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

STAFF REPORT FOR THE REGULAR MEETING OF DECEMBER 1-2, 2005

Prepared on October 31, 2005

ITEM NUMBER: 13

SUBJECT: **Status Report, Unocal Guadalupe Oil Field, San Luis Obispo County**

KEY INFORMATION

Location:	Guadalupe Dunes, Southwest San Luis Obispo County into Northern Santa Barbara County
Discharge Type:	Diluent and Other Oil Field Related Materials
Existing Order:	Cleanup or Abatement Order No. 98-38

SUMMARY

This report is to inform the Board and the public regarding activities and progress at the former Unocal Guadalupe Oil Field. It provides a site and regulatory history and information regarding events that have occurred since the last status report to the Board on October 26, 2001.

DISCUSSION

Setting

The former Guadalupe Oil Field (GOF), approximately 2,700 acres in size (see Attachment 1), is located within the Nipomo Dunes complex, which extends from the Pismo Beach State Park area in San Luis Obispo County to Mussel Rock in northern Santa Barbara County. The Nipomo Dunes have been characterized as the largest, most scenic, and most ecologically diverse of the coastal dune-wetland complexes in California. Many plant and animal species of special concern are known to exist at and near the former oil field. The site is approximately three miles west of the town of Guadalupe, California, and is bounded to the south by the Santa Maria River, to the west by the Pacific Ocean, to the north by the Guadalupe-Nipomo Dunes Natural Wildlife Refuge (owned and operated by the U.S. Fish and Wildlife Service), and to the east by agricultural operations.

Oil exploration and production began at the site with the Sand Dune Oil Company in October 1947. The field was purchased in 1948 by the Continental Oil Company, which completed the first commercial oil well. Thornbury Oil Company acquired the field in 1950. Union Oil Company of California (currently owned by Chevron[1]) acquired the lease in the early 1950s and continued to operate the field until 1994[2]. At the peak of production in 1988, there were 215 production wells producing approximately 4,500 barrels of oil per day. To put these quantities into perspective,

---

[1] Chevron acquired Union Oil Company of California (doing business as Unocal) on August 10, 2005; however, because Unocal is a wholly owned subsidiary of Chevron, it is still appropriate to refer to the responsible party of the former GOF contamination as "Unocal."

[2] Unocal purchased the former GOF in July 2002. Prior to that time, in June 2001, the California Coastal Conservancy accepted previously existing (initiated 21 years earlier) offers-to-dedicate (OTD) for an easement for limited public access, as well as an easement for habitat protection and open space preservation along the western portion of the oil field. In September 2004, Unocal recorded irrevocable OTD easements for open space, habitat protection, and managed public access over the remainder of the former oil field property. Unocal is currently working with the U.S. Fish and Wildlife Service to have the Service accept these easements and incorporate them into the Guadalupe-Nipomo Dunes National Wildlife Refuge.

the Bakersfield, California Kern River oil field (one of California's most productive fields), produced approximately 141,600 barrels per day from about 4,000 wells during its peak production in 1985.

Crude oil from the GOF is extremely viscous, behaving like molasses in ambient conditions. Unocal used several methods to enhance oil recovery, including diluent mixing. Diluent, a mid-range hydrocarbon distillate from crude oil was piped to the GOF from Unocal's (now ConocoPhillips') refinery on the Nipomo Mesa. Unocal installed a diluent distribution system at the GOF, including storage tanks and pipelines to individual wells. Diluent was piped into the oil wells, where it was mixed with the crude oil to reduce its viscosity.

Over time, large quantities of diluent were released to the environment from surface spills and leaks in the distribution system. Although the exact amount of released diluent is unknown, estimates range from eight to over eighteen million gallons. Released diluent tends to migrate quickly through the sandy environment, causing groundwater contamination. Because diluent is lighter than water, much of it remains as "free product," floating on groundwater to form what are termed separate-phase diluent sources on the water table ("diluent sources"). Over 90 individual diluent sources, in soil at the water table, have been identified at the GOF (see Attachment 2). Accumulations of diluent in monitoring wells with thicknesses greater than five feet have been recorded historically at the largest diluent source (the Diluent Tank source). In other sources there is little more than a sheen evident in monitoring wells. In addition, as groundwater flows through diluent sources, diluent dissolves into and is transported with the groundwater to form what are termed dissolved-phase diluent plumes ("diluent plumes"). Diluent release and transport have resulted in groundwater contamination beneath much of the GOF (see Attachment 3), with flow toward the ocean and, locally, toward the Santa Maria River. Where groundwater flows into surface water bodies, there is a potential for releases of diluent to the surface water. Historically, diluent has been documented in the Santa Maria River, the ocean, and in on-site fresh-water marsh ponds.

The shallowest water-bearing zone underlying the GOF is the dune sand aquifer. Depth to water across the site ranges from zero to about 130 feet, depending on the height of the dunes. Underlying the dune sand aquifer is a unit consisting of interbedded layers of silt, clay, and sand. This unit, known as the confining unit, is roughly 100-feet thick and appears to impede, but not necessarily stop, flow to lower strata. Underlying the confining unit is the principal aquifer, consisting of permeable sands and gravel. Water supply wells located to the east and south of the GOF draw water mainly from the principal aquifer. Characterization of the hydrogeology beneath the dune sand aquifer is one of the main aspects of ongoing site characterization efforts. To date, only sporadic detections of very low levels of hydrocarbons have been detected below the dune sand aquifer, and many of these hydrocarbon detections are not petroleum-related. More specifically, it appears that the non-petroleum-related hydrocarbons may be due to either biological sources of organic matter or to possible hydrocarbon mixtures unrelated to diluent.

Enforcement Background

In the early 1990s, both the Water Board and the California Department of Fish and Game initiated steps that resulted in enforcement actions against Unocal for practices and contamination at the GOF. They are described separately, below, although the enforcement actions and consequent results overlapped somewhat.

1. California Department of Fish and Game Enforcement Actions

In July 1992, Fish and Game wardens seized more than 20 boxes of records from Unocal's offices to investigate if Unocal had purposely failed to report spills at the GOF. Based on this investigation, the San Luis Obispo County District Attorney filed a criminal complaint against Unocal in July 1993 alleging failure to report spills and leaks. On March 15, 1994, Unocal entered a no contest plea on three misdemeanor counts to settle the San Luis Obispo County complaint. Unocal paid a $1.5 million fine and was put on probation for three years. Under the terms of the probation, Unocal was required to investigate and remediate hydrocarbon contamination at the GOF to the Water Board's satisfaction. The Water Board was obligated to submit reports to the court twice per

year regarding Unocal's compliance with this term of probation. Because the Water Board alleged that Unocal violated the terms of its probation, Unocal agreed on April 22, 1997, to an 18-month extension of probation until August 15, 1998. At approximately that same time, the Water Board and Unocal established a mediated dispute-resolution process to improve communication, move the site towards cleanup, and avoid perceived problems with the terms of probation.

2. Water Board Enforcement Actions

On September 10, 1993, this Water Board requested that the Attorney General petition the superior court of the State of California to impose, assess, and recover civil liability from Unocal for discharging diluent to groundwater at the GOF. The Board also asked the Attorney General to seek an injunction requiring cleanup of the GOF. On March 23, 1994, the Attorney General, on behalf of the Water Board, Fish and Game, California Coastal Conservancy, and California Department of Toxic Substances Control, filed a civil suit in San Luis Obispo County Superior Court against Unocal seeking damages, penalties, costs, and injunctive relief for its spills at the GOF. The lawsuit was settled out of court on July 22, 1998. Unocal agreed to pay $43.8 million to settle the State's claims, approximately $15.7 million of which is available to this Board to fund water-quality projects. The Water Board evaluated and funded an initial group of water-quality projects in May 1999. To date, approximately half of the original $15.7 million has been encumbered in existing water-quality contracts. Currently, staff requests Water Board approval for funding of projects that satisfactorily address a settlement fund spending plan that was approved on July 11, 2003.

Prior to settlement of the lawsuit, Water Board staff began preparation of an order requiring Unocal to clean up contaminants resulting from the GOF that had adversely affected or threatened waters of the State. As you know, the Water Board has delegated authority to the Executive Officer to issue cleanup or abatement orders. However, because (1) this case has periodically generated significant public and agency interest, and (2) the proposed order was an integral part of the above-referenced settlement, the Executive Officer brought the proposed order to the Water Board for review and public comment. Cleanup or Abatement Order (Order) No. 98-38 was thus issued to Unocal on April 3, 1998, and amended on November 6, 1998.

Cleanup or Abatement Order No. 98-38

Because the GOF is a large, complex site, Water Board staff concluded that a phased approach to regulating cleanup would be most beneficial to the environment. The fundamental goals of this approach are to (1) protect surface waters, including the Santa Maria River and estuary, Pacific Ocean, and wetlands, (2) protect the regional aquifer from degradation, and (3) reverse the current trend of continuing pollution of the shallow dune sand aquifer. Furthermore, Water Board staff concluded that after information is synthesized from initial cleanup efforts, site investigations, and pilot cleanup technology testing, the Board will have a better understanding of what would be appropriate requirements for later phases of remaining site cleanup and management.

1. Goals of Order

Phase I of the cleanup prescribed in Order No. 98-38 was designed to get cleanup started at locations where threats to water quality are greatest and where our understanding of the site is most complete. These locations are primarily sites near surface water where there are ongoing or threatened diluent releases to surface waters. Additional Phase I goals are for Unocal to (1) perform field-scale pilot tests to identify appropriate cleanup technologies for the site, and (2) continue monitoring of (a) pollution migration to the principal aquifer and surface water, (b) migration of diluent as free-product, (c) cleanup technology effectiveness, and (d) impacts of cleanup technologies to natural resources. An additional Phase I goal for the Water Board is to base future site decisions on field experience.

2. Cleanup Technology Evaluation

Order No. 98-38 requires Unocal to employ a mix of cleanup technologies including excavation, biosparging, monitored natural attenuation, as well as active and passive free product recovery. As already stated, based on information known to Water Board staff in 1998, specific diluent sources at which specific technologies are to be used are identified in Order No. 98-38. Since 1998, Water Board staff has been evaluating the effectiveness

of these technologies as they have been initiated and monitored by Unocal in the field. Excavation is a familiar cleanup technology that is effective at removing soil and groundwater contamination; however, it also has the potential to be highly destructive of natural resources. Therefore, Order No. 98-38 requires Unocal to evaluate technologies other than excavation that may be appropriate for removal of separate-phase diluent (i.e., diluent as free product) at the GOF. This evaluation has been underway in the form of a number of pilot studies that are discussed below.

Non-Excavation Pilot Studies

In accordance with Order No. 98-38, a panel of three remediation experts[3] was convened in early 1999 to implement the pilot test program. The Pilot Test Panel (PTP; selected by the Water Board and Unocal) completed its initial phase of work on April 3, 2000, with the *Final Report of the Pilot Test Panel, Recommendations for Pilot Testing of Remediation Technologies at the Guadalupe Oil Field.* The three PTP scientists recommended pilot testing two technologies: hot water/steam injection and biosparging. They also recommended pilot testing a combination of these two technologies (hot water/steam injection followed by biosparging). After obtaining approval from the Executive Officer, Unocal initiated the early stages of these pilot tests in 2000.

The hot water/steam injection pilot test was conducted in a 70-foot by 70-foot area at the part of the GOF containing the large Diluent Tank diluent source[4]. The combination of hot water flooding and steam injection was recommended because it was thought to provide a significant potential for diluent removal within reasonable time and within generally reasonable economic constraints. The PTP based this recommendation on the knowledge that the combination of these two operations would (a) increase diluent mobility due to decreased interfacial tension, increased relative permeability, and decreased viscosity, and (2) increase volatility due to higher temperatures. The hot water flooding stage of the study began in June 2003 and ended in September 2003. The steam injection phase extended from October 2003 until March 2004. Throughout the pilot study, the companies implementing the study, with oversight by the PTP, collected data to evaluate the effect of treatment on groundwater quality impact. These data included chemical analyses of pre- and post-test soil cores and groundwater samples, as well as in-situ and laboratory-scale leaching experiments.

In its August 16, 2005 report, *Pilot Test Panel Report on the Hot Water/Steam Injection Pilot Test for the Former Guadalupe Oil Field*, the PTP interpreted all applicable pilot test data and addressed the technology's realistic performance expectations and the extrapolation of the design and operation of a full-scale steam treatment system at the GOF. The PTP's findings about the pilot study itself include the following:

(1.) Although optimal target steam temperatures were achieved quickest in the sub-surface region subjected to pre-steam hot water flow, there was not a significant enhancement in the diluent recovery rate due to hot water flooding.

(2.) During the steam phase of the test, steam was not successfully transmitted to the entire thickness of the saturated portion of the dune sand aquifer that had been intended to be targeted by steam. It is unknown if this is due to design specifics (well design and spacing, for instance) and/or pilot test operating conditions.

(3.) It is uncertain if closer steam injection and extraction well spacing and/or further lowering and control of groundwater levels would result in steam delivery to a more significant vertical target zone.

(4.) The upward extent of the steam zone was well-controlled throughout the pilot test. (This is an important consideration in cases where it would be necessary to prevent heating of the shallow subsurface above an area where steam treatment was occurring [i.e., where adverse impacts to natural resources may result].) This control was achieved via operation of vapor extraction wells located above the steam injection wells coupled with active subsurface

[3] The three remediation experts comprising the Pilot Test Panel are Kent Udell of the University of Utah, David Huntley of San Diego State University, and Paul Johnson of Arizona State University.

[4] A DVD of the hot water/steam injection pilot test, filmed by Unocal at the request of the Water Board, has been mailed to Water Board members separately from this staff report. It is noted herein as Attachment 4.

temperature and steam injection rate monitoring.

(5.) Diluent removal occurs during steam treatment via
- a decrease in diluent viscosity with increasing temperature,
- an increase in the pressure gradient towards the liquid recovery wells, thereby increasing diluent flow towards these wells, and
- decreasing the mass and changing the composition of diluent remaining trapped in soil pores (i.e., diluent residuals), thereby resulting in volatilization of the small amount of volatile organic compounds present in the diluent (specifically benzene, toluene, ethylbenzene, and xylenes).

The PTP further indicated in its August 2005 report that although diluent was recovered during the pilot test, it does not appear likely that steam injection alone would achieve soil and groundwater cleanup results as effectively and thoroughly as excavation. This is because following steam treatment, diluent residuals and their associated contaminant mass remain in the soil. These residuals would not remain with full excavation.

The PTP is currently in the process of generating a final report on the evaluation of pilot tests involving biosparging. This technology was recommended by the PTP because it may be implemented with less surface environmental impacts than either excavation or steaming, and the operation and maintenance requirements for this technology are relatively low. Biosparging is a technology in which oxygen is delivered to a targeted subsurface saturated zone at a sufficiently low rate to allow for degradation of aerobically biodegradable contaminants. Due to the low oxygen injection flow rates, volatilized vapors would also be biodegradable in the subsurface, and therefore the need for a vapor extraction system during implementation of this cleanup technology would be eliminated. The PTP expects its biosparge report will be completed in early 2006.

In addition, the PTP is in the process of writing a report that evaluates the results of all the pilot tests, and assesses the technologies' performance in terms of specific evaluation criteria. In this document, the PTP will compare the pilot-tested cleanup technologies to both excavation and monitored natural attenuation. The PTP also expects to complete this document within the first quarter of 2006.

Evaluation of Other Cleanup Technologies

In a letter dated April 17, 2001, the Water Board required Unocal to submit reports and documentation regarding the implementation and, ultimately, the effectiveness of the following cleanup technologies:
- Excavation
- Biosparging at Tank Battery 8
- Phytoremediation at C8 and O13
- Natural attenuation
- Land treatment of excavated contaminated soil

Excavation Effectiveness

Although Unocal had been conducting limited investigations at specific portions of the GOF prior to 1993, assessment activities increased significantly in response to Fish and Game's 1993 filing of the criminal complaint. At that time, Unocal initiated investigations to address the nature and extent of petroleum releases from the GOF to the Pacific Ocean and Santa Maria River. Unocal's initial assessments focused on the 5X and C12[5] diluent sources. Cleanup activities in the form of excavations resulted from these investigations. Excavations completed prior to April 1998 were conducted under emergency permits due to severe weather conditions. All of the emergency excavations were located in the southwestern portion of the GOF, north of the Santa Maria River.

Unocal provided the Water Board with a report entitled *Comparison and Evaluation of Excavation Activities for the Guadalupe Restoration Project* dated July 3, 2003. This document contains an evaluation of 23 excavations that occurred at the GOF from September 1994 to February 2001. Of these excavations completed in 16 areas of the GOF, eight were separate-phase diluent source areas, nine were sumps, two were areas with both separate-phase diluent source areas and sumps,

[5] As directed in the Water Board's Order No. 98-38, the C12 plume was identified as requiring excavation. Excavation of this plume in concert with the B12 plume is expected to commence in Spring 2006.

two were areas with layers of oil-affected sand, one was a former access road, and one was a steam generator pad restoration. Additionally, of the 23 excavations, nine were partial excavations (i.e., some of the hydrocarbon source remains in the subsurface), 14 were full excavations, and one of those was so large, it necessitated a phased excavation approach that spanned from 1995 to 2001 (5X plume). Over 16.6 million pounds of hydrocarbon (approximately 2.1 million gallons) were removed using excavation as a cleanup method.

Based on the evaluation of data associated with these excavations, Unocal proposed, and Water Board staff approved, the following recommendations[6] for future excavations:

(1.) So as to minimize overburden quantities and surface area disturbance, sheetpiling should continue to be used for excavations that are anticipated to extend below the water table.

(2.) De-watering should continue to be used for excavations that extend below the groundwater table. This process will minimize residual post-excavation total petroleum hydrocarbon (TPH) concentrations in soil and will consequently reduce TPH concentrations dissolved into groundwater.

(3.) Excavations of non-diluent features (i.e., sumps, oil/tar layers, and roads) that do not extend into groundwater do not have a significant effect on groundwater quality and do not require a high level of post-excavation groundwater monitoring.

(4.) Based on site-specific considerations, addition of biodegradation-enhancing nutrients should continue to be added to excavations that extend into groundwater, except at sites that will be graded post-excavation to include a wetland with surface water. Post-excavation monitoring of the nutrients is not necessary.

(5.) Post-excavation groundwater monitoring frequency and target analytes should be tailored to the specific type of excavation (full or partial), the type of hydrocarbon source (diluent versus non-diluent), whether the excavation extends into groundwater and whether it was dewatered, as well as the proximity of upgradient hydrocarbon sources.

[6] These recommendations were based on excavation criteria contained in Order No. 98-38.

Biosparging at TB8

Biosparging at Tank Battery 8 (TB8) consists of three horizontal wells, each with a 300-foot screen located approximately five to seven feet below the water table, and nine vertical wells. The entire "system" at this site includes the horizontal and vertical wells, a 60-horsepower blower, and several vertical monitoring wells to assess biosparge performance at reducing dissolved-phase diluent plume concentrations in groundwater.

Operation of the horizontal biosparge system was started on August 20, 1999. A variety of air delivery scenarios at a variety of pressures have been applied to the wells in the hopes of optimizing oxygen flow (and consequently, biodegradation of diluent) to groundwater. In a report entitled *Report on Tank Battery 8 Biosparge System Performance* dated August 2003, Unocal provided the Water Board with an evaluation of the system's ability to reduce diluent concentrations in groundwater. It was determined that an increased air injection pressure was needed to improve the overall system performance. As a result of this pressure increase, a higher volume of air was able to flow to each horizontal well. Since January 2003, the blower has been operating continuously (except for operational and unexpected shut-downs) with two of the three wells receiving air at any given time for 2-hour cycles. During this same time, it was still apparent that the northernmost and center horizontal wells were more efficient at delivering air to the subsurface, and reducing TPH concentrations in groundwater, than the southernmost well. This system ineffectiveness has been attributed to the presence of a peat layer along a portion of the length of the southernmost horizontal well, which prevents airflow to this area. Data continue to be evaluated to indicate the suitability of continuing to biosparge with the southernmost well.

In May 2005, nine vertical biosparge wells were installed along an approximate 120-foot length of the overlap area between the central and northernmost horizontal well to evaluate whether the performance of the biosparge system in that area could be enhanced by the addition of vertical biosparge wells. Except for routine maintenance and unexpected shutdowns, vertical wells are receiving air continuously.

TB8's biosparge system operation and monitoring activities are ongoing and reported in accordance with frequency and procedures noted in the September 27, 2005 *Monitoring Plan for Water Monitoring and Remediation Activities at the Former Guadalupe Oil Field (Version 4.1)*.

Phytoremediation at C8 and O13

Phytoremediation is a process whereby plants reduce contaminant concentrations in areas with very shallow groundwater through enhancement of biodegradation by naturally occurring microorganisms associated with root systems. Phytoremediation test plots were installed at O13 and C8 following partial excavations of separate-phase diluent in 1999 and 2000, respectively. At both sites, phytoremediation is being tested over a five-year period to see if the presence of recently installed vegetation can reduce diluent concentrations in groundwater downgradient of remaining source areas. Phytoremediation monitoring data are collected on a quarterly basis and reported in accordance with the September 27, 2005 *Monitoring Plan for Water Monitoring and Remediation Activities at the Former Guadalupe Oil Field (Version 4.1)*. In addition, based on an April 2001 Water Board requirement, Unocal provides annual evaluations of the phytoremediation plots' effectiveness. These annual reports address monitoring plan effectiveness, plant growth and mortality, and phytoremediation's effect on dissolved-phase diluent concentrations. Unocal is also required to provide a larger-scale evaluation of the effectiveness of phytoremediation at the GOF at the end of the five-year period. This report is expected in early 2007.

Natural Attenuation

Remediation by natural attenuation (NA) is often mistakenly referred to as the "do nothing" cleanup alternative, but this method of cleanup is the complex combination of natural physical, chemical, and biological processes that have a combined effect to reduce contaminant concentration and mass.

The Water Board has required Unocal to monitor for NA and evaluate its effectiveness at six sites throughout the GOF, and Unocal has initiated NA monitoring at additional locations at the former oil field as well.

NA is evaluated using measurements of contaminant concentrations and other chemicals that indicate the amount and rate of any attenuation that is occurring. Unocal is conducting monitoring to characterize four different facets of NA at the GOF:

- NA of diluent dissolved in groundwater
- NA of separate-phase diluent (i.e., diluent source zones)
- The stability of dissolved-phase diluent plumes (i.e., is NA keeping pace with dissolution of diluent into groundwater?)
- The sustainability of NA over the long-term.

NA monitoring is conducted and reported in accordance with the September 27, 2005 *Monitoring Plan for Water Monitoring and Remediation Activities at the Former Guadalupe Oil Field (Version 4.1)*, and is collected to support the joint Water Board-Unocal effort to evaluate NA as a potential cleanup alternative that, since 2001, has been occurring through the mediation process.

Since 2002, reports have been finalized that address the following:

- Initial synthesis and evaluation of NA data
- Analysis of dissolved TPH in groundwater versus distance from a diluent source
- Dissolved TPH plume stability
- Sustainability of dissolved-phase NA
- Evaluation of source zone NA field data.

In addition, efforts are currently underway to address diluent source zone stability and longevity.

Empirical data reviewed by participants in the mediation process have shown that dissolved-phase diluent concentrations attenuate to one milligram per liter (mg/L) or less over a distance of about 1,000 feet downgradient of diluent sources. At present, NA appears to be degrading 62,000 to 150,000 gallons of diluent per year from source zones at the GOF. Based on evaluation of more than 10 years of sitewide data, diluent plumes currently appear to be stable and significantly expanding, and key NA processes appear to be sustainable into the future.

Land Treatment of Excavated Contaminated Soil

At the time Order No. 98-38 was drafted, it was anticipated that land treatment would be the soil treatment/management method for the many tons of excavated contaminated soils[7]. In fact, it was hoped that if land treatment was successful, treated soil would be used as backfill for the many excavations at the GOF. Unocal performed several land treatment tests to evaluate its effectiveness in treating diluent contaminated soils. Results indicated that residual soil TPH concentrations remained around 1,000 mg/kg after 90 days of land treatment, and preliminary bioassay testing showed that leachate from the treated soil was potentially toxic to sensitive organisms. Based on these results, Unocal and the Water Board agreed that land-treated soils would not be suitable for use as backfill at or below the water table. Therefore, there was no reason to continue with any further land treatment tests.

3. Environmental Impact Report

San Luis Obispo County prepared a final Environmental Impact Report (EIR) that evaluated Unocal's proposed GOF remediation project as well as various cleanup alternatives. The County certified the EIR on March 26, 1998. As one of the "responsible agencies" per the CEQA process, the Water Board adopted Resolution No. 98-04 at the same time Order No. 98-38 was adopted. This resolution contains findings of changes in Unocal's cleanup project to mitigate significant environmental impacts of Phase I cleanup described in Order No. 98-38, as well as a mitigation monitoring plan. The findings are limited to the portion of Unocal's project that has been approved by the Water Board and to mitigation measures that are within the Board's jurisdiction.

[7] A thermal desorption unit (TDU) was also considered a possible means of treating the contaminated soil from cleanup excavations; however, Unocal and the Water Board agreed to eliminate this alternative from consideration when it became apparent that air quality issues associated with emissions from thermal treatment would be cumbersome from a regulatory perspective and environmentally unfavorable. In addition, the suitability of TDU-treated soils as backfill would be questionable due to sand discoloration and compaction issues.

Remaining Phase I Work

As of the first quarter of 2001, Unocal completed approximately half of the excavations required by Order No. 98-38. At that time, it became apparent that soil from the land treatment unit would not be acceptable for backfilling purposes. Therefore, a stockpile of approximately 335,000 cubic yards of contaminated soil needed to be appropriately treated and/or disposed, and an additional source of clean backfill needed to be approved. The oversight agencies and Unocal agreed that remaining excavations would be postponed until appropriate soil management could be defined. Currently, approximately 360,000 cubic yards of contaminated soil are stored at four stockpiles on the GOF[8]. The largest, at TB8, is composed of 335,000 cubic yards and is 65 feet high with a 5.6-acre footprint. A stabilizing and vapor suppressant material known as Soil Sement™ was sprayed on the stockpile in 2001, and continues to be maintained at the present time.

In 2001, personnel from the San Luis Obispo County Department of Planning and Building began performing environmental reviews of soil treatment and disposal options. The culmination of this effort was a Supplemental Environmental Impact Report (SEIR) that was prepared by San Luis Obispo County in accordance with CEQA, and dated June 2005. The SEIR addresses the volume of soil currently stockpiled on the site, as well as contaminated material anticipated to be excavated with the remainder of Phase I cleanup operations specified in Order No. 98-38, for a total of approximately 860,000 cubic yards. Soil management options evaluated in the SEIR include the following:

1. **Off-site trucking-** an off-site disposal option involving trucking to the Santa Maria landfill. This material, which has satisfied Water Board regulations for classification as non-hazardous impacted soil, would be used at the landfill as

[8] The Water Board issued Unocal a Waiver of Waste Discharge Requirements for Petroleum Degraded Soil Stockpiles in 2001. In accordance with this waiver, Unocal provides the Board with quarterly updates of the volume and source of material moved into or out of the stockpiles. Each of the stockpiles has a vapor suppressant cover and associated runoff water collection systems that are maintained by Unocal and inspected every other week.

cover for closing landfill cells. This is the "preferred alternative" in the SEIR, and has been supported by staff from the Water Board, San Luis Obispo County, the City of Santa Maria, and numerous other agencies that have been involved with the GOF over the years. Off-site trucking to other appropriate destinations was also considered; however, the Santa Maria landfill was the closest destination addressed in the SEIR.

2. **Treated material land feature-** a man-made sand dune constructed above the water table of contaminated excavated soil that has been bioremediated in a land treatment unit. Unocal would have to comply with Title 27 requirements for protection of groundwater quality.
3. **Engineered containment unit-** an engineered landfill compliant with all Title 27 regulations.
4. **Deep well slurry injection-** contaminated soils would be mixed with water and injected into the oil reservoir underlying the GOF.

The San Luis Obispo County Planning Commission approved the SEIR on July 27, 2005; however, an appeal was filed to dispute this approval in August 2005. The outcome of this appeal, as well as the fate of the existing and future excavated soil, will be discussed at a San Luis Obispo County Board of Supervisors' meeting in early 2006. Water Board staff will attend this meeting and testify to the Board of Supervisors that, from a water quality perspective, the preferred alternative appears to be the most environmentally practicable way of managing the GOF excavated soil, as well as being protective of water quality at both the GOF and the Santa Maria landfill. Implementation of the preferred alternative is critical to continuation of the Phase I cleanup activities. Water Board staff has communicated their desire to have Unocal fulfill the terms of Order No. 98-38 to San Luis Obispo County staff on several occasions. Even in light of the potential further delay in resumption of excavations due to the appeal to the Board of Supervisors, Unocal is proceeding with planning activities to initiate trucking and resume excavations as soon as possible. Water Board staff is hopeful that both activities will begin no later than spring 2006. Completion of Phase I activities (which also include San Luis Obispo County Planning Commission approval of wetland restoration plans) is expected to extend into mid-2009.

Mediation Process

As noted in the Enforcement Background section of this staff report, Unocal and the Water Board entered into a mediated dispute resolution process in late 1997. Via this process, Unocal and Water Board staff meet as frequently as needed at mediated fact-finding sessions to work on issues of site characterization, environmental risk posed by the presence of GOF contamination, and, to a limited extent, cleanup technologies. Additional stakeholders that have participated in the process include Fish and Game, California Office of Health Hazard Assessment, National Oceanic and Atmospheric Administration, San Luis Obispo County Public Health Department, and U.S. Fish and Wildlife Service.

CONCUR, Inc. was the initial mediation consultant working with both parties. Since 2002, Kreimes Associates, Inc. has fulfilled this role. Neutral experts have been retained by Kreimes Associates, Inc. to provide additional technical capability and technical review when applicable.

Water Board staff believes the mediation process continues to yield many positive results associated with the eventual cleanup and management of the GOF. Specifically, the process has resulted in an improved working relationship with Unocal, scientifically based conclusions regarding site characterization, and information that will be important for future regulatory requirements expressed in additional phases of cleanup orders. Numerous topics have been evaluated and assessed throughout the years the mediation process has been used, and the mediation consultant provides Unocal and the Water Board with regular updates on mediation work products and tasks. The following is a list of current work items addressed in mediation:

- Characterization of the deeper hydrostratigraphic units,
- Evaluation of the stability and longevity of diluent source zones,
- Evaluation of the sustainability of diluent source zone natural attenuation, and
- Characterization of diluent transport in specific dissolved-phase diluent plumes.

Phase II Cleanup

Via separate but overlapping efforts, Unocal and Water Board staff have begun evaluating information that will be used to make determinations associated with Phase II of the GOF cleanup. As a first step in this evaluation, Unocal and Water Board staff have agreed on critical issues addressed and resolved during Phase I that now must be synthesized to arrive at management of Phase II activities. Specifically, the synthesis will enable Water Board staff to determine (1) a standard procedure for determining prioritization of remaining areas of contamination, (2) cleanup and restoration methods that will be prescribed in a new Cleanup or Abatement Order, and (3) long-term post-cleanup monitoring that Unocal will be required to perform. As already mentioned, although completion of Phase I activities is expected to extend into mid-2009, Water Board staff anticipates seeking Water Board approval of a Phase II cleanup order in early 2008. Some of the activities associated with this second phase of cleanup will likely last for decades.

CONCLUSION

Water Board staff has a long history of involvement with the GOF. Since the time Unocal and the Water Board entered into a mediated process to advance towards understanding the nature and extent of contamination, Water Board staff believes a great deal of progress has occurred that will ultimately result in vast improvements of the water and other natural resources. Water Board staff believes decisions and conclusions leading to these improvements will continue to be both reasonable and scientifically justifiable. To this end, Water Board staff expects to provide Unocal with an Order to proceed with Phase II of the overall GOF cleanup within the next two years. Staff will be available to discuss the former GOF at the December 2, 2005 Board meeting.

ATTACHMENTS

1. Site location map
2. Separate-Phase Diluent Source Areas
3. Dissolved-Phase Diluent Plumes
4. DVD: "Pilot Test Study" (mailed separately from staff report)

S:\SLIC\Regulated Sites\San Luis Obispo Co\GUAD\Board meetings\status dec0205 110705.doc