposited by the Salinas River and its tributaries.

The southern Salinas Valley area lies mainly on the Salinian block; a structural element of the Coast Ranges that is characterized by a

basement of granite and high-grade metamorphic rocks. Productive Miocene sandstones at San Ardo lie unconformably on this basement high. The San Andreas Fault Zone borders the Salinian block to the east, and a complex fault system borders the block on the southwest side. Locally, the Jolon Rinconada Fault Zone forms the western boundary at San Ardo. Quaternary deposits were shed off the adjacent Coast Ranges from variable source areas to fill up the somewhat narrow and long Salinas River Valley.

San Ardo is located in the southern part of the Upper Valley Area of the Salinas basin, just downgradient of the headwaters of this groundwater basin. The Salinas Valley narrows at the southern part of the oilfield study area and broadens to the northwest. The alluvial aquifer in the San Ardo area is directly fed by the Salinas River as it flows out of the narrow canyons and recharges the fluvial basin fill deposits (alluvium) starting near Wunpost and Bradley. A hydrogeologic cross-section through the northern part of the San Ardo Field shows the asymmetrical nature of the alluvial package associated with the Salinas River and also how the river recharges the aquifer. It appears that the alluvial aquifer is 200 to 400-feet thick in the San Ardo Oil Field area, which was confirmed by boreholes drilled by Monterey County in 1991. There were no significant clay or silt layers described within either of these boreholes, which bracket the north and south ends of the study area. No regional confining units are known to exist within the alluvium adjacent to the river, therefore groundwater in the basin is considered to be present at water table (or phreatic) conditions. Calculated hydraulic conductivity for the alluvium is 104 feet/day based on aquifer testing performed in December 2002.

Depth to groundwater ranges from approximately 10 to 20 feet below ground surface in the San Ardo area. Groundwater was found at approximately 14 feet below ground surface in the North 20s steam generator area where the recharge field pilot was situated. The local groundwater gradient in the alluvial aquifer is approximately 0.001 to the northwest.

Water derived from overland flow, storm water runoff, and releases from the San Antonio and Nacimiento reservoirs reach the Salinas River, which then flows into the adjacent alluvium as the main source of aquifer recharge. Mean annual precipitation in the San Ardo area is 10 inches per year. Approximately 10 percent of this rainfall percolates to the aquifer as deep recharge and is a secondary, albeit minor, source of recharge for the alluvial aquifer.

Evapotranspiration is active in this semi-arid climate. Pan evaporation in this area of the Central Coast is approximately 70 inches per year measured at the Nacimiento Dam.

Groundwater is discharged from the alluvial aquifer near the San Ardo Oilfield in three ways:

1. Northward flow out of the study area associated with the Salinas River,
2. Vertical seepage into the Paso Robles and deeper aquifers, and
3. Pumping.

It is postulated that horizontal flow in the alluvium, which is associated with the river, constitutes the major component of the discharge from the aquifer in the study area.

Receiving water quality

Treated produced water discharged to land will enter the Salinas Valley Groundwater Basin's Upper Valley Subarea. In the San Ardo area few water quality problems exist. However, the Monterey County Water Resources Agency reports that nitrate concentrations in the Salinas Valley are relatively high in the Upper Valley subarea, although groundwater monitoring by MCWRA indicates no conclusive trends regarding nitrate contamination. The immediate area north of the proposed discharge, in the direction of groundwater flow, is subject to intense agriculture.

Surface Water

The nearest surface water, the Salinas River, lies about 650 feet southwest of the disposal area. The Basin Plan lists the following existing and

anticipated beneficial uses of the Salinas River in the vicinity of the discharge:

- a. Municipal Supply;
- b. Water Contact Recreation;
- c. Non-Contact Water Recreation;
- d. Industrial Process Supply;
- e. Industrial Service Supply;
- f. Ground Water Recharge;
- g. Contact and Non-Contact Water Recreation;
- h. Wildlife Habitat;
- i. Fish Migration;
- j. Warm and Cold Water Habitat;
- k. Agricultural Supply;
- l. Fish Spawning and Reproduction; and,
- m. Rare, Threatened or Endangered Species Habitat.

Total Maximum Daily Load

Total maximum daily load (TMDL) allocations will be developed for impaired surface waters in the Salinas River Basin. TMDL documents will allocate responsibility for constituent loading throughout the watershed. During development of the TMDL source assessment and implementation plan, if Regional Board staff find constituent contributions from waste discharged may adversely impact beneficial uses or exceed water quality objectives, TMDL documents may require changes in Waste Discharge Requirements. Waste Discharge Requirements may be modified to implement applicable TMDL provisions and recommendations.

Proposed Order

The proposed Order substantially conforms to the land disposal requirements of the previous Order adopted by the Board.

COMPLIANCE HISTORY/STATUS

The discharger has held an NPDES Permit since October 1994, but has not discharged. There have been no compliance problems.

POTENTIAL PROBLEMS

Saline groundwater can precipitate sulfate (for example, gypsum), carbonate (for example, calcite), and silicate scales. Saline groundwater also may contain some constituents, such as arsenic, elevated radioactivity, and dissolved organic material.

However, the proposed treatment process will discharge only purified produced waters. Sulfate, carbonate, and silicate will be removed by the treatment processes.

It is possible that treatment facility effluent could not meet specifications. In such a case, the Discharger has the option of sending off-specification effluent back to the oil field via class II injection wells.

Flood Protection

A review of the flood zone information published by the Federal Emergency Management Agency (FEMA) indicates that while the proposed water treatment facility is located outside of the 100-year floodplain, the constructed post-treatment wetland and the recharge basin are not. As only treated water and its associated infrastructure are subject to 100-year floods, staff expects minimal impact to water quality from a flood event. Also, if a flooding event occurs, treated water can be redirected to the existing class II disposal wells for re-injection back into the oil-bearing formation.

ENVIRONMENTAL SUMMARY

The Monterey County Planning Department completed an Initial Study and certified a Mitigated Negative Declaration for the project in accordance with the California Environmental Quality Act (Public Resources Code, Section 21000, et seq.) and the California Code of Regulations on June 29, 2005. The County determined there are no significant adverse environmental effects or that all potentially significant adverse effects can be avoided through implementation of mitigation measures. Mitigation measures to prevent nuisance and ensure protection of beneficial uses of surface and groundwaters will be implemented through this order.

Waste discharge requirements for this discharge are exempt from the provisions of CEQA (Public Resources Code Section 21100, et. seq.) in accordance with Section 13389 of the California Water Code.

COMMENTS AND RESPONSES**ChevronTexaco**

1. ChevronTexaco wanted to increase the flow limit from 2.1 MGD to 2.5 MGD because the RO Plant is nominally designed to discharge 2.1 MGD of treated water. However, the major equipment and piping systems have been designed for expandability to 2.5 MGD, if needed.

Staff Response:

Since the RO Plant is designed to produce 2.1 MGD, staff chose to keep the limit at 2.1 MGD.

2. ChevronTexaco requested that some language be altered to portray the discharge more as a reuse project.

Staff Response:

Reuse is incidental to the primary goal of the project: to treat and dispose of the produced water outside of the oil-bearing formation. The need to develop water for supply was not the project's driving force. This distinction aligns with other precedents set by the California Department of Health Services when that agency considers whether or not a project can be considered a groundwater recharge reuse project.

3. ChevronTexaco changed its post-treatment constructed wetlands liner from HDPE to bentonite-amended soil.

Staff Response:

The change in liner technology should not impact water quality. Both HDPE and clay soils have long been acceptable for liners. In addition, the impounded water has already been highly treated.

The following parties did not respond to staff's direct request for comments:

Monterey County Planning & Building
 Monterey County Water Resources Agency
 Monterey County Public Works Department
 Monterey County Health Department
 Monterey Bay Sanctuary
 Association of Monterey Bay Area Governments
 State Water Resources Control Board
 California Department of Fish and Game
 California Department of Health Services
 U.S. Environmental Protection Agency
 U.S. Fish and Wildlife Service

RECOMMENDATION

Adopt Order No. R3-2005-0070 as proposed.

ATTACHMENTS

1. Proposed Order No. R3-2005-0070.
2. Monitoring and Reporting Program No. R3-2005-0070.

TJK

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Task: 126-01

File: ChevronTexaco Produced Water Management Facility, San Ardo Oil Field, Monterey County