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Dockets Unit
California Energy Commission
1516 Ninth Street, MS 4
Sacramento, CA 95814

RE: Marsh Landing Generating Station
AFC CEC Docket No. 08-AFC-3

On behalf of Mirant Marsh Landing, LLC, the applicant for the Marsh Landing Generating Station (MLGS), we are pleased to submit the enclosed documents:

- Twelve (12) print copies and 12 CDs of the Responses to the December 18, 2008 Data Response and Issues Resolution Workshop.

Please include these documents in the AFC record.

URS Corporation

Anne Connell
Project Manager

Enclosure

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Responses to the December 18th, 2008 Data Response and Issues Resolution Workshop

Application for Certification (08-AFC-03)

for

MARSH LANDING GENERATING STATION

Contra Costa County, California

February 2009

Prepared for:

Prepared by:

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LIST OF ACRONYMS AND ABBREVIATIONS USED IN RESPONSES

ADF	average daily flow
AFC	Application for Certification
BLS	Bridgehead Lift Station
CCPP	Contra Costa Power Plant
CEC	California Energy Commission
CEQA	California Environmental Quality Act
dB	decibels
dBA	A-weighted decibels
EDI	electrodeionization
DDSD	Delta Diablo Sanitation District
DWST	demineralized water storage tank
ESA	Endangered Species Act
HCP	Habitat Conservation Plan
HDPE	high-density polyethylene
L_{eq}	equivalent sound level
MBR	membrane bioreactor
MDF	maximum daily flow
MGAL	million gallons
mgd	million gallons per day
MLGS	Marsh Landing Generating Station
NCCP	Natural Community Conservation Plan
NCCPA	Natural Community Conservation Planning Act
p.e.	population equivalent
PG&E	Pacific Gas & Electric Company
RO	reverse osmosis
ROPWST	reverse osmosis permeate water storage tank
RWST	raw water storage tank
SIS	System Impact Study
USBR	U.S. Bureau of Reclamation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife
UV	Ultraviolet
WRP	Water Reclamation Plant
WWST	waste water storage tank
WWTP	Wastewater Treatment Plant

SOIL AND WATER RESOURCES

Technical Area: Soil and Water Resources
CEC Staff: Richard Latteri

WORKSHOP QUESTION

1. Please prepare an expanded summary on the reliability of the proposed water supply for Marsh Landing Generating Station (MLGS).

RESPONSE

In Data Request 27, the California Energy Commission (CEC) requested additional information regarding the reliability of the proposed makeup water supply system (including the satellite treatment plant at the Bridgehead Lift Station [BLS]) and the need for a backup water supply.

Reliability of Treatment Plant

The applicant agrees with CEC Staff that water supply and treatment process reliability are important areas of analysis related to the reliability of the proposed facility and the applicant will continue its analysis and evaluation to ensure that the proposed facility meets or exceeds necessary reliability criteria.

Delta Diablo Sanitation District (DDSD) will design, construct, operate and maintain the proposed satellite treatment plant at the BLS based on specifications established by Mirant Marsh Landing, LLC. DDSD has been in the water treatment business for more than 50 years, has operated a highly reliable recycled water facility in Contra Costa County since 2001, and has trained operators and maintenance crews on staff that work around-the-clock. Mirant Marsh Landing, LLC will fund the construction of the new treatment plant, and will pay for costs associated with its ongoing operation and maintenance through fees to be paid under a recycled water supply agreement with DDSD.

To provide a high level of reliability, the proposed treatment facilities will include redundant standby equipment and redundant process tanks. For example, the conceptual design includes the following:

- The plant's major process tanks would have 2 × 50 percent redundancy.
- The mechanical systems serving the tanks, such as the pumps and blowers, would have greater redundancy (e.g., 3 × 50 percent).

As such, if the system were to be interrupted during peak demand, the satellite treatment plant would still be able to provide at least 50 percent of the peak water supply demand to the project. While specific details may change during design by DDSD, the general concepts would be similar. The level of redundancy anticipated for each process step is described below.

A portion of the sewage received at the BLS would be diverted to the new treatment facility using pumps installed at the existing lift station. The conceptual design includes new pumps; however, the feasibility of using the existing pumps will be evaluated during detailed design. Two submersible sewage handling pumps would be installed in a wet well adjacent to or within the BLS. One pump would serve as the primary pump while the other would provide standby redundancy. The pumps would discharge to the new satellite treatment plant.

The proposed satellite or "scalping" water treatment plant that would supply MLGS with plant makeup water includes three process areas: primary, secondary, and tertiary treatment. The primary treatment is the screening and grit removal process. The secondary treatment consists of the aeration tanks where biological digestion of carbonaceous waste occurs. The tertiary treatment would be a membrane bioreactor (MBR).

The primary and secondary processes of the satellite treatment facility are standard sewage treatment plant processes that have been used successfully at water treatment plants in California and around the United States (and the world, for that matter) for many years. These processes are proven technologies that are highly reliable.

Primary Treatment. The screening and grit removal facilities would be located in a common headworks structure. Screening would be a two-step process to remove large and stringy material that would otherwise foul downstream treatment processes. The first step would include coarse bar screens to remove the majority of the material. The second step would include fine screens to protect the membrane filtration process located downstream of the headworks.

For redundancy, the screens would be installed in two parallel influent channels, one primary channel and a standby channel. Each set of screens would include one primary and one standby screen.

After screening, sewage would enter two parallel grit removal systems consisting of vortex grit removal chambers with associated equipment and pumps. Each treatment train would have full redundancy to ensure reliable service.

Secondary Treatment. After the flow stream passes through the headworks structure (i.e., after screening and grit removal), aluminum sulfate (alum) solution would be injected to remove phosphorus. The alum solution would be stored in two tanks (one primary and one standby) and metered into the water using two chemical metering pumps (one primary and one standby). The tanks would be sized to store a 15- to 30-day supply of alum.

Water would then enter aeration basins where organic material and nitrogen would be removed from the water in an aerobic biological treatment process. Two parallel aeration basins would be provided to allow one basin to be taken out of service for maintenance while some water is still being treated. Aeration basins are generally reliable and can normally operate for extended periods without being shut down. Periodic maintenance activities that require a basin to be taken out of service could be scheduled for off-peak periods when system electric demand is reduced and necessary or economic dispatch of the proposed facility is not anticipated.

Aeration would be provided by three mechanical blowers (two primary and one standby) and aeration diffusers mounted in the bottoms of the aeration basins. Recirculation pumps would be provided to transfer flow between the aeration basins and the membrane separation process. Each set of pumps would include a redundant, standby unit.

Tertiary Treatment. An ultrafiltration or microfiltration membrane separation process would be coupled with the aeration basins to remove ammonia and phosphorous from the water. The coupled process is known as a membrane bioreactor or MBR. Submersible, hollow-fiber or sheet membrane cartridges would be installed in two parallel tanks. Although full standby redundancy would not be provided by the tanks, no less than 50 percent would be available during maintenance activities that would require taking a bank of membranes out of service. The maintenance would be planned for off-peak periods when demand for water at the MLGS

would be reduced. Given the storage tanks available at the MLGS site, this would be sufficient to serve demand during the maintenance periods.

Filtrate from the membrane filtration process would be disinfected by an ultraviolet (UV) light irradiation process. The UV irradiation system would be installed in an open channel. Water would pass through the channel and be irradiated by UV lamps submerged in the channel. The UV system could be installed with an extra bank of lamps to provide standby/redundant capacity, if necessary.

A small amount of sodium hypochlorite solution (NaOCl), also known as liquid chlorine or bleach, would be added to the disinfected water to prevent regrowth of pathogens in the treated water conveyance and storage facilities. Sodium hypochlorite solution would be stored in two tanks (one primary and one standby) and metered into the water using two chemical metering pumps (one primary and one standby). The tanks would be sized to store a 15- to 30-day supply of sodium hypochlorite.

Reliability of Membrane Bioreactor Technology

As described above, the tertiary treatment at the proposed satellite treatment plant would be accomplished by MBR technology. MBR systems are composed of two primary parts: the biological unit responsible for the removal of biological waste compounds and the membrane module for the physical separation of the treated wastewater. MBR technology is a proven technology that has been used world-wide, including numerous municipal and private applications in California, for many years. Literature and vendor information about MBR technology is provided in Appendix A.

A MBR is an activated sludge system coupled with a low-pressure membrane that is capable of treating primary effluent wastewater. The effluent water produced is of a substantially better quality than that produced by conventional activated sludge followed by granular media filtration. The effluent from an MBR process also has the added advantage of producing water suitable for use by a reverse osmosis (RO) membrane system.

Advantages and disadvantages of the MBR technology as compared to conventional wastewater treatment are listed below.

Advantages of MBRs as compared to conventional wastewater treatment:

- Production of high-quality effluent
- Smaller footprint
- Reduction in process difficulties and issues associated with settling
- Remote operation is possible with minimal supervision
- Modular systems can be designed to easily accommodate additional future demand
- Can be operated at higher suspended solids concentrations to provide greater treatment capacity per unit volume.

Disadvantages of MBRs as compared to conventional wastewater treatment:

- Fouling problems can lead to frequent cleaning of the membranes that requires halting operation of a portion of the system
- Waste-activated sludge disposal can be an issue due to poor settleability and filterability
- During high solids retention times, inorganic compounds can accumulate in the bioreactor and result in harmful concentration levels affecting the microbiological population or membrane surface.

These disadvantages can be addressed with proper design, operation and maintenance.

Membranes were first used to treat wastewater over 25 years ago. The earliest commercial MBR systems, in the 1970s and 1980s, were based on the side stream configuration. Vendors of proprietary MBR systems had further refined their designs by the early 1990s. The government of Japan launched a 6-year research and development project in the early 1990s that led to the development of submerged membrane modules. Over the last decade, MBRs have been installed in thousands of applications (Solid Waste.com, 2008). Some examples are listed below.

- GE-Zenon has approximately 25 MBR treatment facilities in Northern California (see Table 1-1). As of January 2009, approximately 19 of these facilities are operating, processing a total of approximately 29 million gallons per day (mgd). Approximately six additional facilities with a total of 39 mgd are currently in design.
- Traverse City, Michigan, has an 8.5 mgd MBR facility that has been operational for a couple of years. It was designed, built and operated by CH2M HILL.
- Arapahoe County Water and Wastewater Authority in the Denver, Colorado, metropolitan area owns and operates a 2.4 mgd MBR facility.
- A facility in Modesto, California, processes 28.0 mgd.
- Los Angeles County Sanitation District's Lancaster Water Reclamation Plant (WRP) in California operates a 2 mgd MBR facility.
- Générale-des-Eaux's plant in Thélus, France, has a capacity to treat 90,000 gallons per day.
- The Porlock Wastewater Treatment Plant (WWTP) in the United Kingdom was commissioned in 1998 and serves a population equivalent (p.e.) of 3,800.
- The Buchel and Rodingen WWTPs in Germany were built in 1999 and serve 1,000 and 3,000 p.e., respectively.
- An MBR facility in Kaarst, Germany, was built in 2004 and serves 80,000 p.e.
- In 2005 there were 1,400 MBR installations in Korea (Cranfield University, 2006).

- Bega Valley Sewerage Program in Australia installed MBR treatment plants in several rural towns in 2006 and 2007 (Von Gottberg et al., 2008).

- Running Springs, CA, has a Kubota MBR treatment plant built in 2003 with a capacity of 0.6 mgd.

Municipal/domestic wastewater treatment was the earliest application of MBRs and is still the largest application, accounting for 44 percent of all systems. In the next few years, sewage treatment will continue to be the primary use for MBR systems. A trend toward larger-capacity municipal plants is prevalent in the United States and Europe. However, satellite wastewater plants also are in demand for smaller communities, housing developments, tourist resorts, schools, shopping centers, etc. Growth in this sector is expected to increase in all world regions, driven by the adoption of MBRs for treating numerous small domestic waste streams (Water & Wastes Digest, 2008). The MBR market in the United States is growing at a faster rate than other sectors of the U.S. water industry and the number of products and suppliers is expanding rapidly (Cranfield University, 2006).

Table 1-1
GE-Zenon's Membrane Bioreactor Facilities in Northern California

Market	Plant	City	Technology	ADF (mgd)	MDF (mgd)	Commission	Sector
Commercial WW	Carneros Inn	Napa	WW - MBR	0.037	0	Jun-03	Hotels & Resorts
Commercial WW	Trinidad Rancheria	Eureka	WW - Cycle-Let	0.0012	0.0012	Feb-01	Hotels & Resorts
Commercial WW	Valley View Casino	Valley View	WW - MBR	0.11	0.11	Jun-04	Casinos
Commercial WW	Viejas Casino	Viejas	WW - MBR	0.3	0.45	Jun-00	Casinos
Ind WW	Bell Carter Olive Company	Corning	Tertiary Treatment	0.8	0.8	Aug-02	Food & Beverage
Ind WW	Diestel Turkey Farms	Sonora	MBR	0.1	0.1	Sep-05	Food & Beverage
Ind WW	Envirogen - Aerojet Chemicals	Mt. Holly	MBR	0.02	0.02	Oct-01	Pharmaceutical
Ind WW	Hilmar Cheese	Hilmar	Tertiary Treatment	2.2		Feb-09	Food & Beverage
Ind WW	Hilmar Cheese	Hilmar	Tertiary Treatment	3	0	Jun-05	Food & Beverage
Mun WW	Big Creek WWTP	Big Creek	MBR ultrafiltration with nitrification/denitrification	0.03	0.03	May-07	Mun WW
Mun WW	Corona WWTP	Corona	MBR ultrafiltration with nitrification/denitrification	1.1	1.1	Dec-01	Mun WW
Mun WW	Fillmore WWTP	Fillmore	MBR ultrafiltration with nitrification/denitrification	1.8	2.4	Sep-08	Mun WW
Mun WW	Hollister WWTP	Hollister	MBR ultrafiltration with nitrification/denitrification	5	6	Jul-08	Mun WW
Mun WW	Ironhouse Sanitation District WWTP	Oakley	MBR ultrafiltration with nitrification/denitrification	5.4		2010	Mun WW
Mun WW	Irvine Ranch WWTP	Irvine	MBR ultrafiltration with nitrification/denitrification	11	12	Sep-10	Mun WW
Mun WW	Laguna County (MBR) Sanitation District Wastewater Reclamation Facility	Santa Maria	MBR ultrafiltration with nitrification	0.5	0.5	Dec-02	Mun WW
Mun WW	Laguna County (Tertiary Plant)	Santa Barbara	Tertiary treatment ultrafiltration	3.2	3.2	Feb-03	Tertiary Treat. 10-20 TSS

Table 1-1
GE-Zenon's Membrane Bioreactor Facilities in Northern California (Continued)

Market	Plant	City	Technology	ADF (mgd)	MDF (mgd)	Commission	Sector
Mun WW	Lancaster Water Reclamation Facility – Los Angeles County Sanitation District	Lancaster	MBR ultrafiltration with nitrification/denitrification	1	0	Aug-07	Mun WW
Mun WW	Modesto WWTP	Modesto	MBR ultrafiltration with nitrification/denitrification	2.3	2.3	Jan-10	Mun WW
Mun WW	Moss Avenue Sewer Pumping Station	Santa Monica	Surface Direct Ultrafiltration	0.5	0.5	Apr-00	Mun WW
Mun WW	Rancho Malibu	Malibu	WW - MBR	0.0175	0.035	Jan-04	Mun WW
Mun WW	Redlands WWTP	Redlands	MBR ultrafiltration with nitrification/denitrification	6	6.6	Jun-04	Mun WW
Mun WW	Rio Vista WWTP	Rio Vista	MBR ultrafiltration with nitrification/denitrification	1	1	Jul-06	Mun WW
Mun WW	Smith River Rancheria WWTP	Eureka	MBR ultrafiltration with nitrification/denitrification	0.025	0.05	Jan-09	Mun WW
Mun WW	Victor Valley WRP	Victor Valley	MBR ultrafiltration with nitrification/denitrification	18	22	2010	Mun WW
TOTAL				**63.44**	**59.20**		

Note: List provided by GE, Water Resources and Process Technologies and represents projects GE has installed or are in design as of January 2009.

Legend

ADF = average daily flow
Commercial WW = commercial waste water
Ind WW = industrial waste water
MBR = membrane bioreactor
MDF = maximum daily flow
MGD = million gallons per day
Mun WW = municipal waste water
WRP = wastewater reclamation plant
WWTP = waste water treatment plant

Several agencies in the United States have conducted studies and published documents regarding the acceptance and viability of MBR technology. The U.S. Bureau of Reclamation (USBR) published the Membrane Bioreactors for Water Reclamation – Phase II, Final Technical Report in November 2000. A copy of this report is included in Appendix A. This report summarizes studies completed on evaluating the MBR process for producing reclaimed water. USBR concluded that MBR is a viable and feasible technology. The California Department of Public Health (CDPH) Division of Drinking Water and Environmental Management "Treatment Technology Report for Recycled Water", updated in September 2008, contains a list of accepted membrane technologies for use in California (CDPH, 2008). The report reviewed more than a dozen MBR technologies and concluded that all of the MBR technologies "have demonstrated their ability to meet the performance objectives of current Water Recycling Criteria (Title 22)." The U.S. Environmental Protection Agency (USEPA) published "Guidelines for Water Reuse" in September 2004 (USEPA, 2004). The guidelines report that MBRs have been shown to effectively produce high quality effluent and list several unique advantages.

Reliability of Pump Station

A treated water pump station would convey the treated water to the MLGS. The pump station would use vertical turbine pumps mounted in a wet well connected to the UV disinfection channel. There would be three pumps: two primary and one standby. During periods of peak demand for makeup water supply, the pump station would be able to ensure delivery of at least 66 percent of the flow in the event of failure of one pump.

Reliability of Conveyance Pipeline

The proposed water supply pipeline would be approximately 4,700 feet long, of which approximately 3,600 feet would be within Wilbur Avenue and the remainder within an existing access road on the Contra Costa Power Plant (CCPP) property. The makeup water pipeline is expected to be a 10-inch-diameter high density polyethylene (HDPE) pipe. The pipe will be installed in a trench using standard pipeline installation techniques in accordance with applicable standards and specifications.

HDPE pipe is durable, lightweight, flexible, and is commonly used for the transmission of water and other fluids. It is highly resistant to corrosion, abrasion, and chemicals. With proper installation, HDPE piping systems provide long service life and leak-free joints. Flows from the treatment plant and inflows to the raw water storage tank at the MLGS will be continuously monitored, such that any significant change in flows that might indicate a leak would be quickly identified. Typically, emergency repairs could be completed quickly upon detection of a leak.

Reliability of Treated Water Storage Tanks

The MLGS will have the following storage tanks:

- 1.8 million-gallon (mg) raw water storage tank (RWST)
- 1.0 mg reverse osmosis permeate water storage tank (ROPWST)
- 1.0 mg demineralized water storage tank (DWST)
- 0.75 mg waste water storage tank (WWST)

Table 1-2a summarizes backup water supply for various operating scenarios assuming that the makeup water supply from the BLS treatment plant is reduced to 50 percent of full flow. The BLS plant would have redundant features, such that the plant would be able to provide at least 50 percent of its peak flow.

For comparison, Table 1-2b summarizes backup water supply for MLGS in the unlikely event that flow from the BLS is completely lost.

Table 1-2a
Mirant Marsh Landing Generating Station[1,2]
Tank Sizing and Backup Water Supply Scenarios

Assume 50% inflow from BLS	**Power Augmentation On and Evaporative Cooling On**			**Power Augmentation On and Evaporative Cooling Off**			**Power Augmentation Off and Evaporative Cooling On**		**Power Augmentation Off and Evaporative Cooling Off**	
Hours of Plant Operation	24	18	12	24	18	12	24	18	24	18
Power Augmentation On/Off	On	On	On	On	On	On	Off	Off	Off	Off
Hours of Power Augmentation On	24	18	12	24	18	12	0	0	0	0
Evaporative Cooling On/Off	On	On	On	Off	Off	Off	On	On	Off	Off
Hours of Evaporative Cooling On	24	18	18	0	0	0	24	18	0	0
Max Power Output (94° F) – MW	930	930	930	858	858	858	888	888	819	819
Inflow from BLS	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Number of days plant can operate (Synchronized Tank Draw-Down) [3]	2.8	4.5	>14	9.0	>14	>14	13.5	>14	>31	>31
Add'l Storage to run 2 days (total) – % each supply tank[4]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Add'l Storage to run 3 days (total) – % each supply tank[4]	10%	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 1-2b
Mirant Marsh Landing Generating Station[1,2]
Tank Sizing and Backup Water Supply Scenarios

Assume NO inflow from BLS	Power Augmentation On and Evaporative Cooling On			Power Augmentation On and Evaporative Cooling Off			Power Augmentation Off and Evaporative Cooling On		Power Augmentation Off and Evaporative Cooling Off	
Hours of Plant Operation	24	18	18	24	18	18	24	18	24	18
Power Augmentation On/Off	On	On	On	On	On	On	Off	Off	Off	Off
Hours of Power Augmentation On	24	18	12	24	18	12	0	0	0	0
Evaporative Cooling On/Off	On	On	On	Off	Off	Off	On	On	Off	Off
Hours of Evaporative Cooling On	24	18	18	0	0	0	24	18	0	0
Max Power Output (94° F) – MW	930	930	930	858	858	858	888	888	819	819
Inflow from BLS	0	0	0	0	0	0	0	0	0	0
Number of days plant can operate (Synchronized Tank Draw-Down)[3]	1.7	2.3	3.5	3.0	4.0	12	2.8	3.7	31	>31
Add'l Storage to run 2 days (total) – % each supply tank[4]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Add'l Storage to run 3 days (total) – % each supply tank[4]	70%	25%	NA	NA	NA	NA	10%	NA	NA	NA

Notes:

1 MLGS consists of two FP10s and two Simple Cycle units
2 MLGS water storage tanks include:
1.8 mg raw water storage tank (RWST)
1.0 mg reverse-osmosis permeate storage tank (ROPST)
1.0 mg demineralized water storage tank (DWST)
0.75 mg waste water storage tank (WWST)
3 Analysis based on synchronized tank draw-down of all water storage tanks. It is assumed that the tanks are 80 percent full at the start of the simulation when water supply is lost.
4 Relative to tank capacities stated in Note 2.

Legend
MW = megawatts
BLS - Bridgehead Lift Station
NA = not applicable; indicates plant can operate for more than 2 or 3 days and additional storage (or backup water supply) not needed

During periods of peak demand for electricity, the MLGS would most likely operate for up to 18 hours per day. Evaporative cooling would be on for the entire 18 hours; however, power augmentation would generally be on for only about 12 hours each day to coincide with the peak demand hours during the day. As shown on Table 1-2a, during those periods, and when 50 percent of the BLS treatment plant's peak inflow is available, the onsite water storage system would provide sufficient storage for the MLGS to operate for more than 14 consecutive days.

Even if the MLGS were required to operate at full load for 24 hours (with both evaporative cooling and power augmentation on for the entire 24 hours), the MLGS would still be able to operate for almost 3 consecutive days if the inflow from BLS was 50 percent of its peak flow. If, in the unlikely event that there were no flow from the BLS treatment plant, the MLGS could operate under the conditions described above (i.e., 18 hours a day, with evaporative cooling on 12 hours a day) for 3.5 consecutive days. Even under extreme (and unlikely) conditions when there is no inflow from BLS and the MLGS is operating at full load 24 hours a day (with both power augmentation and evaporative cooling on for the entire 24 hours), the MLGS would still be able to operate for almost 2 consecutive days.

This demonstrates that the onsite water storage system provides sufficient capacity to ensure reliable operation of the MLGS and that an additional backup water supply is not needed.

Reliability of the Advanced Treatment Process

Reverse osmosis (RO) and electrodeionization (EDI) are mature technologies that have been used for at least 20 years. These membrane technologies have displaced ion-exchange in popularity over the years because they are inherently reliable and easy to operate and maintain as long as the feedwater to the membranes meets RO feedwater quality limits. For standard preventive maintenance to avoid fouled membranes, a clean-in-place system will be provided for all of the proposed project's membrane-based components.

For the proposed project, the MBR at the BLS treatment plant will provide water that meets RO feedwater quality specifications. All critical membrane systems will be designed with sufficient redundancy to ensure that the plant can continue to operate at full load even if a critical component were to fail.

Backup Water Supply

As discussed above, the onsite water storage system provides sufficient backup water supply for the proposed project and there is no need for an additional source of backup water supply.

Other options for backup water supply that were evaluated, but deemed unnecessary (and in some cases, infeasible), include:

- Water from the City of Antioch
- Water from the Contra Costa Canal
- Groundwater
- Water from the San Joaquin River

The City of Antioch would provide potable water to the MLGS for the plant's washrooms, safety eyewash stations, and other potable water uses. This water could also be used as a backup water supply for the plant's makeup water in the event that the satellite treatment plant cannot meet the makeup water supply demand and the onsite storage capacity of the tanks has been depleted. The potable water supply pipeline will connect to the existing CCPP water supply

pipeline. Because the onsite storage tanks provide sufficient storage in the event of a water supply interruption, this additional supply is not needed.

Another option would be to use raw surface water from the Contra Costa Canal. Contra Costa Water District charges a backup water supply connection fee as compensation for reserving capacity in its system so that water can be served when needed. Both the Delta Energy Center and Los Medanos Energy Center have backup water supply agreements with Contra Costa Water District; however, since operation at these plants began in 2001 there has never been a need for backup water from the canal to be delivered. The connection closest to the MLGS is an existing 30–inch–diameter lateral referred to as the East Gaylord lateral. The applicant would need to negotiate an agreement with the owner of this lateral. The applicant has not made any contact with the owner of this lateral. A new pipeline would need to be constructed between the East Gaylord lateral and the raw water storage tank at the MLGS site. This pipeline would be approximately 0.5 mile long and could be installed within Wilbur Avenue and the existing CCPP access road. Because the onsite storage tanks provide sufficient storage in the event of a water supply interruption, this additional supply is not needed.

If an agreement for connection to the East Gaylord lateral could not be negotiated, the proposed project could connect directly to the Contra Costa Canal via a new pipeline. The canal is located approximately 2 miles south of the proposed project site. Connection to the canal would require the construction of an approximately 3-mile–long pipeline that would cross roads, rail lines, and creeks, assuming a similar alignment as the East Gaylord lateral connection to the Contra Costa Canal. Because the onsite storage tanks provide sufficient storage in the event of a water supply interruption, this additional supply is not needed. In addition, costs and potential environmental impacts associated with construction of this pipeline make this option infeasible, considering that this backup water supply may never be needed.

Groundwater could provide another potential backup water supply. Groundwater is not currently used at the CCPP site. Additional information is needed regarding the availability, quantity, and sustainability of groundwater supplies before a conclusion can be reached regarding the feasibility of using groundwater as a backup water supply for the project. Because the onsite storage tanks provide sufficient storage in the event of a water supply interruption, this additional supply is not needed and has not been fully analyzed.

The existing CCPP uses San Joaquin River water as its cooling water supply. One option would be for the project to connect to the CCPP's water supply for emergency backup purposes. In light of current regulatory policies, this option likely is not an optimal solution. Because the onsite storage tanks provide sufficient storage in the event of a water supply interruption, this additional supply is not needed and has not been fully analyzed.

WASTE MANAGEMENT

Technical Area: Waste Management
CEC Staff: Cheryl Closson

WORKSHOP QUESTION

2. Please provide a Phase I Environmental Site Assessment (ESA) for the offsite natural gas transmission line route, water pipeline route and satellite treatment facility at the BLS that has been completed to ASTM standards.

RESPONSE

A Phase I Environmental Site Assessment that covers the proposed offsite natural gas transmission line route, the water pipeline route, and the satellite treatment facility was prepared by URS and is provided in Appendix B.

With regards to Data Request 46 (Waste Management), Mirant Marsh Landing had been working with Delta Diablo Sanitation District ("DDSD") since the Workshop to locate a Phase I Environmental Site Assessment ("ESA"), or equivalent information, for the site of the new water treatment facility that will be constructed to supply recycled water to the MLGS. In January 2009, DDSD notified Mirant Marsh Landing that it was unable to locate a Phase I ESA or equivalent documentation for the BLS site. Therefore, Mirant Marsh Landing engaged its consultant to prepare a Phase I ESA that covers the site of the DDSD satellite water treatment facility at BLS. The Phase I ESA provided in Appendix B covers the BLS site, the offsite linear routes for the pipelines that will connect the water treatment facility with the MLGS, and the natural gas transmission line route.

WORKSHOP QUESTION

3. Please identify the oversight agency that will oversee additional site investigation and required remediation activities.

RESPONSE

In the previous responses to Data Request 48 and Data Request 49, submitted to the CEC as part of the Responses to Data Request Set 1 (#1-54), the applicant asked for additional time so that it could coordinate with the former owner of the project site, which retained responsibility for certain remediation activities at the project site. Mirant Marsh Landing has engaged in discussions with the former owner and the following additional information is provided in response to Data Requests 48 and 49.

Mirant Delta, LLC (Mirant Delta) currently owns the project site and is a party to contractual arrangements in which the previous owner of the project site retained responsibility for certain remediation activities at the project site. Mirant Delta and Mirant Marsh Landing, LLC (collectively, "Mirant") are working with the previous owner to develop a plan for addressing any investigation and remediation activities that may be necessary for the project site due to construction of the MLGS.

Based on preliminary discussions, the California Environmental Protection Agency Department of Toxic Substances Control (DTSC) has been identified as the likely oversight agency for investigations and remediation activities at the project site. The previous owner has informed Mirant that DTSC has confirmed its willingness to serve as the responsible oversight agency.

Mirant expects to work with the previous owner of the project site to initiate the Voluntary Cleanup Program (VCP) process with DTSC, and to prepare and submit a workplan for review and approval by DTSC for conducting additional site assessment activities prior to the commencement of construction of the MLGS project. The VCP process will be initiated when the start date for construction is finalized, which is dependent on the timing of the CEC certification process and potentially other factors associated with commercial arrangements and project economics. The workplan would be developed with input from the previous owner of the project site, but Mirant expects the workplan to generally include:

Existing Data Review

- A description of the existing data from previous Phase I and Phase II assessments for the MLGS site;
- An assessment of the Human Health Risk Assessment (HHRA) methodology used in the 1998 Phase II Environmental Site Assessment and recommendations for updating the HHRA based on current risk assessment practices as well as assessing the need for an Ecological Risk Assessment;
- A data gaps analysis to assess additional sampling requirements in areas not previously investigated (i.e., beneath the existing aboveground storage tanks (ASTs) and areas where previous investigation results may need to be verified).

Scope of Work and Timeline

- Preparation of a detailed scope of work to collect additional data to update the HHRA and prepare an Ecological Risk Assessment (if necessary).

- A phased schedule for executing the proposed scope of work including work that can be done prior to AST demolition (i.e., site investigation activities outside the AST area) and work to be conducted after/during AST demolition (i.e., site investigations of the AST area).

After the additional site investigation activities have been completed, the HHRA would be updated and used for the development of site specific cleanup goals. Based on the risk assessment results, if required, a Remedial Action Work Plan would also be developed to address the presence of soil and/or groundwater contamination requiring remediation that would be submitted to DTSC for review and approval.

The work described above (i.e., initiation of the VCP process, additional DTSC coordination, workplan development, site investigation activities and remedial actions) would be conducted prior to any soil disturbance at the project site, and prior to the initiation of construction of the project. The investigation activities and any required remedial activities at the project site would be performed in accordance with DTSC oversight and a DTSC-approved workplan. Mirant Marsh Landing is prepared to comply with Conditions of Certification that reflect the foregoing requirements.

BIOLOGICAL RESOURCES

Technical Area: Biological Resources
CEC Staff: Laurel Cordonnier

WORKSHOP QUESTION

4. Provide a discussion and analysis of potential noise impacts to biological receptors at the shoreline and the onsite detention basin.

RESPONSE

As requested by CEC Staff at the workshop, the effects of noise from construction and operation of the proposed MLGS on wildlife were evaluated, specifically at the shoreline and at the CCPP's onsite detention basin. As stated in the AFC, no special-status species are known to be present at the shoreline or at the detention basin. However, there is a low potential for migratory birds, which are protected under the Migratory Bird Treaty Act, to nest in the surrounding area. Using the best available information, the analysis suggests that noise levels will not exceed U.S. Fish and Wildlife Services (USFWS) guidelines for sensitive wildlife. To further avoid potential impacts, additional avoidance and minimization measures are recommended.

Effects of Noise on Wildlife Species

Potential effects of noise on terrestrial wildlife include behavioral and physiological effects, damage to hearing, and masking of communication signals (Dooling and Popper, 2007; Figure 4-1). Birds generally flush in response to auditory disturbance if the source is within 200 feet and sound levels exceed 95 decibels (dB), but this tendency often declines with experience or habituation (Delaney et al., 1999). Nesting birds will often relocate their nests, rather than continue nesting near heavy construction (Johnson et al., 2003). Few standards exist regarding acceptable noise levels for wildlife, but the USFWS recently provided some guidance (USFWS, 2006). To be regarded as a "take" for northern spotted owl or marbled murrelet (two species that do not occur at MLGS, but that could serve as proxies for other sensitive species), at least one of the following noise-related conditions must be met:

- Project-generated sound exceeds ambient nesting conditions by 20 to 25 A-weighted decibels (dBA)
- Project-generated sound plus existing ambient conditions, exceeds 90 dBA

Ambient Noise Levels

As part of the AFC for the MLGS, noise monitoring was conducted. Ambient noise levels were recorded at five locations (two long-term and three short-term measurements) surrounding the project site (URS, 2008). Methods, conditions during measurement, and results of this noise analysis are described in Section 7.5 of the May 2008 AFC (URS, 2008).The measurement locations are shown on Figure 4-2.

Ambient noise levels are attributed to traffic along Wilbur Avenue, industrial noise associated with a concrete batch facility, and other noise such as distant traffic noise and wildlife. Table 4-1 summarizes the results of the noise measurements.

Noise Levels Due to Proposed Project Operations

The noise analysis presented in the AFC Section 7.5 Noise included the analysis of noise impacts due to the operation of the proposed project. The overall change in sound (e.g., cumulative sound minus ambient sound) is approximately 0.3 dBA at LT-1, 0.1 dBA at LT-2, 0.3 dBA at ST-1, and 0.1 at ST-2 (URS, 2008). Using the most conservative (i.e., lowest) ambient level from LT-1 and the estimated sound levels in terms of equivalent sound level, L_{eq} (see Figure 4-2), the project generated sound at the detention basin was estimated from the noise model. This approach is considered to be very conservative as the detention basin is located closer to existing sources than LT-1. As summarized in Table 4-1, sound level change at the detention basin would be expected to be no more than approximately 3.5 dBA using this conservative method.

Table 4-1
Ambient and Plant Design Sound Levels (in dBA)

Receptor[1]	Distance from Source to Receptor	Measured Ambient Sound Level (dBA L_{eq})[2]	Calculated Project Sound Level (dBA L_{eq})[2]	Calculated Project Plus Measured Sound Level (dBA L_{eq})[2]	Change in Sound Level (dBA L_{eq})
LT-1	2,100 feet	59	48	59	0.3
LT-2	2,900 feet	61	45	61	0.1
ST-1	2,050 feet	60	49	60	0.3
ST-2	2,640 feet	69	46	69	0.0
Estimated for Detention Basin[3]	approximately 1,150 feet	59	60	63	3.5

Source: URS, 2008

Notes:

1. See Figure 4-1 for receptor locations.
2. Levels for LT-1, LT-2, ST-1 and ST-2 are from Table 7.5-7 in AFC Section 7.5, Noise.
3. For the purposes of this analysis, the ambient sound level at the detention basin is assumed to be the same as the lowest ambient level measured (59 dBA at LT-1). The detention basin is estimated to be approximately half way between LT-1 and LT-2.

There are no existing data regarding ambient noise levels at the shoreline. Based on the noise modeling, the estimated noise that would be generated by the proposed project at the shoreline would not be expected to exceed approximately 65 to 66 dBA (URS, 2008). If lowest recorded ambient data is used (59 dBA at LT-1), the project sound levels plus measured sound levels would be 67 dBA, an increase of approximately 1 dBA.

Potential Noise Sources During Construction

During construction of the proposed project, noise will be generated by a variety of construction equipment and activities. With respect to biological receptors, and for purposes of this analysis, construction noise resulting from pile-driving was reviewed. Based on the preliminary schedule presented in the AFC, foundation work, which would include pile driving, is estimated to occur

between April and August 2010. The level of noise associated with pile driving will be highly dependent on the type of piles used and the technique. For example, driving steel piles generates more noise than using concrete piles and impact hammers typically generate more noise than vibration hammers. Similar to the Gateway Generating Station, it is anticipated that pile driving for the proposed project's foundation would be accomplished using concrete piles driven by an impact hammer.

Based on similar projects, estimated sound levels associated with pile driving could reach 95 dBA at 50 feet using the loudest technique (CEC, 2001). Pile driving would take place at least 800 feet from the detention basin and at least 300 feet away from the shoreline. Therefore, pile driving sound levels could be expected to be approximately 71 dBA at the detention basin and as high as 79 dBA near the shoreline.

Potential Effects of Sound on Wildlife Species in the Project Vicinity

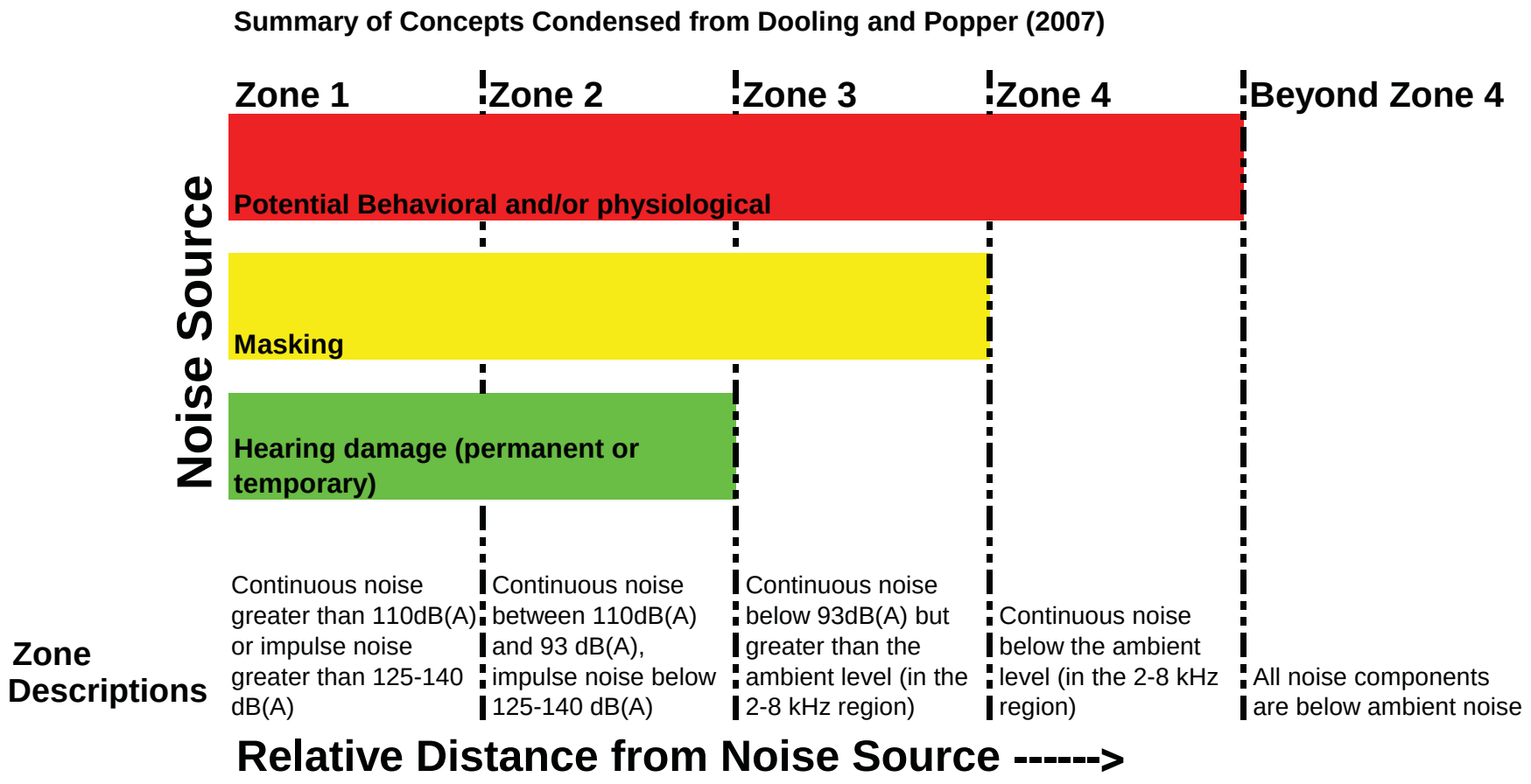
No special-status wildlife are expected to occur near the project area. However, migratory birds, which are protected under the Migratory Bird Treaty Act, have a low potential to nest in vegetation surrounding the plant site. Because construction mobilization and grading are scheduled to begin in October, after the bird nesting season (April 1 to August 15), no new nests are expected to be built during construction. Should nesting occur in the area, results of this noise analysis indicate that impacts would be less than significant.

By using the highest estimated sound level change at the detention basin, the cumulative sound level could reach 55 dBA, an increase of approximately 13 dBA. These sound levels do not exceed the thresholds presented by USFWS in regard to cumulative levels (90 dBA) or exceeding ambient levels (a change of 20 to 25 dBA) for northern spotted owl or marbled murrelet. As a result, it is highly unlikely that any noise generated from this project would be sufficient to qualify as a significant impact to sensitive wildlife species. In addition, the level of noise generated from this project would fall well below thresholds of hearing loss and the level that elicits the flushing response (Delaney et al., 1999; Dooling and Popper, 2007).

Noise levels during construction are below all standards at the detention basin, but approach USFWS standards for sensitive species at the shoreline. While no special-status wildlife is expected at the shoreline, and no nesting is expected after the start of mobilization, the following additional avoidance measures could be implemented to avoid any potential impacts to species protected under the Migratory Bird Treaty Act during this period of potentially increased noise levels.

Avoidance and Minimization Measures

- No more than 30 days prior to the start of pile driving, a pre-construction survey for nesting birds (i.e., migratory birds, raptors, special-status birds) will be conducted.
- Should a nesting bird be identified during the preconstruction survey, a buffer would be established around the nest. The size of the buffer would be dependant on the species observed: 200 feet for migratory birds, 300 feet for raptors, 500 feet for federal or state listed species.
- No work would occur within buffer areas until the nest had fledged. Should it be necessary for work to occur within the buffer area prior to fledging, a biologist would monitor the nest for disturbance during construction within the buffer. A monitoring log would be made available to agencies upon request.



SUMMARY OF IMPACTS OF NOISE ON BIRDS

Marsh Landing Generating Station
Mirant Marsh Landing, LLC
Contra Costa County, California

February 2009
28067344

URS

FIGURE 4-1

1/16/09 vsa ..T:\Mirant Contra Costa-Marsh Landing\Graphics\DATA REQUESTS\DR Workshop Responses\Fig 4-1_impact birds.ai

LEGEND

LT Long-Term Measurement Location

ST Short-Term Measuerment Location

NT Night-Time (Short-Term) measurement Location

Noise Contour (L_{eq})

MLGS Project Boudndary

L_{eq} NOISE LEVELS DURING MLGS OPERATION

February 2009
28067344

Marsh Landing Generating Station
Mirant Marsh Landing, LLC
Contra Costa County, California

FIGURE 4-2

1/20/09 vsa ..T:\Mirant Contra Costa-Marsh Landing\Graphics\DATA REQUESTS\DR Workshop Responses\Fig 4-2_Leq noise.ai

WORKSHOP QUESTION

5. Review the East Contra Costa County Natural Community Conservation Plan (NCCP) Permit (2835-2007-001-03) requirements and determine relevance to the proposed project.

RESPONSE

As requested at the workshop, the applicant has reviewed the "Natural Community Conservation Plan Permit (2835-2007-001-03) for the East Contra Costa County Natural Community Conservation Plan" dated August 2007 (Natural Community Conservation Plan Permit, 2007). The applicant has also reviewed the "East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan" dated October 2006 (the HCP/NCCP).

As stated in Section 1.2.4, page 1-7, of the HCP/NCCP document, "The primary goal of this Plan is to obtain authorization for take of covered species under ESA [Endangered Species Act] and NCCPA [National Community Conservation Planning Act] for the reasonable expansion of urban development in the cities of Clayton, Pittsburg, Brentwood, and Oakley and specific areas of Contra Costa County in accordance with approved land use plans." The Permit (2835-2007-001-03) states, "The HCP/NCCP provides a coordinated process for permitting and mitigating the take of Covered Species…" (NCCP Permit 2007, p. 5).

Because there would be no take of special status or "covered" species due to the proposed project, this permit and its requirements are not applicable.

TRANSMISSION SYSTEM ENGINEERING

Technical Area: Transmission System Engineering
CEC Staff: Mike Monasmith

WORKSHOP QUESTION

6. Please confirm what environmental analysis (pursuant to CEQA) would be required for transmission line rerating.

RESPONSE

In the preliminary System Impact Study (SIS) provided to the CEC on September 18, 2008, the results indicate that portions of some 230 kilovolt (kV) transmission lines could be loaded above their line ratings under normal and contingency conditions. Estimated normal overloads for these lines range from approximately 1 to 9 percent. Due to the relatively small size of these normal overload conditions, these lines are considered to be good candidates for rerating.

Transmission line rerating is a process by which the original assumptions and factors used in determining the transmission line rating(s) are reassessed and updated, which may result in an adjustment of the line rating (i.e., rerating). This process can address both the normal and emergency ratings assigned to a particular transmission line.

Factors that affect transmission line rating include, but are not limited to, conductor material and distance between transmission towers, as well as assumptions about ambient temperature, humidity, and wind speed. The thermal capacity of the line is often the limiting factor in the line rating. A thermal limit is typically applied to transmission lines for safe optimal transfer capability and to prevent the thermal destruction of the transmission line or other line damage. If the temperature of the line exceeds the thermal limit, the line may sag, and exceed the ground clearance standards.

Actual transmission line capacity is difficult to predict because the capacity is based on so many variables and operational scenarios. Traditionally, utilities have used conservative assumptions to determine line capacity based on this uncertainty. However, new methods are available to assess transmission line operation in the field (e.g., LIDAR surveys via helicopter), which allows utilities to reassess the assumptions used in setting transmission line capacity. The 2008 California Independent System Operator Transmission Plan contains several recommendations to rerate several transmission lines, demonstrating that transmission line rerating is common practice.

In California, transmission line rerating is considered in transmission planning efforts coordinated between CEC, Western Electricity Coordinating Council, California Independent System Operator, California Public Utilities Commission, and the transmission system owners (i.e., PG&E).

The California Environmental Quality Act (CEQA) requires an assessment of the potential environmental impacts of projects in California. CEQA does not apply to all activities in California, however, but applies only to those activities that result in physical changes in the environment. The CEQA Guidelines define “project” as an activity that may cause “either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment.” Pub. Res. Code § 21065; 14 CCR § 15378(a). Section 15360 of the CEQA Guidelines defines “environment” as “the physical conditions which exist within the area

which will be affected by a proposed project, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance."

Rerating does not cause a physical change in the environment. A transmission line is rated in order to determine the amount of current the line can safely and reliably carry. Rerating is an analytical exercise by which a transmission line is re-evaluated to determine whether or not it can bear additional load. If the conclusion from the analysis is that the line is able to carry additional load, then a new rating is assigned. Rerating a transmission line — recalculating the load a transmission line can carry — does not involve any physical change to facilities or equipment, and will not lead to a physical change in the environment. Actions that do not result in or lead to a physical change in the environment, like rerating, are not "projects" under CEQA and thus, are not subject to CEQA. *See, Not about Water Comm. v. Board of Supervisors* (2002) 95 Cal.App. 982 (holding that the formation of an assessment district to raise revenue is not a "project" under CEQA because there was no physical change in the environment); *City of Agoura Hills v. LAFCO* (1988) 198 Cal.App.3d 480 (a LAFCO decision to adopt a Sphere of Influence is not a "project" under CEQA because there was no physical change); and *Citizens to Enforce CEQA v. City of Rohnert Park* (2005) 131 Cal.App.4th 1594 (a city's adoption of a MOU with a tribe relating to infrastructure funding not a "project" for CEQA purposes because no physical change resulted).

A possibility exists that if the transmission line is rerated, and it is determined that the line can carry additional load, the transmission line may sag due to the increased load. Thus, the transmission line owner may need to tighten the line in order for the line to carry additional load. This tightening of the transmission line would occur as part of the transmission line's routine operations and maintenance activities.

Such routine operations and maintenance activities are exempt from CEQA review under CEQA's categorical exemptions. The CEQA Guidelines delineate several categories of projects that do not have a significant effect on the environment, and thus are exempt from CEQA. Among the categorical exemptions are "existing facilities." Section 15301. Existing facilities are categorically exempt if the proposed activity involves the "operation, repair, maintenance, permitting, leasing, licensing, or minor alteration of existing public or private structures, facilities, mechanical equipment, or topographical features, involving negligible or no expansion of use beyond that existing at the time of the lead agency's determination." Among the examples of "existing facilities," the CEQA Guidelines identifies "existing facilities of both investor and publicly-owned utilities used to provide electric power, natural gas, sewerage, or other public utility services." 14 CCR 15301(b).

In this case, activity associated with tightening the transmission line would be categorically exempt under CEQA because (a) the transmission lines are existing facilities used to provide electric power; and (b) any need to tighten the transmission line is part of the operation of the transmission lines or is a minor alteration thereto.

In sum, the re-rating of the transmission line thus does not require a CEQA analysis. Indeed, the rerating of a transmission line outside of the AFC process, on its own, would not trigger CEQA for the reasons stated above. Thus, no analysis of potential environmental impacts associated with a re-rating is required.

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APPENDIX A

SOIL AND WATER

APPENDIX A-1

VENDOR INFORMATION

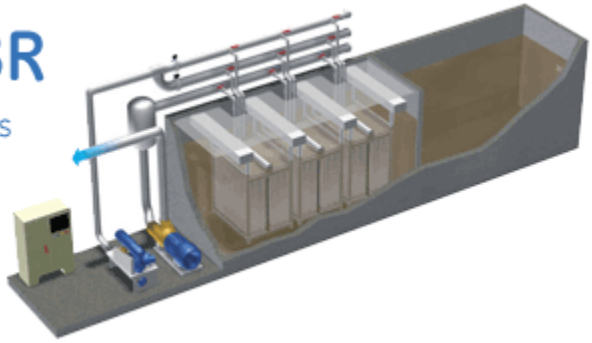
imagination at worl

GE Water & Process Technologies

Membrane Bioreactor (MBR)

ZeeWeed* MBR

ZeeWeed membrane bioreactors (MBR) produce effluent for discharge or reuse that far exceeds the world's most stringent regulations.



Efficient, cost-effective wastewater treatment

With membrane bioreactor installations totalling over 450 MGD** of treatment capacity, GE Water & Process Technologies reinforced hollow fiber membranes are the trusted membrane platform. You're investing in peace of mind as well as technology.
ZeeWeed membrane bioreactor systems combine proven ultrafiltration technology with biological treatment for municipal, commercial and industrial wastewater treatment and water reuse applications. The membrane bioreactor system incorporates reinforced hollow fiber membranes specifically designed to meet the requirements of wastewater treatment. Membrane bioreactor systems replace conventional treatment and combine clarification, aeration and filtration into a simple and cost-effective process that reduces capital and operating costs. The result is consistent, high quality effluent suitable for any discharge or reuse application.

From small and simple membrane bioreactor systems to the world's largest and most dependable, GE has the most system / process engineering and operating experience.

Considering a Membrane Bioreactor Plant?

Learn more about design considerations that will ensure the best value for your dollar, smart features that guarantee trouble-free performance, and operational strategies to handle unexpected situations.

Membrane Bioreactor Design Considerations »

GE offers real world membrane bioreactor knowledge with industry leading design teams and long-term operating experience which ensures that our customers receive reliable and trouble-free MBR solutions for:

Case Studies:

- Cauley Creek Water Reclamation Facility
- Australian Golf Course Recycles Municipal Wastewater with Onsite ZeeWeed MBR
- Vancouver Convention & Exhibition Centre
- Johns Creek Environmental Campus
- Corona Wastewater Treatment Plant

Related Technology:

- Zeeweed 500 Ultrafiltration Membrane

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Contact us to learn more about what we can do for you.

Plant retrofits
Cold climate operation
Bio-phosphorus removal
Bio-nitrogen removal
Reverse osmosis pretreatment
Direct reuse
Direct discharge
Aquifer recharge
Small, medium and large plants

**peak daily flow rates. This includes membrane bioreactor plants in design, construction or operating as of December 31/04.

Membrane Bioreactor (MBR) Process

The ZeeWeed membrane bioreactor (MBR) process is a GE technology that consists of a suspended growth biological reactor integrated with an ultrafiltration membrane system, using the ZeeWeed hollow fiber membrane. Essentially, the ultrafiltration system replaces the solids separation function of secondary clarifiers and sand filters in a conventional activated sludge system.

ZeeWeed ultrafiltration membranes are immersed in an aeration tank, in direct contact with mixed liquor. Through the use of a permeate pump, a vacuum is applied to a header connected to the membranes. The vacuum draws the treated water through the hollow fiber ultrafiltration membranes. Permeate is then directed to disinfection or discharge facilities. Intermittent airflow is introduced to the bottom of the membrane module, producing turbulence that scours the external surface of the hollow fibers. This scouring action transfers rejected solids away from the membrane surface.

ZeeWeed membrane bioreactor technology effectively overcomes the problems associated with poor settling of sludge in conventional activated sludge processes. ZeeWeed MBR technology permits bioreactor operation with considerably higher mixed liquor solids concentrations than conventional activated sludge systems that are limited by sludge settling. The ZeeWeed MBR process is typically operated at a mixed liquor suspended solids (MLSS) concentration in the range of 8,000 to 10,000 mg/L. Elevated biomass concentrations allow for highly effective removal of both soluble and particulate biodegradable material in the waste stream. The ZeeWeed MBR process combines the unit operations of aeration, secondary clarification and filtration into a single process, producing a high quality effluent, simplifying operation and greatly reducing space requirements.

ZeeWeed Membrane Bioreactor Features and Benefits

- **Physical ultrafiltration (UF) barrier**

  Produces a high quality effluent suitable for direct reuse

- **Unmatched fiber ruggedness**

  Ensures a longer membrane life in harsh wastewater operating environments

- **Hollow fiber geometry**

  Provides a greater filtration surface area which reduces plant footprint and effectively distributes cleaning solutions

- **Effective backpulse cleaning**

  Maintains long-term, peak system performance and provides a simple, rapid method of recovery in the event of a plant upset

- **Automated in-situ cleaning**

  Simplifies system operation and maintenance, while reducing operating costs

- **"Self-healing" fibers**

  No catastrophic membrane failures means that your plant keeps working

- **Compact design**

  Smaller plant footprint reduces capital costs

- **Proven system performance**

  Successful track record of operation in hundreds of municipal and industrial applications provides you with peace of mind

ZeeWeed Membrane Bioreactor Treatment Results

BOD	< 2 mg/L
TSS	< 0.5 mg/L
NH3-N	< 0.5 mg/L
TN	< 3 mg/L**
TP	< 0.05 mg/L**
Turbidity	< 0.2 NTU
Fecal Coliform	< 10 CFU/100 mL
Transmisivity	> 75%

**with appropriate biological design and/or chemical addition

Reinforced Membranes for Membrane Bioreactor Applications

Reinforced membranes™ are preferred for membrane bioreactor (MBR) applications because it's never a perfect world.

The reinforced hollow fiber membrane design philosophy benefits users today and in the future. You may never need to use the built-in safety features such as the ability to effectively backpulse, but if you do,

you'll be glad the security is there.

- Unmatched ruggedness results in a longer membrane life and lower plant life cycle costs
- "Self-healing" fibers mean no catastrophic membrane failures and no plant shutdowns
- Effective back-pulse cleaning ensures long-term, peak system performance and a simple method to recover the membrane permeability in the event of a plant upset
- Compact design means smaller plants and reduced capital and operating costs.

The rugged membranes have a proven track record for operating in all types of demanding environments, including municipal/commercial/industrial wastewater and landfill leachate applications.

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GE
Water & Process Technologies

Case Study

Corona Wastewater Treatment Plant

Application: Wastewater treatment that meets California Title 22 discharge criteria for water reuse

Capacity: 1.0 MGD (3,785 m3/d)

Location: Corona, California, United States

Commissioned: December 2001

Process Overview

In 1998, CH2M Hill awarded a contract to GE Water & Process Technologies, to supply a ZeeWeed* MBR (membrane bioreactor). The system incorporates reinforced ZeeWeed 500 immersed membranes, which provide a physical barrier for separating biosolids from the treated wastewater. The process combines aeration and solids separation (filtration) into a single-step, resulting in a compact treatment facility.

One major reason for the selection of the ZeeWeed MBR process was the small footprint. The ZeeWeed MBR occupied only 25% of the land area required by alternative conventional processes.

The ZeeWeed MBR system is designed to meet the following discharge criteria: biological oxygen demand < 5 mg/L; total inorganic nitrogen < 10 mg/L; total suspended solids < 5 mg/L; and turbidity of < 0.2 NTU.

Solution

The facility consists of three separate process trains. The process trains are divided into two distinct zones: anoxic and aerobic/membrane filtration.

The pre-screened wastewater is fed directly to the anoxic zone, where denitrification occurs. The mixed liquor then flows by gravity to the aerobic zone, where BOD oxidation and nitrification occurs.

The ZeeWeed immersed membranes are located in the aerobic zone. The membrane modules are connected to a permeate pump, which creates a low-pressure suction of -1 to -8 psi (-6.9 to -55 kPa). Water is drawn from the mixed liquor through the surface of the membrane in an "outside-in" flow path. From there, the effluent is pumped through the discharge system. Air is supplied to the membranes, where it emerges as a coarse bubble stream from the bottom of the membrane module. This membrane aeration performs several key functions, including mixing of the biomass, membrane surface cleaning, and provides a portion of the aeration required of the biomass.

Results

The effluent from the plant is designed to meet California Title 22 standards, and is suitable for reuse on a nearby golf course for landscape irrigation, or can be safely discharged to a local creek bed

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SIEMENS

MEMCOR® Membrane Products – Celebrating 25 Years of Innovation

MEMCOR® products have become an industry leader in the global water and wastewater treatment markets, with microfiltration and ultrafiltration solutions for drinking water, water reuse, wastewater, desalination pretreatment and industrial process water.

MEMCOR Products pioneered the application of membrane filtration to the municipal and industrial water treatment market. The MEMCOR Continuous Microfiltration (CMF) technology was introduced in the early 1980's. The first generation of CMF systems (Now called Classic MEMCOR® CMF Pressurized Membrane Filtration Systems) were robust microfilters, geared toward low volume process streams such as wine, juice and pharmaceutical applications. Small modules were assembled on skids using standard plumbing fittings. The second generation M1 and M2 series modules reduced costs and simplified the systems by doubling the membrane area of the modules, and by using injection molded manifolding.

The third generation of the CMF system, the M10 series, was commercialized in the early 1990's specifically to process high volumes of water and wastewater. The M10 modular design utilized repairable membrane sub-modules and a high degree of automation.

MEMCOR® CS (previously called CMF-S) was the fourth generation of the MEMCOR technology, the result of over 15 years of research, development and operational experience in low-pressure membrane technology. The primary aim in the development of CS was to reduce capital and operating costs, footprint, complexity and simplify scale-up of the microfiltration process for large scale systems. The membrane module cell size and construction is adaptable based on a modular approach to meet specific application requirements. The development of the CS system has resulted in more cost-effective solutions particularly for higher capacity membrane plants.

MEMCOR® CP, our latest pressurized technology, was designed to meet the needs of turn-key projects, offering a "building block" approach to large capacity projects. The CP is fully assembled, saving valuable on-site labor time.

Today, the MEMCOR membrane portfolio includes both pressurized and submerged technologies, available as either package plants or custom solutions to suit the needs of a variety of water and wastewater applications.

Milestones:

1983 - Memtec America Formed
1985 - M1 and M2 membranes introduced
1986 - Founding of Memtec America and Memtec Europe Limited
1987 - 1st MEMCOR Drinking Water System Operating
1988 - Founding of Memtec Japan Limited
1990 - 1st MEMCOR Wastewater Reuse System Operating
1991 - M10 membranes introduced
1993 - 1st MEMCOR multiple skid system operating in the United States
1998 – MEMCOR CS submerged technology introduced
2000 - PVDF oxidant tolerant membranes introduced
2001 – World's largest drinking water membrane plant in Coliban WTP in Bendigo, Australia operating
2002 - Water Factory 21 (OCWD) 86 MGD plant awarded- the largest wastewater reuse membrane plant in the world upon its completion in 2006
2003 - 1st Fullscale MemJet MBR system operating
2003 - MEMCOR XS Packaged Submerged Plant introduced
2004 - Sky Hydrant units sent to Sri Lanka for disaster relief
2005 - MEMCOR CP Custom Pressureized System introduced

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Xpress™ Membrane Bioreactor Packaged Plants

The Xpress™ membrane bioreactor (MBR) packaged plant from Siemens Water Technologies is a robust wastewater treatment process with inherent features designed to reduce maintenance and provide reliable and efficient wastewater treatment for small scale applications.

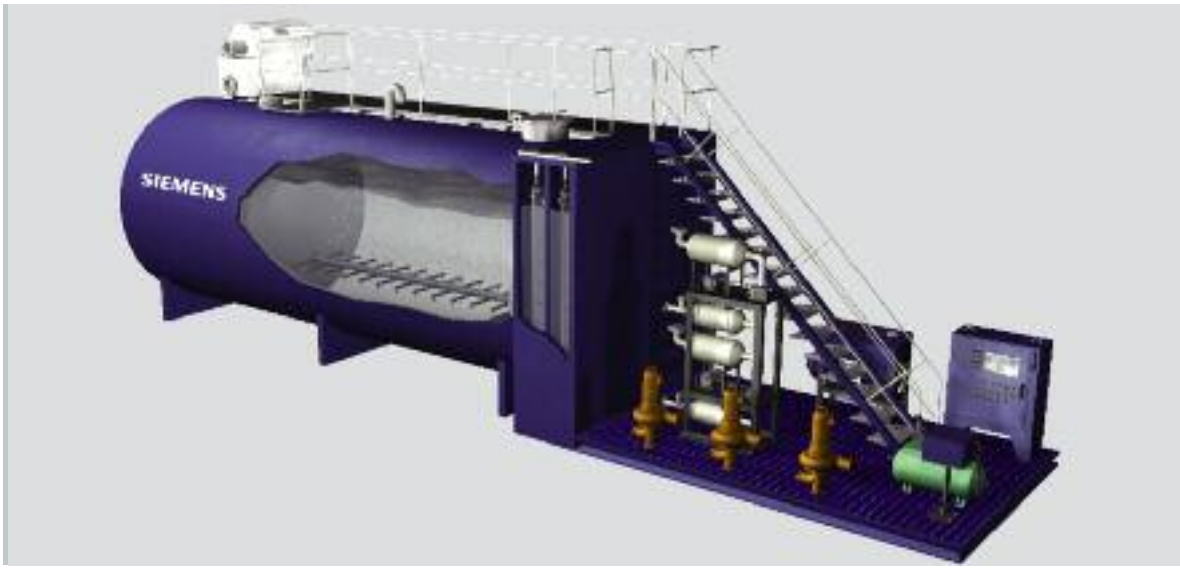
The Xpress™ utilizes the immersed membrane bioreactor operating system from the MBR process, a unique wastewater treatment process designed for municipal and industrial applications.

Membrane bioreactor systems may be used in such applications as water reuse, new housing developments, parks and resorts, retrofits, municipalities, industrial and turnkey projects. With the limited supply of potable water to support communities and industries, the increased cost of water and wastewater treatment, and stricter environmental regulations the MBR process is a viable solution for current and future wastewater treatment.

Xpress™ Process

The pre-designed and skid-mounted system can be offloaded quickly and efficiently at your wastewater treatment site. Designed for applications from 25,000 gallons per day (gpd) to 100,000 gpd, the Xpress is ideally suited for land development sites, golf courses, resorts, small municipalities or industrial applications. The prefabricated steel tanks will include pre-installed internals and skid-mounted pumps and blowers to reduce time and onsite labor for installation.

In the MBR process, wastewater is screened before entering the tank where biological treatment process takes place. Aeration within the aerobic reactor zone provides oxygen for the biological respiration and maintains solids in suspension. To retain the active biomass in the process, the MBR relies on submerged



membranes rather than clarifiers, eliminating sludge settleability issues. This allows the biological process to operate at long sludge ages (typically 20-100 days) and increased mixed liquor suspended solids (MLSS) concentrations (typically 8,000–14,000 mg/L).
High MLSS concentrations promote numerous process benefits, including stable operation, complete nitrification, and reduced biosolids production reducing biological volume requirements (and associated footprint) to only 20–30 percent of conventional biological processes. Further, the membrane tanks provide extremely space efficient solids separation and do not require a clarifier in the system.

The submerged microfiltration membranes are located in a separated membrane tank, and consist of polymeric hollow fibers. These hollow fibers are bound together in modules, using a unique dual-potting system. By applying a low vacuum to the inside of the hollow fibers, the fully oxidized and nitrified water is filtered through the membranes. Meanwhile, mixed liquor and air are pumped continuously into each membrane module fiber bundle. The resulting flow across the membrane (known as cross-flow) continuously scours the membrane surface, preventing solids buildup.

There are many equipment variations, configurations, and options that can be used with the MBR system, all of which are designed to provide the necessary treatment for each wastewater project. Equipment selection is dependent on effluent requirements, ease of maintenance and operation, power consumption, future expansion, and initial capital costs. Above all, the Xpress™ MBR operating system is designed to be safe and convenient for plant operators.

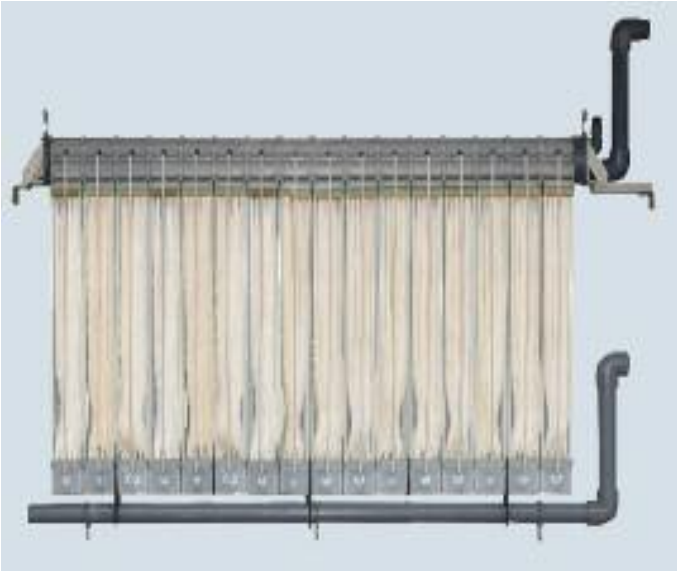
Features & Benefits

- Pre-assembled and pre-skidded equipment package
- Compact design
- Advanced nitrogen and P removal
- Prescreening
- Low-cost wastewater treatment system
- Minimal operator attention

Applications

- Water reuse and recycling
- Ground and surface water discharges requiring advanced treatment
- Pretreatment for reverse osmosis (RO) or other advanced filtration processes
- Satellite reclamation
- Industrial wastewater
- Residential and commercial development
- Food and beverage applications
- Pharmaceutical projects
- Remote installations
- Emergency response wastewater treatment
- Military bases and rapid infrastructure deployment
- Sports facilities, schools, and office parks, etc...

The Xpress™ MBR packaged plant system from Siemens Water Technologies provides reliable and efficient wastewater treatment for your small scale applications.



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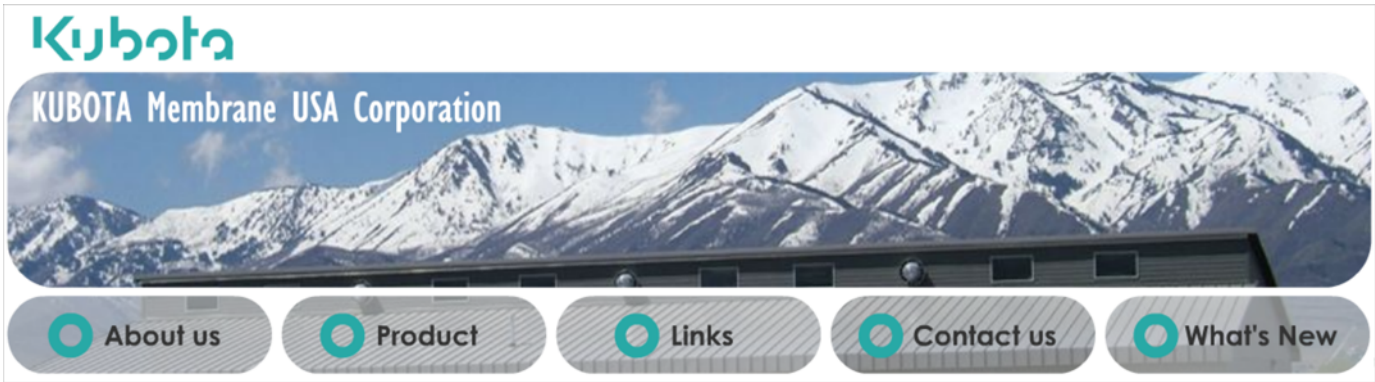

KUBOTA Submerged Membrane Unit®

We are pleased to offer KUBOTA Submerged Membrane Unit® as the solution to various requirements in wastewater treatment.

SOLUTION 1

Permeate Without SS

Membrane separation system removes not only SS but also substances such as detergent. This enables the treated water to be re-used.

SOLUTION 2

Simple Maintenance

All that is required is control of transmembrane pressure and basic water quality analysis, both of which you can easily learn.

SOLUTION 3

Energy Conservative Operation

KUBOTA Submerged Membrane Unit system is designed for energy conservation. Aeration plays two roles to save energy:
- Oxygen supply for biological treatment
- Cleaning of membrane surface with turbulent flow

SOLUTION 4

Remarkably Small Footprint

KUBOTA Submerged Membrane Unit is installed in an aeration tank. Since it performs high-concentration activated sludge treatment, no settling tank or sludge thickening tank is required. The size of the aeration tank is also minimized.

Hyrum

BandonDunes

Tulalip

Enviroquip, Inc.

Membrane Bioreactor

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Product Overview

MPAC™ Systems:

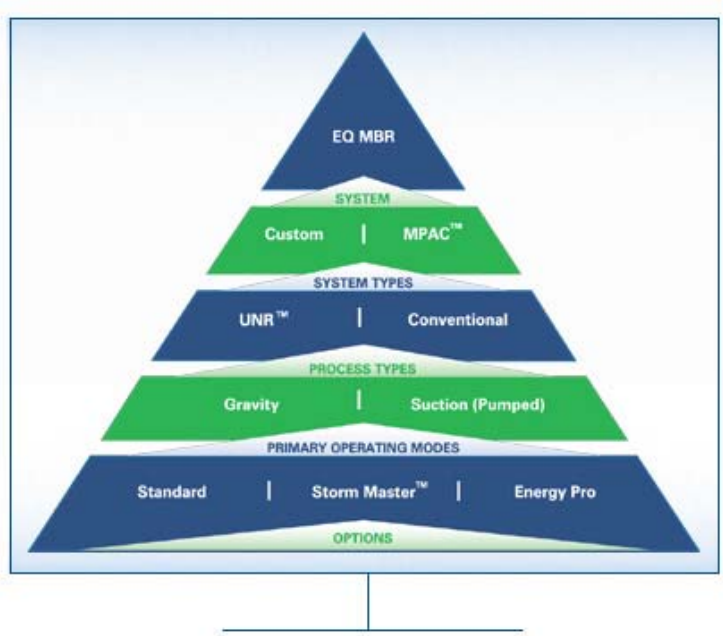
- MPAC-S
- MPAC-B
- MPAC-C

Custom Systems

- Process Types
- Primary Operating Modes
- Options

THE SYSTEM

Simple in design and easy to operate, an Enviroquip MBR System provides the benefits of membrane technology without the complexity. From point-of-use package plants (see MPAC™ Brochure) to custom municipal installations, Enviroquip has designed and/or commissioned over 100 MBR facilities. Our experienced staff of professionals is trained to help you customize your plant using several available options as shown in the diagram below.



MPAC™ Systems

Membrane Bioreactor
Kubota
Benefits
Applications
Tech Overview
Product Overview
Tech Resources
Case Studies
Presentations
Workshops
Contact
Back to Products

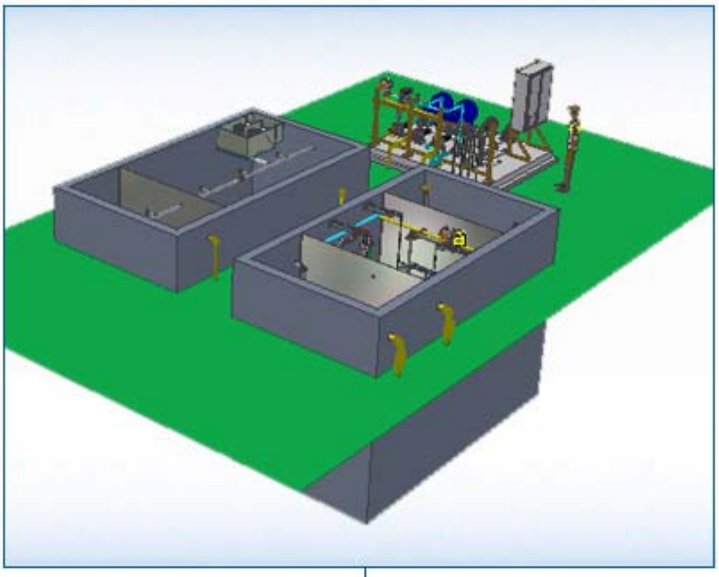
For small systems ranging in capacity from 5,000gpd to 125,000gpd, Enviroquip offers a series of pre-engineered, pre-assembled package plants that can be constructed and installed in 4-7 months. Ideal for decentralized, point-of-use treatment, these systems are easily “hidden in plain site” and provide a superior effluent quality to conventional package plants. Moreover, MPAC™ systems can be completely automated and configured for remote monitoring and control.

Six MPAC™ models are available that include different features and varying levels of instrumentation. Features common to each model include:

- Flexible modular designs
- Superior effluent quality meeting the most stringent reuse standards (Title 22 approved)
- Rugged design for remote installations
- Easy to maintain and operate
- Options include equalization, pre-treatment, disinfection, and sludge handling
- Proven, standardized controls system designed for remote administration

A brief description of each model is provided below.

MPAC-S



The S model is available in either concrete or steel tanks and requires some

site assembly. Process equipment is skid or tank mounted. S models are available as assembled pieces or can be shipped loose for contractor field installation. Features of this model include:

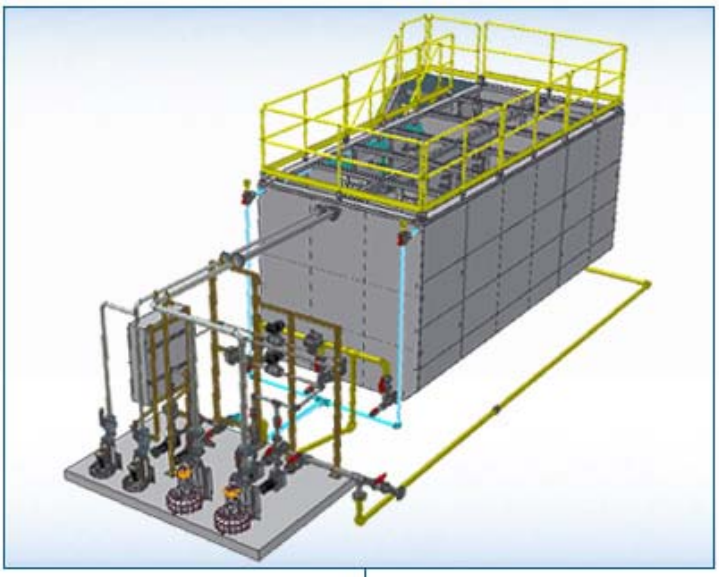
Pre-Cast Concrete Tanks

- Below grade installation
- Easy access to all process equipment
- Ideal for cold weather applications
- Field assembly required

Reinforced Steel Tanks

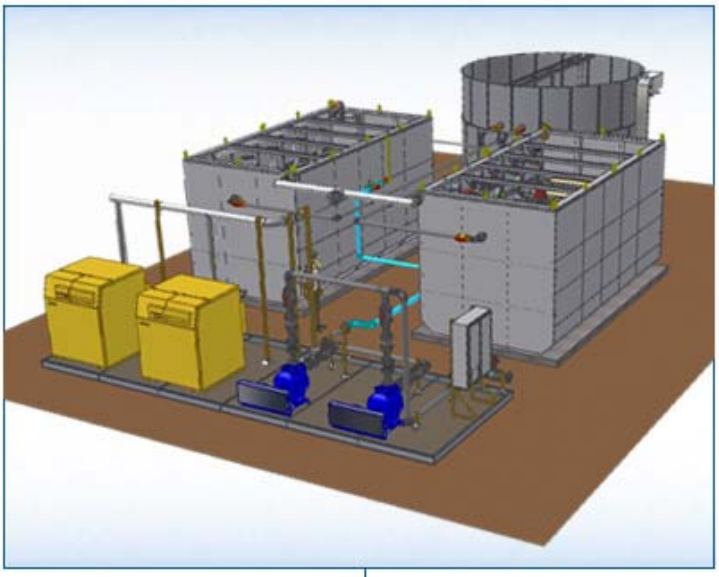
- Transportable above tanks for relocation
- Less field assembly required
- MBR redundancy on all systems

MPAC-B

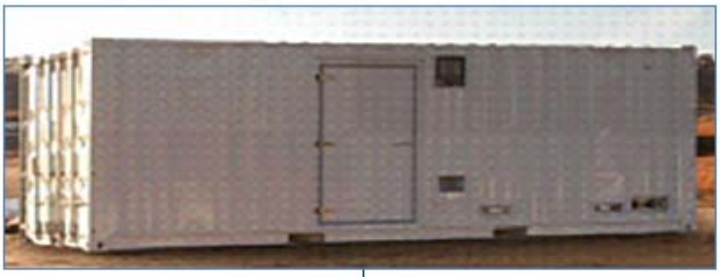


The B model is a self-contained modular system housed in a pre-fabricated concrete building. This system is mounted above grade and is equipped with all components necessary for operation. Features of this option include:

- Plug-and-play" system further reduces any construction costs and setup time
- Durable modular structure with multiple finish options
- Building air-conditioning available as an option



MPAC-C



The C model is a self-contained, easily re-locatable system housed in a weather-tight ISO container. This system is designed for use in extreme conditions and use as temporary treatment.

- Plug-and-play" system further reduces any construction costs and setup time
- Durable modular structure with multiple finish options
- Building air-conditioning available as an option

Custom Systems
Medium (>125,000gpd) to large (>4MGD) scale MBR plants, are custom designed to match the design criteria of each application. However, Enviroquip has standardized design concepts for plants in these size ranges that incorporate beneficial features from our US installations as well as the 1,600 other Kubota MBR plants operating worldwide.

For each of our standard designs, 3D scaled models are available developed in Inventor®. Each model is fully compatible with AutoCAD and provides detailed information regarding unique piping and equipment requirements. In addition to our standardized designs, Enviroquip routinely provides design support to engineers developing unique layouts.

Process Types

UNR™

Using award winning bio-monitoring technology, UNR™ processes improve energy efficiency and biological performance while reducing system complexity.

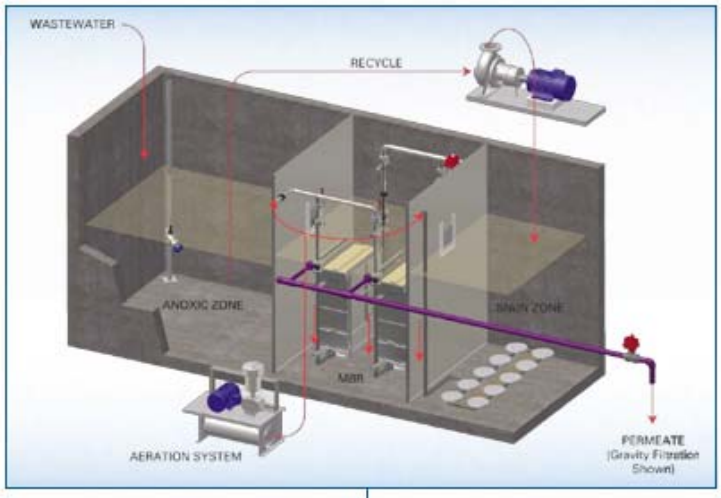
Conventional

Not optimized for biological removal but sufficient for many applications.

Primary Operating Modes

Gravity

Nearly 40% of the 1,800 operating flat-plate MBR plants operate in what is referred to as gravity mode. In this mode of operation, a few feet of water head above the submerged membranes is sufficient to drive the filtration process. The primary advantage of employing this type of pump-less system is reduced maintenance. However, not all applications are suited for a gravity operation and require low head centrifugal pumps to drive the filtration process. An example of a MBR System operating in gravity mode is shown below.



Suction (Pumped)

Low-head pumps can also be used to drive filtration in lieu of gravity. Utilizing pumps provides allows for pressurized discharge to remote outfall or storage locations.

Options

STORM MASTER™

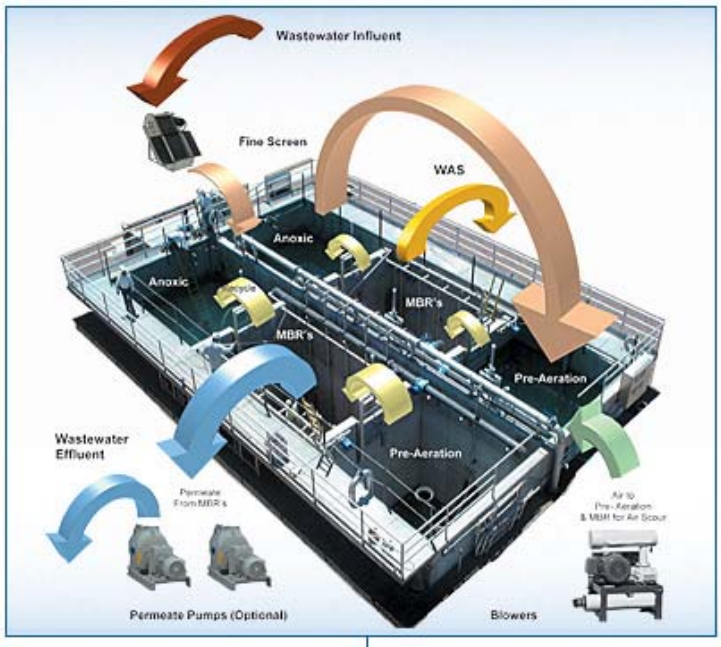
This configuration provides a cost-effective means of handling storm events and can significantly reduce solids handling costs. This option also incorporates features of the Energy Pro configuration.

ENERGY PRO

Using an automated system of slide gates and specific plant layouts, this configuration incrementally brings plant capacity online to match demand and optimize energy efficiency.

STANDARD

Standard systems include few moving parts and are extremely easy to operate. In fact, automation is optional for smaller systems.



APPENDIX A-2

CASE STUDIES, ARTICLES, AND OTHER PUBLICATIONS

SIXTH FRAMEWORK PROGRAMME

Project no.: 018480

EUROMBRA

Membrane bioreactor technology (MBR) with an EU perspective for advanced municipal wastewater treatment strategies for the 21st century.

STREP
Global Change and Ecosystems: Priority 1.1.6.3
Activity code: SUSTDEV-2004-3.II.3.2.2

D1 – Data acquisition and compilation

Due date of deliverable: 31/12/2005
Actual submission date: 05/03/2006

Start of project: 1 October 2005 Duration: 3 years

Organization name of lead contractor for this deliverable:
Cranfield University

Revision: 1.0

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)
Dissemination Level

PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Introduction

The status of MBR technology worldwide has been the subject of a recent report (Hanft, 2006), and has also featured in a number of text books (Judd, 2006; WEF 2006; Pinnekamp and Friedrich, 2006). As part of the EUROMBRA programme one of the initial tasks is to collect data from existing plant and pilot plants and compile an overview of the operating data as per date. A review of the current status of the technology is presented so as to ascertain:

- the market value of the technology, and
- the technologies currently available.

Market value and drivers

Market analyst reports indicate that the MBR market is currently experiencing accelerated growth, and that this growth is expected to be sustained over the next decade. The global market doubled over a 5-year period from 2000 to reach a market value of $217 million in 2005, this from a value of around $10 million in 1995 (Fig. 1). It is expected to reach $360 million in 2010 (Hanft, 2006). As such, this segment is growing faster than the larger market for advanced wastewater treatment equipment and more rapidly than the markets for other types of membrane systems. In Europe, the total MBR market for industrial and municipal users was estimated to have been worth €25.3 million in 1999 and €32.8 million in 2002 (Frost and Sullivan, 2003). In 2004, the European MBR market was valued at $57 million (Frost and Sullivan, 2005). Market projections for the future indicate that the 2004 figure is expected to rise annually by 6.7%; the European MBR market is set to more than double its size over the next 7 years (Frost and Sullivan, 2005).

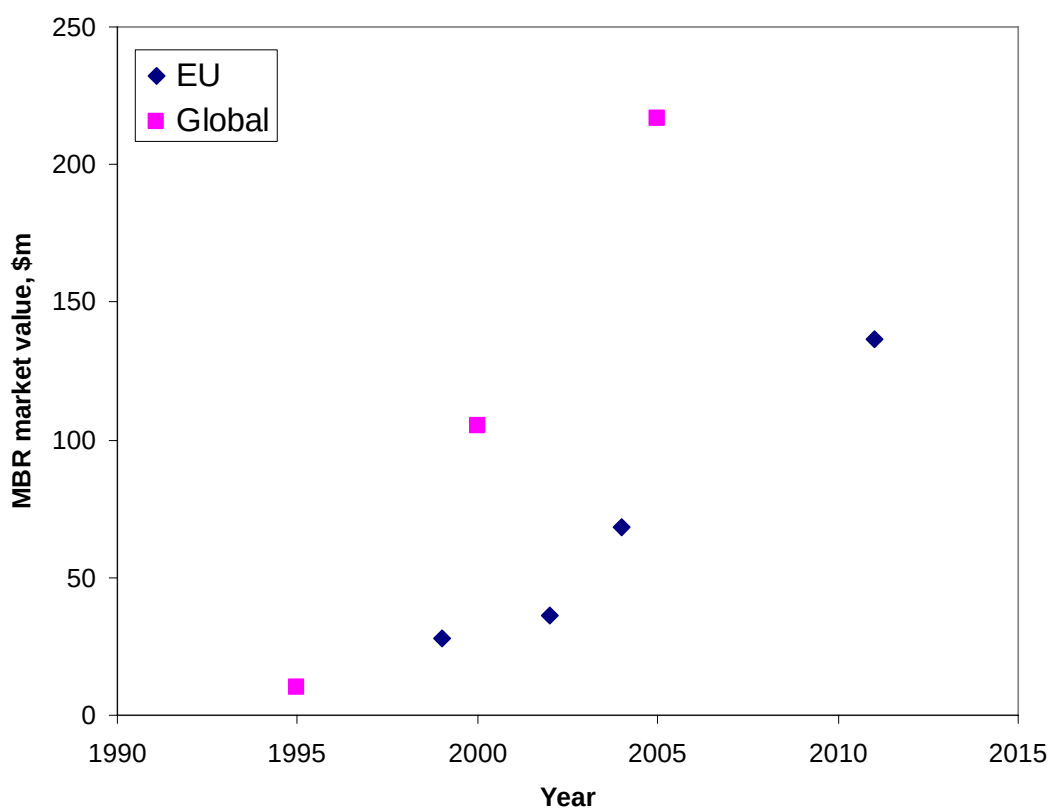

Fig. 1 Estimations of market value (Hanft, 2006; Frost and Sullivan, 2005)

The US and Canadian MBR market is also expected to experience sustained growth over the next decade, with revenue from membrane-based water purification, desalination and waste treatment totalling over $750 million in 2003, and projected to reach $1.3 billion in 2010 (Frost and Sullivan, 2004a, b, c). According to some analysts, the MBR market in the USA (for the years 2004–2006) is growing at a significantly faster rate than other sectors of the US water industry, such that within some sub-sectors, such as the filtration market, technologies like membrane filters or ultraviolet radiation are growing at rates in excess of 15% (Maxwell, 2005). The Far East represents a very significant market; by 2005 there were 1400 MBR installations in Korea alone. The future for the MBR market is thus generally perceived to be optimistic with, it is argued, substantial potential for growth. This level of optimism is reinforced by an understanding of the key influences driving the MBR market today and those which are expected to exert an even greater influence in the future. These key market drivers include greater legislative requirements regarding water quality, increased funding and incentives allied with decreasing costs and a growing confidence in the performance of the technology.

Available technologies

Currently available technologies have been reviewed by Judd (2006). There are essentially three different membrane process operational modes (diffusion, extraction and rejection, Fig. 2) of which only the latter – the classical biomass rejection mode of operation – has been commercialised. Extractive and diffusive systems are still at the developmental stage and appear to be limited to niche applications. Process configurations include immersed (iMBR) and sidestream (sMBR), of which the former has achieved more extensive market penetration since its commercialisation in the early 1990's due to its lower operating cost than the sidestream mode. Membrane configurations comprise hollow fibre (HF), flat sheet (FS) and multi-tube (MT). The latter are employed exclusively for sMBRs and FS and HFs predominantly for iMBRs.

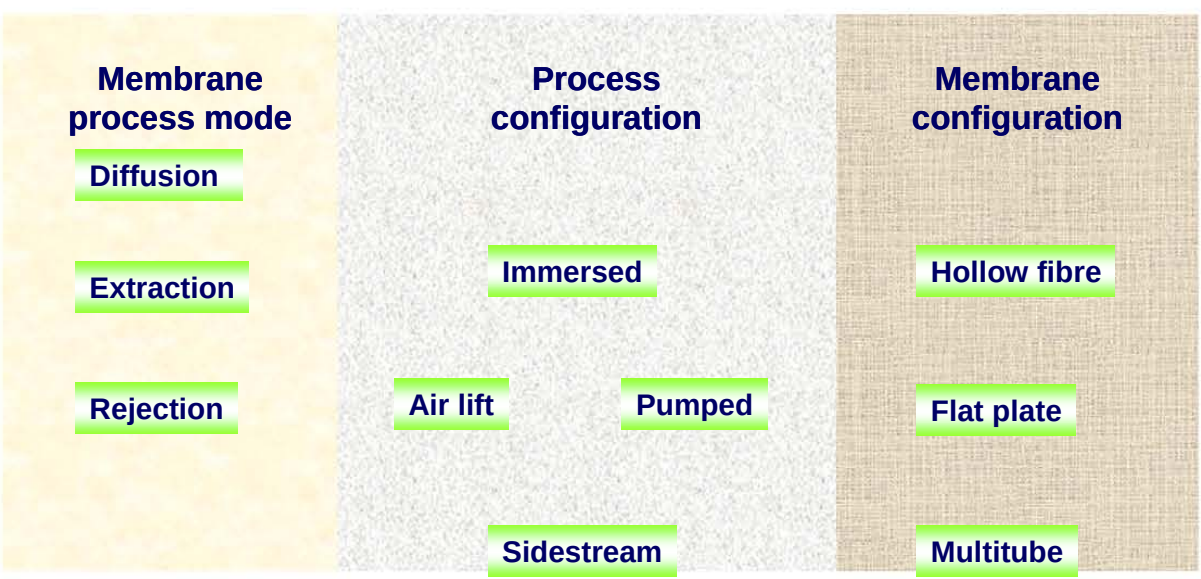

Fig. 2 Membrane and process configurations

Commercial technologies identified by Judd (2006) are listed in Table 1. Whilst this listing is unlikely to be comprehensive, it provides an indication of the dominance of the FS and HF iMBR technologies in the marketplace, accounting for the two leading technology suppliers: GE-Zenon (HF) and Kubota (FS). It should be noted that whilst some membrane suppliers offer a process, typically GE-Zenon, Koch Membrane Systems–Puron and Siemens Water Technologies–Memcor, some suppliers provide only the membrane (e.g. Kubota, Norit-Xflow and Toray). Some companies, such as Wehrle in Germany and Dynatech in the US, provide patented processes based on generic MT membranes for sMBRs. Since around the turn of the Millennium there has been significant market activity, with key acquisitions by some significant multinational companies (Table 2). A number of products (e.g. the *Membright* MBR by Brightwater, Toray's flat sheet membrane, Mitsubishi Rayon's vertical PVDF *SADF* membrane, Huber's *Vacuum Rotating Membrane* and Memcor's *Memjet* system) date back no more than 5-6 years and some products are undoubtedly under development currently and due for launching within the next few years.

Whilst the number of products and suppliers appears to be expanding rapidly, Kubota and GE-Zenon still account for the majority of the MBR installations worldwide. Around half of all MBR global installations (2500-3000) are Kubota, whilst GE-Zenon account for a significant proportion of the installed capacity; the total installed capacity for Zenon is over 1.5 gigalitres a day and they account for 9 of the 210 largest MBR plant worldwide. Having said this, the consolidation in the marketplace indicated by Table 1 suggests that other major players are likely to materialize.

Table 1 Commercial technologies

FS	*HF*	*MT*
Kubota	Asahi Kasei	Berghof
Huber	Siemens Water Technologies-Memcor	Norit X-Flow
Toray	Kolon*	Novasep Orelis (Kerasep)
Novasep Orelis (Pleiade®)	Mitsubishi Rayon	Millenniumpore*
Colloide*	Motimo*	
Brightwater	Polymem*	
ITRI non-woven*	Koch Membrane Systems-Puron	
Microdyn-Nadir*	GE-Zenon	
Han-S*	Ultraflo	
A3*		

**Small companies and/or incipient stages of development*

Table 2 Key membrane company acquisitions since 2000

Membrane company	*Buyer*	*Year*
Zenon	GE	2006
Puron	Koch Membrane Systems	2005
Memcor	Siemens	??
PCI Membranes	ITT	2002

Features of commercial technologies

A summary of some of the technologies is provided in Table 3. As expected, the specific surface area (the membrane area per unit module volume) tends to increase from the FS to the HF configuration, with little change for the FS products and the SSA tending to increase with decreasing filament diameter for the HF products. Across the range of products summarised in the table, a number of generalisations can be made:

All but one **sMBR** technology is based on **pumped MT modules**, the exceptions being:

- the Orelis *Pleaide* FS membrane module,
- the Polymem (and possibly Ultraflo) HF, and
- the Norit/Wehrle air-lift sidestream system.

Almost all **iMBRs** are either:

- **vertically oriented PVDF HF** modules of **outside diameter predominantly between 2 and 2.8 mm**, or
- **FS rectangular membranes 1-1.2m in depth** with a **membrane separation between 6 and 10 mm**,

the exceptions being:

- the Huber VRM rotating membrane module,
- the Mitsubishi Rayon horizontal *Sterapore* membrane, which is a horizontally oriented PE, and
- the Koch-Puron membrane (PES), the Polymem (PS) and the Ultraflo (PAN).

The principal differences between the most common products therefore arises from:

- the membrane and panel substrate materials, in the case of the FS iMBRs,
- the use of reinforcement (for the HF modules), and
- the air-sludge contacting

There are none-the-less some recognisably original features, some of the more striking being:

- the use of a rotating membrane to ensure the whole membrane surface is effectively air scoured (Huber VRM);
- the use of individually sealed hollow fibres to allow debris to be readily flushed from the top of the membrane (Koch-Puron);
- the use of a pressure-sealed system to form a single stack with integral permeate collection channels along the length of the panels (Kubota EM).

Table 3 Membrane specifications

Supplier	*Membrane (Config., material)*	*Pore size, µm*	*Channel width or fibre diameter (spacing), mm*	*Specific surface area, m^{-1}*	*Proprietary name, membrane or module*
Brightwater	FS, PES	0.08	9	110	MEMBRIGHT®
Kubota	FS, PE	0.4	8	115	Kubota
Colloide	FS, PES	0.04	10	133	Sub Snake
Toray	FS, PVDF	0.08	7	135	Toray
Huber	FS, PES	0.038	6	160	VRM
Berghof	MT, PES or PVDF	0.08 0.12	9	110	Hy*Perm-AE* Hyper*Flux*
Millenniumpore	MT, PES	0.1	5.3	180	Millenniumpore
Norit-Stork	MT, PVDF	0.038	5.2 8	320 290	F4385 F5385
Koch-Puron	HF, PES	0.05	2.5 (3.5)	260	Puron
Zenon	HF, PVDF	0.04	1.9 (3.0)	300	Zeeweed 500c,d
Mitsubishi	HF, PE	0.4	0.54 (1.7)	425	SUR Sterapore
Rayon	HF, PVDF	0.4	2.8 (2.9)	333	SADF
USF-Memcor	HF, PVDF	0.04	1.3 (1.4)	600-700	Memjet B10R, B30R
Asahi Kasei	HF, PVDF	0.1	1.3 (1.3)	710	Microza
Polymem	HF, PS	0.08	0.7 (1.1)-1.4	800	Immem
Motimo	HF, PVDF	0.1-0.2	1.0 (0.9)	1100	Flat Plat

Summary

The available commercial MBR technologies largely comprise immersed membrane products of either flat sheet (FS) or follow fibre (HF) configurations. With only a few exceptions, the products do not ostensibly differ greatly in design, although the small differences are sufficient to differentiate one product from another. The main barriers to implementation remain insufficiently well understood phenomena such as fouling, clogging and foaming, and the possibly related impacts of dynamic effects. The latter include changes in MLSS concentration through dilution, hydraulic and organic loading changes, shock loading of onerous reagents (e.g. chlorine, salt) and interruptions in air and power supply. Further incremental improvements can be expected as more is understood about the interrelationship between operation, biomass characteristics and permanent fouling and cleaning, and as membrane costs continue to be driven downwards. More significant “quantum leap” improvements are less easily envisaged, however, and it remains to be seen whether any profoundly original MBR products will arise from current research and development activity.

Rationale

Recent years have seen a significant increase in the number of pilot plant studies based on real sewage feedwaters. A vast number studies, mainly at bench scale, have also been conducted in which hydraulic performance (*i.e.* permeability and/or its rate of decline) has been correlated with specific operating parameters and other system characteristics such as aeration rate or hydrodynamic parameters derived from aeration, biomass concentration or biomass-derived candidate foulant concentration and membrane characteristics. However, it is well-recognised that hydraulic performance elucidated at bench-scale cannot be reliably applied to higher scales. Against this, correlations produced from data derived from different pilot and/or full-scale studies have been rare and, in particular, the bases for cost evaluation, in those instances where such data is produced, are not always clear and rarely the same between different studies.

In this WP the cost issue is addressed through identifying and calculating key unifying normalised parameters across a number of studies within a single simple cost model. The work reported in this progress report focuses on data collated from both pilot trials, including those conducted by two of the partners alongside other published data, and full-scale operating plant. The use of normalised parameters allows data from such a large number of disparate sources to be compared on what is ostensibly a common basis. It is intended that this will provide valuable benchmark information for the EUROMBRA and AMEDEUS programmes as a whole.

As a first step towards producing a practical model based on analytical expressions derived from empirical and heuristic information, the latter must be acquired and collated. The results of this exercise, with information taken from both pilot and full-scale plant, are presented in this report.

Data acquisition

An opportunity was taken to conduct the review of both literature pilot plant comparative data and full-scale operating plant for the forthcoming reference book (Judd, 2006) to substantially supplement data from the pilot plant studies conducted by two of the partners (Annexes 1-2). Data from long-term pilot trials has been provided by two of the collaborators, and data from two of the case studies were provided by two other collaborators. Data has been acquired from a number of sources, including five published pilot-scale studies (Table 4) and 16 full-scale operating plants.

Table 4 Comparative pilot plant trials

Technology tested	Reference				
	Adham et al (2005)	*van der Roest et al (2002)*	*Tao et al (2005)*	*Trento Annex 2*	*Eawag Annex 2*
Zenon	X	X	X	X	X
Kubota	X	X	X	X	X
Mitsubishi Rayon	X	X	X		X
Norit X-Flow	-	X	-		
Memcor	X			X	

Data summary, MBR plant

Data from the pilot trials (Table 5) and case studies (Table 6) have been processed to produce the key operating and primary normalised parameters for each plant. It should be noted that the data provided refer to the *mean* values provided by the plant operator, and they are therefore subject to significant temporal, diurnal and seasonal variation.

Table 5 Summary of pilot plant SAD data, four common MBR technologies

Technology	*J, LMH*	*K, LMH/bar*	*R_M, $Nm^3m^{-2}hr^{-1}$*	*R_V*	*Source*
Kubota	8.3-12.5	500-500	0.75	60-90	van der Roest et al, 2002
	32.5-42[1]	350[1]	0.75[1]	60-90[1]	van der Roest et al, 2002[1]
	25	250	0.6	24	Adham et al, 2005
	26	650[2]	0.67-1.2	28-50	Tao et al, 2005
	18-25	200-500	0.67-1.2	28-50	Tao et al, 2005
	15-16	261-320	0.7-0.98	19-79	Trento[3]
	9.5	200	1.5	88	Eawag
M. Rayon	5-8	200	0.28-0.38	48-56	van der Roest et al, 2002
	20[1]	140-150[1]	0.28-0.38[1]	12-14[1]	van der Roest et al, 2002[1]
	20-25	140	0.9-1.14	45	Adham et al, 2005
	16-24	66[2]	0.38-0.58	16-24	Tao et al, 2005
	4.8	90	0.37	38	Eawag
Zenon	20	200-250	0.54	27	van der Roest et al, 2002
	35[1]	200-250[1]	0.54[1]	15[1]	van der Roest et al, 2002[1]
	37.2	270	0.52	14	Adham et al, 2005
	6.2-29.6	124[2]	0.25-0.37	20-30	Tao et al, 2005
	16-31	61-120	0.33-0.38	12-27	Trento[3]
	10	200	0.54	28	Eawag
Memcor	20-40	150	0.39	10-20	Adham et al, 2005
	21-22	182-270	0.2	17-22	Trento[3]

[1]peak loading conditions; [2]initial permeability; [3]range refers to mean-optimum

The key normalised parameters to which the data refer are:

$$K = \frac{J_{net}}{\Delta P} \tag{1}$$

$$R_M = \frac{Q_{A,m}}{A_m} \tag{2}$$

$$R_V = \frac{Q_{A,m}}{JA_m} \tag{3}$$

where K is the permeability (l m^{-2} hr^{-1} bar^{-1}), J_{net} is the net flux (l m^{-2} hr^{-1}), ΔP the transmembrane pressure (bar), $Q_{A,m}$ the aeration rate per membrane module or element, and A_m the membrane module or element area. R_M (Nm^3 m^{-2} hr^{-1}) and R_V (Nm^3 m^{-3}, or unitless) then both represent the **aeration demand**: the air flow rate normalised against membrane area and permeate flow rate respectively.

Table 6 Summary of full-scale plant specific aeration demand data

Technology	Capacity MLD	Flux LMH	K LMH bar^{-1}	R_M^2, Nm^3 $m^{-2}hr^{-1}$	R_V^2 -	MLSS g/L
FS (Flat Sheet)						
Kubota	1.9	20	350	0.75	32	12-18
	13	33	330	1.06	32	8-12
	4.3,s	25	680	0.56	23	na
Brightwater	1.2	27	150	1.28	47	12-15
Toray	0.53	25	208	0.54	22	6-18
	1.1,i	21.6	1500	0.4	19	22
Huber	0.11	24	250	0.35	22	ns
Colloide	0.29	25	62.5	0.5	20	ns
HF (Hollow Fibre)						
Zenon	2	18	95	1	56	15
	48*	18	144	0.29	16	8-10
	0.15*,i	12	71	0.65	54	10-15
	3.2	26	300	0.44	17	14
	48*	24	200	0.40	17	12
M. Rayon	0.38	10	30	0.65	65	12
USF Memcor	0.61	16	150	0.18	11	12
Asahi-kasei	0.9, i	16	80	0.24	15	8
KMS Puron	0.63*	25	160	0.25	10	ns
Polymem	-	10-20	ns	0.15-0.25	13-25	ns

*intermittent/cyclic aeration, i – industrial effluent feedwater, ns – not specified, s - stacked

Summary and future work

The data provided and summarised in this report is be used for the model defining operating costs in an MBR. The model will combine empirical expressions relating flux or permeability with aeration demand, using the values for SAD garnered from pilot plant and full-scale data. Thus far summary data from 16 full-scale case studies and five comparative pilot trials have been surveyed for use to provide the relationship between feedwater quality and cost for specific membrane configurations.

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Annex 1 Pilot plant report: Pietramurata, University of Trento

In the trials conducted by the University of Trento at Pietramurata wastewater treatment plant in Italy the plants tested were originally Zenon and Kubota. More recently a Memcor plant has also been studied. The first plant installed in June 2001 consisted of two separate MBRs whose biotreatment tanks were provided by dividing a single rectangular stainless steel tank into two separated treatment lines for a Zenon and Kubota MBR, both configured with pre-denitrification. All experimental activities on site have been performed between March and December; the whole system is outdoors and the ambient temperature is too low to operate during the winter months.

The biological volume was calculated according to a rather conservative flux value of 15 LMH resulting in volumes of 5.14 and 4.23 m^3 for the aerobic tanks, and 2.76 and 2.27 m^3 for the anoxic tanks for the respective Zenon and Kubota processes. The permeate is removed by suction, originally using progressing cavity (*Mono*) pumps but a self-priming pump was installed in 2003. A PC pump is also used for recirculation from the aerobic to the anoxic tank at recycle ratios between 3 and 5. Aeration for the biological process is supplied to both aerobic tanks from the main aeration pipe of the full scale plant and is measured by specific air flow meters. The Zenon/Memcor and Kubota systems were operated under different SRTs, imposed by daily sludge wasting. All the usual operating parameters have been monitored (TMP, DO, etc.) and, since this effluent is re-used for agriculture, from 2004 onwards the effluent nitrate concentration from the Zenon plant has been measured.

Membrane modules originally installed comprised a Zenon 500c (66.6 m^2 membrane surface area) and a Kubota E50 (40 m^2 of membrane surface area). In November 2003 a new hollow fibre module (US-Filter Memcor) was installed as a side-stream to the Zenon MBR tank. The module, 40 m^2, was immersed in a tank (0.3 m^3) and fed with sludge from the aerobic tank and fed back to it under gravity. Due to this special combination, the permeate flow suctioned from both HF lines was often reduced to avoid excessive organic loading of the biological system. Simultaneous short and long term flux-step tests on both systems were likewise also avoided. Due to some technical and budgeting problems, operation of some modules was stopped for long periods; the Zenon module was not used during 2003 and the Kubota module was not used during 2005. In 2005 the Memcor module was operated for a few weeks on biomass previously acclimatised by the Zenon module. The aerator depth was 1.9-2.0m for the Zenon and Memcor modules and 2.4m for the Kubota stack.

During 2002 the Zenon module was cleaned monthly using 300 mg/L NaOCl as Cl_2. From 2004 onwards the concentration for the monthly clean was reduced to 200 mg/L. From 2002 to 2003 the Kubota module was cleaned twice yearly with 3000 mg/L (i.e. 0.3 wt%) NaOCl as Cl_2 and once a year with a 10,000 mg/L (1 wt%) solution of oxalic acid. From 2004 the module was cleaned monthly with a 200 mg/L NaOCl solution with no additional acid cleaning. The Memcor module was cleaned monthly using 300 mg/L NaOCl. For all three modules the membranes were additionally cleaned using 100 mg/L NaOCl immediately before each flux step test.

The mean feed COD and $N\text{-}NH_4^+$ levels were 575-988 and 23-33 mg/L respectively, with the BOD/COD ratio generally being <0.5. The corresponding outlet concentrations were <22 and <5 respectively, with the TON being below 11 mg/L at all times. Summary data are provided below.

Table 7 O&M data: data summary

Parameter	*No.*[1]	*Zenon*		*Kubota*		*Memcor*	
Membrane aeration rate, Nm^3/h	1-2	16.7	25.0	38	46	8	
	3	25.0	25.0	38	46	8	
	4	-	-	38	46	-	-
	5	-	-	28		-	-
Cycle, mins	1-2	9 on / 1 off		9 on / 1 off		9 on / 1 off	
	3	9 on / 1 off		8 on / 3 off		-	-
	4	-	-	9 on / 1 off		-	
	5	-	-	continuous		-	-
Net flux, LMH^2	1	7.2	28.8	6.3	28.4	9	31.5
	2	9	30.6	7.6	11.9	21.6	
	3	8.6	14	6.9	16.7	-	-
	4	-	-	8.6	9.5	-	-
	5	-	-	16	37.5	-	-
HRT, h	1	4.1	16.5	10.7	42.9	4.5	14
	2	4.5	14	18.1	18.1	11	
	3	10	13.4	10	22	-	-
	4	-	-	18		-	-
	5	-	-	5.5	8	-	-
SRT, d	1	35		40		8	20
	2	8	20	8		15	
	3	15		20		-	-
	4	-	-	12		-	-
	5	-	-	9	12	-	-
DERIVED DATA							
Permeability LMH/bar	1	144	144	630	81	250	58
	2	138	61	167	264	300	200
	3	123	108	276	239	-	-
	4	-	-	264	271	-	-
	5	-	-	320	100	-	-
SAD_m, $Nm^3/(h.m^2)$	1	0.25	0.375	0.95	1.2	0.2	
	2	0.25	0.375	0.95	1.2	0.2	
	3	0.375	0.375	0.95	1.2	-	-
	4	-	-	0.95	1.2	-	-
	5	-	-	0.7		-	-
SAD_p, m^3 air/m^3 permeate	1	35	13	37	136	5.7	20.0
	2	28	12	87	113	8.3	
	3	44	27	50	100	-	-
	4	-	-	110	100	-	-
	5	-	-	19	44	-	-

[1]Trial number; trials range between 2 and 9 months in duration
[2]Temperature-corrected to 20ºC

Table 8 O&M data: most optimum and mean

Parameter	*Zenon*		*Kubota*		*Memcor*	
	Opt[1]	***Ave***	*Opt*[1]	***Ave***	*Opt*[1]	***Ave***
HRT, h	14	**10**	6	**17**	11	**10**
SRT, d	20	**21**	9	**17**	15	**14**
Membrane aeration rate, Nm^3/h	25	**22**	28	**39**	8	**8**
Cycle, mins	**9 on / 1 off**		**-**[2]		**9 on / 1 off**	
Flux, LMH	31	**16**	16	**15**	22	**21**
Permeability, LMH/bar	61	**120**	320	**261**	270	**182**
SAD_m, $Nm^3/(h.m^2)$	0.38	**0.33**	0.70	**0.98**	0.20	**0.20**
SAD_p, m^3 air/m^3 permeate	12	**27**	19	**79**	22	**17**

[1]conditions employed under which the highest fluxes and lowest aeration rates were sustained
[2]9 on / 1 off routinely, continuous operation for final trial

Annex 2 Pilot plant report: Eawag pilot plant MBR, Kloten/Opfikon

Eawag (The Swiss Federal Institute of Aquatic Science and Technology) is a Swiss national research organisation committed to ecological, economical and socially responsible management of water. A pilot scale MBR was set up and operated continuously for 4 years by the engineering department of Eawag to gain hands-on experience of running such plants. The test protocol incorporated the study of the impact of membrane maintenance protocols, SRT and chemical flocculants on performance with reference to three different MBR technologies. The pilot plant was also used for studying the fate of micropollutants in an MBR compared with conventional technologies.

The pilot plant is located on the municipal sewage treatment plant of Kloten/Opfikon, a conventional activated sludge plant with an average dry weather flow of 17±4.3 MLD (55,000 p.e; maximum flow 645 l/s). This plant receives sewage from Zürich airport (~50% of the influent flow) and from the nearby towns of Kloten and Opfikon. The pilot plant is fed with primary effluent (Table 6) from the full scale plant following primary treatment, comprising screening at 10mm, a sand/oil trap and primary clarification at 2h HRT). The flow rate was proportional (~0.2%) to the full scale facility. The volume of wastewater treated was 30±12 m^3/d, with a maximum daily flux of 74 m^3/d.

Table 9 ***Feedwater quality*** (value ± standard deviation)

Parameter, mg/l	*MBR feed (after primary clarification)*
Ammonia-N	21±5 mgNH_4^+-N L^{-1}
BOD_5	not available
COD	282±91 mgCOD L^{-1}
TOC	not available
TKN	38±9 mgN L^{-1}
Ortho-Phosphate-P	2.1±0.7 mgP L^{-1}
P total	4.2±1.3 mgP L^{-1}

The pilot comprises a cascade of 2 to 6 tanks (Fig. 4), each of 2 m^3 volume, providing anaerobic and anoxic treatment at recycle rates of 80±30 and 50±23 m^3/d respectively and at mean sludge concentrations of around 4.8 g/l. Aerobic treatment at mean MLSS concentrations of between 7 and 8.3 g/l was coupled with membrane separation in discrete compartments, operated in parallel and providing a membrane area of between 40 and 80 m^2 (Table 8), all modules being single-deck. 4 phases of work can be identified:

- 1st year (day 1 to 385): 17±2 d sludge age, 8 m^3 anaerobic volume
- 2nd year (day 410 to 745): 32±3 d sludge age, 6 m^3 anaerobic volume
- 3rd year (day 770 to 1090): 58±10 d sludge age, 6 m^3 anaerobic volume
- 4th year (day 1090 to 1510): 56±11 d sludge age, no anaerobic volume, Fe^{3+} addition

Table 10 ***Design information*** (value ± standard deviation)

	Kubota	*Zenon*	*Mitsubishi Rayon*
Tank size, m^3	2.6	1.6	1.9
Sludge recycle ratio	1.3±0.5	1.2±0.5	1.3±0.5
Sludge content, gSS/L	8.3±3.4	8.2±3.5	7.0±2.9
MEMBRANE			
Type	0.8 m^2 panels	ZW500a	Sterapore SUR
Configuration	50 panels	1 module	80 x 1m^2
Total membrane area, m^2	40	46	80
Net permeate prod., m^3/d	9.1±3.9	11±4.5	9.4±3.8
Max. permeate prod., m^3/d	25.4	28.7	24.2

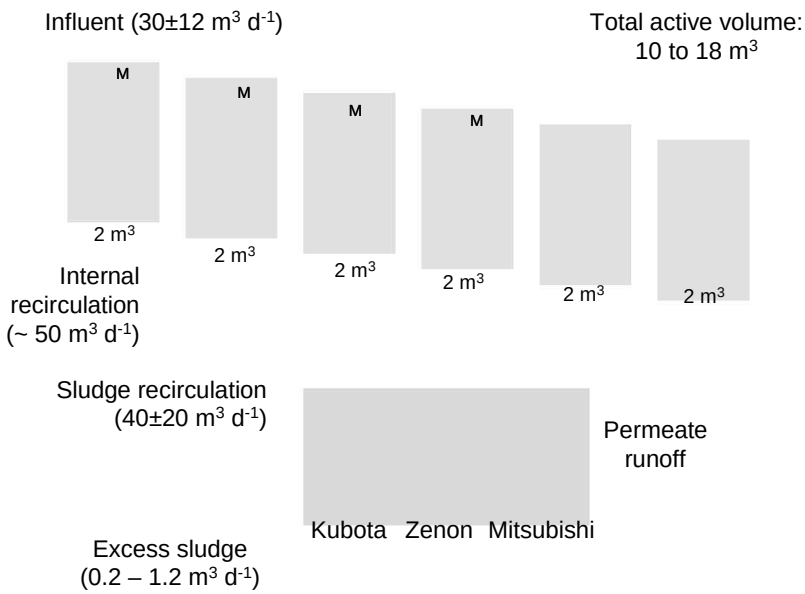

Figure 1 ***Pilot plant operated at Eawag***

Data for the three technologies (Table 9) indicate considerable changes in permeability (Fig. 5), particularly for the Kubota module. Permeability fluctuations for this membrane did not appear to correlate with operational changes such as cleaning protocols. For the Zenon module permeability correlated roughly with MLSS concentration in the membrane compartment from the start of operation until January 2004. The permeability increase from January 2004 onwards correlated with the introduction of regular maintenance CIPs (Table 10) every 14 days with 150 ppm NaOCl followed by a citric acid clean pH 2.5.

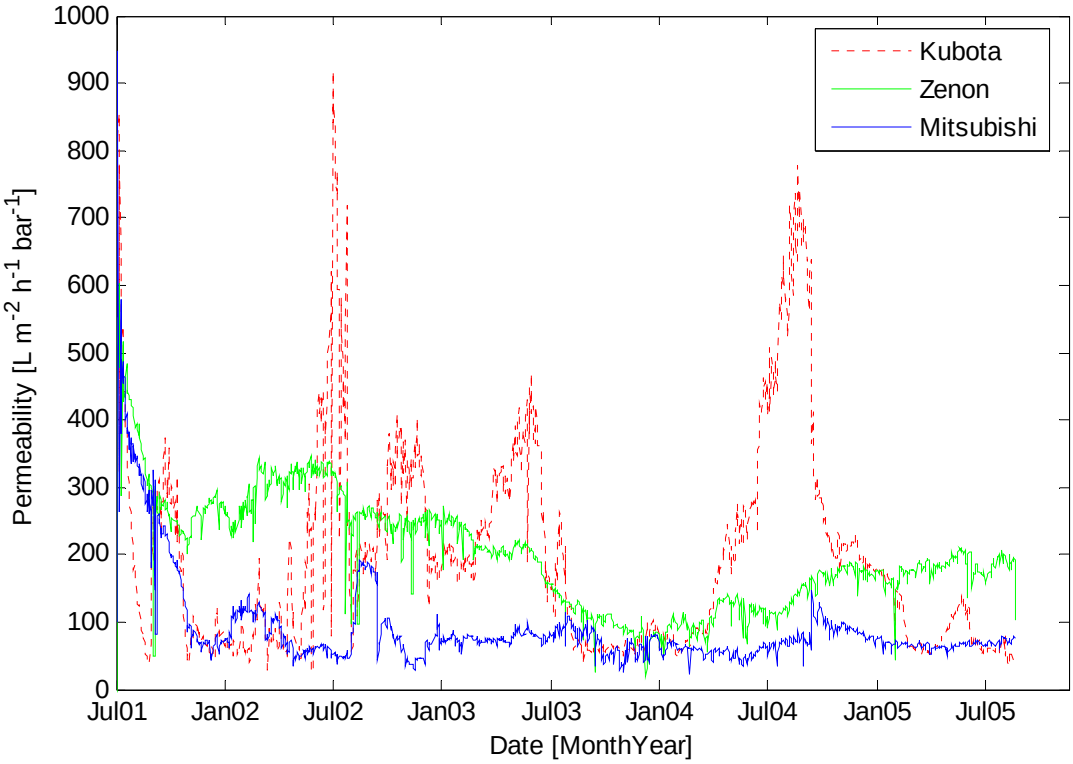

Figure 2 ***Permeability of the modules as observed during the total operation time of the MBR pilot. Data corrected to 20°C according to viscosity correction.***

Table 11 ***O&M data***

	Kubota	*Zenon*	*Mitsubishi Rayon*
Membrane aeration rate, Nm^3/h	60±4	50±5, air cycling on/off 10s/ 10s	29±4
Cycle, min	8 on / 2 relax	5 on / 0.5 bflsh.	8 on / 0.5 bflsh. +1.5 relax
Ave. net flux, LMH	9.5±4	10±4	4.8±2
Gross flux, LMH	17±4	19.5±3	10±2
Fine bubble aeration rate, Nm^3/h	0 - 10	0 - 10	0 - 10
HRT, h**	3±1.3	1.9±0.8	1.9±1.1
SRT, d	15 - 67	15 - 67	15 - 67
MLSS, g/L	8.3±3.4	8.2±3.5	7±2.9
DERIVED DATA			
SAD_m, $Nm^3/(h.m^2)$	1.5	0.54	0.37
SAD_p, m^3 air/m^3 permeate	88	28	38
$TSAD_p$, m^3 tot. air/m^3 perm.	88-90	28-38	38-48
Mean permeability, LMH/bar	200±160	200±83	90±70
Cleaning cycle time[2], d	variable	variable, 14d	variable

**HRT in the membrane compartment only

The Mitsubishi Rayon unit provided a low permeability throughout the study due to clogging of the hollow fibres by dehydrated sludge. Several measures taken to ameliorate this problem, such as overnight relaxation and intensive or regular chemical cleaning, were unsuccessful. Regular backflushing for 30s during each permeate production cycle, as applied to the Zenon module, provided a stable low permeability. No difference in efficacy of maintenance cleaning at low hypochlorite concentrations “in air” rather than in place was noted.

Table 12 Cleaning protocols for the four MBR technologies

	Kubota	*Mitsubishi Rayon*	*Zenon*
Reagents used	NaOCl, 150 – 2000 mg/L Citric acid pH 2.5	NaOCl, 150 – 1000 mg/L Citric acid pH 2.5	NaOCl, 150 – 1000 mg/L Citric acid pH 2.5
Established protocol	-*	-*	Maintenance clean, 150 mg/L NaOCl and citric acid clean every 14 days.

*no protocol tested yielded satisfactorily reproducible results.

Maintenance cleaning in place was conducted through backflushing for 20-30 minutes using 150 mg/L NaOCl followed by an acid clean at pH 2.5±0.5. For hollow fibre membranes the backflush (1.5 times the maximum operating flux) was applied intermittently with 20-30 second pulses at applied at 5 minute intervals. FS membranes where backflushed continuously under gravity at a maximum hydrostatic head of 0.1 bar (the limit recommended by the supplier is 0.2 bar). Chemical usage per backflush was between 2 L/m^2 for the HF membranes to 5 L/m^2 for the FS ones. Intensive (recovery) cleaning was through soaking the membranes for 3-6 hours in a high-strength (0.1-0.5 wt%) NaOCl solution with pulsed aeration combined with suction for 5-10 seconds every 20 minutes. For hypochlorite significant foam formation took place due to the organic matter present. The amount of chemical solution required depended on the packing density of the membrane, but appeared to be in the range of 200-100 L/m^2. Care was taken to drain the membrane of hypochlorite before applying the acid wash of 0.5 mM sulphuric acid together with a 5 mM citric acid buffer, the mineral acid being used to counter the alkalinity and the citric acid to stabilise the pH at 2.5.

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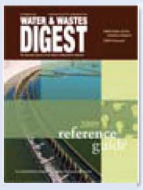

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Global Market for Membrane Bioreactors Worth $488 Million by 2013

Market has grown steadily since 1990, when it was worth only $1 million

July 25, 2008

According to a new technical market research report, "MEMBRANE BIOREACTORS: GLOBAL MARKETS (MST047B)" from BCC Research, the global market for membrane bioreactor technology is expected to grow at a compound annual growth rate (CAGR) of 10.5%, increasing in value from $296 million in 2008 to $488 million by 2013.

The global market for membrane bioreactor (MBR) technology for wastewater treatment has grown steadily since 1990, when it was worth only $1 million. Growth rates of MBR systems are not the same for all world regions and are not increasing from the same base. Common to all regions, however, is the fact that sales of the technology are growing faster than the gross domestic products of countries installing the systems and more rapidly than the industries that use them.

Municipal/domestic wastewater treatment was the earliest application of MBRs and is still the largest application, accounting for 44% of all systems. During the forecast period, sewage treatment will continue to be the primary use for MBR systems. A trend toward larger capacity municipal plants is prevalent in the U.S. and Europe. However, satellite wastewater plants for smaller communities, housing developments, tourist resorts, schools, shopping centers, etc. also are in demand. Growth in this sector is expected to increase in all world regions, driven by the adoption of MBRs for treating numerous small domestic waste streams.

In the earth's hydrologic cycle, fresh water supplies are fixed and constant, while global water demand is growing. With each passing year, the quality of the planet's water measurably deteriorates, presenting challenges for the major users: the municipal, industrial and environmental sectors. MBR systems have emerged over the past 10 years as an effective solution to transforming various wastewaters into high-quality effluent suitable for discharge to the environment and increasingly into a reusable product.

Source: *BCC Research* July 25, 2008

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Waterscapes

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MBR 101

By Guillermo Garcia, P.E.

As a result of the Clean Water Act, many of our nation's wastewater treatment facilities were upgraded in the late 1970s and early 1980s to meet secondary treatment standards. Today, in addition to replacing aging equipment, municipalities have to contend with population growth, stringent and ever-changing regulations, tight capital improvement and operation and maintenance budgets, and new wastewater technologies.

A relatively new and evolving technology is the use of membranes in wastewater treatment applications. Research combining membranes and wastewater treatment started more than 35 years ago with the first commercial applications appearing in the mid 1980s. In a conventional activated sludge process, the liquid-solid separation takes place in secondary sedimentation tanks, where the process depends on the settling characteristics of the activated sludge and sedimentation basin design. With membranes, the liquid-solid separation is a function of pore size. Currently the membranes can be categorized in four groups depending on pore size. Combining microfiltration or ultrafiltration membranes with a biological process results in a membrane bioreactor, commonly known as MBR. The other two types of membranes, nanofiltration and reverse osmosis, have been widely used in the water industry for many years and now are beginning to emerge as an additional process to remove dissolved salts from MBR effluents.

Information provided by four MBR membrane manufacturers shows a rapid increase in both the number of facilities using MBR technology and the size of facilities in which MBRs are being used. The capacity of older facilities is usually less than 0.2 million gallons per day (mgd), increasing in capacity during the last five years up to 6.0 mgd with other facilities either in construction or final design capable of treating up to 47.0 mgd. There is no doubt that MBR technology is here to stay. The question is whether MBR technology is cost-effective for a particular facility.

The answer to that question should be based on economics and regulatory compliance. This is best illustrated by two HDR projects where these factors were considered in developing the recommended project.

Improving performance and capacity at an extended aeration plant

In 1999 HDR was retained by a Southern California gaming facility to evaluate the operation of their extended aeration wastewater treatment plant, which was unable to meet strict effluent water quality standards mandated by the local regulatory agency. The facility, with a rated capacity of 150,000 gallons per day average flow, was unable to meet the required effluent quality when flows exceeded 70,000 gallons per day average flow. The study concluded that the facility was unable to meet discharge requirements due to wide variations in flow rates and organic loading, and the rapidly increasing flows generated by the gaming facility.

To improve treatment plant performance and capacity, HDR evaluated various treatment processes for their ability to:

- Handle wide variations in flow and organic loading,
- Maximize use of existing facilities,
- Maximize use of available land,
- Be designed and constructed under an accelerated schedule, and
- Facilitate implementation of a future water recycling project.

The various treatment alternatives evaluated included a parallel extended aeration train, a new conventional activated sludge plant, a sequential batch reactor using existing tanks, and an MBR also using existing tanks.

The engineering evaluation concluded that the best treatment process for meeting the client's objectives was the MBR process. However, additional work was required to assure the client and consulting engineers that indeed this relatively new process was going to be a success. To this end, the team visited MBR facilities outside the United States, reviewed operation and maintenance data and interviewed treatment plant operators. The consensus was to use the MBR process provided that the project specifications included equipment performance bonds, extended performance guarantees and extended membrane guarantees. The completed project included the following results:

- The membrane and associated equipment is modular, which facilitated subsequent treatment plant expansions. Now the facility is rated for 300,000 gallons per day average flow. The rated treatment capacity was achieved using the same tanks as the original extended aeration plant.
- The process is producing effluent with turbidities about one-tenth the limit set by California's Administrative Code Title 22 standards for recycled water. This is accomplished without secondary sedimentation, flocculation, coagulation and filtration.
- The process can handle large fluctuations in organic loads.
- Sludge production is lower than extended aeration activated sludge.
- The membranes remove a significant portion of total coliform bacteria, thus chlorine demand in the disinfection process is significantly reduced.

Improving performance at an activated sludge plant

Early this year, HDR was retained by a Southern California agency responsible for wastewater treatment and disposal facilities serving a community of 30,000 people. The existing facility, rated for an average flow of 4.5 mgd, is a conventional activated sludge plant using irrigation fields and percolation ponds for effluent disposal. Until recently, the solids generated by the treatment process were aerobically digested and land applied to the irrigation fields. This practice contributed to high nitrogen concentrations found in the groundwater basin underlying the treatment plant site. Recently, the regulatory agency issued a cease-and-desist order prohibiting on-site solids disposal and it is anticipated that the revised waste discharge permit would limit total nitrogen effluent concentrations to 5 milligrams per liter (mg/L) or less.

Preliminary work indicates that the treatment capacity of the existing facilities would be de-rated from 4.5 mgd to 3.4 mgd once the activated sludge process is modified to operate in the nitrification-denitrification mode, and that additional facilities would be required to bring the treatment plant capacity back to 4.5 mgd and reduce the total nitrogen concentration to 5 mg/L or less. MBR is one of the technologies being evaluated to identify the recommended project. Conventional treatment process modifications required to maintain treatment capacity and meet the anticipated total nitrogen limit may require additional primary, aeration and secondary sedimentation tanks plus filters to remove organic nitrogen.

The MBR alternative being evaluated will not require additional tanks and would allow the existing shallow rectangular secondary sedimentation tanks to be converted into a chlorine contact tank. The basis of the recommended project would be the results of an economic analysis comparing MBR and nitrification-denitrification followed by filtration. Other issues that will be factored into the evaluation include anticipated wastewater treatment plant expansions to meet projected population growth and the desire to recycle plant effluent for landscape irrigation.

Summary

For the most part, municipalities that need to increase treatment capacity, improve effluent quality or consider a water recycling program will be confronted with challenges similar to those illustrated by the above examples. The following facts about MBR can help municipalities make an informed decision.

- MBR technology continues to evolve at a rapid pace. Now that MBR operating and maintenance data are available, municipalities and the engineering community are no longer concerned about being the first ones to try something new.
- MBR can be economical when high-quality effluent is required. The process achieves a superior effluent quality with fewer treatment processes. In water reclamation, secondary sedimentation tanks are eliminated and there is no need for coagulation, flocculation and filtration. The cost for disinfection is reduced because membranes remove pathogens to higher levels than other treatment technologies.
- MBR eliminates the need for several treatment processes thereby requiring less space than other treatment technologies to produce the superior effluent quality.
- A well-planned facility using MBR can easily be expanded by adding membrane modules.
- MBR generates fewer solids than conventional processes to produce a higher quality effluent.
- The MBR process is very forgiving and thus requires less operator interaction.
- The MBR process is well suited for retrofits where existing tankage can be modified to fit the process.
- The seven commercially available MBR systems use different membrane pore size, methods to clean the membrane, methods to withdraw permeate, hydraulic loading per square foot of membrane surface area and membrane configuration. This represents an additional challenge with the equipment procurement process and the detailed design. The approach used most often is to pre-select a membrane equipment supplier before embarking on the detail design.

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BY ANTONIA VON GOTTBERG, DARREN LAWRENCE, AND CHRISTOPH KULLMANN

MBR Technology for Wastewater Reclamation in Rural Areas

Bega Valley Shire, approximately 450 miles south of Sydney, Australia, is the largest local government in coastal New South Wales and has a population of more than 30,000 people.

The capacity of the valley's wastewater treatment systems was being stretched by urban growth as well as by seasonal population increases. Four villages in the valley without sewer service were at risk for environmental and public health issues as a result of discharge from septic tanks.

The Bega Valley Shire Council and Tenix Alliance, a company that provides services to Australia's and New Zealand's utility markets, worked together to solve these problems. The resulting Bega Valley Sewerage Program upgraded five existing sewage treatment plants to biological nutrient removal facilities and installed new pressurized sewage collection systems coupled with membrane bioreactor (MBR) treatment plants in the towns of Cobargo, Wolumla, Kalaru, and Candelo. The program also includes operation and maintenance of the new and existing sewage treatment plants for 10 years, with an option for the council to extend the agreement for an additional five years. All collection systems will remain the responsibility of the council. (For more information about the BVSP, visit www.bvsp.com.au.) The Cobargo MBR plant was commissioned in July 2006, and the three remaining plants went on line in 2007.

The BVSP is designed to keep capital and operating costs at a minimum and to produce a very-high-quality effluent for reuse. Reclaimed water from the upgraded plants will be used at golf courses adjacent to the plants and at a nearby dairy farm. Reclaimed water from the MBR plants will replace potable water as the primary source of irrigation water for public facilities such as the Cobargo Showground, Wolumla Recreation Reserve, Candelo Showground, and the Sapphire Coast Turf Club. In the future, water reclaimed from the plants may also be used for a car wash as well as for flushing toilets.

MBR PROCESS REDUCES PLANT FOOTPRINT, PROVIDES SAVINGS

In an MBR, ultrafiltration (UF) membrane modules are submerged in the activated sludge to combine the biological step and the solid–liquid separation step into a single process. The membrane acts as a barrier, which improves the effluent quality. In addition, this barrier eliminates the necessity for secondary clarification and allows the activated sludge to be more concentrated. This reduces the volume requirement for biological tanks, thus saving space and construction costs. The MBR process reduces the overall plant footprint significantly compared with wastewater treatment followed by sand filtration or UF. The footprint savings attributable to the wastewater treatment plant alone can be as much as 50%. Because there are no additional tertiary filtration steps, there are additional footprint savings.

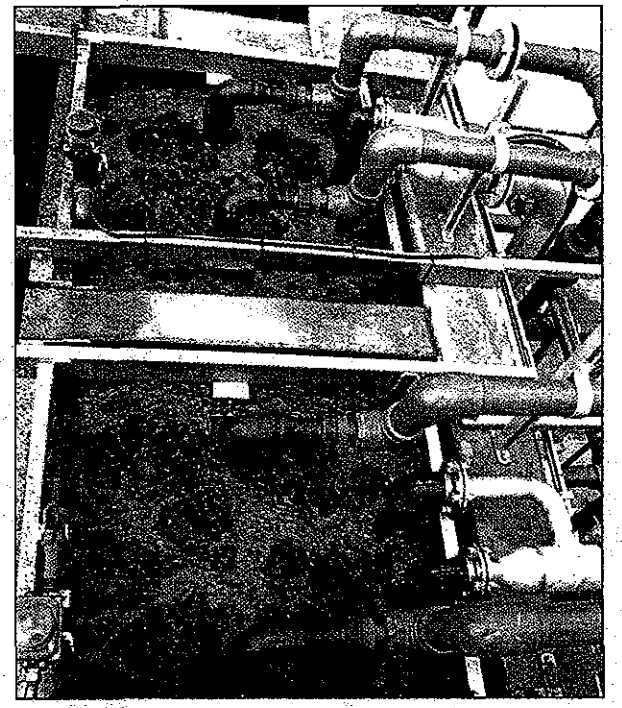
There are many different configurations of MBR technology. One example that optimizes both membrane and module design is the PURON™ submerged hollow-fiber UF module from Koch Membrane Systems of Wilmington, Mass. The patented module is designed to avoid the clogging and sludging that are issues with some MBR module designs. The module features hollow-fiber membranes with a pore size of approximately 0.05 µm. The lower ends of the membrane fibers are fixed in a header while the upper ends are individually sealed and free to move laterally. All solids

and particulates remain on the outside of the fibers while permeate is pulled from the inside of the fibers by means of a vacuum.

The fibers are arranged in bundles and are submerged vertically into the activated sludge. To maintain the filtration rate of the membrane modules, air-scouring is carried out at regular intervals. An air nozzle is integrated into the center of the bundles to apply the air for scouring purposes. The central arrangement of the air nozzles inside the membrane bundles reduces energy consumption because the air is injected at the point at which the risk of sludging is highest. The module design ensures that even hairs and fibrous compounds will be removed reliably from the system so that a coarse prescreen can be used, thus improving capital and operating costs. A special added feature of these membranes is their high degree of mechanical strength, which is provided by a braid inside the membrane material.

The individual fiber bundles are connected in rows. Several of these rows are mounted into a frame made of stainless steel to form a module. The free-moving fibers combined with central aeration ensure stable filtration during plant operation, long membrane life, and low operating costs by reducing the need for energy, cleaning, and maintenance.

The four MBR systems installed in the Bega Valley are identical, which resulted in significant cost savings for the council and the communities. Each plant has a footprint of approximately 66 × 49 ft and is designed for 800 people equivalents or an annual average flow of 180 m^3/d (47,000 gpd). Each system includes two modules, each with 235-m^2 of capacity. The maximum daily flow is 300 m^3/d (80,000 gpd), and the peak hourly flow is 360 m^3/d (95,000 gpd). Each plant includes prescreening with 3-mm perforated plate screens followed by a biological treatment system with nitrification and denitrification. The UF membranes are submerged in the mixed liquor and are used to separate the treated wastewater from the suspended solids.



To maintain the filtration rate of the membrane modules, air-scouring is carried out at regular intervals.

MBRs WORK WELL FOR RURAL AREAS

There are a number of reasons MBR technology can be an appropriate choice for rural areas. MBR systems provide excellent water quality without the risk of problems that can occur with a secondary clarifier. Additionally, an MBR system can operate with minimal supervision but still guarantee water of high-enough quality for reuse. Many MBR systems in remote areas are designed with a supervisory control and data acquisition system, which allows off-site access to the data, and are set up to have an operator visit the plant daily or weekly to perform checks, do routine maintenance, and top off chemical tanks. Because MBR systems are modular, they can be designed to easily accommodate additional future demand.

MBR systems occupy approximately half the footprint of a more conventional wastewater treatment plant, making them less visible to the community. If desired, an MBR system can be installed so that it completely blends into the landscape. For example:

- in a farming community, the MBR could be installed inside a building that looks like a barn;
- in a park, the MBR building could be built partially underground with landscaping over the building so that it is visible only at access points; or
- in a small town, the MBR could be installed inside a building that looks like a typical house in the town.

As in the four villages in Bega Valley, many rural areas derive income from tourism. MBR technology helps support this revenue stream by supplying high-quality water while keeping a low profile in the environment. Because of the high quality of the discharge water produced by MBR systems, some rural communities have selected this technology in order to maintain the quality of their streams, rivers, and lakes. The quality of MBR effluent is so high that it can also be recycled to provide additional water to the community to meet increased demand.

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Getting Through Membrane Technology

Membrane Technologies Are Becoming Part of a Growing Number of Treatment Facilities

Having appeared more than 25 years ago, the use of membranes in the treatment of wastewater has surged dramatically in the past decade as economic and technologic barriers have diminished and new regulatory and customer demands have increased.
Facilities that were once the exception have been joined by hundreds employing membranes to enhance or perform a variety of treatment applications. From removal of colloidal or suspended solids to reduction of pathogens, new membrane processes hold the potential to significantly improve traditional wastewater treatment and prepare effluent for many different uses.

Several large treatment facilities in the United States are using microfiltration and ultrafiltration for primary disinfection and particle removal. Microfiltration has proven effective in removing bacteria, Giardia, and Cryptosporidium; utlrafiltration removes even smaller contaminants, such as viruses and dissolved organics. On a smaller scale, nanofiltration and reverse osmosis are proving to be effective tools in removing inorganic chemicals, such as nitrates, synthetic organic chemicals, and various byproducts generated in the disinfection treatment process.

Communities in arid climates are also turning to membrane technologies for water reuse options. A specialized application of membranes, known as membrane bioreactors (MBRs), is providing drought-proof sources of reusable water for irrigation, heating and cooling, and industrial processing.

Much of WERF's membrane research has focused on the use of MBRs and their role in reducing or eliminating secondary clarifiers and tertiary filtration processes. This reduction in unit processes can substantially shrink a facility's footprint. MBR has been extremely popular in Japan and Europe where space is at a premium, and as municipalities in the United States begin to feel the crunch, retrofitting with MBRs has become a more appealing option. Without the need for large settling tanks, these systems can be housed entirely in buildings that reduce noise and odors. Many MBR systems are also realizing reduced sludge production, by incorporating designs that lengthen sludge age and are less dependent on coagulants and polymers. The technology also lends itself to process automation.

George Crawford of CH2M Hill is a leader in the field of MBRs. Through two research projects for WERF, Crawford and his team have developed the definitive resource on MBR technology. Crawford writes about a few of the benefits of the online tool in his article, "Online Tool Brings Membrane Bioreactor
Information to Your Desktop."

Additional WERF membrane research featured in this issue focuses on the effects of fouling or reduced permeability of membranes. Fouling and the cost of energy needed to reduce it are two of the most prominent hurdles for the implementation of membranes in the treatment train. The project provides valuable insight into proper operation and maintenance to ensure optimum performance.

Membranes increasingly are helping utilities provide safe, clean, and affordable water for their communities and businesses. So whether you're just beginning to consider membranes or looking to enhance your existing systems, look to WERF research to guide you through it.

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From Single-Source To Best-Of-Breed

December 11, 2008

Submerged membrane bioreactor (MBR) technology continues to experience rapid growth due to the two main advantages over conventional biological wastewater treatment systems: significantly improved effluent quality, and a substantially smaller footprint. Throughout the past decade, MBR systems have been installed in thousands of municipal and industrial wastewater treatment plants of all sizes for a wide variety of challenging wastewater applications for plants like paper mills, breweries, food processors, chemical plants and textile manufacturers.

The history of membrane bioreactors follows a typical pattern of technology evolution. The idea of coupling an activated sludge bioreactor with an external membrane separation system dates back to the mid-1960s. The concept of submerging membranes in the bioreactor was first conceived in the late 1980s and early 1990s when independent teams in Japan and North America experimented with different membrane designs, notably hollow fibers and flat sheet panels. A number of proprietary MBR systems became commercially available, and each vendor has refined its respective designs over the years. As a result, the industry as a whole has benefited from the independent and competing innovations of the various MBR manufacturers.

Existing MBR users seek to benefit from these technological advances, especially as their first generation product reaches the end of its useful life. Most find that to implement the latest technology in their plant, the investment in changes to infrastructure, piping and utilities are miniscule when compared to the dramatic savings in lifecycle costs that are attainable with the newer designs.

Second Generation MBR

In recent years, MBR membranes have evolved to the point that they require less maintenance and at the same time have a longer useful life. An added benefit comes from the more advanced designs that consume significantly less energy and lower operating costs.

The new PURON™ module from Koch Membrane Systems, Inc. (KMS) of Wilmington, Mass., is a second generation MBR membrane module that employs hollow fibers. Like several other second generation membranes, the high-strength fibers that comprise the PURON modules also overcome the fiber breakage problems typical of first generation systems that utilize non-braided fibers. Unlike the "double header" design of other hollow fiber MBR membrane that pot the hollow fibers at both ends, the PURON module uses a single header with hollow fibers potted at the base, allowing the tips of the fibers to float freely at the top with a seaweed-like action. This revolutionary design eliminates the build-up of hair and other fibrous debris by allowing this material to pass through the module rather than collecting at the top as is typical of dual header designs. Compared to double header designs, the single header design also places less mechanical stress on the fibers.

Another advantage of the PURON design is the introduction of air scouring at the center of the fiber bundle. Low pressure compressed air creates coarse bubbles that shake the membranes and effectively scour the entire length of the membrane fiber, enabling the air to remove accumulated debris from the membrane fibers within the bundle. The ability to supply compressed air in a cyclical pattern avoids sludging and reduces energy consumption.

Unlike most flat sheet membranes that do not accommodate backflushing, the PURON membrane resists fouling and maintains flux by introducing a small portion of the filtrate back through the fiber pores from the inside-out at timed intervals. PURON hollow fibers provide significantly higher membrane surface area and higher filtration capacity within the same module footprint compared to flat sheet membrane designs.

Retrofit Considerations

For these reasons, a growing number of wastewater treatment plant operators have opted to replace their first generation MBR modules with PURON modules. When planning such a retrofit installation, several factors must be considered:

Performance of the MBR System. The most important consideration in the retrofit of an existing MBR is the performance of the biological system. In many cases, poor performance in the bioreactor will result in problems with membrane performance. In such situations, changes to the biological treatment system may be needed to improve the system; simply changing the membrane modules may not be sufficient.

Physical Module Dimensions. The new modules must have a flexible design to accommodate the

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existing tank size and module layout. The frame of the new modules must have the necessary exterior dimensions (height, width, length). The membrane area must also closely match the system design to support the required operating flux.

For example, the new 1,500 m2 module from KMS is designed specifically for large-scale MBR retrofit applications. Features such as optimized permeate extraction manifold and air supply lines reduce the number of piping connections during installation.

Module Operation. Each MBR manufacturer has optimized performance in different ways depending on the membrane module and membrane configuration. Careful consideration is required to evaluate the existing equipment that supports backwashing, air scouring and chemical cleaning sequences. This equipment may need modification or an upgrade along with a membrane retrofit.

For example, some systems backwash the membranes with permeate while others do not. The choice depends upon the robustness of the membrane when pressure is applied from the opposite direction. Typically, flat sheet membranes and some unsupported hollow fibers cannot be backwashed. Therefore, the necessary piping and pumping capacity for backwashing may not be in place.

Moreover, membrane manufacturers use different air flow rates and cycle times for air scouring on those systems that are able to cycle the delivery of air. Therefore, retrofit installations may require adjustments to the air scouring sequence (typically a programming issue), and changes to the size of blowers and the position of automatic valves that move air.

Three Retrofit Examples

Municipal Wastewater

An example of a municipal MBR module retrofit is the wastewater treatment plant that serves Thélus, a community near Calais in the north of France. Generale-des-Eaux, a Veolia Water company, had been using a municipal MBR to treat the wastewater from this community since 2000. However, reliability and energy consumption of the existing double-header hollow fiber membrane modules never met the operator's expectations. Therefore, in June 2006 the plant owner chose to retrofit the system with second generation PURON membrane modules.

The retrofitted MBR plant now has a capacity of 335 m3/day (90,000 gpd). Incoming wastewater passes through a 1 mm slot screen prior to entering the MBR. The blower for air scouring of the membrane modules was replaced by a unit that is half the size of its predecessor due to the reduced air scour demands of the PURON single header design that uses central aeration. The reduced air scour demand of the new membrane module reduced dissolved oxygen concentration in the recycle flow, thereby reducing the air entering the denitrification zone, improving the overall denitrification performance of the system. As a result, effluent values for total nitrogen have dropped considerably and effluent quality has improved significantly.

Landfill Leachate

Another example of a retrofit is at the Ecopark De Wierde landfill for household and industrial waste in the Netherlands. Leachate from the landfill has been treated by means of a membrane bioreactor since February 2003, but in 2004 the 126,000 gal/day (477 m3/day) capacity of the system was insufficient and consideration was given to expanding the MBR to 222,000 gal/day (833 m3/day) hydraulic capacity. In September 2005, two second generation PURON membrane modules were installed and operated in parallel with the existing MBR modules. This system was the first of its kind to employ submerged membrane modules from two different manufacturers. The stable performance of the new MBR modules was very encouraging, and after one year, the operator chose to retrofit the remaining two original double header modules. The retrofit was conducted in just one day.

Trucking Company

The Belgium transport company, Dekker, had been operating a wastewater treatment plant with submerged MBR membrane technology for a few years. The existing system was a first generation membrane design with non-reinforced hollow fibers fixed at both ends. The original membrane experienced various problems including fiber breakage and low membrane permeability as the existing membrane was not capable of a backwashing operation. After careful consideration the existing membrane modules were replaced by PURON modules which utilize a reinforced membrane fiber that supports backwashing and contains a total membrane area of 2,500 ft2 (232 m2).

Retrofits With Second Generation Technology Make Sense

Second generation systems position the membrane bioreactor industry for even more rapid growth. They offer several advantages, including improved performance in terms of reduced fouling and lower energy consumption. They are also more robust than first generation systems and are usually designed with compatibility in mind to minimize retrofitting costs.

SOURCE: Koch Membrane Systems, Inc

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Membrane Bioreactors

MBR Technology

The technology of membrane separation of activated sludge, commonly referred to as "membrane bioreactor" (MBR), is the combination of activated sludge treatment together with a separation of the biological sludge by micro- or ultra-filtration membranes with pore size of typically 10 nm to 0.5µm to produce the particle-free effluent. The latter step replaces the final clarifiers used in conventional activated sludge treatment which achieve solid separation by gravity only. The physical barrier imposed by the membrane system provides complete disinfection of the treated effluent. It also enables operation at higher sludge concentrations (typically up to 20 g/L instead of max. 6 g/L with conventional systems), and therefore permits to reduce the required footprint and/or sludge production. However, for municipal applications, the MBR technology is usually related to a higher total life cost, due to the high energy cost. In addition, the perceived risk related to the fouling and the replacement costs of the membrane remains an important limiting factor to its broad application.

Short history of MBR filtration systems

After initial development started in the late 60s, the MBR technology for wastewater treatment experienced rapid development from the early 1990's onwards. The first systems commercialised in the 70's and 80's were based on what have come to be known as sidestream configurations, i.e. the membrane separation step was employed in an external sludge recirculation loop, mainly with in-to-out flow through organic or ceramic tubular membranes. Due to the high energy demand, these technologies targeted only small and niche market applications such as treatment of ship-board sewage, landfill leachate or industrial effluents.

In the early 90's, the Japanese Government launched an ambitious 6-year R&D project which led to a major technological and industrial breakthrough of the MBR process: the conception of submerged membrane modules, working with low negative pressure (out-to-in permeate suction) and membrane aeration to reduce fouling. This paved the way towards a significant reduction of capital and operation costs, due to the reduction and simplification of equipment and the abandonment of the energy demanding sludge recirculation loop.

Nowadays, two types of technologies of submerged membrane modules are predominant on the MBR market. Both feature out-to-in permeate filtration and comprise the flat-sheet (or plate & frame) membrane module and the hollow fibre membrane module. Novel and alternative MBR filtration systems have recently appeared in the market and we can expect that the most innovative products will raise commercial interest in the coming years.

The commercialisation of the submerged MBR system precipitated rapid and extensive market penetration. The first pilot-scale European submerged MBR plant for municipal wastewater was built in 1996 (in Kingston Seymour, UK), soon followed by the construction of the full-scale Porlock WWTP (UK, commissioned in 1998, 3,800 p.e.), Büchel and Rödingen WWTPs (Germany, 1999, resp. 1,000 and 3,000 p.e.), and Perthes-en-Gâtinais WWTP (France, 1999, 4,500 p.e.). A few years later only, in 2004, the largest MBR plant worldwide was commissioned to serve a population of 80,000 p.e. (in Kaarst, Germany). In 2005 MBR Varsseveld (18.000 p.e.) was the first fully operational MBR in the Netherlands followed by the MBR Heenvliet (9.000 p.e.) in 2006 and later on the MBR Ootmarsum. The size of installations has thus grown from few thousand to hundreds of thousands population equivalent in only a few years.

Industrial and Municipal MBRs in Europe

By 2006, around 100 municipal full-scale plants with a capacity >500 p.e. were in operation in

Europe, and around 250 large industrial plants with a capacity >20 m3/d. The development and successful commercialisation of the technology in the past few years has led to significant decrease in capital and operating costs. However, the delineation between municipal and industrial systems shows that the technology remains especially competitive for industrial applications. In the municipal sector, it is now considered that for a green field and for a given treatment quality the capital cost of MBR plants is comparable to a conventional scheme. However, the energy costs remain 30 to 50% higher. Should this discrepancy be reduced in the coming years, the MBR technology would become a State-of-the-Art process for the municipal sector.

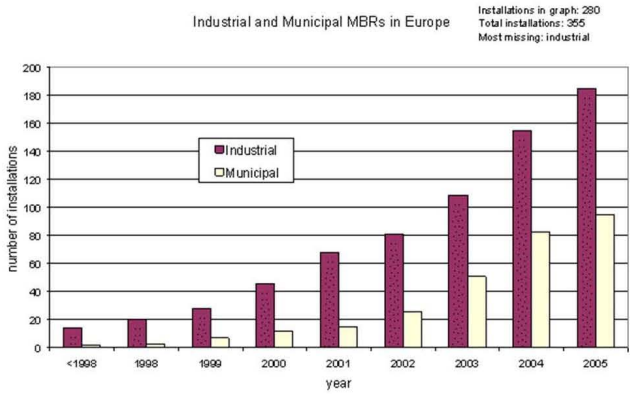

Figure 1. MBR installations in Europe anno 2006

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Membrane Bioreactors (MBRs)

Membrane bioreactors are becoming more popular for wastewater treatment in the United States. Strict discharge requirements and limited water resources have made membrane systems attractive in a number of applications, including industrial and domestic wastewater treatment. Historically, the major disadvantage of membrane systems has been cost-effectiveness.

Membrane cassettes in MBR tank.

Introduction

Municipal governments in the United States face a number of challenges when it comes to treating and disposing of wastewater. Increasingly strict discharge limits to streams and rivers require a higher level of treatment from wastewater service providers. In some areas, the lack of water resources requires that wastewater be reused to reduce demand on the potable water system. These challenges are testing the limits of wastewater treatment technology.

The membrane bioreactor (MBR) is a new treatment technology that has shown promise in addressing these challenges. MBR systems couple activated sludge biological treatment with microfiltration or ultrafiltration membranes. They are capable of producing a high quality effluent that can be discharged to sensitive bodies of water or reused for a number of non-potable uses. MBRs have been successfully used for treating domestic and industrial wastewater over a large range of flow rates. The question remains, are they cost-effective when compared to conventional wastewater treatment technologies?

Conventional vs. MBR Treatment

Conventional wastewater treatment refers to methods that are commonly used in the United States for treating domestic and industrial wastewaters to meet effluent limits. These methods have been used for a number of years at many different locations, and their limitations are known.

MBR systems are composed of two primary parts: the biological unit responsible for the biological removal of the waste compounds and the membrane module for the physical separation of the treated wastewater. These systems have been arranged in two fashions: integrated and recirculated. Integrated systems have membranes internal to the bioreactor. The driving force is achieved by pressurizing or creating negative pressure on the membrane side. Recirculated systems have membranes external to the bioreactor. Mixed liquor is pumped through the membrane and a portion is returned to the bioreactor. Several different membrane configurations are commercially available. These include tubular, plate and frame, and hollow fiber.

The treatment trains for conventional treatment and MBRs are substantially different. For example, the treatment train may consist of screening, grit removal, aeration basins, secondary clarifiers, and UV disinfection. Modifications to the aeration basins may

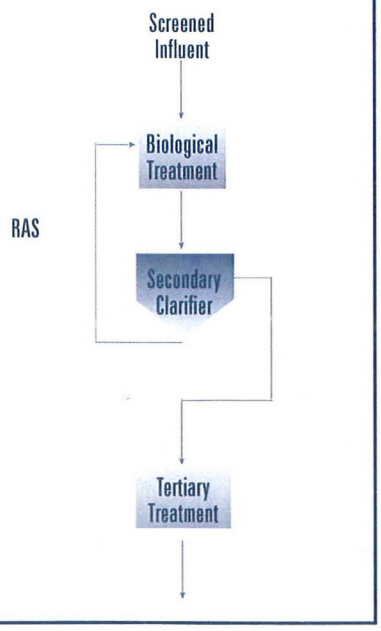
Continued inside.

enhance biological removal of nitrogen and phosphorus. Tertiary filtration, in the form of media or membranes, can be added for phosphorus removal and non-potable reuse.

The MBR treatment train consists of screening, grit removal, fine screening, flow equalization, and membrane bioreactors. Fine screening down to 2-mm openings is required to remove fibrous material that has proved problematic to membrane operation. Flow equalization can be used to reduce the number of membranes necessary in the treatment system. All of the plant effluent passes through the membranes. Reducing the flow rate by equalization reduces the membrane surface area required to process the effluent. Disinfection is not needed, unless the water is required for non-potable reuse. Changes to the biological process of the MBR can be made to allow for nitrogen and phosphorus removal. Coagulant can be added directly to the MBR for chemical removal of phosphorus.

BOD removal, nitrogen removal, phosphorus removal and non-potable reuse are four applications where MBRs may compare favorably to conventional wastewater treatment.

Conventional Biological Reactor with Tertiary Treatment



Zenon membrane cartridge
Courtesy of ZENON Environmental Inc.

Advantages of MBRs

Membrane bioreactors have a number of advantages over conventional wastewater treatment. Secondary clarifiers and sand filtration, where necessary, can be replaced by microfiltration or ultrafiltration membranes. MBRs therefore reduce process difficulties and problems associated with settling, which can be the most troublesome part of wastewater treatment.

Replacing the clarifier with membranes allows the biomass concentration to be increased within the bioreactor. This allows for a reduction in the size of the footprint of the biological system because the same biomass is retained in a smaller volume.

Another advantage of the MBR process is the production of a very high quality effluent. Ultrafiltration has been employed successfully to treat municipal wastewater. These membranes reject bacteria and viruses, potentially eliminating the need for extensive disinfection.

Disadvantages of MBRs

There are also a number of disadvantages associated with MBR systems. Fouling problems can lead to frequent cleaning of the membranes. This stops operation of a portion of the system periodically. The MBR mixed liquor typically exhibits poor settleability and filterability, making waste activated sludge disposal problematic. When operated at high solids retention times (SRTs), inorganic compounds accumulating in the bioreactor may reach harmful concentration levels, which can affect the microbiological population or membrane surface.

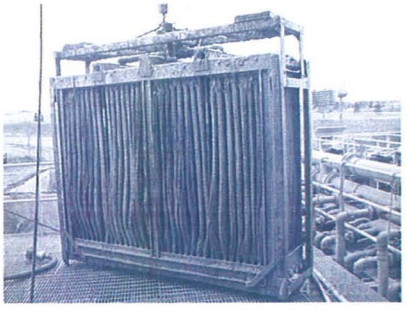
Cost-effectiveness

For BOD removal, conventional wastewater treatment is more cost-effective than MBRs. The difference is due to the equipment associated with the MBR itself, which includes the membranes, blowers to clean the membranes, and permeate pumps. Flow equalization reduces the total cost of the membrane equipment by reducing peak hour to the peak day flow. However, the cost of a flow equalization tank may be offset by the savings achieved by not needing UV disinfection or secondary clarifiers in the MBR system.

For nitrogen removal, conventional wastewater treatment is generally the most cost-effective solution. There is not a significant difference between the process configuration for BOD removal and nitrogen removal. The reasons for the increased cost of the MBR system for BOD removal are the same for the nitrogen removal.

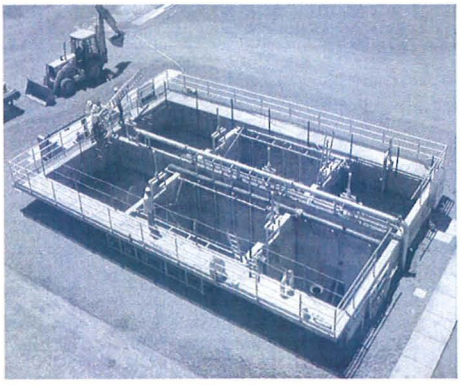
For phosphorus removal, the MBR system can be cost competitive with a conventional wastewater treatment system. The need for filtration following biological treatment significantly increases the cost of the conventional system, while the cost of the MBR system is relatively constant.

For non-potable reuse, the MBR system may be cost competitive with the conventional wastewater treatment system. The MBR system can be more cost-effective if it decreases disinfection requirements. Even with stringent E coli limits and the requirement for disinfection of the effluent, it may be possible to meet the limits with a low dose of chlorine. This may not be true for the conventional system.



Used Zenon membrane cartridge ~ Centennial, CO

Membrane Bioreactors (MBRs), continued



0.5 mgd MBR plant in Chino Valley, AZ
Courtesy of Enviroquip

Operation and maintenance (O&M) costs also differ between conventional wastewater treatment and MBRs. Electricity, labor, chemical use, and membrane replacement all effect the O&M costs of the two systems. MBRs use more electricity than conventional systems. High biomass concentrations require more air because oxygen transfer is less efficient, additional blowers are required for membrane cleaning, and permeate pumps are required. All of these things increase electricity demand. Labor is roughly the same for the two systems, although limited data is available for MBR systems. Cleaning of the membranes and maintaining additional equipment is required for MBR systems. The chemical requirements for MBR cleaning is not substantial. When coagulant is required, doses are similar for phosphorus removal in both systems. Membrane replacement cost is a substantial long-term investment. Most membranes are warranted for eight years. However, the majority of systems have not been in operation for that long, and the actual life of the membranes is unknown.

The waste activated sludge from conventional systems and MBR systems will likely have different characteristics and volumes, which need to be considered in the evaluation. However, the requirements for stabilizing the sludge will depend on local conditions for disposal. The volume of solids generated by MBR systems may be less than conventional systems due to a decreased wastage rate, but, as noted earlier, MBR solids have been found to be more difficult to handle than conventional solids.

The cost of land may be important in comparing MBR and conventional systems. Key advantages of MBR systems are the reduced footprint of the system and the elimination of secondary clarification. If the cost of land is high, or if adequate land is not available, the cost comparison may favor the MBR system.

Conclusion

MBR systems may be cost-effective compared with conventional wastewater treatment systems under certain conditions. When conventional systems require filtration for phosphorus removal or non-potable reuse, MBR systems should be considered. MBR systems are a viable treatment technology as discharge standards become increasingly strict and land is limited or costly.

FIRM NEWS

Arber Relocates Company Headquarters to Lakewood

Richard P. Arber Associates moved their company headquarters to Lakewood, Colorado on March 14, 2005. Arber Associates started their 25th year of service in March. Rick Arber, Company President stated, "We are excited to be starting this new chapter of the company's history. We enjoyed our offices in the Historic Mansion on Grant Street for 10 years, but in order to continue to meet our client's needs, we need more space to add more engineers."

Arber Named Top 50 Civil Engineering Firm to Work For In the U.S.

Richard P. Arber Associates was recently ranked as one of the Top 50 Best Civil Engineering Firms to Work For in the U.S. This is the second year in a row that Arber Associates has attained the Top 50 ranking. CE News Magazine organized the competition which placed Richard P. Arber Associates 42nd. Richard P. Arber Associates was the only Colorado headquartered firm to be honored among the Top 50 and the only firm that specializes exclusively in water and wastewater engineering.

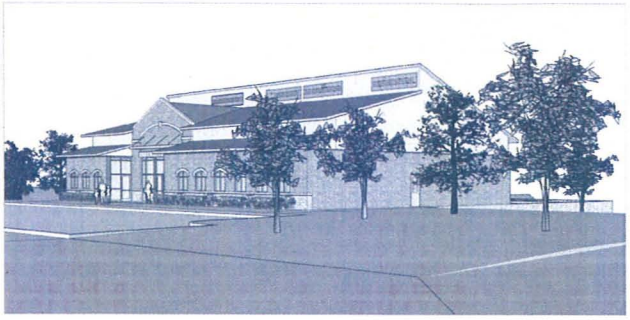
Arber Projects Receive Engineering Excellence Awards

The City of La Junta's New Water Treatment Plant and Denver Water's New Water Reuse Facility were both honored by the American Council of Engineering Companies (ACEC) at the 2005 Engineering Excellence Awards Competition. Richard P. Arber Associates provided design services for both of these projects. La Junta's new water treatment facility (pictured below)produces 6.6 million gallons per day of water, making it the second largest Reverse Osmosis System in Colorado.

City of La Junta Reverse Osmosis System

ARBER PROJECTS

City of Troy, Missouri ~ Membrane Bioreactor Design



Richard P. Arber Associates served as a Membrane Bioreactor (MBR) Process Consultant to THH of Columbia, MO. The City of Troy is located in eastern Missouri, 60 miles northwest of St. Louis. The new facilities being designed include a new headworks building consisting of coarse screening, grit removal, and fine screens. An equalization basin will be used to equalize flow to the MBRs. UV disinfection will be used prior to discharge or possible reuse of the treated wastewater.

City of Alamosa, Colorado ~ Membrane Water Treatment Plant Design (Arsenic Removal)

Richard P. Arber Associates is preparing to start final design of the City of Alamosa's new Water Treatment Plant. The facility will be approximately 4.5 mgd which will make it the largest arsenic removal project in the State of Colorado. Treatment processes will include coagulation followed by microfiltration membranes.

Arapahoe County and Cottonwood W&S District, Colorado ~ Indirect Potable Reuse

Richard P. Arber Associates is working with Arapahoe County Water and Wastewater Authority and Cottonwood Water and Sanitation to complete final design for Colorado's first indirect potable water reuse system. Recharge of the alluvium with effluent from the wastewater plant will increase water supply for the agencies. The joint system will use the Cherry Creek alluvium to supply potable drinking water. The treatment system includes reverse osmosis and advanced oxidation processes.

FIRM NEWS CONTINUED

Arber Supports 2nd Annual RMWEA/RMSAWWA Student Conference

Kevin Bergschneider of Richard P. Arber Associates represented the firm at the RMWEA/RMSAWWA Student Conference at the University of Wyoming in Laramie in May. He was part of a judging team that named three top oral presentations winners as well as three poster presentations winners. Students from the University of Wyoming, CU-Boulder, CSU, and the Colorado School of Mines participated. Next year's conference is scheduled for May in Fort Collins.

Student winners from the RMWEA/RMSAWWA Conference

PEOPLE

Arber Heads AWWA Membrane Standards Committee

Rick Arber has been heading up the AWWA Membrane Standards Committee. Mark Beebe of the firm is also on the committee that recently met at the June AWWA National Convention in San Francisco.

Johnson and Noteboom Honored As Young Engineers

Ben Johnson, P.E. and Matthew Noteboom, P.E. of Richard P. Arber Associates were both presented with ACEC awards recently. The ACEC New Faces of Engineering program highlights the interesting and unique work of young engineers and the resulting impact on society. Young engineers with two to five years of experience are the focus of this recognition program. The New Faces of Engineering program (www.eweek.org), sponsored by the National Engineers Week Foundation, recognized 65 nominees out of 1.8 million engineers in the U.S. Congratulations also to Ben and Matthew who both recently received their Professional Engineers Licenses.

Ben Johnson, P.E. and Matthew Noteboom, P.E.

New Hires at Arber

Sarah Ladenburger and Jamie Eichenberger, both recent graduates of the Masters of Environmental Engineering program at the Colorado School of Mines, have recently joined Richard P. Arber Associates. Sarah will be giving a presentation on Endocrine Disruptors at the WateReuse Symposium to be held in Denver on September 18-21.

Sarah

Jamie

EXECUTIVE SUMMARY

WERF

WATER ENVIRONMENT RESEARCH FOUNDATION

WASTEWATER TREATMENT AND REUSE

Membrane Treatment of Secondary Effluent for Subsequent Use

The future is bright for membrane technology in water reuse as costs go down and recognition of its advantages goes up. Membrane processes can remove virtually the entire range of contaminants found in wastewater, achieving water quality requirements for almost any reuse application. In addition to indirect potable reuse applications, membrane-treated wastewater may be appropriate for other applications requiring high quality water within particular industries, in agriculture, for recreation purposes, or for non-potable municipal use.

Nearly universal membrane fouling is the biggest single technical problem with the use of membranes for treatment of municipal wastewater. Other technical barriers include the difficulty and expense in managing concentrate, and the undefined ability of membranes to effectively remove all chemical contaminants and pathogens that are found in municipal secondary effluent, either alone or as part of a larger treatment system.

Research Highlights

- Ultrafiltration (UF) provides better pretreatment than microfiltration (MF) for high-pressure membranes, which translates into less frequent chemical cleaning and less energy consumption.
- Virus removal was nearly 100 percent higher for UF than for MF in both high- and low-pressure membranes, after each membrane was chemically cleaned.
- The addition of $FeCl_3$ is essential for maximizing the removal of foulants in the UF unit by backwashing. Shortening the backwash time reduced the long-term fouling rate better than lengthening the time.
- Extracellular polymeric substances, which are byproducts of biological secondary treatment, steadily accumulated over time on UF fibers.

So, why does UF provide better pretreatment than MF for high-pressure membranes? It is possible that the fraction of organic components that pass through MF but are rejected by UF (those between 0.02 mm and 0.2 mm) are particularly important foulants of high-pressure membranes. Another possibility is that some components removed by UF may be particularly suitable substrates for microbial growth on high-pressure membranes. There are many possibilities, and this research is a good step toward understanding the complex nature of this technology.

Research Approach

The project team created a bibliographic database with over 3,000 references, and linked it to a searchable public website. They conducted a world-wide inventory of full-scale municipal treatment facilities using membrane technology, and then surveyed several of the facilities, comparing membrane design and operation.

The report summarizes the major issues associated with membrane applications for water reuse, and presents a summary of the survey data and published data on demonstration projects. It discusses issues like unit costs, energy requirements, fouling potential and control methods, maintenance requirements, and management of concentrate streams. The team also evaluated federal and state reclamation regulations and guidelines.

BENEFITS

- Comprehensively summarizes full-scale experience with the application of membrane processes in wastewater treatment and water reuse applications.
- Identifies the limited extent to which membrane processes are considered in state regulations or guidelines on water reuse.
- Evaluates the applicability and potential economic feasibility of membrane processes for each of a variety of water reuse applications.

RELATED PRODUCTS

Membrane Bioreactors: Feasibility and Use in Water Reclamation (98CTS5)

Membrane Technology: Pilot Studies of Membrane-Aerated Bioreactors (00CTS11)

Membrane Bioreactors for Anaerobic Treatment of Wastewaters (02CTS4 & 4a)

Membrane Treatment of Secondary Effluent for Subsequent Use: Phase II (01CTS6a)

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Table 1. Requirements of Contaminant Removal for Various Reuse

Reuse Application	Suspended Solids	Oxygen-Demanding Materials	Nutrients	Pathogens	TDS	Organic Compounds	Metals	Hardness
Agricultural	●	●		●	●			
Non-potable Municipal	●	●		●	●			
Indirect Potable	●	●	●	●	●	●	●	
Industrial	●	●	●	●	●	●	●	●
Environmental and Recreational	●	●	●	●			●	

● Always required ● May be required

Summary of Knowledge and Knowledge Gaps

The literature review identified several key concepts and knowledge gaps. The key concepts include:

- The role of membrane technology in water reuse projects greatly depends on water quality requirements, which may become more demanding if limits on specific synthetic organic chemicals (SOCs) are added in the future.
- All membrane processes will provide essentially complete removal of particulate matter, and the ability to remove dissolved constituents increases as the pore size decreases.
- Far less modeling work explains fouling of NF and RO membranes, rather than MF and UF membranes.
- Membrane treatment processes are among the most compact treatment technologies available for wastewater treatment.
- The most common method of concentrate disposal for plants employing membranes is discharge to the inlet of municipal wastewater treatment by various methods (including discharge to sewer systems). The next most common methods are deep-well injection and land application.
- MF and UF technology is increasingly a substitute for tertiary filtration in existing conventional secondary treatment facilities.
- A better understanding of membrane fouling mechanisms will lead to improvements in the design and operation of membrane systems, which will reduce costs and optimize performance.

Knowledge gaps exist in detailed data on existing facilities, including long-term reliability and operation and maintenance requirements. Other needs include:

- Better models to compare the cost and expected quality of potable water developed from high-salinity sources with those from wastewater reclaimed with membrane technology.
- More research on installation of membranes in closed-loop reuse schemes.
- Alternative technologies for concentrate disposal on inland areas where ocean disposal is not an option.
- Investigation of fouling as an alternative to conceptual models.
- Analysis of the economic viability of using lower RO water recovery instead of pretreatment processes to remove scalants.
- Better knowledge of the rejection capabilities of various types of membranes for a very wide range of contaminant properties.

The next phase of research (Phase II) will include pilot studies examining the feasibility of membrane systems in wastewater reclamation, focusing on barriers that appear most amenable to removal and applications with the greatest potential for reuse.

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10/08

APPENDIX 1

FULL-SCALE FACILITIES USING MEMBRANE TECHNOLOGY TO TREAT SECONDARY EFFLUENT

Table A-1. Summary of the Current List of Full-Scale Reclamation Facilities Using Membrane Technology for Treatment of Secondary Effluent

Index	Facility Name	City	State/Country	Membrane Design Flow (US mgd)	Startup Date	Membrane Low Pressure	Membrane High Pressure	Membrane Manufacturer	Feed Waste Water
1	Aberporth	Aberporth	Wales, UK	1.1	01/1995	MF	—	US Filter - MF	Secondary Effluent
2	Alamitos WRD	Cerritos	CA / United States	3.00	2002	MF	RO	Pall - MF Severn Trent UAT - RO	Secondary Effluent
3	American Canyon WWTP	Napa Valley	CA / United States	2.50	02/2002	MBR	—	Zenon	Raw
4	Anthem Water Campus	Sun City	AZ / United States	0.5 1.5 3.0	Phase 1 10/1998 Phase 2 06/2001 Phase 3 11/2003	MBR	—	Zenon	Raw
5	Arrecife		Spain	1.6	Proposed	MF	—	US Filter - MF	Secondary Effluent
6	Ashland WWTP	Ashland	OR / United States	4.00	06/2002	UF	—	Zenon	Secondary Effluent
7	Avonmore Company	Glanbia	Ireland	1.80	1998	MBR	—	Kubota	Dairy waste
8	Ballyragget ETP	Glanbia	Ireland	2.4	05/1999	MBR	—	Kubota	Dairy waste
9	Barranco Seco		Spain	1.6	Proposed	MF	—	US Filter - MF	Secondary Effluent
10	Bedford Hills Correctional Facility	Bedford Hills	NY / United States	1.00	09/2001	MF	—	Pall	Wastewater

Table A-1 (continued)

Index	Facility Name	City	State/Country	Membrane Design Flow (US mgd)	Startup Date	Membrane Low Pressure	Membrane High Pressure	Membrane Manufacturer	Feed Waste Water
11	Blackheath WWTP	Blackheath	Australia	0.90	1/1/1991	MF	—	US Filter	Unfiltered Secondary
12	Brescia WWTP	Brescia	Italy	10.00	08/2002	MBR	—	Zenon	Raw
13	Broad Run Water Reclamation Facility	Loundon County	VA / United States	10.00	Proposed	MBR	—	Zenon	Municipal
14	Bucchel STP	Bucchel	Germany	0.25	1999	MBR	—	Kubota	Raw
15	Cache Creek Casino	Woodland	CA / United States	0.35	2003	MBR	—	Zenon	Raw
16	Calls Creek	Watkinsville	GA / United States	0.67	12/2003	MBR	—	US Filter	Raw
17	Cambeltown WWTP	Kintyre	United Kingdom	1.03	10/2001	MBR	—	Zenon	Raw
18	Carlsbad Water Reclamation Plant	Carlsbad	CA / United States	4.00	Proposed	MF	RO		Secondary Effluent
19	Carmel No. 2 WWTP	Carmel	NY / United States	1.3	Proposed	MF	—	US Filter - MF	Secondary Effluent
20	Cauley Creek WRF Phase I & II	Fulton County	GA / United States	4.50	04/2002 9/2002	MBR	—	Zenon	Raw
21	Chartered Semiconductor Fab-7	Singapore	Singapore	1.9	2002	MF	RO	US Filter - MF	Secondary Effluent
22	Chennai Sewage Renovation Plant	Chennai	Tamil Nadu / India	13.50	Proposed	—	RO	—	Filtered Secondary
23	Chino Valley	Prescott	AZ / United States	0.50	12/2003	MBR	—	Kubota	Municipal
24	Clean Water Revival Treatment Facility	Dublin San Ramon	CA / United States	2.50	12/15/1998	MF	RO	US Filter - MF Hydranautics - RO	Unfiltered Secondary
25	Cohasset WWTP	Cohasset	MA / United States	0.40	06/2000	MBR	—	Zenon	Raw
26	Creemore WWTP	Creemore	Ontario / Canada	0.23	07/2002	MBR	—	Zenon	Raw
27	Cromarty WwTW	Cromarty	Scotland	0.27	12/2003	MBR	—	Kubota	Municipal

Index	Facility Name	City	State/Country	Membrane Design Flow (US mgd)	Startup Date	Membrane Low Pressure	Membrane High Pressure	Membrane Manufacturer	Feed Waste Water
28	Cronulla Membio Facility	Cronulla (Near Sydney)	Australia	0.99	11/1/1992	MF	—	US Filter	Unfiltered Secondary
29	Daldowie, Glasgow	Glasgow	Scotland	2.85	12/2001	MBR	—	Kubota	Sludge Liquor Treatment
30	E.C. Katowice	Katowice	Poland	1.50	1999	MF	—	Zenon	Secondary Effluent
31	El Obour WWTP	El Obour	Egypt	0.99	09/1998	MBR	—	Zenon	Raw
32	Epping WWTP	Epping	NH / United States	0.35	02/2002	MBR	—	Zenon	Raw
33	Eraring Power Station (Phase 1 and Phase 2)	Lake Macquarie	New South Wales/ Australia	0.92 0.92	03/01/96 11/2000	MF	RO	US Filter	Unfiltered Secondary
34	Essen WWTP	Essen	Germany	10.0	2003	MBR	—	Zenon	Raw
35	F. Wayne Hill Water Resources Center	Gwinnett County	GA / United States	60.0	Proposed	UF	—	Zenon	Secondary Effluent
36	F. Wayne Hill Water Resources Center (Demonstration Facility)	Gwinnett County	GA / United States	1.2	2000	UF	—	Zenon	Secondary Effluent
37	Fairview City	Fairview City	UT / United States	0.3	02/2003	MBR	—	Kubota	Municipal
38	Forestville County Sanitation District	Forestville	CA / United States	0.6	09/2003	MF	—	Pall	Secondary Effluent
39	Forsyth WWTP	Forsyth	GA / United States	1.00	Proposed	MBR	—	Zenon	Raw
40	Fountain Hills Sanitation District	Fountain Hills	AZ / United States	2.00	01/2000	MF	—	Pall	Tertiary Effluent
41	Gairloch WwTW	Gairloch	Scotland	0.38	12/2003	MBR	—	Kubota	Municipal
42	Ganges Phase I & II WWTP	Ganges	BC / United States	0.30	1998	MBR	—	Zenon	Unfiltered Secondary
43	Gerringong and Gerroa	Baileys Island	Australia	1.0	2002	MF	RO	US Filter - MF	Secondary Effluent

Table A-1 (continued)

Index	Facility Name	City	State/Country	Membrane Design Flow (US mgd)	Startup Date	Membrane Low Pressure	Membrane High Pressure	Membrane Manufacturer	Feed Waste Water
		(120 km SW from Sydney)							
44	Glasgow WWTP	Glasgow	United Kingdom	3.40	2000	MBR	—	Kubota	Dewatered Sludge Filtrate
45	GMR Vasavi Power Corporation	Chennai	India	1.82	June, 1999	—	RO	Filmtec	Raw
46	Golf de Calafell		Spain	0.7	Proposed	MF	—	US Filter - MF	Secondary Effluent
47	Grahamsville STP	Grahamsville	NY / United States	0.36	4/1/1997	MF	—	US Filter	Unfiltered Secondary
48	Grand Gorge WWTF	Grand Gorge	NY / United States	1.25	8/1/1998	MF	—	US Filter	Filtered Secondary
49	Greyabbey WwTW	Greyabbey	Ireland	0.31	6/2003	MBR	—	Kubota	Dewatered Sludge Filtrate
50	Groundwater Replenishment System	Fountain Valley	CA / United States	70.00	Proposed	MF	RO	USFilter	Secondary Effluent
51	Har Homa	Jebel Abu Ghneim in east Jerusalem	Israel	0.26	Proposed	MBR	—	Zenon	
52	Harlingen WWTP	Harlingen	TX / United States	2.10	1990	—	RO	Fluid Systems	Filtered effluent
53	Hawks Prairie Reclaimed Water Plant (LOTT)	Olympia	WA / United States	1.00	Proposed	MF	—	USFilter	Wastewater
54	Hobart WWTP	Hobart	NY / United States	0.47	2002	MF	—	Pall	Wastewater
55	Honouliuli Wastewater Treatment Plant	Eva Beach	HI / United States	13.00	07/2000	MF	RO	USFilter/Memcor/	Secondary Effluent
56	Hyrum	Hyrum	UT / United States	2.00	Proposed	MBR	—	Kubota	Municipal
57	Ile de Yeu	Coast of Vendee (Port Joinville)	France	0.60	2000	MBR	—	BioSep	Raw

Index	Facility Name	City	State/Country	Membrane Design Flow (US mgd)	Startup Date	Membrane Low Pressure	Membrane High Pressure	Membrane Manufacturer	Feed Waste Water
58	Illawarra Wastewater Strategy (Wollongong STP)	Sydney	Australia	6.3	Proposed	MF	RO	US Filter - MF	Secondary Effluent
59	Industrial Process Water Treatment Facility	Chandler	AZ / United States	1.75	1999	MF	RO	Pall/Filmtec/ Hydranautics	Primary
60	Iqualuit WWTP	Nunavut	North West Territories / Canada	0.95	10/1999	MBR	—	Zenon	Wastewater
61	IVWA	Belgium	Belgium	1.80	2002	UF	RO	Zenon	Clarified Effluent
62	Katasonica	Katasonica	Poland	1.00	1999	MBR	—	Zenon	Raw
63	Kawagei Green Garden	Mie	Japan	0.29	1999	MBR	—	Kubota	Raw
64	Key Colony WWTP	Key Colony Beach	FL / United States	0.40	1/1/1999	MBR	RO	Zenon	Unfiltered Secondary
65	Kircubbin WwTW	Kircubbin	Ireland	0.46	5/2003	MBR	—	Kubota	Dewatered Sludge Filtrate
66	Kommunale Wasserwerke	Leipzig	Germany	0.9	01/2000	MBR	—	Zenon	Raw
67	Kouzu Shima I term	Tokyo	Japan	0.48	2001	MBR	—	Kubota	Raw
68	Kranji High Grade Water Reclamation Plant	Singapore	Singapore	10.6	12/2002	MF	RO	Hydranautics	Secondary Effluent
69	Kwinana Water Reuse Project		Australia	1.56	Proposed	MF	RO	Dow	Secondary Effluent
70	Laguna WWTP	Santa Maria	CA / United States	0.50	1999	MBR	RO	Zenon	Raw
71	Laguna WWTP	Santa Maria	CA / United States	2.70	2003	UF	—	Zenon	Secondary Effluent
72	Lehigh Wastewater Treatment Plant	Lehigh Acres	FL / United States	0.50	10/1/1998	MBR	—	Zenon	Raw
73	Livermore WRC	Livermore	CA / United States	0.75	02/01/97	MF	RO	USFilter - MF	Filtered Secondary

Table A-1 (continued)

Index	Facility Name	City	State/Country	Membrane Design Flow (US mgd)	Startup Date	Membrane Low Pressure	Membrane High Pressure	Membrane Manufacturer	Feed Waste Water
								Koch - RO	
74	Lone Tree Creek WWTP	Lone Tree (Arapahoe County)	CO / United States	2.80	Phase I 8/1/1998 Phase II 2001	MBR	—	Zenon	Raw
75	Longbridge WwTW	Longbridge	England	0.41	04/2003	MBR	—	Kubota	Domestic Effluent
76	Lowestoft	Lowestoft	United Kingdom	1.90	10/2001	MBR	—	Zenon	Raw
77	Luggage Point Wastewater Treatment Plant	Brisbane	Australia	3.70	10/2000	MF	RO	Pall / Dow	Raw
78	Lynmouth WwTW	Exmoor National Park	England	0.43	3/2003	MBR	—	Kubota	Wastewater
79	Madras Fertilizers Limited	Chennai	Tamil Nadu / India	3.20	01/1993	—	RO	Dow	Secondary Effluent
80	Madras Refineries Limited	Chennai	Tamil Nadu / India	2.50	01/1993	—	RO	Trisep	Secondary Effluent
81	Mahopac	Mahopac	NY / United States	0.50	5/2002	UF	—	Zenon	Secondary Effluent
82	Margaretville STP	Downsville	NY / United States	0.48	4/1/1999	MF	—	USFilter	Unfiltered Secondary
83	Marucan WWTP	Marucan	Australia	0.40	1998	MBR	—	USFilter	Raw
84	McDowell Creek WWTP	Mecklenburg Co.	NC / United States	3.00	07/2001	MF	—	Pall	Secondary Effluent
85	Milton WWTP	Milton	Ontario / Canada	0.26	6/1/1997	MBR	—	Zenon	Primary
86	Minch Malt	Athy	Ireland	0.45	7/2001	MBR	—	Kubota	Brewery
87	Monheim WWTP	Monheim	Germany	0.40	2002	MBR	—	Zenon	Raw
88	Mount Barker STEDS Effluent Treatment Plant	Mount Barker	New South Wales / Australia	0.62	1998	MBR	—	Zenon	Unfiltered Secondary
89	Mt. Washington Ski Resort WWTP	Mt. Washington	BC / United States	0.30	11/1/1996	MBR	—	Zenon	Raw

Index	Facility Name	City	State/Country	Membrane Design Flow (US mgd)	Startup Date	Membrane Low Pressure	Membrane High Pressure	Membrane Manufacturer	Feed Waste Water
90	Mubarak WWTP	Mubarak	Egypt	1.50	05/1999	MBR	—	Zenon	Raw
91	NEWater Factory	Bedok	Singapore	2.6	5/2000	CMF	RO	USFilter - CMF Hydranautics -RO	Secondary Effluent
92	NEWater Reclamation Plant	Bedok	Singapore	8.5	12/2002	UF	RO	Zenon - UF Hydranautics -RO	Secondary Effluent
93	Nordkanal WWTP	Nordkanal	Germany	8.10	2003	MBR	—	Zenon	Raw
94	North Lakes Golf Course	Brisbane	Australia	1.0	2002	MF	—	US Filter - MF	Secondary Effluent
95	Oakwood WWTP	Oakwood	NJ / United States	0.35	2/1/1998	MBR	—		Raw
96	Orascum WWTP	Orascum	Egypt	0.40	09/1997	MF	—	Zenon	Unfiltered Secondary
97	Petromin	Riyadh	Saudi Arabia	3.30	01/1980	—	RO	Trisep	Raw
98	Picnic Bay	Magnetic Island	Australia	0.43	10/2002	MBR	—	Kubota	Raw
99	Pine Hill WWTP	Pine Hill	NY / United States	1.25	11/1/1998	MF	—	USFilter	Filtered Secondary
100	Pooler Wastewater Treatment Facility	Pooler	GA / United States	2.4	Proposed	MBR	—	Zenon	Raw
101	Porlock STP	Porlock	United Kingdom	0.50	02/1998	MBR	—	Kubota	Raw
102	Port McNicoll WWTP	Port McNicoll	Ontario / Canada	0.50	02/1999	MBR	—	Zenon	Raw
103	Port Orchard	Port Orchard	WA / United States	1.70	2003	MBR		Zenon	Municipal
104	Pumpkinvine Creek	Paulding County	GA / United States	0.50	09/2003	MBR		Kubota	Municipal
105	Randolph Park WWTP	Tucson	AZ / United States	3.10	9/2003	MBR	—	Zenon	Raw
106	Rashtriya Chemicals and Fertilizers	Mumbai	India	5.98	12/2000	—	RO	Filmtec	Raw
107	Redlands WWTF	Redlands	CA / United States	6.00	Proposed	MBR	—	Zenon	Raw

Table A-1 (continued)

Index	Facility Name	City	State/Country	Membrane Design Flow (US mgd)	Startup Date	Membrane Low Pressure	Membrane High Pressure	Membrane Manufacturer	Feed Waste Water
108	Roedingen WWTP	Roedingen	Germany	0.84	06/1999	MBR	—	Zenon	Raw
109	Roquetas		Spain	3.7	Proposed	MF	—	US Filter - MF	Secondary Effluent
110	Rouse Hill Stage 1/ Stage 2	Northwest Sydney	Australia	1.4	01/2001 2002	MF	—	US Filter - MF	Secondary Effluent
111	Rubes Creek Water Reclamation Facility	City of Woodstock	GA / United States	1.2	12/2003	MBR	—	Zenon	Raw
112	Running Springs WWTP	Running Springs	CA / United States	0.60	2002	MBR	—	Kubota	Raw
113	Sammamish Valley RWPF	King County	WA / United States	1.50	Proposed	MBR	—	Zenon	Municipal
114	Schilde WWTP		Belgium	1.59	2002	MBR	—	Zenon	Raw
115	Scottsdale Water Campus	Scottsdale	AZ / United States	12.00	02/1999	MF	RO	US Filter - MF Koch - RO	Filtered Secondary
116	Skipsea WWTP	Skipsea	United Kingdom	0.34	03/2003	MBR	—	Kubota	
117	Sonoma WWTP	Santa Rosa	CA / United States	3.00	2001	MF	—	Pall	Secondary Effluent
118	State College	State College	PA / United States	0.75	2001	MF	RO	US Filter	Secondary Effluent
119	Sulaibiya WWTP	Sulaibiya	Kuwait	100.00	Proposed	UF	RO	Norrit - UF Ionics - RO	Secondary Effluent
	Swanage Sewage Treatment Plant	Swanage	United Kingdom	1.30	07/2000	MBR	—	Kubota	Raw
	Tannersville WTF	Tannersville	NY / United States	0.80	8/1/1998	MF	—	US Filter	Filtered Secondary
120	Telde	Las Palmas	Spain	1.6	02/2002	MF	—	US Filter - MF	Secondary Effluent
121	Terminal Island Treatment Plant	Los Angeles	CA / United States	5.00	2001	MF	RO	US Filter Hydranautics	Filtered and Settled Secondary
122	The Hamptons	Hampton Creek	GA / United States	0.90	September, 2003	MBR	—	Kubota	Wastewater

Index	Facility Name	City	State/Country	Membrane Design Flow (US mgd)	Startup Date	Membrane Low Pressure	Membrane High Pressure	Membrane Manufacturer	Feed Waste Water
123	Thunder Valley Casino	Lincoln (Sacramento)	CA / United States	0.35	2003	MBR	—	Zenon	
124	Tianjin Ji Zhuang Zi STP	Tianjin	China	6.3	2003	MF	—	US Filter - MF	Secondary Effluent
125	Tianjin TEDA STP	Tianjin	China	7.7	2002	MF	RO	US Filter - MF	Secondary Effluent
126	Tias WWTP Phase I & II	Lanzarote	Canary Islands	0.27 1.59	Not in service yet	MF	RO	US Filter Dow Chemical	Effluent
127	Topan Electronics WWTP	San Diego	CA / United States	0.30	03/2000	MF	RO	Pall - MF	Industrial
128	Traverse City	Traverse City	MI / United States	7.10	07/2003	MBR	—	Zenon	Municipal
129	Tulalip Tribes WWTP	Marysville	WA / United States	1.20	2002	MBR	—	Kubota	Raw
130	Wastewater Treatment Plant #3	Corona	CA / United States	1.0	12/2001	MBR	—	Zenon	Raw
131	Water Factory 21	Fountain Valley	CA / United States	5.00	1976	—	RO	Koch	Secondary Effluent
132	West Basin Carson	Carson	CA / United States	5.00	2000	MF	RO	US Filter - CMF Koch and Hydranautics	Settled Secondary
133	West Basin Chevron Refinery	El Segundo	CA / United States	5.14	11/1/2001	MF		US Filter - CMF	Settled Secondary
134	West Basin El Segundo Phase 1	El Segundo	CA / United States	5.00	1995	MF	RO	US Filter - CMF Trisep - RO	Settled Secondary
135	West Basin El Segundo Phase 2	El Segundo	CA / United States	2.50	1997	MF	RO	US Filter - CMF; Koch - RO	Settled Secondary
136	West Basin El Segundo Phase 3	El Segundo	CA / United States	4.30	2001	MF	RO	US Filter -CMF Koch - RO	Settled Secondary
137	West Basin Mobil Torrance	Torrance	CA / United States	3.20	1997	MF	RO		Settled Secondary

Table A-1 (continued)

Index	Facility Name	City	State/Country	Membrane Design Flow (US mgd)	Startup Date	Membrane Low Pressure	Membrane High Pressure	Membrane Manufacturer	Feed Waste Water
	Refinery								
138	Westbury WWTP	Westbury	United Kingdom	1.25	05/2002	MBR	—	Kubota	Raw
139	Westview Water Reclamation Facility	Powell River	BC / United States	2.0	10/1/1998	MBR	—	Zenon	Raw
140	Wheelabrator	Pinellas	FL / United States	0.5	08/2001	MF	—	Pall	Secondary Effluent
141	WRAMS-2000 Olympic Site	Sydney	Australia	2.0	07/2000	MF	RO	US Filter - MF	Secondary Effluent

APPENDIX A-3

RELATED AGENCY DOCUMENTS

MEMBRANE BIOREACTORS FOR WATER RECLAMATION-PHASE II

FINAL TECHNICAL REPORT

City of San Diego, CA
Metropolitan Wastewater-Public Works

by

Samer Adham, Ph.D. and Rion P. Merlo (Montgomery Watson)
Paul Gagliardo, P.E. (City of San Diego)

Agreement No. 98-FC-81-0031

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GLOSSARY OF TERMS

A-C

BOD_5	5-day Biological Oxygen Demand
BP	Back Pulse
BPR	Biological Phosphorus Removal
cm	centimeter
CAS	Conventional Activated Sludge
CIP	Clean in Place
COD	Chemical Oxygen Demand
CST	Capillary Suction Test
CSTR	Continuously Stirred Tank Reactor

D-F

d	day
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
ENRCCI	Engineering News-Record Construction Cost Index
ft^2	square foot

G-I

gfd	gallons per square foot per day
gpd	gallons per day
gpm	gallons per minute
h	hour
HRT	Hydraulic Retention Time
in	inch

J-L

kg	Kilograms
L	Liter
$L/h\text{-}m^2$	Liters per hour per square meter

M-O

m^2	square meter
m^3	cubic meter
m^3/min	cubic meter per minute

m^3/d	cubic meter per day
MBR	Membrane Bioreactor
MF	Microfilter
mg	Milligram
mg/L	Milligrams per Liter
mg-N/L	Milligrams per Liter as Nitrogen
mL	Milliliter
MGD	Million Gallons per Day
MLSS	Mixed Liquor Suspended Solids
MLVSS	Mixed Liquor Volatile Suspended Solids
mm	millimeter
MPN	Most Probable Number
NaOCl	Sodium Hypochlorite
NCWRP	North City Water Reclamation Plant
ND	Non-Detect
NH_3-N	Ammonia as Nitrogen
NH_4Cl	Ammonium Chloride
NTU	Nephelometric Turbidity Units
NO_2-N	Nitrite as Nitrogen
NO_3-N	Nitrate as Nitrogen
OCP	Zenon ultrafilter trade name
OKC	Zenon microfilter trade name
O&M	Operations and Maintenance
OOS	Out of Service

P-R

PFU	Plaque Forming Units
PLC	Process Logic Controller
PO_4-P	Ortho Phosphate as Phosphorus
psi	Pounds per Square Inch
RAS	Return Activated Sludge
RO	Reverse Osmosis
RR	Recycle Ratio

S-U

scfm	Standard Cubic Feet per Minute
SDI	Silt Density Index
SPWRP	San Pasqual Water Reclamation Plant
SRT	Solids Retention Time
$SRT_{7\text{-}Day}$	Average Solids Retention Time over 7 days
TFC	Thin Film Composite
TKN	Total Kjeldahl Nitrogen

TOC	Total Organic Carbon
TSS	Total Suspended Solids
UF	Ultrafilter
UV-254	Ultraviolet absorbance at 254 nanometer

V-Z

USBR	United States Bureau of Reclamation
VSS	Volatile Suspended Solids
WAS	Waste Activated Sludge
y	year

Symbols

°C	Degrees Celsius
$k	Thousands of Dollars
µg	Microgram
µmho	Micromho

1. EXECUTIVE SUMMARY

Water reclamation is a powerful tool for supplementing water supplies in arid environments. The application of water reclamation has resulted in the emergence of new technologies that can efficiently produce a high quality effluent water. The Membrane Bioreactor (MBR) is one of these emerging technologies that proves to be a viable alternative for use in reclaimed water applications. The MBR is an activated sludge system coupled with a low-pressure membrane that is capable of treating primary effluent municipal wastewater. The effluent water produced is substantially better than that produced by conventional activated sludge followed by granular media filtration. The effluent from an MBR process also has the added advantage of producing water suitable for use by a reverse osmosis (RO) membrane system.

The City of San Diego was awarded a cooperative agreement by the Bureau of Reclamation to evaluate the MBR for its potential application to water reclamation. The City of San Diego and their program manager, Montgomery Watson, performed a parallel comparison of MBRs from two leading manufacturers, Zenon Environmental Systems, Inc. and Mitsubishi Rayon Corporation. Both systems were operated on a pilot scale for over 6,500 hours (270 d). Each system was operated in a nitrification/denitrification and nitrification only mode. The effluent from each MBR system was further treated by two RO pilot units operated in a single-stage mode.

The MBR was evaluated both for its ability to produce high quality effluent as as well as its ability to produce water suitable for use by an RO system. Both membranes demonstrated little fouling throughout the testing period. Both systems were capable of producing water with BOD_5 values of less than 3 mg/L, and up to 6-log removal of total coliforms. The effluent water had consistent turbidity values less than 0.1 NTU and SDI values of less than 3 leading to little fouling by the subsequent RO membranes.

The cost competitiveness of the MBR technology with current water reclamation technologies was also evaluated. A cost comparison was performed analyzing several technologies capable of producing conventional secondary effluent, Title 22 reclaimed water, and water suitable for use by an RO system. The cost analysis evaluated capital and O&M costs to assess the feasibility of future MBR application on an economic basis. The analysis revealed that the MBR is a cost competetive alternative to producing water suitable for use by an RO system at a 1 and 5-MGD capacity. However, existing technologies remain more cost competitive for producing Title 22 reclaimed water.

2. INTRODUCTION

2.1 Background

The increased need for reclaimed water in arid environments has encouraged the development of new wastewater reclamation technologies. The membrane bioreactor (MBR) is one of these. It combines activated sludge treatment with a membrane separation process that eliminates the need for a secondary clarifier. A low-pressure membrane, such as a microfilter (MF) or an ultrafilter (UF), performs the solids separation. The MBR process therefore contains the process elements of secondary, tertiary and advanced wastewater treatment in a single unit operation.

The MBR process can produce high quality effluent with high BOD_5 removal (about 98%), complete nitrification and partial denitrification. (Kishino et al, 1996; Fan et al., 1996; Cicek et al., 1998) The MBR process also achieves virtually complete TSS removal. (Cicek et al., 1998) MBR effluents have low turbidity values (<0.3 NTU) and SDI values (<3), and previous work has shown that MBR effluent can be used as RO feed water with moderate success. (Lozier et al., 1999)

The use of a membrane for solids separation instead of a gravity clarifier eliminates many of the solids seperation problems associated with solids/liquid seperation by sedimentation, such as low settling rates caused by high mixed liquor suspended solids (MLSS) concentrations and filamentous bulking, and others such as dispersed growth and pinpoint floc. (Metcalf & Eddy, 1991) The overall footprint of an MBR system is much smaller than of an activated sludge plant with a secondary clarifier. (Cote et al., 1997)

There are two configurations for MBRs: which are in-series and submerged MBRs. (Adham et. al., 1998) In the in-series MBR configuration sludge is pumped from an aeration basin to a pressure-driven membrane system outside the bioreactor where the suspended solids are retained and recycled back to the bioreactor and the effluent passes through the membrane. The membranes are regularly backwashed to remove suspended solids build-up and accumulations, and are chemically cleaned when the operating pressures become too high. Lyonnaise-des-Eaux/Degremont currently markets an in-line configuration MBR.

In the submerged MBR configuration, a low-pressure membrane is submerged in the aeration basin and operated under vacuum pressure. The membrane is agitated by coarse bubble aeration that helps prevent suspended solids accumulation at the membrane surface. The submerged membranes are either regularly backwashed or relaxed, and are chemically cleaned when the operating pressures become too high. The following three companies are marketing the submerged MBR configuration: Mitsubishi Rayon Corporation (Mitsubishi, Japan), Zenon Environmental Systems, Inc. (Zenon, Canada) and Kubota Corporation (Kubota, Japan).

Full-scale MBR processes exist world-wide. (Adham et al., 1998) To date, the largest U.S. MBR installation treating municipal water is in Arapaho County, CO (Zenon). It is a 1-MGD capacity retrofitted sequencing batch reactor. (Mourato et al., 1999)

2.2 Objectives of the Study

The City of San Diego and their program manager, Montgomery Watson, received a cooperative agreement from the United States Bureau of Reclamation (USBR) to investigate the application of the MBR process for producing reclaimed water. A Mitsubishi pilot-scale MBR and a Zenon pilot-scale MBR were operated in parallel for over 6,500 h (270 d). To evaluate the feasibility of using MBR effluent for RO feed water, the effluents were further treated by a pilot-scale RO unit using Dow/Filmtec thin film composite membranes. The objectives of the study were to:

- Evaluate the MBR performance in both nitrification and nitrification/denitrification modes;
- Evaluate the suitability of the MBR effluent as RO feed water;
- Compare the treatment efficiency and operation reliability of two leading MBR manufacturers; and
- Develop preliminary cost estimates for the MBR technology in comparison to conventional secondary, tertiary and advanced wastewater treatment.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions from Pilot Testing

- The MBR pilot systems were capable of producing a good quality effluent water suitable for use by an RO system.
- Both membranes were operated at reasonable cleaning intervals.
- Both systems showed very high removal of total and fecal coliforms and total coliphage.
- Excellent organic removal was achieved by both MBRs.
- Both MBR pilot systems showed moderate phosphorous removal during Part 1.
- The Zenon MBR pilot system achieved complete nitrification and partial denitrification during Part 1, and complete nitrification during Part 2.
- The Mitsubishi MBR pilot system achieved complete nitrification and partial denitrification during Part 1, and complete nitrification during Part 2.
- The Mitsubishi MBR ran at an 8-hour 15% flux increase over a 5-day period with minimal fouling during Part 1, and both systems ran well at an 8-hour 25% increase in flux over a 5-day period with minimal fouling during Part 2.
- Both RO pilot units showed continuously high salt rejection.
- The RO pilot unit following the Mitsubishi MBR only required one chemical clean during the duration of Part 1, and was not cleaned during Part 2.
- The RO pilot unit following the Zenon MBR did not require a chemical clean during the duration of Part 1, however it was operated at a lower flux than the RO skid following the Mitsubishi MBR , and was not cleaned during Part 2.
- The air flowrate used to agitate the membrane fibers is a critical parameter in respect to membrane cleaning intervals.

3.2 Conclusions from Cost Analysis

To establish relative costs, the MBR was compared to a conventional process using an oxidation ditch as a treatment tool for three different purposes: 1) producing 30/30 secondary effluent; 2) producing California Title 22 tertiary effluent; and 3) producing water suitable for repurification via reverse osmosis. All costs were based on a constant flow, 1 or 5 MGD plant that skims sewage from a regional system and returns the residuals to the sewer. The conclusions were:

- The oxidation ditch is the most cost-effective process for producing secondary effluent quality water.
- The oxidation ditch with tertiary filtration and disinfection is the most cost-effective process for producing California Title 22 reclaimed water.
- The MBR process is the most cost-effective process for producing water suitable for RO membranes.

It should be noted that none of these costs include consideration for the cost of land, a consideration where MBR has substantial advantages.

3.3 Other Conclusions

- Capillary Suction Tests showed a slight relationship between dewaterability and MLSS concentration. The larger MLSS values showed better sludge dewaterability.
- The Zenon MBR was capable of operating with intermittent aeration of the membrane with no decline in membrane performance.
- MBR needs to have sufficient free board and a sprayer system in order to control foaming episodes.
- An appropriate aeration system needs to be designed in order to achieve nitrification all of the time.
- The anoxic tank needs to be well mixed in order to prevent foam build-up.

3.4 Recommended Future Work

This project has demonstrated successful performance of the MBR process at the pilot-scale. It is the team's overall recommendation that the City of San Diego and the USBR carry this forward to a full-scale demonstration at the 1 or 5-MGD level. This will address any scale-up issues with the technology and evaluate the long-term performance of the MBR technology including operation and maintenance (O&M) issues. The demonstration scale project will also develop more accurate and refined capital and O&M costs for MBR.

4. MATERIALS AND METHODS

4.1 Testing Site

All pilot testing was performed at the Aqua 2000 Research Center at the San Pasqual Water Reclamation Plant (SPWRP) in Escondido, California.

4.2 Primary Effluent

The pilot units were operated on the same municipal primary effluent wastewater that was being treated by the SPWRP. The primary treatment processes included a travel screen, a vortex grit chamber, a rotary drum screen, and a rotary disc filter. The charecteristics of the primary effluent are presented in the "Results and Discussion" sections.

4.3 Experimental Set-Up

Figures 4-1 and **4-2** are schematic diagrams of the pilot treatment trains for Part 1: nitrification/denitrification and Part 2: nitrification only, respectively.

4.3.1 Mitsubishi MBR

The Mitsubishi MBR pilot unit was equipped with a 1,259-gal (4.77m^3) serpentine 3-compartment anoxic tank and a 1,706-gal (6.46 m^3) aerobic tank. During the course of the study, two submerged propeller mixers were installed to keep the contents well mixed. The MBR was fed from the primary effluent break tank using a submersible pump controlled by the programmable logic controller (PLC). The primary effluent passed through a 0.5-mm screen before entering the anoxic zone. The mixed liquor was pumped from the anoxic tank to the aerobic tank during Part 1 of the testing. Overflow from the aerobic tank returned by gravity to the anoxic tank. Activated sludge was batch wasted once per day from the transfer line between the anoxic and aerobic tanks. In Part 2 of the testing, when the anoxic tank was not in service, batch wasting was from the aerobic tank overflow pipe. In Part 2, influent screens were taken out of service, and primary effluent was fed directly into the aerobic tank. The volume of the aerobic tank was increased to 1,886 gal (7.14 m^3), and a surface sprayer system spraying mixed liquor was installed to control aeration basin foaming.

Two membrane banks were submerged in the aerobic tank. Coarse bubble air diffusers agitated the membranes continuously as well as aerating the mixed liquor. Schematics of the Mitsubishi MBR during Part 1 and Part 2 of testing are given in **Figure 4-3** and **4-4**, respectively. Pictures of the Mitsubishi MBR pilot unit and the microfilter are shown in **Appendix D**. Each membrane bank consisted of 50, 10.76 ft^2 (1 m^2) Mitsubishi Sterapore HF microfiltration (MF) membranes with a total membrane surface area of 1,076 ft^2 (100 m^2). The hollow fibers are arranged horizontally and attached at both ends to two permeate lines. The membranes are operated under vacuum pressure. Membrane specifications are given in **Table 4-1.**

The first membrane tested during Part 1 had a design flaw that warranted its replacement. Apparently, plastic stitching down the center of the fibers to help support them caused more

frequent fiber breakage. After three months of testing this membrane module was replaced with a new module that did not have the plastic stitching.

In Part 1 of the testing, the Mitsubishi MBR was operated at a target flux of 13 gfd (22 L/h-m^2). Initially, an operating cycle of 8 min production and 2 min relaxation was used. To allow production of sufficient water for the RO pilot plant, these conditions were changed to a cycle of 12 min production and a 2 min relaxation. The coarse bubble diffusers air flow rate was 41 scfm (1.2 m^3/min).

4.3.2 Zenon MBR

The Zenon MBR pilot unit was equipped with a 734-gal (2.78 m^3) anoxic tank, a 1,287-gal (4.87 m^3) aerobic tank and a 185-gal (0.7 m^3) ZenoGem unit. The MBR was fed with 3-mm prescreened primary effluent by a PLC-controlled submersible pump, placed in the primary effluent break tank. Anoxic tank mixed liquor flowed by gravity to the aerobic tank, from whence it was pumped to the ZenoGem tank. The ZenoGem tank mixed liquor overflowed back to the anoxic tank. A spray system sprayed mixed liquor on to the surface of the anoxic tank to control foam. During Part 2 of the testing, this spray system was placed in the aerobic tank.. At 1,471 h, the level of the aeration basin was raised in order to improve the suction head to the recirculation pump, causing the aeration basin volume to be 1,375 gal (5.20 m^3). Batch mixed liquor wasting was initially performed from the aerobic tank, and later from the ZenoGem tank. In Part 2 of the testing the anoxic tank was removed from service and the primary effluent was fed directly to the aerobic tank.

One membrane cassette was submerged in the ZenoGem tank where it was agitated with coarse bubble air diffusers. During Part 1, continuous coarse air in the ZenoGem tank was used, and in Part 2 the coarse bubble aeration was operated on a 10 s on and 10 s off cycle. Schematics of the Zenon MBR pilot unit during Parts 1 and 2 of the testing are shown in **Figures 4-5** and **4-6**, respectively. Pictures of the Zenon MBR pilot unit and the ultrafilter are shown in **Appendix D**. During the first 800 h of testing, the ZeeWeed OKC MF was evaluated. The remainder of the testing was performed with ZeeWeed OCP UF membrane. The performance of the MF and the inability to achieve acceptable coliform rejection warranted replacement. The specifications of both membranes are given in **Table 4-2**.

During the start-up period, the ZenoGem system was operated without an anoxic or aerobic tank. Operating conditions were flux = 6 gfd (10 L/h-m^2) using the OKC MF, and a cycle of 10 min production and a 15-s backpulse using product water. Once the full tankage (i.e. aerobic and anoxic tanks) had been installed the MBR was operated as follows: flux = 25 gfd (43 L/h-m^2); ZenoGem tank airflow = 25 scfm (0.7 m^3/min); aerobic tank airflow = 40 scfm (1.1 m^3/min); and the recycle ratio (RR) was set at 6. For the Zenon OCP UF membrane initial operating conditions were flux = 19 gfd (32 L/h-m^2) and ZenoGem tank airflow = 30 scfm (0.8 m^3/min). After demonstrating acceptable performance under these conditions, the flux was increased to 21 gfd (36 L/h-m^2).

4.3.3 RO Pilot Units

Each RO pilot unit housed two pressure vessels in series that were operated in a single pass mode. Each pressure vessel contained 3 spiral-wound 4 in by 40 in (10.2 cm x 101.6 cm) thin film composite (TFC) RO membranes with a surface area of 78 ft^2 (7.2 m^2) per element. Both RO pilot units contained Dow/Filmtec low-pressure polyamide BW30-4040 RO membranes that were operated in a constant flux, variable pressure mode. A target chloramine residual of 1 to 2-mg/L was maintained in the RO feed water to control biological and organic fouling. The RO influent was also dosed with a manufacturer-recommended antiscalant[1] at 1-mg/L, and was filtered through a 5-µm cartridge filter. Cartridge filter effluent was passed through a high-pressure pump to the first pressure vessel. **Table 4-3** contains the RO specifications.

The Mitsubishi MBR was operated with 6 membrane elements at a 12-gfd (20.4 L/h-m^2) flux for the duration of the study. Because the Zenon MBR only produced sufficient effluent to operate the downstream RO unit at 6 gfd (10 L/h-m^2), 3 of the RO elements were replaced with 3 dummy elements to increase the flux to 12 gfd in Part 2.

4.3.4 Determination of Calculated Parameters

Pressure Calculations

The net operating pressure (P_{net}) for the RO systems was calculated as follows:

$$P_{net} = \frac{(P_i - P_o)}{2} - P_p - \Delta\pi \qquad (1)$$

Where,

P_{net}	=	Net operating pressure (psi)
P_i	=	Pressure at pressure vessel inlet (psi)
P_o	=	Pressure at pressure vessel outlet (psi)
P_p	=	Permeate pressure
$\Delta\pi$	=	Net osmotic pressure of the feed and permeate (psi)

The integrated averaging factor (IAF) assuming 100% salt rejection can be used to estimate the osmotic pressure as follows:

$$\Delta\pi = IAF \times \pi_f \qquad (2)$$

[1] King Lee Technologies, Pretreatment Plus 0100, San Diego, CA

Where,

π_f = Osmotic pressure of the feed stream (psi)
IAF = 1.386 (for 50% recovery)

For the RO membranes, the following approximate rule of thumb can be used:

1,000 mg/L NaCl solution ≅ osmotic pressure, π of 11.5 psi

Flow Calculations

The net permeate rate for the Mitsubishi MBR can be calculated from:

$$Q_{NET} = \left(\frac{t_{ON} - t_{OFF}}{t_{ON}}\right) \times Q_P \tag{3}$$

Where,

Q_{NET} = Net permeate rate (gpm)
t_{ON} = MBR membrane production time (min)
t_{OFF} = MBR membrane relaxation time (min)
Q_p = Permeate flow rate (gpm)

The Zenon MBR net permeate rate can be calculated from:

$$Q_{NET} = \frac{Q_P t_{ON} - V_{BP}}{t_{ON} + t_{BP}} \tag{4}$$

Where,

V_{BP} = Backpulse volume (gal)
t_{BP} = Backpulse time (min)

Flux Calculation

The flux of the RO membranes and the MBR membranes can be calculated as follows:

$$J = \frac{Q_p \times 1440}{A} \tag{5}$$

Where,

J = Membrane flux (gfd)
A = Total membrane surface area (ft^2)

Temperature Correction

Low-pressure membrane fluxes are normally adjusted to a temperature of 20°C, and RO membrane fluxes are adjusted to a temperature of 25°C using:

$$J\,@\,20°C = J \times e^{-0.0239(T-20)} \tag{6}$$

Where,

T = Feed water temperature (°C)

The RO membranes were temperature corrected according to manufacturer's correction factors.

Specific Flux

The specific flux is the relationship between flux and the net operating pressure as follows:

$$J_{SP} = \frac{J}{P_{NW}} \tag{7}$$

Where,

J_{SP} = Specific flux (gfd/psi)

The temperature-corrected specific flux can be calculated using the temperature corrected flux.

Salt Rejection

The salt rejection by the RO membranes can be calculated as follows:

$$R = 100\left(1 - \frac{c_P}{c_f}\right) \tag{8}$$

Where,

R = Rejection (%)
c_p = Permeate conductivity (μmho)
c_f = Feed conductivity (μmho)

Hydraulic Retention Time

The hydraulic retention time (HRT) for the MBR pilot units was calculated from:

$$HRT = \frac{V}{Q_{NET} \times 60} \tag{9}$$

Where,

HRT = Hydraulic retention time (h)
V = MBR volume (gal)

Sludge Retention Time

Activated sludge was wasted directly from the MBR aeration tank, which was assumed to be completely mixed. The sludge retention time (SRT) is defined as the total mass of activated sludge in the MBR divided by the total mass of activated sludge removed. Since the permeate contained a negligible amount of suspended solids, wasting from the aeration tank is the only way in which suspended solids are removed. Using these assumptions, the SRT is:

$$SRT = \frac{VX_R}{Q_W X_W} = \frac{V}{Q_W} \tag{10}$$

Assuming that X_R is equal to X_W.

Where,

SRT = Solids retention time (days)
X_R = Mixed liquor volatile suspended solids (mg/L)
X_W = Waste stream volatile suspended solids (mg/L)
Q_W = Waste stream flow rate (gpd)

The 7-d SRT ($SRT_{7\text{-}d}$) is calculated by averaging the SRT over 7 previous days as follows:

$$SRT_{7-d} = \frac{SRT_{n=1} + SRT_{n=2} + \ldots + SRT_{n=7}}{7} \tag{11}$$

Where,

$SRT_{7\text{-}d}$ = 7-d average SRT
N = day

Recycle Ratio

The recycle ratio (RR) is defined as the ratio of the flow of mixed liquor from the aerobic tank to the anoxic tank, divided by the net permeate rate. Because mixed liquor from the anoxic tank was pumped to the aerobic tank, and returned by gravity, only the flow rate from the anoxic tank to the aerobic tank was recorded. The recycle ratio (RR) was calculated as follows:

$$RR = \frac{Q_R - Q_{NET}}{Q_{NET}} = \frac{Q_R}{Q_{NET}} - 1 \tag{12}$$

Where,

RR = Recycle ratio
Q_R = Flow rate from the anoxic tank to the aerobic tank (gpm)

4.3.5 Chemical Additions

Combined Chlorine for the RO Influent

To control biological and organic fouling of the RO membranes, a 1-2 mg/L combined chlorine residual was maintained in the RO influent by in-line dosing of MBR effluent with 15% NaOCl solution (using a chemical metering pump[2]) and addition of 12% NH_4Cl solution was added using a chemical metering pump.[3]

RO Membrane Antiscalant Addition

To control inorganic scaling of the RO membranes an antiscalant product[4] was added in-line and upstream of the RO membranes at the manufacturer's recommended dosage of 1 mg/L using a chemical metering pump.[5]

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[2] LMI Milton Roy, Model P121, Acton, MA
[3] LMI Milton Roy, Model P131, Acton, MA
[4] King Lee Technologies, Pretreatment Plus 0100, San Diego, CA
[5] LMI Milton Roy, Model P121, Acton, MA

4.3.6 Chemical Cleaning of Membranes

All chemical cleanings were performed using manufacturers' recommendations. A complete list of cleaning protocols can be found in **Appendix B**.

The Zenon MBR membranes were cleaned with a 2,000-mg/L NaOCl solution. The ZenoGem tank was drained and isolated and the membranes were cleaned in place. A maintenance clean was performed on the Zenon MBR once per week using a 200-mg/L NaOCl solution. The Mitsubishi MBR chemical cleaning was performed using a 3,700-mg/L solution of NaOCl in place in the presence of the mixed liquor.

4.4 WATER QUALITY

4.4.1 On-site Water Quality Analyses

Temperature

The temperatures of the MBR aerobic and anoxic tanks were monitored using a digital temperature probe.[6] RO influent temperature was determined using an on-line pH and temperature probe.[7]

pH

Primary effluent, MBR effluent and RO effluent pH was determined using a portable pH meter.[8]

Particle Count

MBR effluent particle counts were measure using an on-line particle counter[9] and was recorded on a personal computer using data acquisition software.[10] The particle counters were set to monitor 2, 5, 10 and 15-µm sized particles every min.

[6] VWR Scientific Products
[7] Rosemount Analytical SoluComp
[8] Hach Co., EC20 pH/ISE meter, Loveland, CO
[9] Hach Co., 1900 WPC Particle Counter, Loveland, CO
[10] Hach Co, AquaView+, Loveland, CO

Turbidity

MBR effluent turbidity was determined using an on-line turbidimeter[11] and the data was recorded by a personal computer using acquisition software.[12] MBR effluent and primary effluent turbidities were also determined using a bench top turbidimeter.[13]

Silt Density Index (SDI)

Silt Density Index (SDI) analyses were performed on the MBR effluents using an SDI machine[14], which filters a water sample through a disposable 0.45-µm filter and continuously monitors the flow rate at a constant pressure for 15-min.

Total Organic Carbon (TOC)

MBR effluent and the RO permeate total organic carbon (TOC) concentrations were determined using one of two TOC analyzers.[15] One TOC analyzer was dedicated to make low TOC analyses from the RO effluent, and the second was used for the higher TOC samples from the MBR effluents. Grab samples were collected and analyzed on a routine basis.

UV-254 Absorbency

Samples for TOC analysis were also analyzed for UV-254 absorbence using a spectrophometer.[16]

Conductivity

RO influent and effluent conductivity was determined using two bench top conductivity meters.[17] RO influent and effluent conductivity was also monitored using on-line conductivity meters.[18]

[11] Hach Co., Model 1720C, Loveland, CO
[12] Hach Co, AquaView+, Loveland, CO
[13] Hach Co, Model 2100N, Loveland, CO
[14] Chemetek, FPA-2000, Portland, OR
[15] Sievers 800 portable Total Organic Carbon Analyzer, Boulder, CO
[16] Hach Co., DR/4000U spectrophotometer, Loveland, CO
[17] Fisher Scientific, Digital Conductivity Meter, Pittsburgh, PA
[18] Myron L Company, Series 750

Chlorine Residual

The total chlorine residual grab samples of the RO influent was monitored using the DPD method.[19]

Ammonia, Nitrate, Nitrite, and Orthophosphate

The ammonia, nitrate, nitrite and orthophosphate concentrations in the primary effluent, MBR effluent and RO effluent were analyzed on grab samples using the Nessler method, cadmium reduction method, diazotization method and the PhosVer 3 method, respectively.[20]

Capillary Suction Test

Grab samples of mixed liquor were analyzed for capillary suction test (CST) using a CST analyzer.[21]

4.4.2 Off-Site Water Quality Analyses

Several water quality parameters were analyzed by off-site laboratories. Throughout the project, the San Diego Marine Microbiology Laboratory, the San Diego North City Water Reclamation Plant Laboratory, the San Diego Water Quality Laboratory and Montgomery Watson Laboratories were used to analyze water quality parameters. **Table 4-4** summarizes the detection limits, sampling frequencies and methods used for all of the laboratory analyses.

4.4.3 Sampling Protocol

All water quality samples were grab samples collected in sample containers provided by the appropriate laboratory. All samples were transported to the appropriate laboratory in a cooler and were processed within the allowable holding period. When sampling from sample ports, they were flushed before sample collection. All microbial samples were collected using aseptic techniques. Sample ports were flamed and flushed before sample collection.

[19] Hach Co., DR/4000U spectrophotometer, Loveland, CO
[20] Hach Co., DR/4000U spectrophotometer, Loveland, CO
[21] Triton Electronics, Ltd., Type 304B Capillary Suction Timer, Essex, UK

4.4.4 Quality Control/Quality Assurance

Every effort was made at the pilot site to attain the highest amount of quality control and quality assurance. **Appendix C** contains memoranda that document the QA/QC performed at the beginning and the end of the pilot testing.

5. RESULTS AND DISCUSSION PART 1: NITRIFICATION/DENITRIFICATION OPERATION

5.1 MBR Operating Conditions

During Part 1 of the testing, the Mitsubishi MBR system was operated with an anoxic tank and an aerobic tank together having an HRT of 6 h and an internal recycle ratio (RR) of 3. The mixed liquor wasting rate was set to give an SRT of 12 d and an MLSS concentration of 10,000-12,000 mg/L. The HRT and SRT_{7-d} values are presented in **Figure 5-1**. The DO concentrations, shown in **Figure 5-2**, of the aerobic tank and anoxic tank ranged from 0.5 to 4.0 mg/L and from 0.3 to 1.3 mg/L, respectively. The total MLSS and MLVSS concentrations for the Mitsubishi MBR are shown in **Figure 5-3**. After the initial seeding of the MBR, the reactor solids concentration was allowed to increase. The lack of mixing in the anoxic tank at the beginning of the study caused excessive foaming in the anoxic tank, and the anoxic tank had to be drained after 1,141 h (48 d) of operation. Two mixers were installed in the anoxic tank. One of the mixers failed at 4,388 h (183 d) causing an apparent decrease in solids concentration because a foam layer formed again that contained a large portion of activated sludge solids. This foam layer was not included in the TSS sample. After 4,926 h (205 d) of operation, the system was subjected to a shock load[22] that caused it to foam significantly causing a solids loss that substantially decreased the solids concentrations. The lower graph in **Figure 5-3** shows that the normal sludge wasting rate was between 4-6 kg VSS/d.

The Zenon MBR was operated with aerobic and anoxic tanks and with the ZeeWeed OKC MF at a flux of 25 gfd (43 L/h-m^2), an HRT of 5.6 h and an RR of 6. The ZeeWeed UF was initially operated at a flux of 19 gfd (32 L/h-m^2), and later at a flux of 21 gfd (36 L/h-m^2) and an HRT of 5.3 h. The mixed liquor wasting rate was set to give an SRT of 21 d and an MLSS concentration of 8,000-10,000 mg/L. The HRT and SRT_{7-d} values are presented in **Figure 5-4**. The DO concentrations in the Zenon aerobic and anoxic tanks are shown in **Figure 5-5**. The aerobic tank DO concentrations ranged from 0.43 to 4.5 mg/L after the full system was installed, and from 0.37 to 0.80 mg/L in the anoxic tank. The Zenon MBR MLSS and MLVSS concentrations are shown in **Figure 5-6**. A shock load was detected at 3,651 h (152 d) which caused foaming in the Zenon system, but the solids levels were unaffected because there was sufficient freeboard to keep the foam in the reactor. The lower graph in **Figure 5-6** shows that the sludge wasting rate was between 2-4 kg VSS/d.

5.2 Membrane Performance

5.2.1 MBR Pilot Plants

Figure 5-7 shows the membrane performance of the Mitsubishi MBR during Part 1 of the testing. A chemical cleaning was performed after 1,652 h (69 d) with the original membrane

[22] Lab analyses of the foam showed that the following chemicals were present: cineole, pinene, camphene, pinane, camphogen, and terpinene. These compounds are typically found in eucalyptus oil, pine oil, pharmaceuticals, disinfectants, deodorants and polishes.

which resulted in a reduction in vacuum pressure from 4.27 psi (0.29 bar) to 1.42 psi (0.10 bar). After the new membrane was installed, the system ran for 1,986 h (83 d) before a chemical clean was performed. The chemical cleaning reduced the vacuum pressure from 3.98 psi (0.27 bar) to 2.56 psi (0.18 bar). Both of these first two cleanings were performed by backpulsing chlorine solution over a 2-h period as recommended by the manufacturer. To achieve better recovery of membrane performance, all subsequent cleanings of the new membranes were performed by backpulsing chlorine solution over a 3-h period. These took place after 864 h (36 d), and again after 823 h (34 d). The second cleaning of the new membranes reduced the vacuum pressure from 4.41 psi (0.30 bar) to 2.13 psi (0.15 bar). The final membrane cleaning during Part 1 reduced the vacuum pressure from 4.27 psi (0.29 bar) to 2.70 psi (0.19 bar).

Figure 5-8a shows the membrane performance of the Zenon MBR during Part 1 of the testing. The membrane was not chemically cleaned during the start-up period. Once the full system was installed, it ran for 185 h (8 d) before reaching a vacuum pressure that required a chemical cleaning. However, rather than doing this, the flux was lowered to 20 gfd (34 L/h-m^2) until the ZeeWeed OCP UF membrane could be installed. The OCP membrane ran for 2,082 h (87 d) before chemical cleaning. The chemical cleaning reduced the vacuum pressure from 8.10 psi (0.56 bar) to 1.47 psi (0.10 bar). At about this time, the manufacturer recommended that the backpulse pressure be decreased. Following the chemical cleaning, the membrane fouled rapidly. It was thought that the cause of fouling was the decreased back pulse pressure, but returning the back pulse pressure to its initial value did not remedy the fouling. Further investigation revealed that the blower airflow in the ZenoGem tank had decreased because of a blower malfunction, and the decrease in airflow corresponded to the rapid fouling events as can be seen in **Figure 5-8b**. This experience indicates that the importance of maintaining a sufficient airflow for preventing membrane fouling in the Zenon system.

5.2.2 RO Pilot Units

Figure 5-9 shows the membrane performance of the RO pilot unit operating at 12 gfd (20 L/h-m^2) and a 50% recovery treating Mitsubishi MBR effluent during Part 1 of the testing. The RO unit ran for 2,345 h (98 d) before a chemical cleaning was needed and following this cleaning it ran for another 1,143 h (48 d) without a need for chemical cleaning.

Figure 5-10 shows the membrane performance of the RO pilot unit treating Zenon MBR effluent during Part 1 of the testing. Because of the changes in flowrate of the Zenon MBR during Part 1, the RO flux was adjusted from 12 gfd (20 L/h-m^2) to 6 gfd (10 L/h-m^2) and finally to 9 gfd (15 L/h-m^2), and producing a recoveries of 50%, 33% and 43%, respectively. The RO unit ran for 3,350 h (140 d) with minimal fouling.

5.3 Water Quality

5.3.1 Primary Effluent

The results of primary effluent grab sample analyses by the San Diego Water Quality Laboratory are presented in **Table 5-1**.

5.3.2 MBR Pilot Plants

Turbidity, Silt Density Index (SDI), and Particle Counts

The Mitsubishi MBR effluent turbidity grab samples and SDI values are shown in **Figure 5-11**. The primary effluent turbidity was in the range of 14-170 NTU. The MBR effluent was below 0.2 NTU when the first membrane was in service and less than 0.1 NTU after the second membrane was installed. SDI values were below 2.6 when the first membrane was in service, and less than 2.0 after the second membrane was installed. The on-line particle count and turbidity data over an 8-h period between 3,986-3,994 h of operation for the Mitsubishi MBR effluent can be seen in **Figures 5-12**. The counts for particles ≥2 μm were between 4 and 20 particles/mL, and the turbidity values were consistently around 0.06 NTU.

The effluent turbidity and SDI values for the Zenon MBR are presented **Figure 5-13**. The primary effluent turbidity ranged from 14-170 NTU, and the MBR effluent was always below 0.1 NTU following the installation of the UF membrane. The MBR effluent SDI values for the Zenon MBR were less than 2.0 following the installation of the UF membrane. The on-line particle count and turbidity data over an 8-hour period between 2,736 and 2,744 h of operation for the Zenon MBR effluent can be seen in **Figure 5-14**. The counts for particles ≥2 μm were between 1 and 20 particles/mL, and turbidity values were consistently around 0.04 NTU.

BOD_5, COD and TOC

The BOD_5, COD and TOC values for the primary effluent and for the Mitsubishi MBR permeate are shown in **Figure 5-15**. A majority of the MBR effluent BOD_5 values were below the detection limit, and where they are above this they correspond to high NH_3-N levels in the MBR effluent. Therefore, since nitrification was not inhibited in the BOD_5 test, the elevated values are most likely due to ammonia oxidation in the BOD_5 test. MBR effluent COD and TOC values were <35 mg/L and <8 mg/L, respectively.

The BOD_5, COD and TOC values for the primary effluent and Zenon MBR permeate are shown in **Figure 5-16**. A majority of the MBR effluent BOD_5 values were below the detection limit. Most of of the MBR COD and TOC effluent samples were <20 mg/L and <7 mg/L, respectively.

Biological Nutrient Removal

The on-site inorganic nitrogen results from the Mitsubishi MBR are shown in **Figure 5-17.** The system completely nitrified at times with effluent NH_3-N values <1 mg-N/L, but not always because the coarse bubble diffusers did not provide enough oxygen producing values as high as 24 mg-N/L. In part 2 of the testing, supplemental aeration was installed to promote nitrification. The effluent NO_3-N values were between 0.5 and 25 mg-N/L and all of the NO_2-N values were less than 5 mg-N/L. The on-site PO_4-P results of the Mitsubishi MBR are shown in **Figure 5-18**. The primary effluent values were between 2 and 7 mg-P/L, and the majority of the effluent values were <1 mg-P/L. There does seem to be a decrease in PO_4-P concentration because of

biological phoshporus removal (BPR) due to low NO_3 concentrations in the anoxic tank creating the anaerobic zone necessary for BPR. The beginning and end of the testing period show a decline in BPR that corresponds to a decrease in denitrification. The presence of NO_3 in the anoxic tank created an anoxic environment that was not conducive to BPR.

The on-site inorganic nitrogen results from the Zenon MBR effluent are shown in **Figure 5-19.** The system did show complete nitrification at times with values <1 mg-N/L. The majority of NH_3-N values were less than 5 mg-N/L. The NO_3-N values were between 2 and 25 mg-N/L and all of the NO_2-N values were < 5 mg-N/L. The system did not achieve total denitrification, but did achieve partial denitrification most of the time. The on-site PO_4-P results are shown in **Figure 5-20.** The primary effluent had values between 2 and 7 mg-P/L, and the effluent of the Zenon MBR had values between <1 and 4.5 mg-P/L, with a majority of the samples <1 mg-P/L. There does seem to be a decrease in PO_4-P because of BPR. However, the BPR continues in the presence of NO_3 in the anoxic tank. The Zenon anoxic tank was not mixed, unlike the Mitsubishi anoxic tank, which could have resulted in anaerobic regions in the anoxic tank that caused BPR in the presence of NO_3.

Total Coliform, Fecal Coliform, Total Coliphage

The primary effluent and Mitsubishi MBR effluent total coliform, fecal coliform and total coliphage are shown in **Figure 5-21.** A majority of the samples were <2 MPN/100 mL (coliforms), and <2 PFU/100 mL (coliphage), giving an overall log removal of >6 for the total and fecal coliforms and >3 log removal of coliphage.

The primary effluent and Zenon MBR total coliform, fecal coliform and total coliphage results are shown in **Figure 5-22.** The total coliform values in the MBR effluent ranged from <2 to 1,600 MPN/100 mL. The fecal coliforms in the MBR effluent ranged between 2-1600 MPN/100 mL when the MF was in operation. Upon the installation of the UF, the majority of the fecal coliforms were <2 MPN/100mL. This data suggests that the larger pores in the UF gradually became permanently plugged causing the effluent coliform concentration to gradually decrease. The sudden decrease in MBR effluent fecal coliforms could have been due to the lower fecal coliform concentration in the primary effluent. The total coliphage values gave an overall log removal of >3.

Other Water Quality Parameters

The Mitsubishi MBR grab samples analyzed by the Water Quality Laboratory can be seen in **Table 5-2.** The Zenon MBR samples analyzed by the Water Quality Laboratory can be seen in **Table 5-3.**

5.3.3 RO Pilot Units

Inorganic Nitrogen and Ortho-Phosphate Removal

The Mitsubishi MBR RO pilot unit effluent inorganic nitrogen species are shown in **Figure 5-23.** The RO permeate NH_3-N values were between 0.01 and 1 mg-N/L; the NO_3-N values were between 0.02 and 0.4 mg-N/L; and the NO_2-N values were all between 0.003 and 0.05 mg-N/L. The Mitsubishi MBR RO pilot unit effluent PO_4-P values can be seen in **Figure 5-24.** All samples were collected as grab samples and analyzed on-site. The PO_4-P values were <0.3 mg-P/L.

The Zenon MBR RO pilot unit effluent inorganic nitrogen species are shown in **Figure 5-25.** The RO permeate NH_3-N values were between 0.02 and 1 mg-N/L; the NO_3-N values were between 0.02 and 0.5 mg-N/L; and the NO_2-N values were all between 0.003 and 0.05 mg-N/L. The Zenon MBR RO pilot unit effluent PO_4-P values are shown in **Figure 5-26.** The PO_4-P values were <0.4 mg-P/L.

Salt Rejection

The feed and permeate conductivities for the Mitsubishi MBR RO Pilot unit are shown in **Figure 5-27.** The RO membranes produced a percent rejection, based on conductivity, of greater than 98% throughout the testing.

The feed and permeate conductivities for the Zenon MBR RO Pilot unit are shown in **Figure 5-28.** The RO membranes produced a dito of greater than 98% throughout the testing.

Other Water Quality Parameters

The Mitsubishi MBR RO samples analyzed by the Water Quality Laboratory can be seen in **Table 5-4.** The Zenon MBR RO grab samples analyzed by the Water Quality Laboratory can be seen in **Table 5-5.**

5.4 Peaking Study

The results of the Mitsubishi MBR peaking study can be seen in **Figure 5-29.** The MBR flux was increased from 13 gfd (22 L/h-m^2) to 15 gfd (26 L/h-m^2) over an 8-h period in the day. After the 8-h increase, the flux was returned to the target flux of 13 gfd. There was no significant vacuum increase over the 5-d testing period.

A peaking study was not performed on the Zenon MBR at the end of Part 1 of the testing because one of the blowers malfunctioned and the system had to be shut down until it could be repaired.

6. RESULTS AND DISCUSSION- PART 2: NITRIFICATION TESTING

6.1 MBR Operating Conditions

At the end of Part 1 of the pilot testing, both MBR systems were shut down and retrofitted to operate in a "nitrification-only" mode. The anoxic tanks were taken out of service, and all membranes were chemically cleaned before beginning Part 2 of the pilot testing. The Mitsubishi membrane was soaked overnight in a 1,000 mg-NaOCl/L solution. The Zenon MBR was soaked overnight in a 2,000 mg-NaOCl/L solution, followed by a citric acid soak overnight. Both RO systems were chemically cleaned according to the manufacturer's recommendations. The MBR systems were seeded with activated sludge from the NCWRP and they were operated without activated sludge wasting to allow the MLSS to increase to the target values of 8,000 mg/L. Once these values were reached, activated sludge was wasted once every day.

The Mitsubishi MBR was operated at a target flux of 13 gfd (22 L/h-m^2) during Part 2 of the testing. The membrane was in operation for 12 min and then relaxed for 2 min. The aerobic tank HRT was 3.8 h and the target $SRT_{7\text{-}d}$ was 10 days. The HRT and $SRT_{7\text{-}d}$ values can be seen in **Figure 6-1.** The DO concentrations in **Figure 6-2** were in the range of 1-5 mg/L. The MLSS and MLVSS concentrations in the Mitsubishi MBR are shown in **Figure 6-3.** The target TSS was 8,000 mg/L for Part 2 of the study to achieve adequate oxygen transfer. A sudden decrease in MLSS at 1,130 h was attributed to a shock load that caused foaming out of the reactor and solids loss. Following the shock load, MLSS was increased back to its target value by stopping the sludge wasting until the MLSS level reached 8,000 mg/L. The overall sludge wasting rate (**Figure 6-3**) was 4-6 kg of VSS/d.

During Part 2 of the pilot testing, the Zenon MBR was operated at a target flux of 19 gfd (32 L/h-m^2). The membrane was in operation for 10 min, after which time it was backpulsed for 15 s using product water. The aerobic tank HRT was 4 h and the target $SRT_{7\text{-}d}$ was also 10 days. The HRT and $SRT_{7\text{-}d}$ charts can be seen in **Figure 6-4.** The coarse bubble aeration in the ZenoGem tank was operated at 30 scfm (0.8 m^3/min) intermittently (10 s on, 10 s off). The aeration tank air flowrate was set at 40 scfm (1.1 m^3/min). The Zenon aeration basin DO in **Figure 6-5** was maintained between 1-4 mg/L to encourage nitrification. The MLSS and MLVSS concentrations in the Zenon MBR are shown in **Figure 6-6.** The target MLSS was 8,000 mg/L basked on the manufacture's recommendation. The shock load at 817 h did not affect the Zenon system because there was sufficient freeboard to keep the foam in the aeration basin. The overall sludge-wasting rate (**Figure 6-6**) was between 2-4 kg of VSS/d.

6.2 Membrane Performance

6.2.1 MBR Pilot Plants

Figure 6-7 shows the membrane performance of the Mitsubishi MBR during Part 2. A chemical cleaning was conducted at the start-up of testing, then the MBR ran for a 1,337 h (56 d) before another chemical cleaning was required. This cleaning reduced the vacuum pressure from 4.6 psi (0.3 bar) to 2.6 psi (0.18 bar). Prior to the second chemical cleaning, a shock load caused excessive foam that resulted in a significant solids loss. Additional freeboard was constructed to prevent any such future events. Following that chemical cleaning, the MBR ran for 987 h (41 d)

before another cleaning was required. This final cleaning lowered the vacuum pressure from 4.1 psi (0.28 bar) to 2.9 psi (0.20 bar). At 1,769 h (74 d), the MBR influent supply was interrupted for 3 d because of a pipe line break, and the MBRs were unable to operate.

Figure 6-8 shows the membrane performance of the Zenon MBR during Part 2. The pilot unit was operated for 1,007 h (42 d) under continuous aeration to observe its fouling trend. After this, intermittent aeration was started, and the fouling trend appeared to be unaffected by the use of intermittent aeration. The membrane ran without chemical cleaning for a period 2,087 h (87 d) during which the vacuum pressure increased from 1.72 psi (0.12 bar) to 3.49 psi (0.24 bar).

6.2.2 RO Pilot Units

During Part 2 of the testing, the RO pilot unit treating the Mitsubishi MBR effluent was operated at a target flux of 12 gfd (20 L/h-m^2) with 50% recovery. **Figure 6-9** shows the RO membrane performance. The RO unit ran for a total of 1,985 h (83 d) without a chemical cleaning.

During Part 2 of the testing, the RO pilot unit treating the Zenon MBR effluent was operated at a target of flux of 12 gfd (20 L/h-m^2) with a 32% recovery. To achieve this target flux using the Zenon MBR permeate flow, the total RO membrane surface area was reduced by replacing 3 of the 6 RO elements with dummy elements. **Figure 6-10** shows the ROmembrane performance. It ran for 1,796 h (75 d) without chemical cleaning.

6.3 Water Quality

6.3.1 Primary Effluent

The primary effluent grab samples analyzed by the Water Quality Laboratory can be seen in **Table 6-1.**

6.3.2 MBR Pilot Plants

Turbidity, Silt Density Index (SDI), and Particle Counts

The primary effluent turbidity (grab sample) ranged from 15 to 250 NTU. The MBR effluent turbidity was consistently below 0.1 NTU. The SDI values were all less than 1.2. The on-line particle count and turbidity data over an 8-h period between 1,398 h-1,406 h for the MBR effluent can be seen in **Figure 6-12**. The particle count data shows all particles ≥2 μm in diameter. The particle counts were between 10 and 40 particles/mL. The minima correspond to the relax when the particle counter shuts off and particle counts are very low. The turbidity values were between 0.06-0.07 NTU.

The effluent turbidity grab samples and SDI values for the Zenon MBR can be seen in **Figure 6-13**. The Zenon MBR effluent turbidity was <0.1 NTU while primary effluent turbidities

ranged from 15-250 NTU. The Zenon MBR effluent SDI values were <1.0. The on-line particle count and turbidity data over an 8-h period between 1,121 h-1,129 h for the Zenon MBR effluent can be seen in **Figure 6-14**. The particle count data shows all particles ≥2 μm in diameter. The particle counts were in the range of 20-70 particles/mL. The turbidity values were between 0.04-0.055 NTU.

BOD_5, COD and TOC

The BOD_5, COD and TOC values for the primary effluent and the Mitsubishi MBR permeate are shown in **Figure 6-15**. All of the MBR effluent BOD_5 values were below the detection limit (initially was 3 mg/L, and was later set at 2 mg/L). The primary effluent COD samples ranged from 130 to 586 mg/L, and the MBR effluent samples ranged from 7 to 32 mg/L. The primary effluent DOC ranged from 9 to 17 mg/L and the MBR effluent ranged from 5 to 9 mg/L.

The BOD_5, COD and TOC values for the primary effluent and Zenon MBR permeate are shown in **Figure 6-16**. All BOD values were below the detection limit. The primary effluent COD samples ranged from 130 to 586 mg/L, and the MBR effluent samples ranged from 7 to 39 mg/L. The primary effluent DOC samples ranged from 9 to 17 mg/L, and the MBR effluent samples ranged from 5 to 7 mg/L.

Biological Nutrient Removal

The on-site inorganic nitrogen grab sample results are shown in **Figure 6-17**. The effluent NH_3-N concentration spikes at 53, 1,392 and 2,427 h coincide with chemical cleanings suggesting that the chlorine solution used in the chemical cleaning adversely affects the nitrifiers. Complete nitrification was achieved for some of this testing phase with effluent NH_3-N values <1 mg-N/L. The NO_3-N values were between 5-25 mg-N/L and NO_2-N values were <5 mg-N/L. The on-site PO_4-P results are shown in **Figure 6-18.** During Part 2 of the testing, there was no evidence of BPR in this completely aerobic system. The primary effluent had values between 4 and 7 mg-P/L, and the MBR effluent concentration was between 2-6 mg-P/L.

The on-site inorganic nitrogen grab sample results from the Zenon MBR effluent are shown in **Figure 6-19.** The system did show complete nitrification at times with MBR effluent values <1 mg-N/L. The majority of MBR effluent NH_3-N values were <5 mg-N/L. The effluent NO_3-N values were between 5-25 mg-N/L and the NO_2-N values were <5 mg-N/L. The on-site PO_4-P results are shown in **Figure 6-20.** During Part 2 of the testing, there was no evidence of BPR in this completely aerobic system. The primary effluent values were between 4 and 7 mg-P/L, and the effluent of the Zenon MBR was between 0.5-4 mg-P/L.

Total Coliform, Fecal Coliform, Total Coliphage

The primary effluent and Mitsubishi MBR permeate total coliform, fecal coliform and total coliphage are shown in **Figure 6-21**. A majority of the coliform samples were <2 MPN/100 mL, giving an overall removal of >6 logs. The total coliphage values were mostly <2 cfu/100 mL resulting in an overall removal of >3 logs.

The primary effluent and Zenon MBR permeate total coliform, fecal coliform and total coliphage are shown in **Figure 6-22.** A majority of the samples were <2 MPN/100 mL, giving an overall removal of >6 logs. The total coliphage values showed a removal of >3 logs.

Other Water Quality Parameters

The Mitsubishi MBR grab samples analyzed by the Water Quality Laboratory can be seen in **Table 6-2.** The Zenon MBR grab samples analyzed by the Water Quality Laboratory can be seen in **Table 6-3.**

6.3.3 RO Pilot Units

Inorganic Nitrogen and Ortho-Phosphate Removal

The Mitsubishi MBR RO pilot unit grab sample effluent inorganic nitrogen species are shown in **Figure 6-23.** The NH_3-N values were between 0.1-0.5 mg-N/L. The NO_3-N values were between 0.1-0.8 mg-N/Lm and the NO_2-N values were between .005-0.03 mg-N/L. The Mitsubishi MBR RO pilot unit effluent PO_4-P values can be seen in **Figure 6-24.** The values were <0.2mg-P/L.

The Zenon MBR RO pilot unit grab sample effluent inorganic nitrogen species are shown in **Figure 6-25.** The NH_3-N values were between 0.01-0.25 mg-N/L. The NO_3-N values were between 0.04-0.9 mg-N/L and the NO_2-N values were between 0.006-0.05 mg-N/L. The Zenon MBR RO pilot unit effluent PO_4-P values can be seen in **Figure 6-26.** The PO_4-P values were <0.2 mg-P/L.

Salt Rejection

The feed and permeate conductivies of grab samples for the Mitsubishi MBR RO Pilot unit are shown in **Figure 6-27.** The RO membranes showed a consistent salt rejection, based on conductivity measurement, of greater than 98% throughout the testing.

The feed and permeate conductivies for the Zenon MBR RO Pilot unit are shown in **Figure 6-28.** The RO membranes again showed a consistent rejection of greater than 98% throughout the testing.

TOC

The Mitsubishi MBR and Mitsubishi MBR RO permeate TOC grab sample values are shown in **Figure 6-29**. The RO membranes showed >90% rejection of TOC.

The Zenon MBR and Zenon MBR RO permeate TOC values are shown in **Figure 6-30.** The RO membranes showed >90% rejection of TOC.

Other Water Quality Parameters

The Mitsubishi MBR RO grab samples analyzed by the Water Quality Laboratory can be seen in **Table 6-4.** The Zenon MBR RO grab samples analyzed by the Water Quality Laboratory can be seen in **Table 6-5.**

6.4 Peaking Study

The results of the Mitsubishi MBR peaking study can be seen in **Figure 6-31.** The MBR flux was increased from 13 gfd (22 L/h-m^2) to 16 gfd (27 L/h-m^2) over an 8 h period in a day. After the 8-h increase, the flux was returned to the target flux of 13 gfd. This was repeated for 5 consecutive days to determine whether there was any fouling. The vacuum increase on the second day is probably due to a high influent organic load that caused organic fouling on the membrane surface. Overall the system performed well at a 25% increase in flux.

The results of the Zenon MBR peaking study can be seen in **Figure 6-32.** The MBR flux was increased from 19 gfd (32 L/h-m^2) to 24 gfd (41 L/h-m^2) over an 8-h period in the day. After the 8-h increase, the flux was returned to the target flux of 19 gfd. This was repeated over 5 consecutive days to observe any fouling. The vacuum increase on the second day is probably due to a high influent organic load that caused organic fouling on the membrane surface. Overall the system performed well at a 25% increase in flux.

6.5 Activated Sludge Dewatering

The normalized CST testing results (CST/MLSS) are plotted against MLSS in **Figure 6-33.** As MLSS concentration increases, the normalized CST value decreases somewhat suggesting that there is a slight increase in dewaterability with an increase in MLSS concentration.

7. MBR Performance Comparison

7.1 MBR Operating Conditions

The MBR pilot plants were completely automated and required minor attention. Both pilot plants required a well-mixed anoxic zone and a sprayer system for foam control. Two mixers were installed in the Mitsubishi MBR anoxic tank during Part 1, and a sprayer system was installed in the aerobic tank during Part 2. The Zenon MBR had sufficient free board for foam control, and the Mitsubishi MBR was equipped with additional freeboard during Part 2 of the study.

The Mitsubishi MBR relaxed during operation, and no backpulse was performed. This eliminates the additional pipes and/or valves necessary for the Zenon MBR which typically backpulse the membrane every 15 minutes. The membrane integrity of the Mitsubishi MBR is also less of an issue because the system does not backpulse. The applied vacuum pressure typically causes solids to clog broken fibers. Because the system does not backpulse, the membrane fibers become permanently sealed. If a fiber breakage occurs in the Zenon membrane, the repetitive backwashing will force solids out of the compromised fiber, and it will need to be repaired.

Both MBR pilot plants required coarse bubble aeration to agitate the membranes. The Zenon MBR required 30 scfm (0.8 m^3/min) and the Mitsubishi MBR required 41 scfm (1.2 m^3/min). The Zenon MBR successfully operated under intermittent aeration that decreased the overall air use by 50%. No intermittent aeration was tested for the Mitsubishi MBR. Additional aeration equipment was used in both systems to sufficiently aerate the activated sludge.

The Mitsubishi MBR had a simple clean-in-place procedure that did not require the membranes to be removed from the aeration basin. However, in a full-scale application, a crane and chemical clean tank is recommended for more effective cleanings. The Zenon MBR required a weekly chemical maintenance cleaning to achieve longer membrane run times. This was performed manually during the pilot testing, but is automated in full-scale installations. The Zenon MBR is not typically cleaned in place in full-scale applications, since the membranes need to be removed and placed in a chemical-cleaning tank.

7.2 Membrane Performance

Both membranes performed well throughout the study. There was no apparent compromise to membrane integrity detected in either system during the pilot testing. The Mitsubishi was chemically cleaned three times during Part 1 after 1,986 h (83 d), 864 h (36 d), and 823 h (34 d); and twice during Part 2 after 1,337 h (56 d) and 987 h (41). The Zenon MBR was cleaned once during Part 1 after 2,082 h (87 d), and ran for 2,087 h (87 d) during Part 2 without requiring a chemical cleaning. Overall, the Mitsubishi MBR did have shorter cleaning intervals than the Zenon MBR, however the membrane was operated for a 12-min cycle instead of the recommended 8-min cycle for a majority of the testing.

7.3.1 MBR Effluent Water Quality

7.3.1 Particulate Removal

The Mitsubishi MF and the Zenon UF produced effluent turbidity values of <0.15 NTU in 90% of the samples, as shown in **Figure 7-1**. The Zenon UF produced slightly lower turbidity values than the Mitsubishi membrane. However, the Zenon MF membrane achieved <0.2 NTU in <90% of the samples.

The Mitsubishi MF effluent and the Zenon UF effluent had SDI values <2 in 90% of all samples. (**Figure 7-2**). The Zenon UF produced SDI values that were lower than the Mitsubishi MBR. However, the Zenon MF did not perform as well, yielding SDI values >3 in 50% of the samples.

7.2.2 Organics Removal

Both pilot plants achieved similar orgnanics removal throughout the duration of the study. The Mitsubishi MBR effluent achieved BOD_5 values <3 mg/L in 80% of all samples, and the Zenon MBR achieved values <3 mg/L in 90% of all samples. (**Figure 7-3**) A majority of the Mitsubishi MBR BOD_5 samples that were >3 mg/L resulted from ammonia oxidation in the BOD_5 test. The Mitsubishi MBR effluent had COD values <30 mg/L in 90% of all samples, and the Zenon MBR had <20 mg/L in 90% of all samples. (**Figure 7-4**) The Mitsubishi MBR effluent had TOC values that were <7 mg/L in 90% of all samples, and the Zenon MBR had values <6 mg/L in 90% of all samples. (**Figure 7-5**)

7.2.3 Biological Nutrient Removal

During Part 1 of the pilot testing, both systems produced effluent water with total inorganic nitrogen values of <10 mg/L in 30% of all samples. (**Figure 7-6**) The nitrification and denitrification of both systems was not consistent during the testing, however both systems exhibited an ability to remove inorganic nitrogen. The aeration system and tank design was not sufficient to achieve high inorganic nitrogen removal, and this needs to be corrected in future work. Both MBR pilot plants showed biological phosphorus removal producing effluent water with PO_4-P values of <1 mg/L in 60% of all samples during Part 1. (**Figure 7-7**)

The total inorganic nitrogen concentrations in the effluent of each pilot plant during Part 1 were much higher than during Part 2. The effluent concentrations were <20 mg-N/L in 50 % of all samples. (**Figure 7-8**) Lower biological phosphorus removal was observed during Part 2 as compared to Part 1 of the study, with 95% of all samples >1 mg/L. (**Figure 7-9**)

7.2.4 Total Coliform, Fecal Coliform, Total Coliphage

Both pilot plants removed total and fecal coliforms throughout the pilot testing. The Mitsubishi MF effluent total coliform concentration was ≤2 MPN/100 mL in 90% of all samples, and the

Zenon UF effluent total coliform was ≤2 MPN/100 mL in 50% of all samples, respectively. **(Figure 7-10)** The Zenon MF membrane produced positive total coliform in all samples.

The fecal coliform concentration in the Mitsubishi MF effluent were ≤2 MPN/100 mL in 99%+ of the samples, and the Zenon UF effluent samples were ≤2 MPN/100 mL in 96% of the samples. **(Figure 7-11)** The Zenon MF effluent contained fecal coliform in all samples.

The Mitsubishi MF effluent total coliphage concentration was ≤1 PFU/100 mL in 80% of all samples, and the Zenon UF effluent was ≤1 PFU/100 mL in 95% of all samples. **(Figure 7-12)** The Zenon MF effluent total coliphage concentration was ≤1 PFU/100 mL in70% of all samples.

8. COST ANALYSIS

8.1 Description of Evaluated Configurations

A cost analysis was performed to determine the feasibility of full-scale applications of the MBR process compared to current wastewater technology. Cost analyses were performed using various configurations to produce: secondary effluent, Title 22 reclaimed water and RO feed water. The following configurations were considered:

- Oxidation ditch capable of producing secondary effluent (Oxidation Ditch)
- Oxidation ditch with tertiary filtration and chlorination capable of producing Title 22 reclaimed water (Ditch+Filtr/Cl_2)
- Oxidation ditch with microfiltration and chlorination capable of producing Title 22 reclaimed water (Ditch+MF/Cl_2)
- Membrane Bioreactor with chlorination capable of production Title 22 reclaimed water (MBR+Cl_2)
- Oxidation Ditch with lime coagulation, flocculation, sedimentation and filtration capable of producing RO feed water (Ditch+C/F/S/F)
- Oxidation Ditch with microfiltration capable of producing RO feed water (Ditch+MF)
- Membrane Bioreactor capable of producing RO feed water (MBR)

Figures 8-1, 8-2 and **8-3** give a detailed breakdown of each wastewater configuration evaluated.

8.2 Design Criteria

Cost analyses were performed for 1 and 5-MGD (3,785 and 18,927 m^3/d) installations. All configurations were assumed to be scalping facilities designed for a constant flow of medium strength municipal wastewater with the following characteristics:

BOD_5	150 mg/L
TSS	150 mg/L
VSS	120 mg/L
NH_3-N	30 mg-N/L
TKN	40 mg-N/L

All installations were designed to completely nitrify (i.e. NH_4^+-N<0.5 mg/L) and meet a total nitrogen value of less than 10 mg-N/L (i.e. TKN+NO_2-N+NO_3-N<10 mg-N/L).

An oxidation ditch was chosen to represent conventional activated sludge treatment because of its cost competitiveness for small-scale applications. The higher HRT and SRT makes the process robust for small-scale applications. The oxidation ditch was designed using the following criteria:

HRT	24 hours
SRT	25 days
MLSS	4,000 mg/L

The MBR was designed using the following criteria:

HRT	4 hours
SRT	15 days
MLSS	10,000 mg/L

8.3 Capital Costs

Tables 8-1 and **8-2** show the capital costs for the 1 and 5-MGD installations, respectively. Each figure gives the total capital cost for each configuration and the amortized cost in $/y assuming an 8% interest rate over 20 y.

The headworks of all installations consisted of bar screens, grit chamber, lift pumps and odor control. The costs of these facilities (Western Consortium for Public Health, 1997) were taken from the existing costs for San Pasqual Water Reclamation Plant (SPWRP) and adjusted to the current Engineering News-Record Construction Cost Index (ENRCCI) value of 7056.

The screening facility for the MBR consisted of rotary disk filter (nominal pore size = 250 μm), rotary drum screen and odor control. Its costs were taken from existing SPWRP facilities and adjusted to the current ENRCCI value. This primary treatment was chosen because it was suitable for the pilot-scale MBR systems.

The costs of the secondary, tertiary and disinfection processes were adjusted to the current ENRCCI value. The original costs (Richard et al., 1992) were also adjusted for a scalping facility that did not experience peak daily flows by designing secondary clarifiers, tertiary filters, chlorine contact chamber, and the flocculation, coagulation, sedimentation and filtration process that operated at a constant flowrate.

The cost of the microfiltration unit was adapted from the current pricing of the US Filter/Memcor recent installations in California. The microfiltration unit is a U.S. Filter Memcor system designed to treat secondary effluent. The MBR capital costs were provided by Zenon Environmental Systems, Inc.

8.4 Operation and Maintenance Costs

Tables 8-3 and **8-4** provide the annual O&M costs for the first year, and the total estimated O&M costs assuming an 8% interest rate over 20 y, respectively. The costs (Richard et al., 1992) associated with personnel, supervision, power, spare parts, chemicals, sludge handling and disposal were all adjusted to the current ENRCCI value. All O&M costs for the MBR and the microfiltration unit were provided by Zenon Environmental Systems, Inc. and U.S. Filter, respectively.

8.5 Total Costs

Table 8-5 provides a summary of the capital and O&M costs for each process configuration. The total capital costs and the total estimated O&M costs were summed to provide the present worth value of each plant shown in **Figure 8-4**. **Table 8-6** gives the cost of each process in terms of cost per kgal of water produced.

The following conclusions can be made for 1 and 5-MGD installations:

- The oxidation ditch is the most cost-effective process for producing water of secondary effluent quality.
- The oxidation ditch with tertiary filtration and disinfection is the most cost effective process for producing Title 22 reclaimed water.
- The MBR process is the most cost-effective process for producing feed water suitable for RO membranes

- **REFERENCE LIST**

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APPENDIX A

Table 4-1 Specification for the Mitsubishi Sterapore HF Microfiltration Membrane

	Units	Value
Approximate Size of Element (L x W x H)	mm	886x606x1483
Active Membrane Area (outside)	ft2 (m2)	1076 (100)
Flow Direction	---	outside-in
Nominal Membrane Pore size	mm	0.4
Membrane Material/Construction	---	polyethylene, hollow fiber
Membrane Surface Characteristics	---	hydrophilic, symmetric
Membrane Charge	---	slightly negative
Design Flux	gfd (L/hr-m2)	9.9 (16.8)
Vacuum Pressure for System	psi (bar)	<5.8 (<0.4)

Table 4-2 Specifications for the Zenon OKC and OCP Membranes

	Units	Value (OKC Membrane)	Value (OCP Membrane)
Approximate Size of Element (L x W x H)	mm	2 x 0.75 x 0.2	2 x 0.75 x 0.2
Active Membrane Area (outside)	ft2 (m2)	500 (46.5)	519 (48.2)
Number of Fibers	---	~4700	~4700
Inside Diameter of Fiber	mm	0.75	0.75
Outside Diameter of Fiber	mm	1.95	1.95
Approximate Length of Fiber	m	1.65	1.65
Flow Direction	---	Outside-In	Outside-In
Nominal Membrane Pore size	μm	0.4	0.035
Membrane Material/Construction	---	Proprietary	Proprietary
Membrane Surface Characteristics	---	Hydrophilic	Hydrophilic
Membrane Charge	---	Neutral	Neutral
Design Flux	gfd (l/hr-m2)	25 (42)	20 (34)
Acceptable Range of Operating pH Values	---	5-9 (cleaning range 2-10.5)	5-9 (cleaning range 2-10.5)
Vacuum Pressure for System	psi (bar)	-1 to -8	-1 to -8 (-0.07 to -0.55)

Table 4-3 Specification for the RO Membranes

	Units	Value
Manufacturer	---	Filmtec/Dow
Commercial Designation	---	BW30HP-4040
Memrane Material	---	Polyamide (thin film composite)
Operating pH Range	---	2.0-10.0
Maximum Feedwater Turbidity	NTU	1.0
Maximum Feedwater SDI (15 minute)	---	5.0
Maximum Operating Temperature	deg F (deg C)	113 (45)
Free Chlorine Resistance	mg/L	<0.1
Maximum Operating Pressure	psi (bar)	600 (40)

Table 4-4a Anaylytical Methods and Detection Limits for the City of San Diego Water Quality Laboratory

Analyte or Parameter	Units	Method Number and Type	Detection Limit
Ammonia-N	mg/L	EPA350.1	0.015
BOD_5	mg/L	SM5210B	2.0
Bromide	mg/L	EPA300A	0.1
Chloride	mg/L	EPA300A	0.5
Nitrate-N	mg/L	EPA300A	0.2
Nitrite-N	mg/L	SM4500B	0.005
Ortho-Phosphate-P	mg/L	EPA300A	0.2
Total Phosphorus-P	mg/L	EPA365.1TP	0.07
Sulfate	mg/L	EPA300A	0.5
Total Kjeldahl Nitrogen (TKN)	mg/L	EPA351.2	0.08
Dissolved Organic Carbon (DOC)	mg/L	SM5310B	0.25

Table 4-4b Analytical Methods and Detection Limits for the On-Site Laboratory

Analyte or Parameter	Units	Method Number and Type	Detection Limit
Ammonia-N	mg/L	SM4500B&C*	0.017
Nitrate-N	mg/L	SM4500*	0.22
Nitrite-N	mg/L	DR/4000 Hach Spectro-photometer	0.0008
Dissolved Organic Carbon (DOC)	µg/L	Sievers 800 Portable Total Organic Analyzer	2

* Modified method used with Hach DR/4000 Spectrophotometer

Table 4-4c Analytical Methods and Detection Limits for the City of San Diego North City Water Reclamation Plant Laboratory

Analyte or Parameter	Units	Method Number and Type	Detection Limit
Chemical Oxygen Demand (COD)	mg/L	SM5220D	5
Total/Volatile Suspended Solids	mg/L	SM2540D&E	1.6

SM = Standard Methods for the Examination of Water and Wastewater
EPA = United States Environmental Protection Agency

Table 5-1 Primary Effluent Water Quality Laboratory Data During Part 1

	No. of Analyses	Units	Median	Maximum	Minimum
Ammonia-N	8	mg/L	19.0	26.4	3.8
Nitrate-N	9	mg/L	ND	0.055	ND
Nitrite-N	8	mg/L	0.01	0.02	ND
TKN	9	mg/L	30.1	53.6	11.5
Ortho-Phosphate-P	8	mg/L	2.3	12.1	1.2
Total Phosphorus	9	mg/L	4.2	11.5	2.3
Bromide	7	mg/L	0.33	0.42	0.17
Chloride	7	mg/L	210	316	157
Sulfate	7	mg/L	257	296	147
BOD_5	36	mg/L	61.2	98.2	28.6

Table 5-2 Mitsubishi MBR Permeate Water Quality Data During Part 1

	No. of Analyses	Units	Median	Maximum	Minimum
Ammonia-N	5	mg/L	2.3	13.8	0.2
Nitrate-N	9	mg/L	0.4	12.7	ND
Nitrite-N	8	mg/L	0.22	0.51	0.01
TKN	7	mg/L	2.9	16.0	1.8
Ortho-Phosphate-P	8	mg/L	0.1	17.9	ND
Total Phosphorus	9	mg/L	0.1	19.1	0
Bromide	7	mg/L	0.26	0.34	0.21
Chloride	7	mg/L	181	347	170
Sulfate	7	mg/L	247	259	232
BOD_5	40	mg/L	<3	14.8	<2

Table 5-3 Zenon MBR Permeate Water Quality Data During Part 1

	No. of Analyses	Units	Median	Maximum	Minimum
Ammonia-N	5	mg/L	0.31	2.08	ND
Nitrate-N	7	mg/L	2.7	14.2	0.1
Nitrite-N	5	mg/L	0.05	0.11	ND
TKN	8	mg/L	1.08	3.24	0.61
Ortho-Phosphate-P	8	mg/L	0.04	0.22	ND
Total Phosphorus	8	mg/L	0.08	0.22	ND
Bromide	7	mg/L	0.26	0.39	0.245
Chloride	7	mg/L	188	307	174
Sulfate	7	mg/L	243	291	229
BOD_5	36	mg/L	<3	10.3	<2

Table 5-4 Mitsubishi MBR RO Permeate Water Quality Data During Part 1

	No. of Analyses	Units	Median	Maximum	Minimum
Ammonia-N	8	mg/L	0.24	0.74	0.03
Nitrate-N	6	mg/L	ND	0.11	ND
Nitrite-N	7	mg/L	ND	0.01	ND
TKN	9	mg/L	0.46	1.16	0.27
Ortho-Phosphate-P	6	mg/L	ND	ND	ND
Total Phosphorus	9	mg/L	ND	3.04	ND
Bromide	6	mg/L	ND	ND	ND
Chloride	6	mg/L	1.19	2.96	0.59
Sulfate	6	mg/L	0.71	2.43	ND

Table 5-5 Zenon MBR RO Permeate Water Quality Data During Part 1

	No. of Analyses	Units	Median	Maximum	Minimum
Ammonia-N	5	mg/L	0.21	0.54	0.10
Nitrate-N	7	mg/L	0.30	0.67	0.12
Nitrite-N	5	mg/L	ND	ND	ND
TKN	7	mg/L	0.27	0.65	0.11
Ortho-Phosphate-P	6	mg/L	ND	ND	ND
Total Phosphorus	7	mg/L	ND	ND	ND
Bromide	6	mg/L	ND	ND	ND
Chloride	6	mg/L	2.37	3.64	1.78
Sulfate	6	mg/L	0.89	1.93	ND

Table 6-1 Primary Effluent Water Quality Data During Part 2

	No. of Analyses	Units	Median	Maximum	Minimum
Ammonia-N	5	mg/L	28.7	37.7	1.9
Nitrate-N	7	mg/L	ND	ND	ND
Nitrite-N	4	mg/L	0.01	0.03	ND
TKN	8	mg/L	32.4	59.6	15.6
Ortho-Phosphate-P	7	mg/L	3.59	4.24	2.95
Total Phosphorus	7	mg/L	7.04	8.57	4.68
Bromide	8	mg/L	0.24	0.30	0.18
Chloride	8	mg/L	160	173	141
Sulfate	8	mg/L	162	180	142
BOD_5	20	mg/L	72	102	38
DOC	22	mg/L	11.3	24.8	8.9

Table 6-2 Mitsubishi MBR Permeate Water Quality During Part 2

	No. of Analyses	Units	Median	Maximum	Minimum
Ammonia-N	6	mg/L	2.3	18.1	0.1
Nitrate-N	7	mg/L	9.2	24.9	1.1
Nitrite-N	3	mg/L	1.78	2.00	1.44
TKN	7	mg/L	5.6	14.5	1.9
Ortho-Phosphate-P	7	mg/L	2.92	3.25	2.42
Total Phosphorus	7	mg/L	2.99	3.50	2.51
Bromide	8	mg/L	0.26	0.30	0.19
Chloride	8	mg/L	248	280	207
Sulfate	8	mg/L	241	245	226
BOD_5	22	mg/L	ND	ND	ND

Table 6-3 Zenon MBR Permeate Water Quality During Part 2

	No. of Analyses	Units	Median	Maximum	Minimum
Ammonia-N	4	mg/L	0.83	1.94	ND
Nitrate-N	6	mg/L	20.5	24.4	10.0
Nitrite-N	2	mg/L	1.10	1.92	0.28
TKN	6	mg/L	1.1	24.4	10.0
Ortho-Phosphate-P	6	mg/L	2.40	3.12	1.52
Total Phosphorus	6	mg/L	2.59	3.12	1.57
Bromide	7	mg/L	0.23	0.30	0.17
Chloride	7	mg/L	242	263	183
Sulfate	7	mg/L	242	248	230
BOD_5	6	mg/L	ND	ND	ND

Table 6-4 Mitsubishi MBR RO Permeate Water Quality During Part 2

	No. of Analyses	Units	Median	Maximum	Minimum
Ammonia-N	4	mg/L	0.25	0.52	0.21
Nitrate-N	6	mg/L	0.17	0.33	0.05
Nitrite-N	3	mg/L	ND	0.01	ND
TKN	6	mg/L	0.39	1.72	0.30
Ortho-Phosphate-P	6	mg/L	ND	ND	ND
Total Phosphorus	6	mg/L	ND	ND	ND
Bromide	7	mg/L	ND	ND	ND
Chloride	7	mg/L	0.78	1.98	0.68
Sulfate	7	mg/L	ND	0.98	ND

Table 6-5 Zenon MBR RO Permeate Water Quality During Part 2

	No. of Analyses	Units	Median	Maximum	Minimum
Ammonia-N	4	mg/L	0.16	0.19	0.07
Nitrate-N	5	mg/L	0.72	0.90	0.63
Nitrite-N	4	mg/L	ND	0.10	ND
TKN	5	mg/L	ND	ND	ND
Ortho-Phosphate-P	5	mg/L	ND	ND	ND
Total Phosphorus	5	mg/L	ND	ND	ND
Bromide	6	mg/L	ND	ND	ND
Chloride	6	mg/L	1.66	3.02	1.14
Sulfate	6	mg/L	ND	2.81	ND

Table 8-1 Capital Costs for 1-MGD Installations, SK

	Secondary Standards	Title 22 Standards			Pre-RO Water		
Capital Costs	Oxidation Ditch	Ditch + Filtr/Cl_2	Ditch + MF/Cl_2	MBR + Cl_2	Ditch + C/F/S/F	Ditch + MF	MBR
Headworks	$ 834	$ 834	$ 834	$ 834	$ 834	$ 834	$ 834
Screening Facility				$ 816			$ 816
Secondary Treatment	$ 2,103	$ 2,103	$ 2,103		$ 2,103	$ 2,103	
Rapid Mix					$ 14		
Flocculation					$ 50		
Tertiary Clarifiers					$ 529		
Traveling Bridge Filters		$ 97			$ 158		
Backwash Pumping Station		$ 50			$ 81		
Chlorination Handling and Storage		$ 191	$ 191	$ 191			
Chlorine Contact Tank		$ 127	$ 127	$ 127			
Chemical Handling, Storage, Metering					$ 640		
Microfiltration Unit			$ 784			$ 784	
MBR Process Costs				$ 1,750			$ 1,750
MBR Tank				$ 180			$ 180
Operations-laboratory building	$ 368	$ 368	$ 368	$ 368	$ 368	$ 368	$ 368
Maintenance Building	$ 154	$ 154	$ 154	$ 154	$ 154	$ 154	$ 154
Subtotal	$ 3,459	$ 3,925	$ 4,561	$ 4,420	$ 4,932	$ 4,243	$ 4,102
Site Development, 15%	$ 519	$ 589	$ 684	$ 663	$ 740	$ 636	$ 615
Installation of MF/MBR, 30%			$ 235	$ 525		$ 235	$ 525
Process Piping, 15%	$ 519	$ 589	$ 684	$ 663	$ 740	$ 636	$ 615
Instrumentation, 2%	$ 69	$ 78	$ 91	$ 88	$ 99	$ 85	$ 82
Electrical distribution and controls, 16 %	$ 553	$ 628	$ 730	$ 707	$ 789	$ 679	$ 656
Electrical Service, 5%	$ 173	$ 196	$ 228	$ 221	$ 247	$ 212	$ 205
Subtotal	$ 5,293	$ 6,005	$ 7,213	$ 7,267	$ 7,546	$ 6,727	$ 6,601
Contigency, 10%	$ 529	$ 600	$ 721	$ 729	$ 755	$ 673	$ 680
Total Capital Cost, $K	$ 5,822	$ 6,605	$ 7,934	$ 8,016	$ 8,301	$ 7,399	$ 7,481
Interest Rate	8%	8%	8%	8%	8%	8%	8%
Number of Years	20	20	20	20	20	20	20
P/A Factor	9.82	9.82	9.82	9.82	9.82	9.82	9.82
Amortized Capital Cost, $/yr	$ 593	$ 673	$ 808	$ 816	$ 845	$ 754	$ 762

Table 8-2 Capital Costs for 5-MGD Installations, $K

	Secondary Standards	Title 22 Standards			Pre-RO Water		
Capital Costs	Oxidation Ditch	Ditch + Filtr/Cl_2	Ditch + MF/Cl_2	MBR + Cl_2	Ditch + C/F/S/F	Ditch + MF	MBR
Headworks	$ 2,573	$ 2,573	$ 2,573	$ 2,573	$ 2,573	$ 2,573	$ 2,573
Screening Facility				$ 2,517			$ 2,517
Secondary Treatment	$ 5,853	$ 5,853	$ 5,853		$ 5,853	$ 5,853	
Rapid Mix					$ 23		
Flocculation					$ 68		
Tertiary Clarifiers					$ 891		
Travelling Bridge Filters		$ 584			$ 584		
Backwash Pumping Station		$ 113			$ 113		
Chlorination Handling and Storage		$ 221	$ 221	$ 221			
Chlorine Contact Tank		$ 407	$ 407	$ 407			
Chemical Handling, Storage, Metering					$ 927		
Microfiltration Unit			$ 2,417			$ 2,417	
MBR Process Costs				$ 5,703			$ 5,703
MBR Tank				$ 555			$ 555
Operations-laboratory building	$ 485	$ 485	$ 485	$ 485	$ 485	$ 485	$ 485
Maintenance Building	$ 265	$ 265	$ 265	$ 265	$ 265	$ 265	$ 265
Subtotal	$ 9,176	$ 10,500	$ 12,221	$ 12,725	$ 11,781	$ 11,593	$ 12,098
Site Development, 15%	$ 1,376	$ 1,575	$ 1,833	$ 1,909	$ 1,767	$ 1,739	$ 1,815
Installation of MF/MBR, 30%			$ 725	$ 1,711		$ 725	$ 1,711
Process Piping, 15%	$ 1,376	$ 1,575	$ 1,833	$ 1,909	$ 1,767	$ 1,739	$ 1,815
Instrumentation, 2%	$ 184	$ 210	$ 244	$ 255	$ 236	$ 232	$ 242
Electrical distribution and controls, 16 %	$ 1,468	$ 1,680	$ 1,955	$ 2,036	$ 1,885	$ 1,855	$ 1,936
Electrical Service, 5%	$ 459	$ 525	$ 611	$ 636	$ 589	$ 580	$ 605
Subtotal	$ 14,039	$ 16,065	$ 19,423	$ 21,181	$ 18,025	$ 18,463	$ 20,220
Contigency, 10%	$ 1,404	$ 1,607	$ 1,942	$ 2,118	$ 1,803	$ 1,846	$ 2,022
Total Capital Cost, $K	$ 15,443	$ 17,672	$ 21,365	$ 23,299	$ 19,828	$ 20,309	$ 22,242
Interest Rate	8%	8%	8%	8%	8%	8%	8%
Number of Years	20	20	20	20	20	20	20
P/A Factor	9.82	9.82	9.82	9.82	9.82	9.82	9.82
Amortized Capital Cost, $/yr	$ 1,573	$ 1,800	$ 2,176	$ 2,373	$ 2,020	$ 2,068	$ 2,265

Table 8-3 Operations and Maintenance Costs for 1-MGD Installations, $K

	Secondary Standards	Title 22 Standards			Pre-RO Water		
O&M Costs, $/yr	Ditch Only	Ditch + Filtr/Cl_2	Ditch + MF/Cl_2	MBR + Cl_2	Ditch + C/F/S/F	Ditch + MF	MBR
Personnel	$ 85	$ 85	$ 85	$ 85	$ 106	$ 85	$ 85
Supervision-administration	$ 31	$ 31	$ 31	$ 31	$ 31	$ 31	$ 31
Power	$ 115	$ 115	$ 115	$ 115	$ 126	$ 115	$ 115
Spare Parts- replacement	$ 65	$ 65	$ 65	$ 6	$ 91	$ 65	$ 6
Chemicals		$ 4	$ 4	$ 4	$ 218		
Sludge Handling and Disposal	$ 84	$ 84	$ 84	$ 84	$ 182	$ 84	$ 84
MBR Chemicals				$ 1			$ 1
Maintenance Clean				$ 2			$ 2
Membrane Replacement				$ 26			$ 26
Total Microfilter O&M Costs			$ 51			$ 51	
Total O&M Costs in First Year, $K	$ 379	$ 384	$ 435	$ 355	$ 754	$ 430	$ 351
Interest Rate	8%	8%	8%	8%	8%	8%	8%
Number of Years	20	20	20	20	20	20	20
P/A Factor	9.82	9.82	9.82	9.82	9.82	9.82	9.82
Total estimated O&M costs, $K	$ 3,724	$ 3,767	$ 4,269	$ 3,487	$ 7,404	$ 4,225	$ 3,443

Table 8-4 Operations and Maintenance Costs for 5-MGD Installations, $K

	Secondary Standards	Title 22 Standards			Pre-RO Water		
O&M Costs, $/yr	Ditch Only	Ditch + Filtr/Cl_2	Ditch + MF/Cl_2	MBR + Cl_2	Ditch + C/F/S/F	Ditch + MF	MBR
Personnel	$ 151	$ 151	$ 151	$ 151	$ 179	$ 151	$ 151
Supervision-administration	$ 90	$ 90	$ 90	$ 90	$ 90	$ 90	$ 90
Power	$ 469	$ 469	$ 469	$ 469	$ 478	$ 469	$ 469
Spare Parts- replacement	$ 160	$ 160	$ 160	$ 16	$ 212	$ 160	$ 16
Chemicals		$ 22	$ 22	$ 22	$ 1,085		
Sludge Handling and Disposal	$ 419	$ 419	$ 419	$ 419	$ 917	$ 419	$ 419
MBR Chemicals				$ 3			$ 3
Maintenance Clean				$ 6			$ 6
Membrane Replacement				$ 81			$ 81
Total Microfilter O&M Costs			$ 309			$ 309	
Total O&M Costs in First Year, $K	$ 1,289	$ 1,311	$ 1,620	$ 1,258	$ 2,961	$ 1,598	$ 1,235
Interest Rate	8%	8%	8%	8%	8%	8%	8%
Number of Years	20	20	20	20	20	20	20
P/A Factor	9.82	9.82	9.82	9.82	9.82	9.82	9.82
Total estimated O&M costs, $K	$ 12,657	$ 12,874	$ 15,903	$ 12,347	$ 29,067	$ 15,687	$ 12,130

Table 8-5 Summary of Capital and O&M Costs, $K

	1-MGD			5-MGD		
	Capital Costs, $K	Total Estimated O&M Costs, $K	Present Worth Value, $K	Capital Costs, $K	Total Estimated O&M Costs, $K	Present Worth Value, $K
Oxidation Ditch	5,822	3,724	9,546	15,443	12,657	28,100
Ditch+Filtration+Cl2	6,605	3,767	10,372	17,672	12,874	30,546
Ditch+MF/Cl2	7,934	4,269	12,203	21,365	15,903	37,268
MBR+Cl2	8,016	3,487	11,503	23,299	12,347	35,645
Ditch+C/F/S/F	8,301	7,404	15,704	19,828	29,067	48,895
Ditch+MF	7,399	4,225	11,624	20,309	15,687	35,995
MBR	7,481	3,443	10,924	22,242	12,130	34,372

Table 8-6 Summary of Costs, $/kgal

	1-MGD				5-MGD			
	Amortized Capital Costs, $K/yr	O&M Costs, $K/yr	Total Cost per Year, $K/yr	Total Cost $/1000 gal	Amortized Capital Costs, $K/yr	O&M Costs, $K/yr	Total Cost per Year, $K/yr	Total Cost $/1000 gal
Oxidation Ditch	593	379	972	2.66	1,573	1,289	2,862	1.57
Ditch+Filtration+Cl2	673	384	1,056	2.89	1,800	1,311	3,111	1.70
Ditch+MF/Cl2	808	435	1,243	3.41	2,176	1,620	3,796	2.08
MBR+Cl2	816	355	1,172	3.21	2,373	1,258	3,631	1.99
Ditch+C/F/S/F	845	754	1,600	4.38	2,020	2,961	4,980	2.73
Ditch+MF	754	430	1,184	3.24	2,068	1,598	3,666	2.01
MBR	762	351	1,113	3.05	2,265	1,235	3,501	1.92

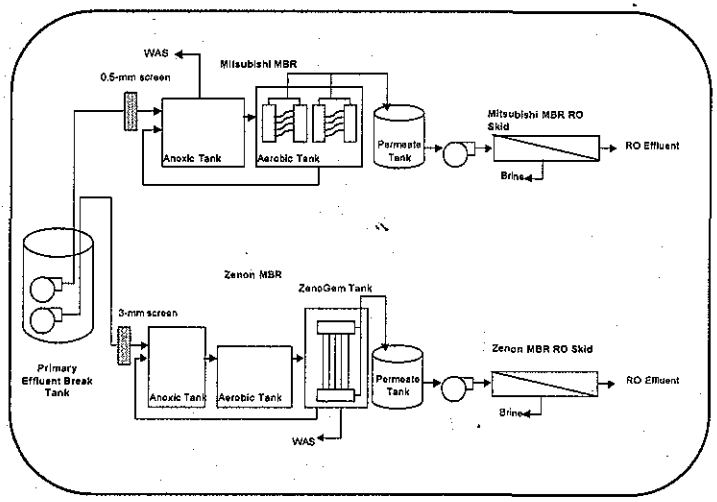


Figure 4-1 Schematic Diagram of the Treatment Trains During Part 1

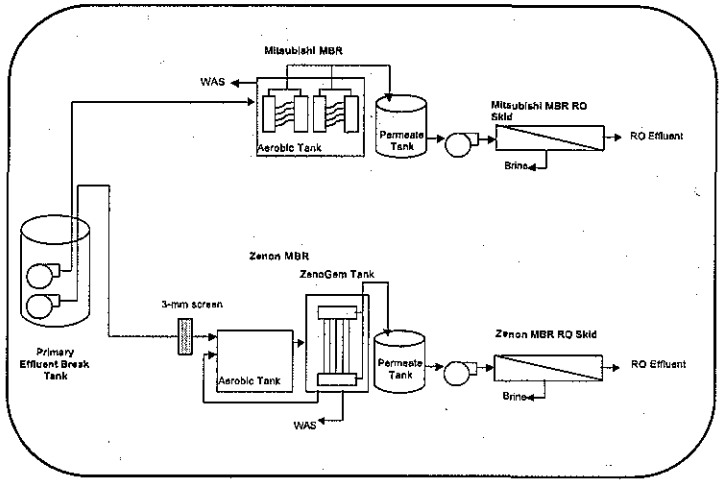


Figure 4-2 Schematic Diagram of Treatment Trains During Part 2

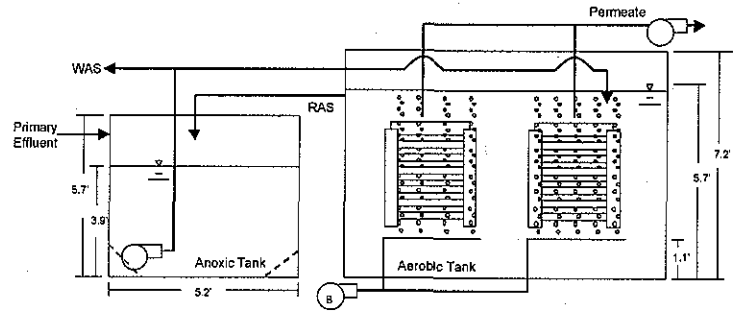


Figure 4-3a Mitsubishi MBR Side View During Part 1

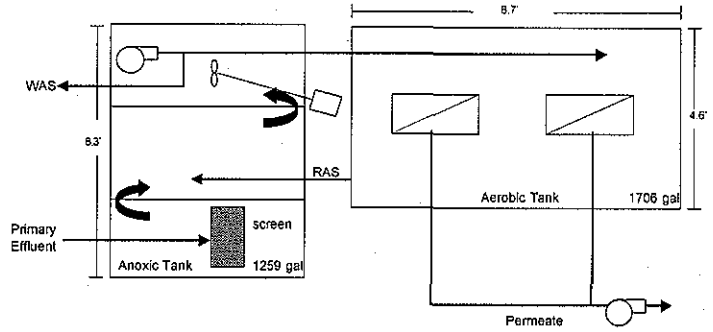


Figure 4-3b Mitsubishi MBR Plan View During Part 1

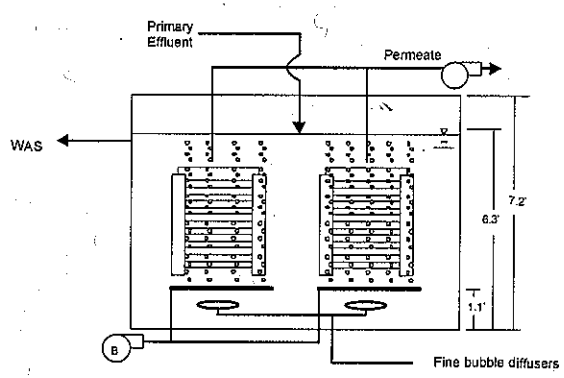


Figure 4-4a Mitsubishi MBR Side View During Part 2

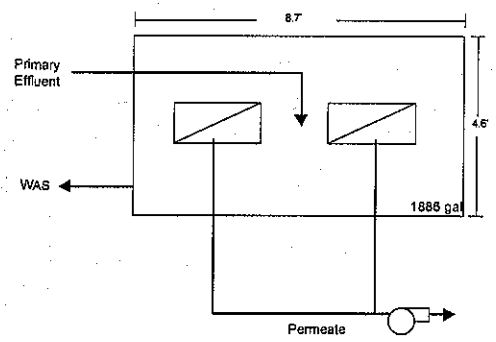


Figure 4-4b Mitsubishi MBR Plan View During Part 2

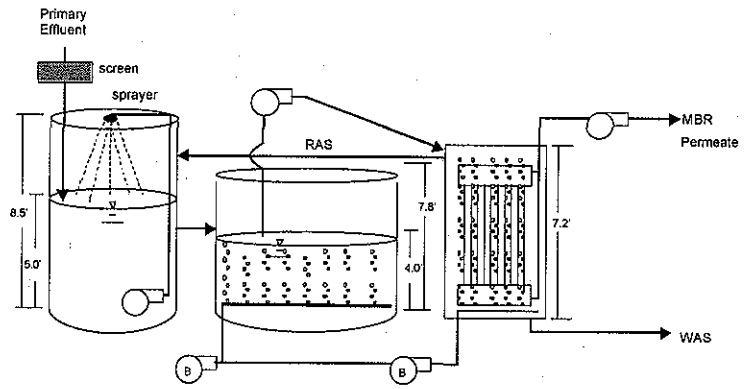


Figure 4-5a Zenon MBR Side View During Part 1

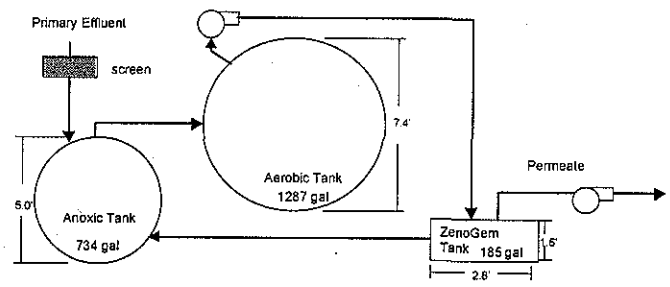


Figure 4-5b Zenon MBR Plan View During Part 1

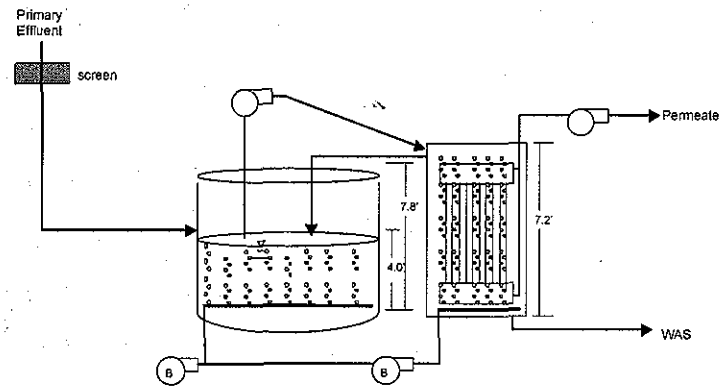


Figure 4-6a Zenon MBR Side View During Part 2

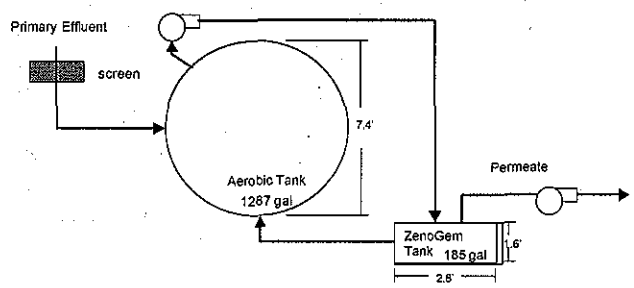


Figure 4-6b Zenon MBR Plan View During Part 2

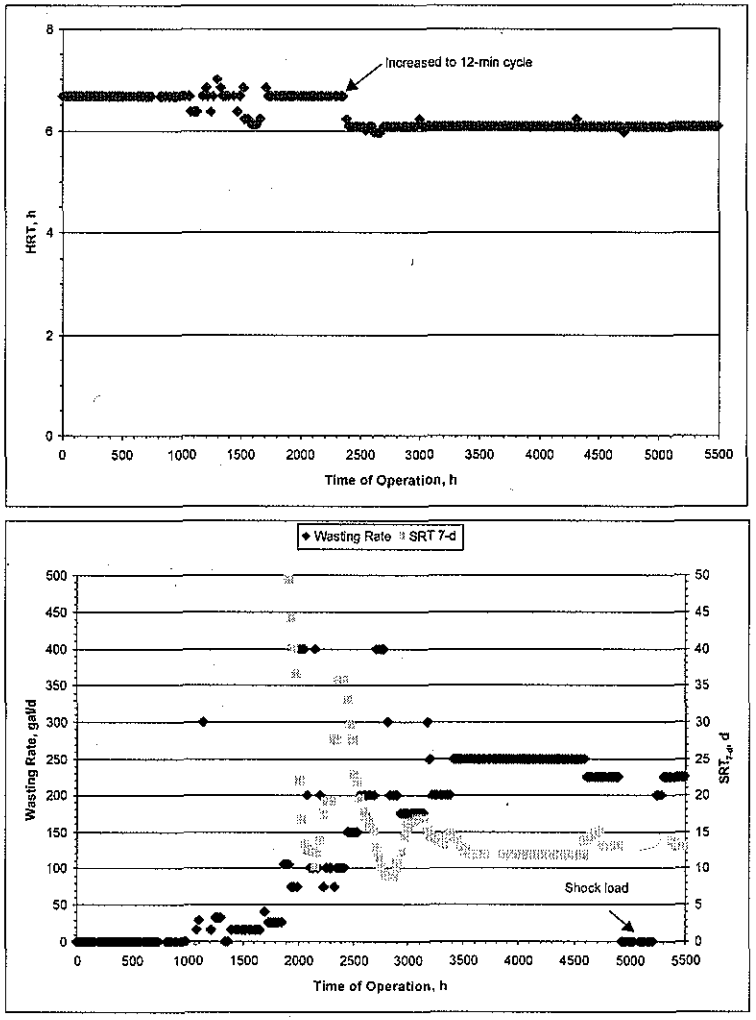


Figure 5-1 HRT and SRT_{7-d} of the Mitsubishi MBR During Part 1

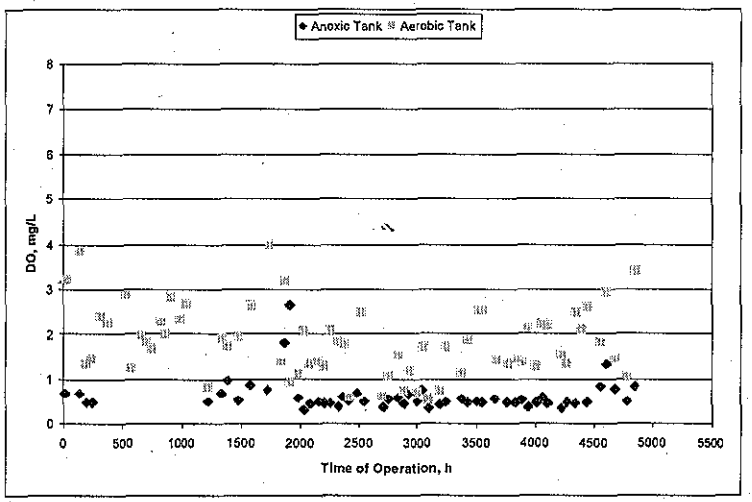
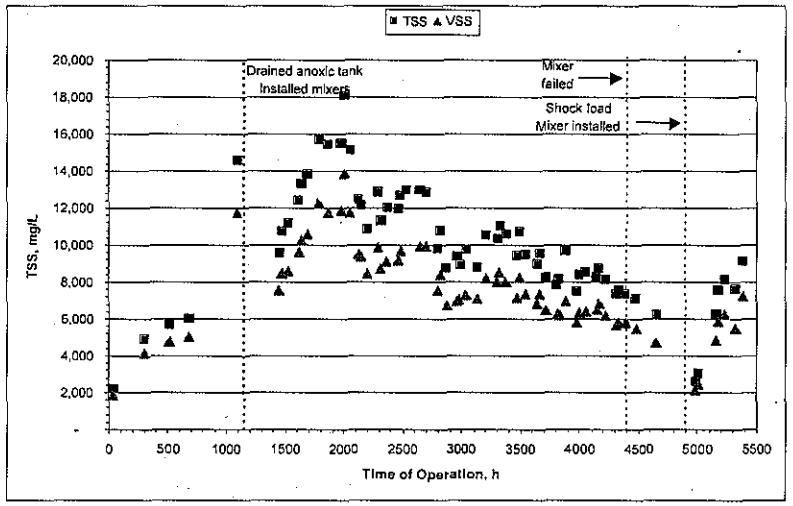


Figure 5-2 DO Concentration in the Mitsubishi MBR During Part 1



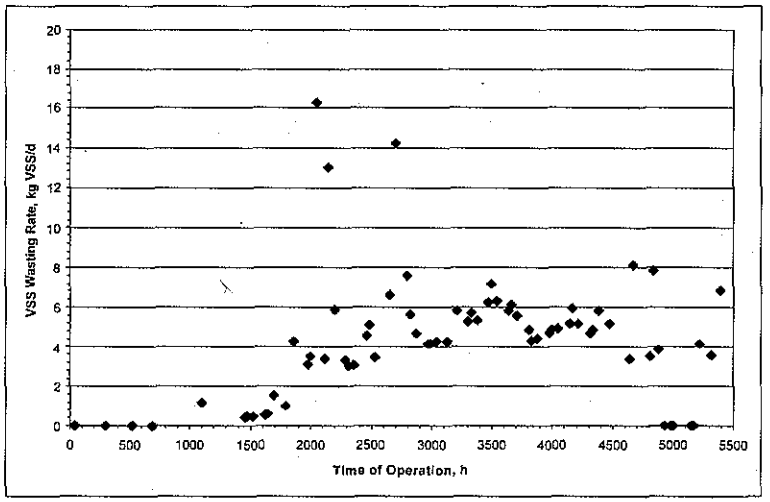
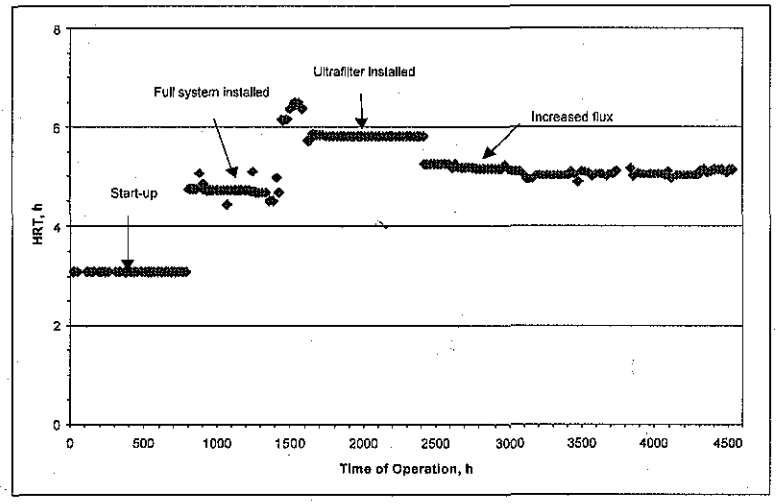


Figure 5-3 Mixed Liquor Solids Data for the Mitsubishi MBR During Part 1



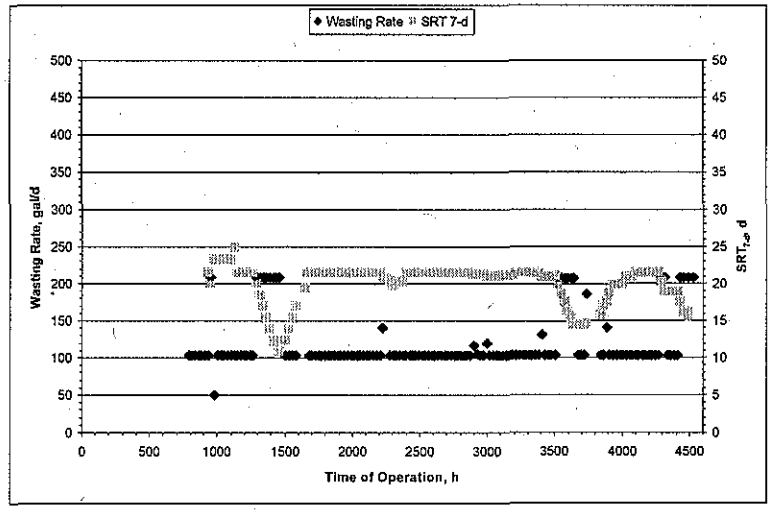


Figure 5-4 HRT and SRT_{7-d} of the Zenon MBR During Part 1

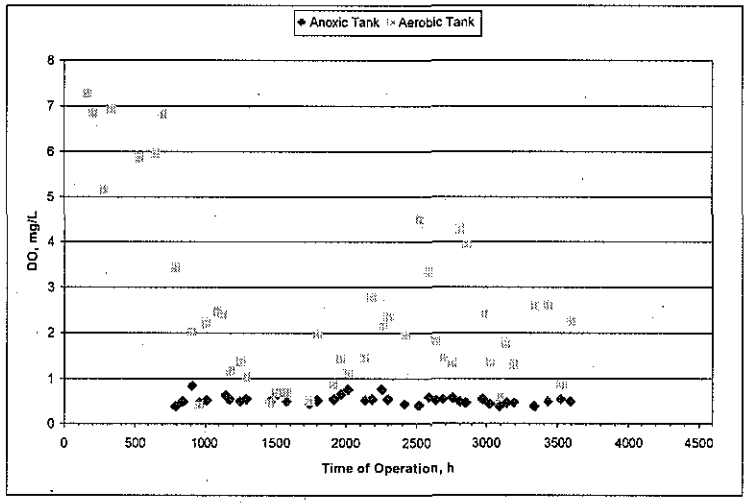


Figure 5-5 DO Concentration in the Zenon MBR During Part 1

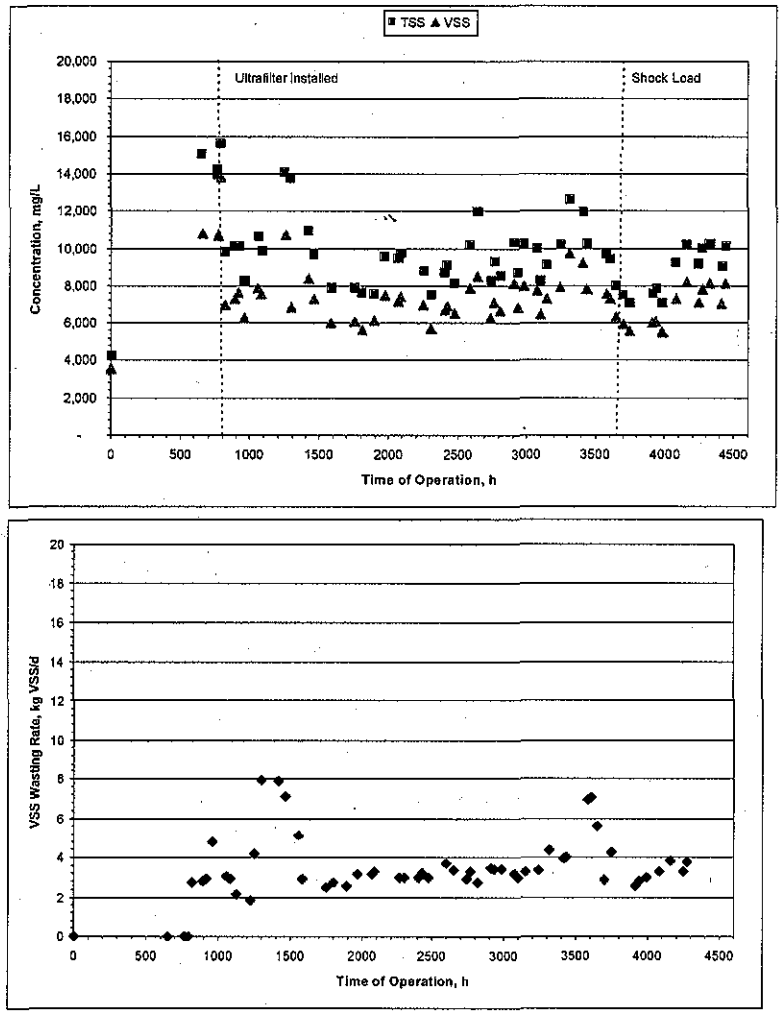


Figure 5-6 Mixed Liquor Solids Concentration in the Zenon MBR During Part 1

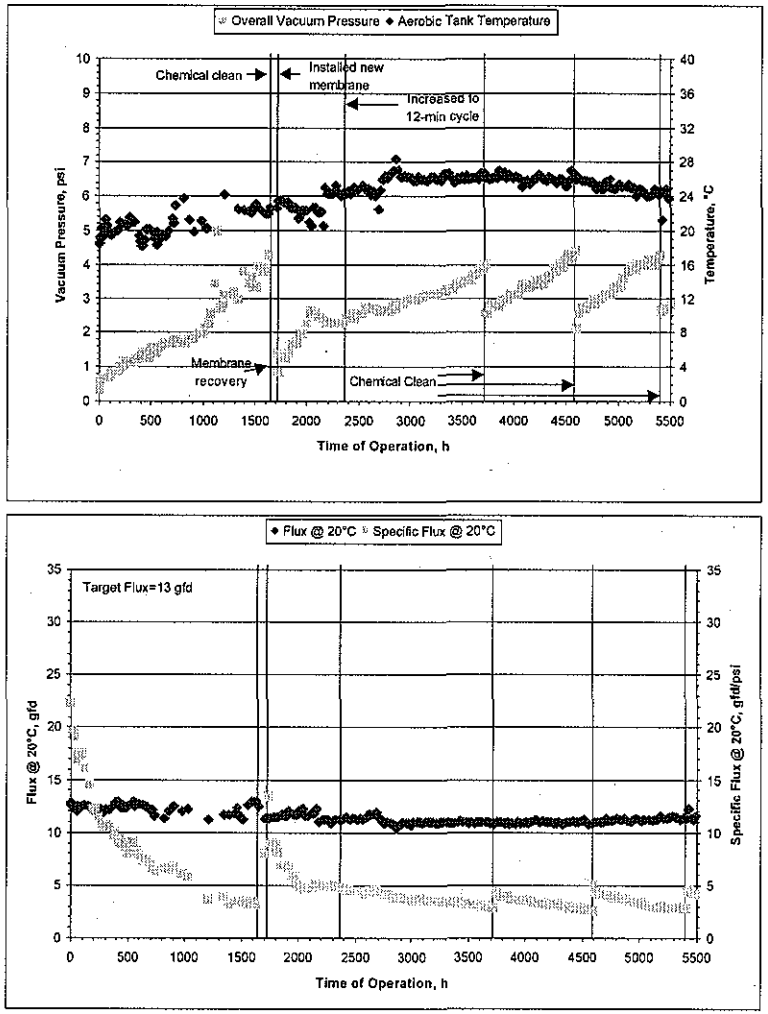
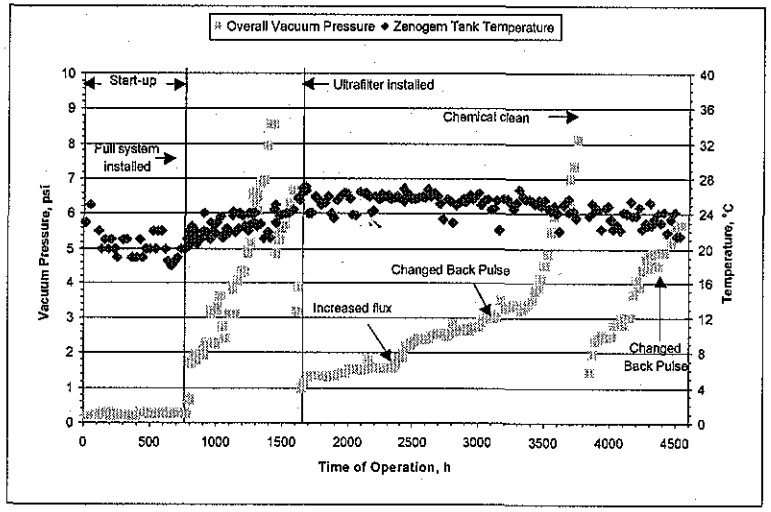


Figure 5-7 Membrane Performance of the Mitsubishi MBR During Part 1



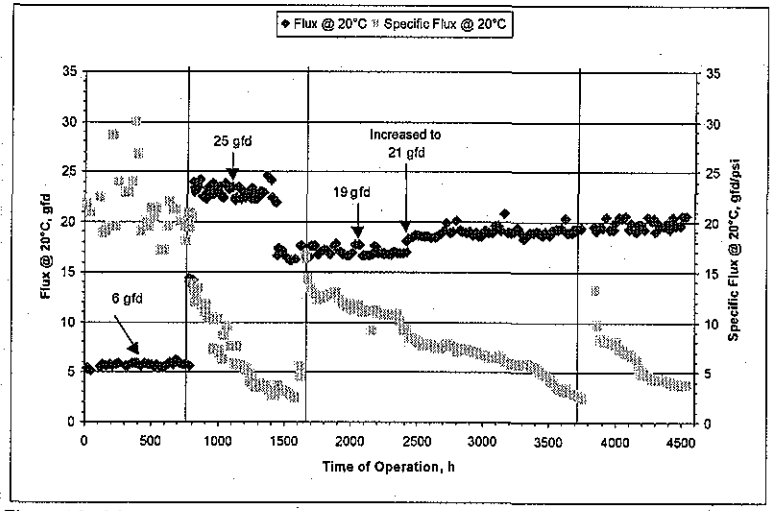


Figure 5-8a Membrane Performance of the Zenon MBR During Part 1

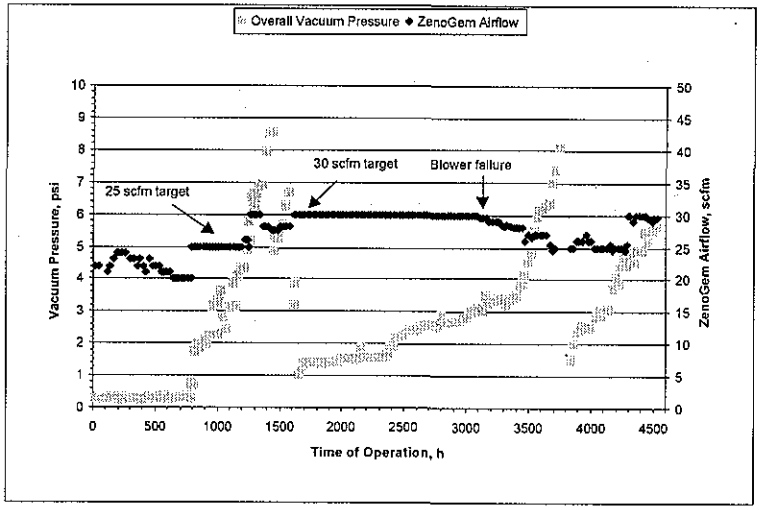


Figure 5-8b Zenon MBR Airflow and Vacuum Pressure During Part 1

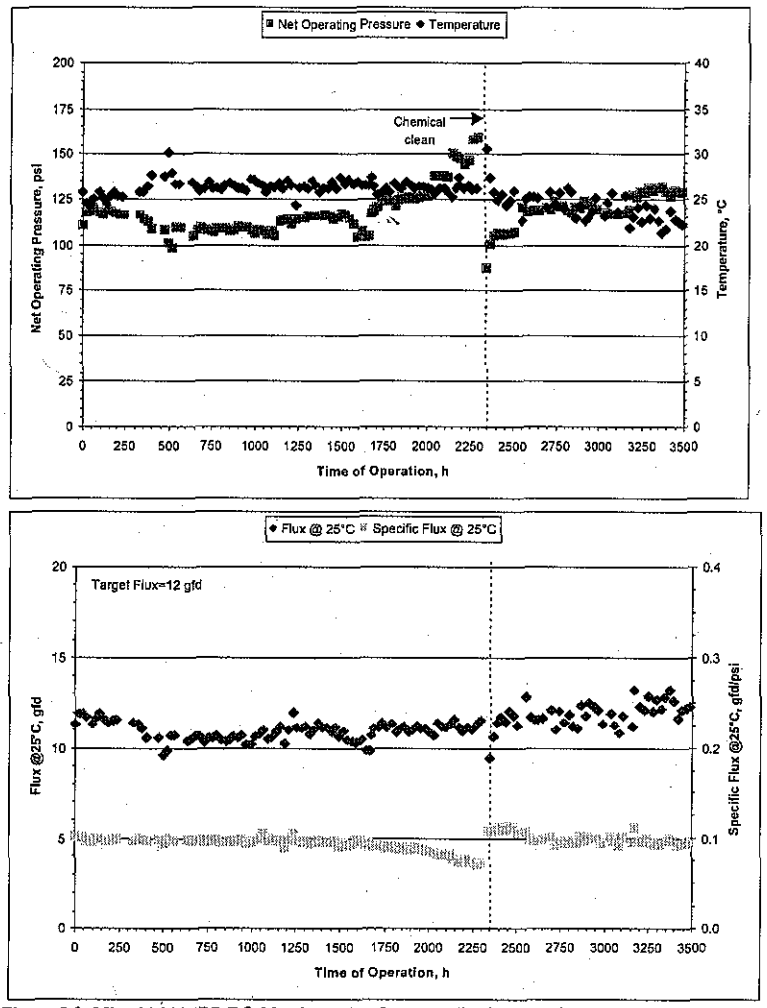


Figure 5-9 Mitsubishi MBR RO Membrane Performance During Part 1

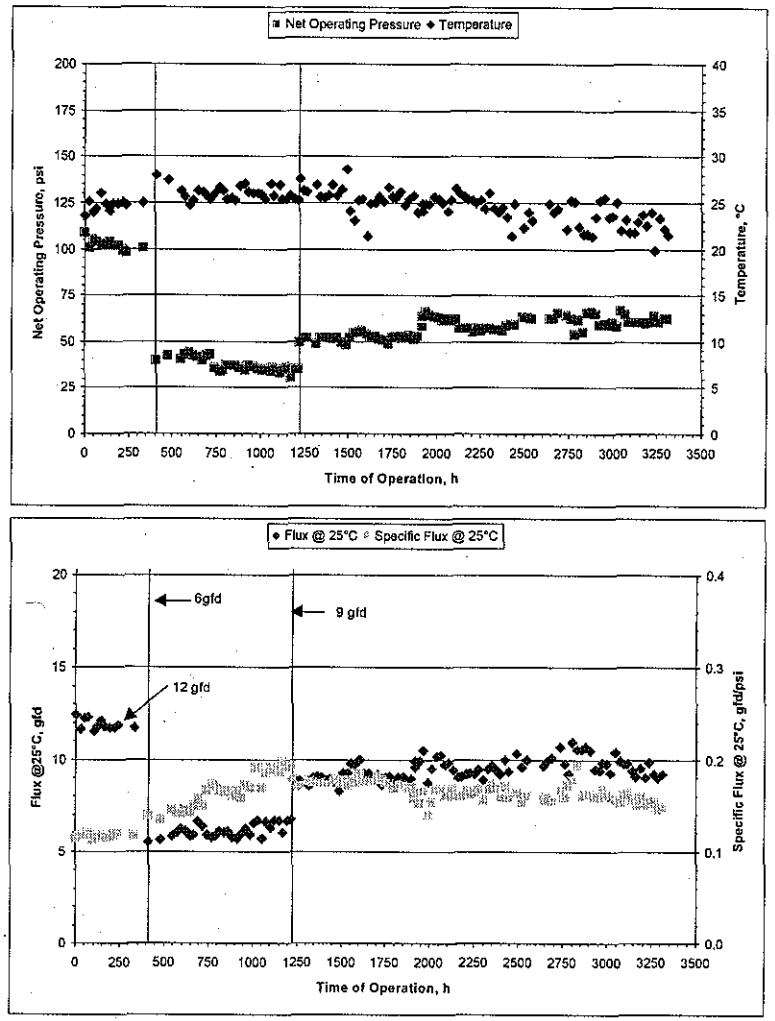


Figure 5-10 Zenon MBR RO Performance During Part 1

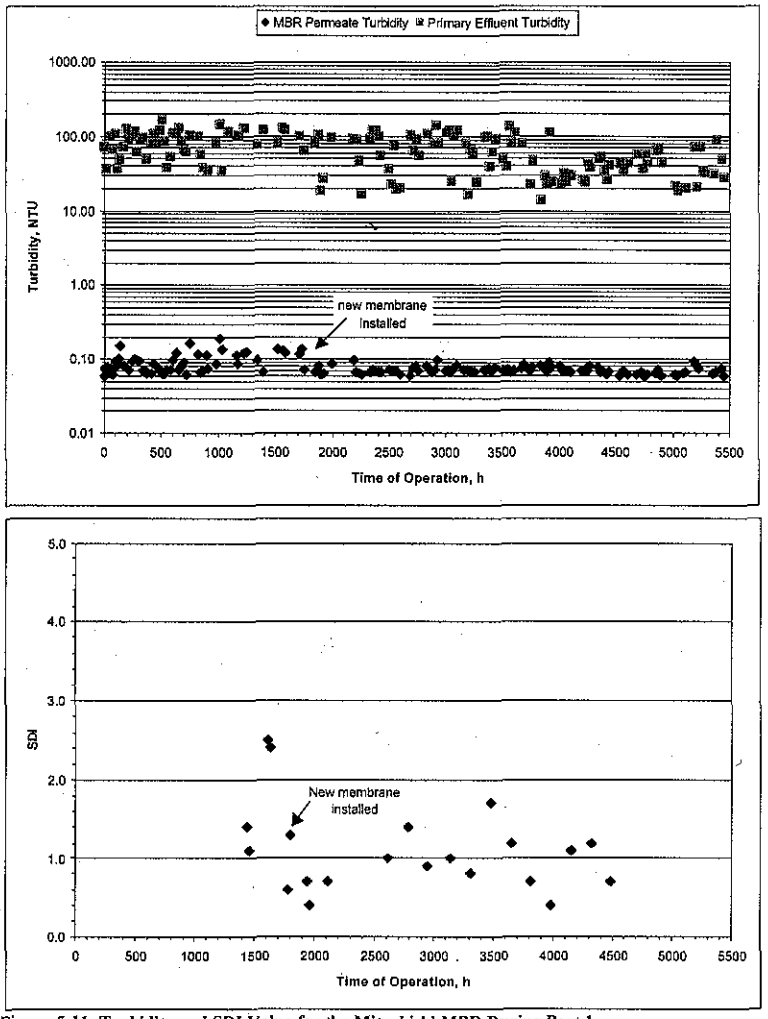


Figure 5-11 Turbidity and SDI Value for the Mitsubishi MBR During Part 1

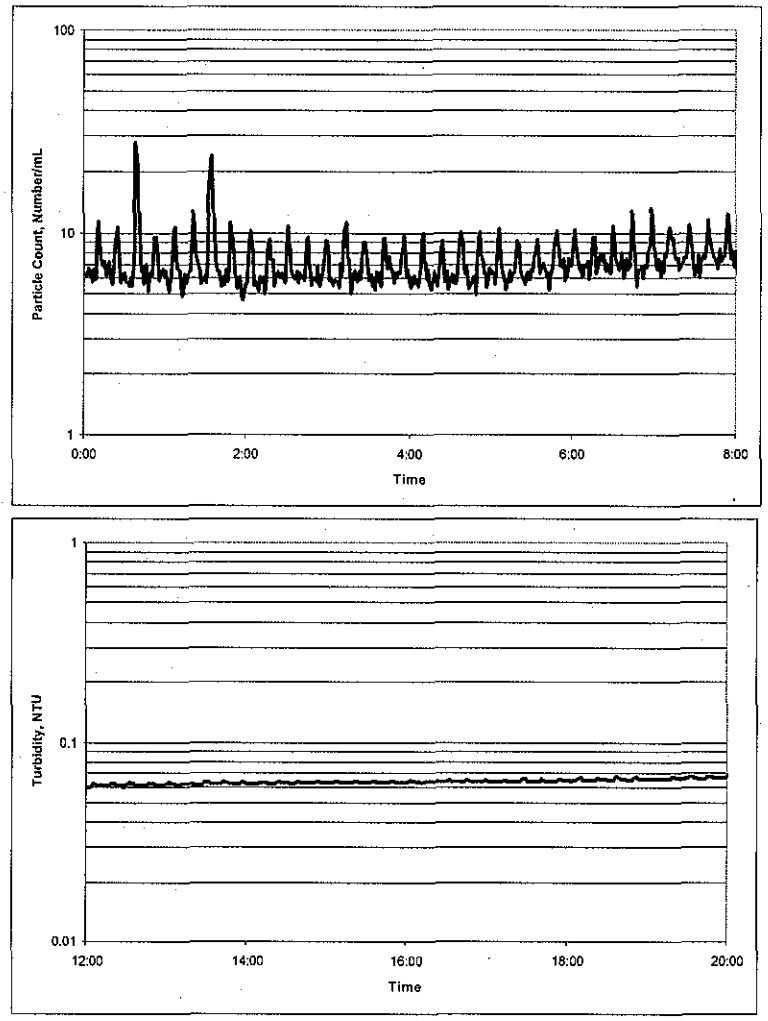


Figure 5-12 On-line Monitoring of the Mitsubishi MBR During Part 1

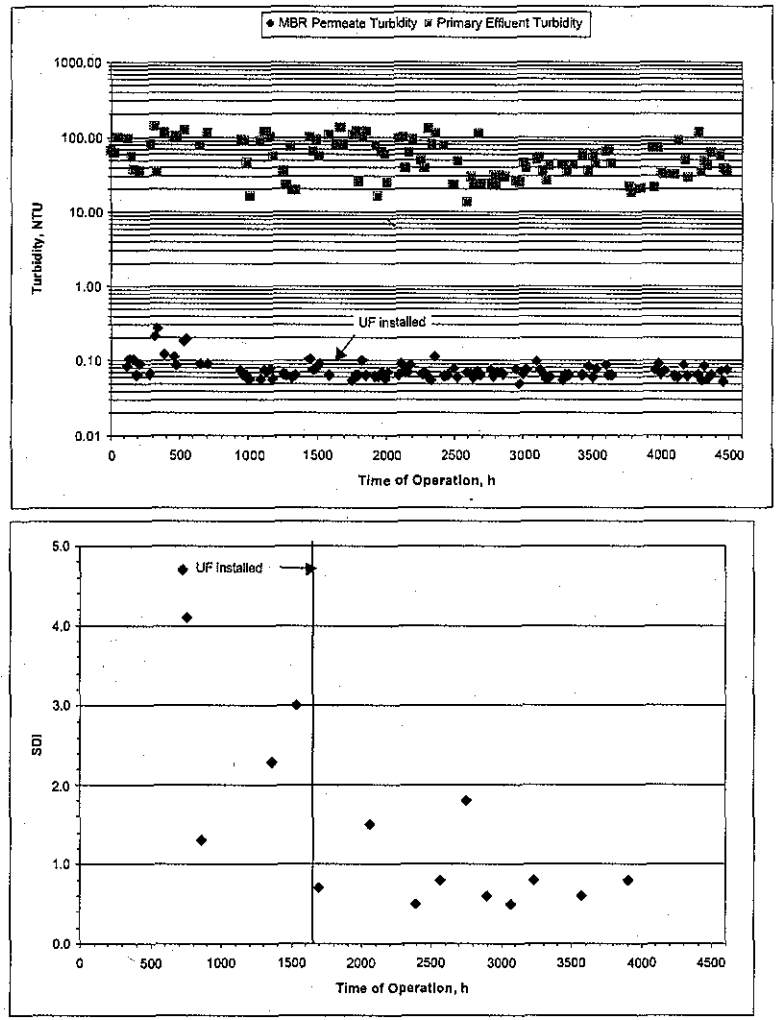


Figure 5-13 Turbidity and SDI Values for the Zenon MBR Permeate During Part 2

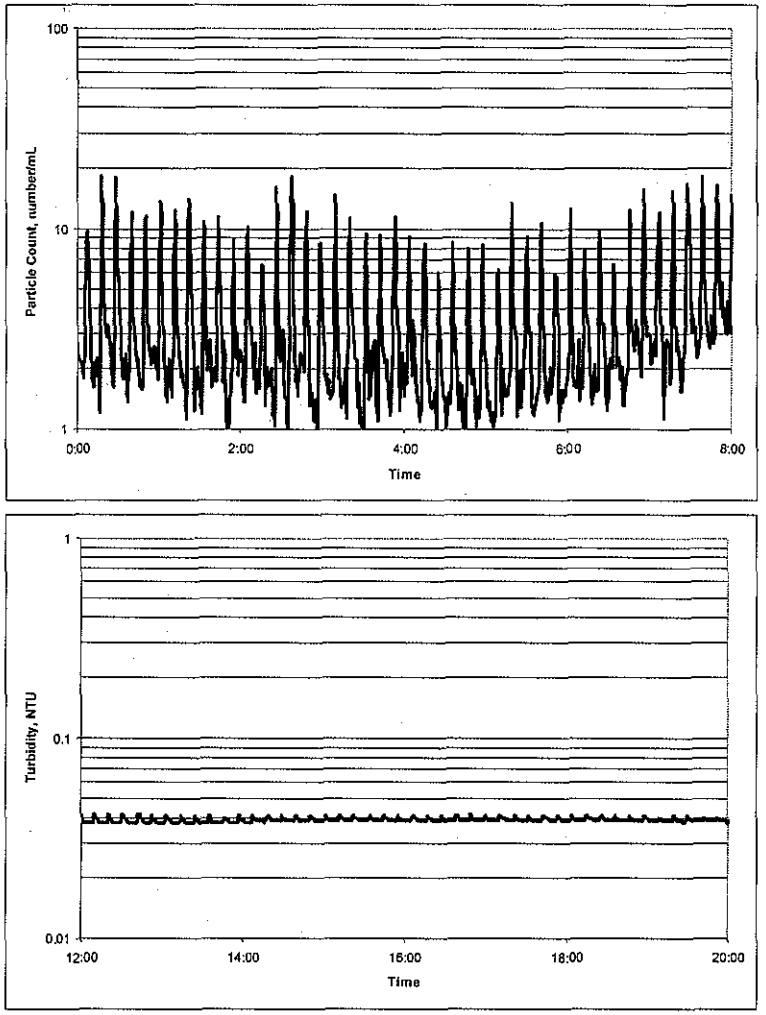


Figure 5-14 On-line Monitoring of the Zenon MBR Permeate During Part 1

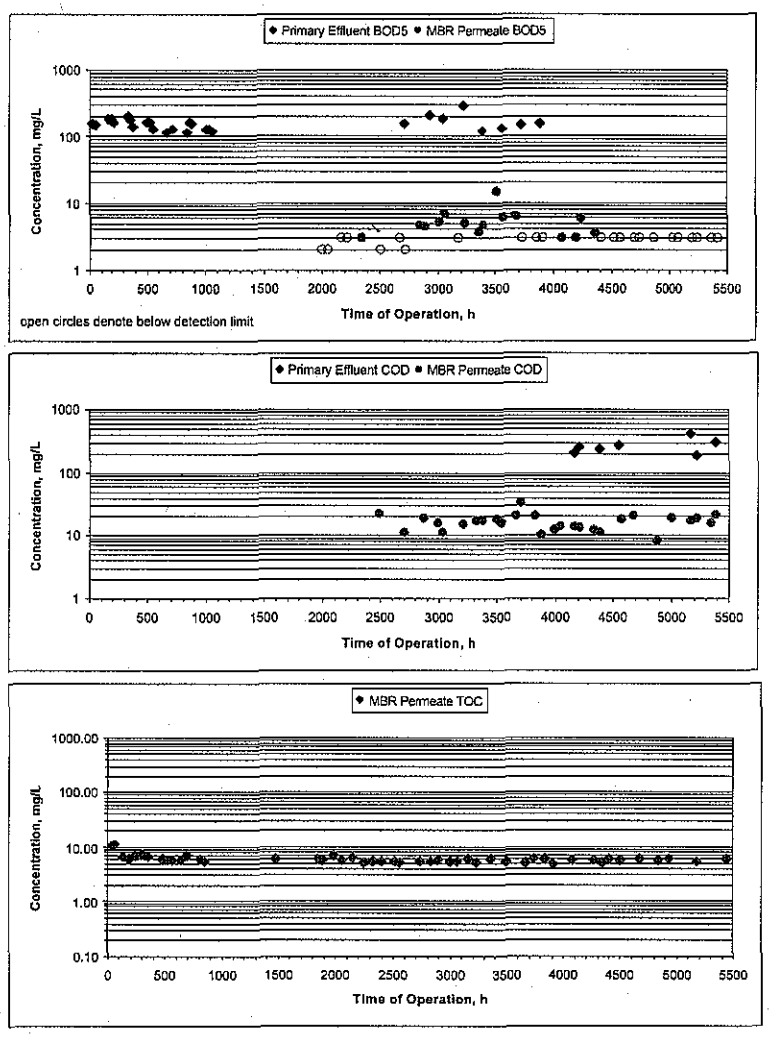


Figure 5-15 Organics Removal by the Mitsubishi MBR During Part 1

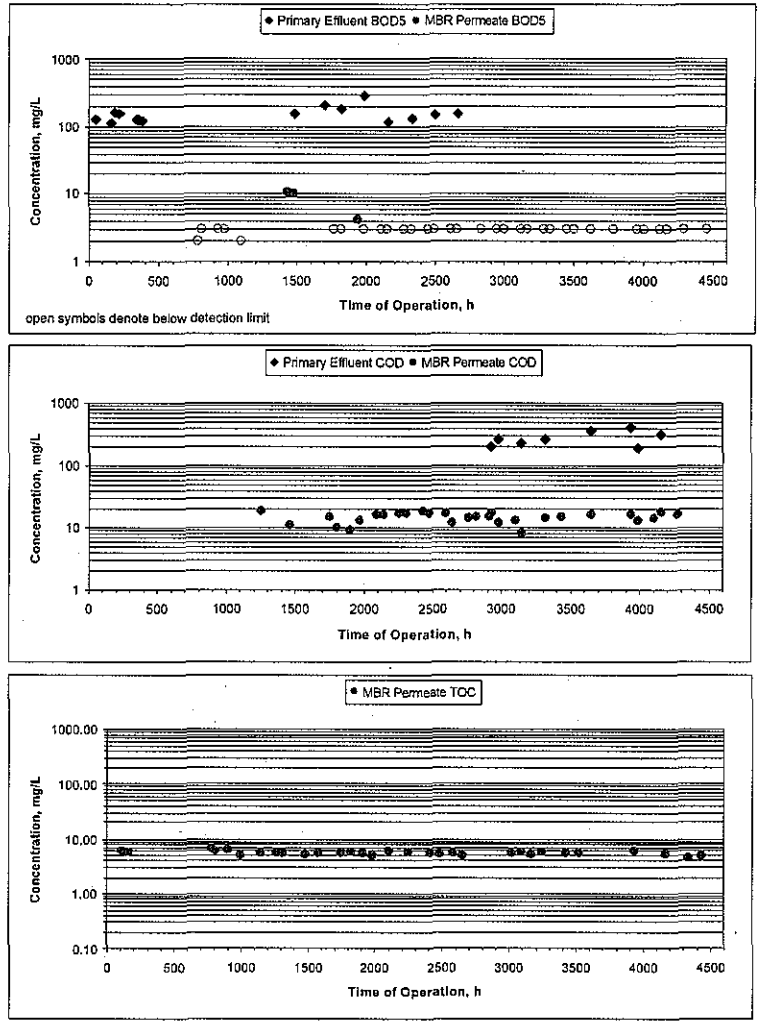


Figure 5-16 Organics Removal by the Zenon MBR During Part 1

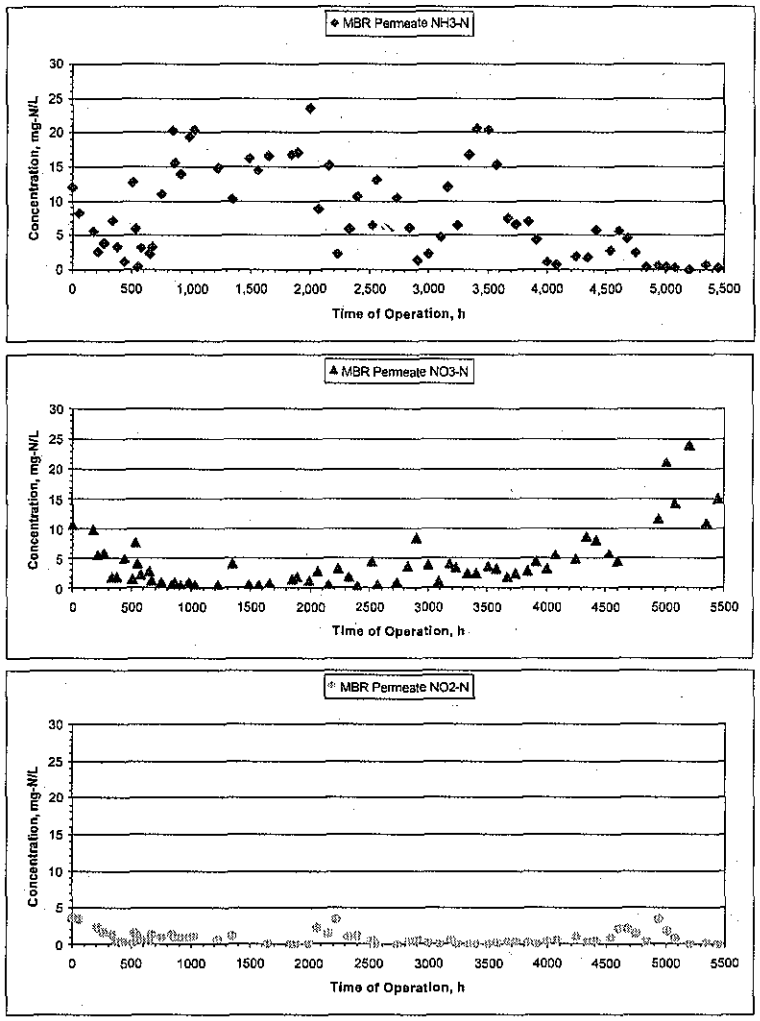


Figure 5-17 Inorganic Nitrogen Species in the Mitsubishi MBR Permeate During Part 1

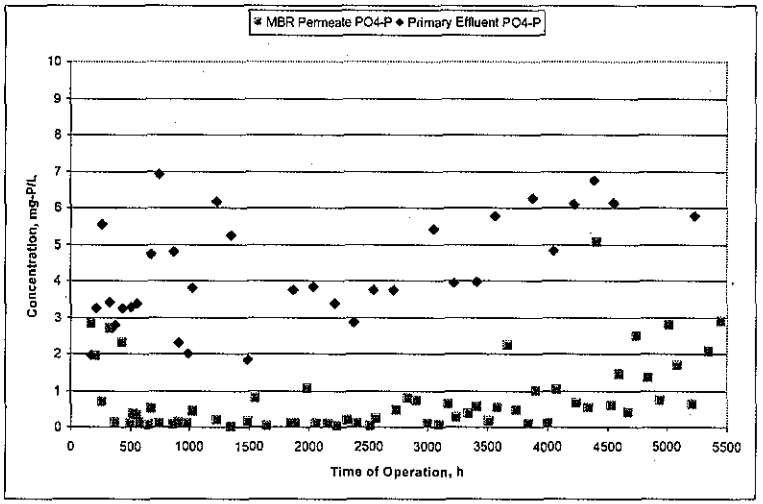


Figure 5-18 Ortho-Phosphate in the Mitsubishi MBR Permeate During Part 1

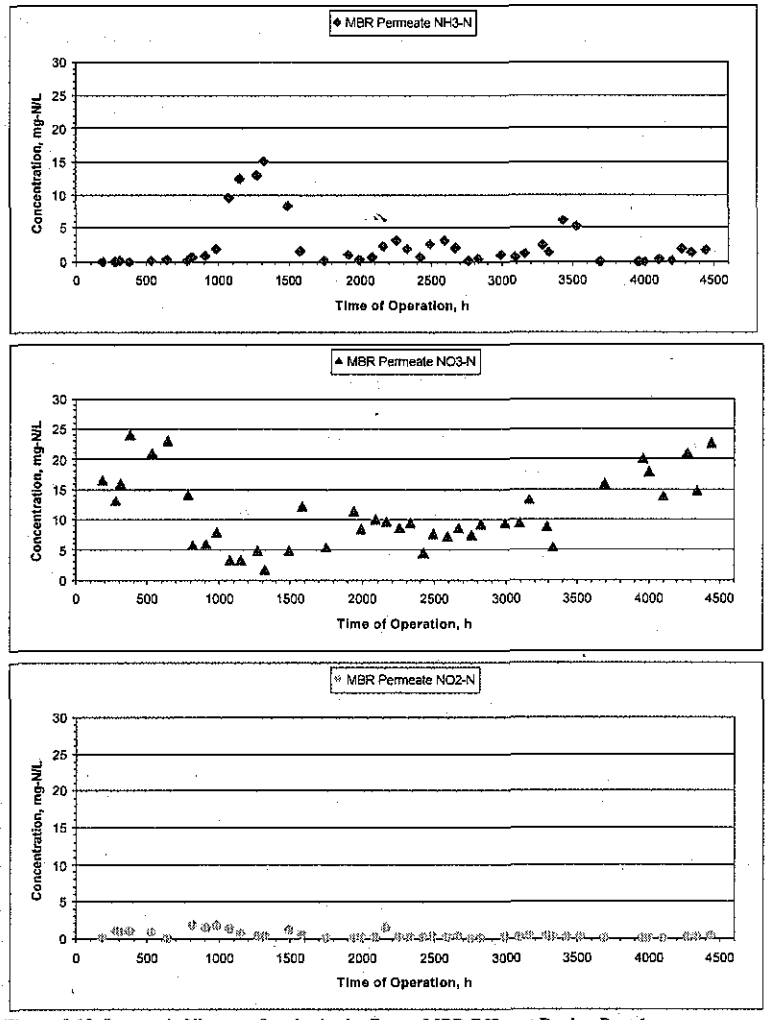


Figure 5-19 Inorganic Nitrogen Species in the Zenon MBR Effluent During Part 1

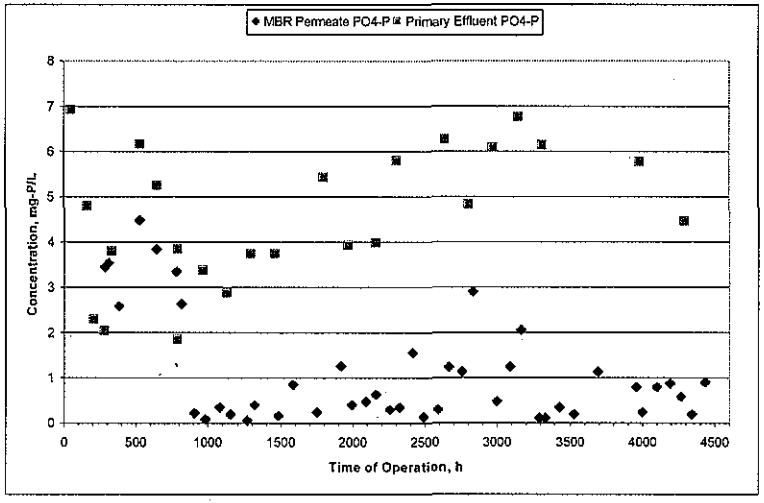


Figure 5-20 Ortho-Phosphate Removal by the Zenon MBR During Part 1

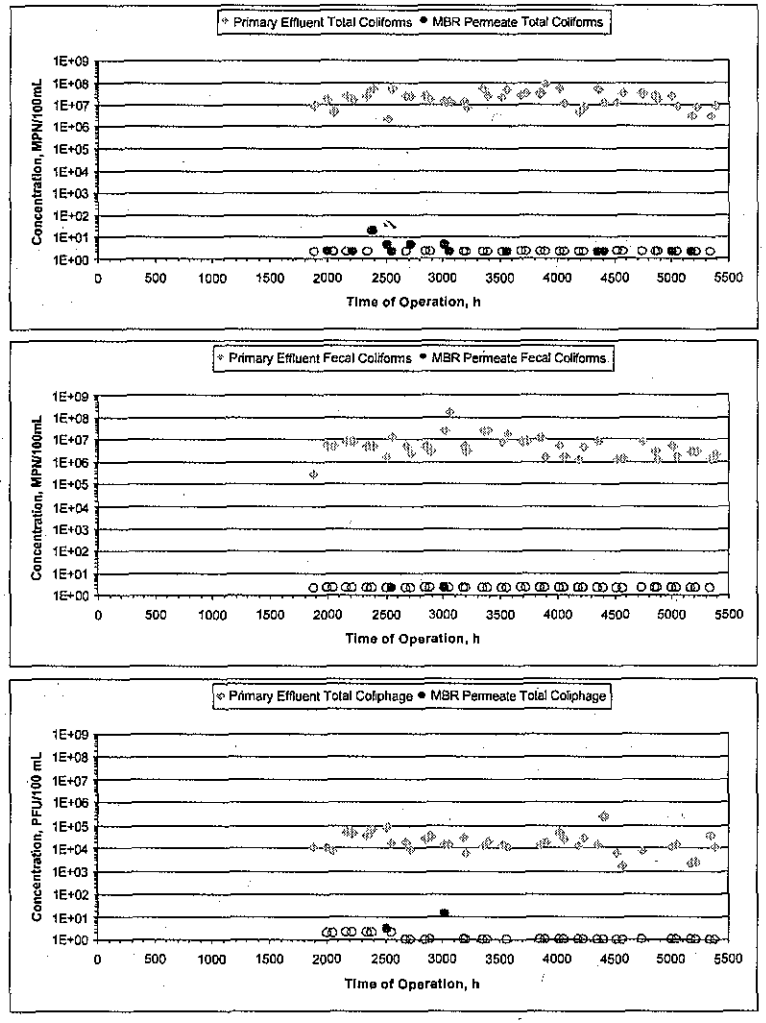


Figure 5-21 Microbial Removal by the Mitsubishi MBR During Part 1

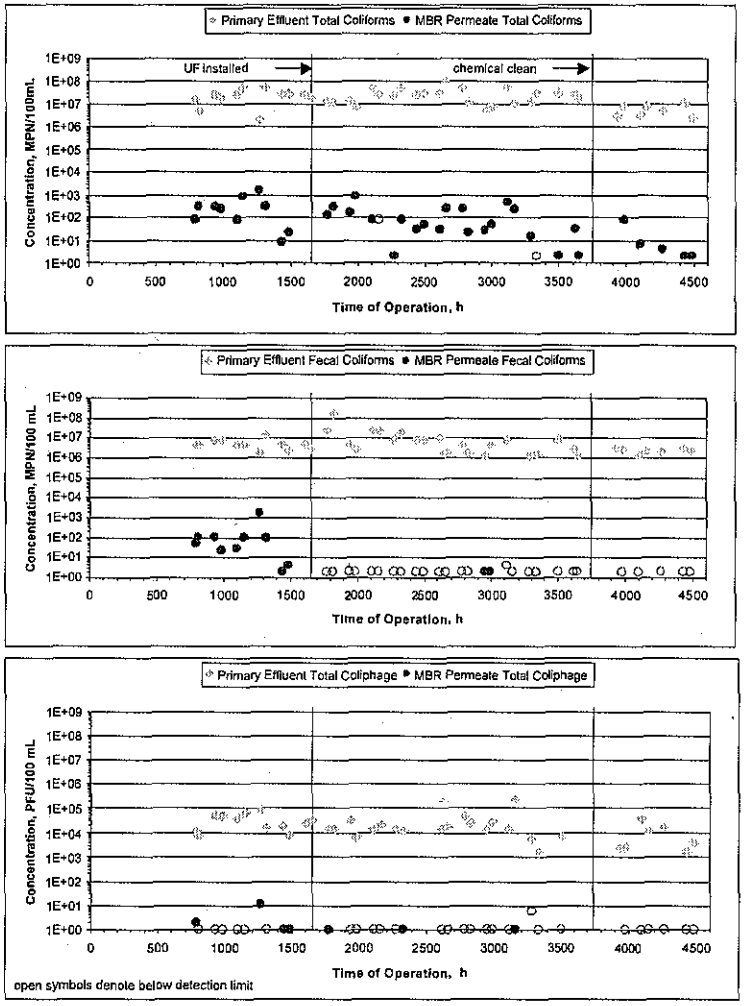


Figure 5-22 Microbial Removal by the Zenon MBR During Part 1

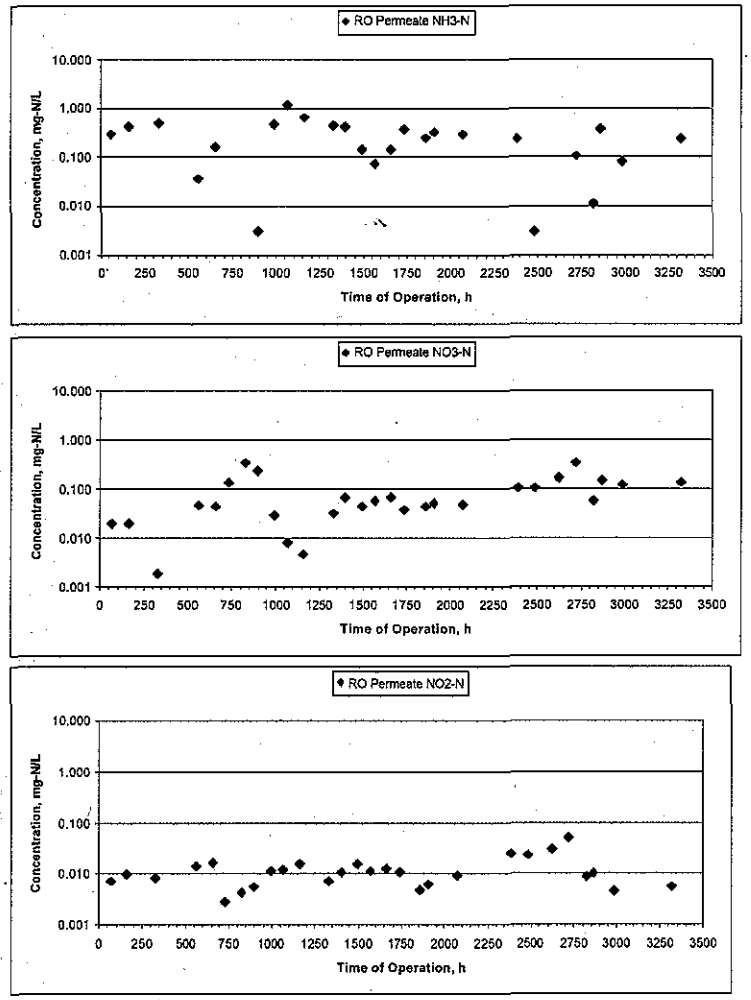


Figure 5-23 Inorganic Nitrogen Species in the Mitsubishi MBR RO Permeate During Part 1

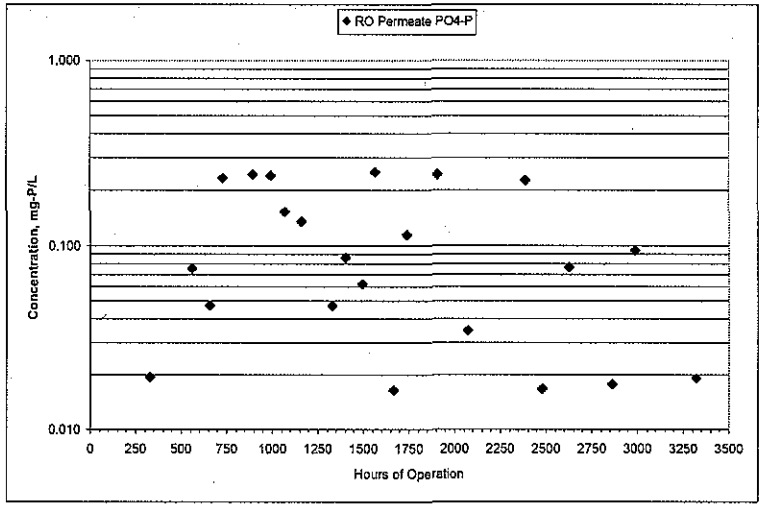


Figure 5-24 Ortho-Phosphate in the Mitsubishi MBR RO Permeate During Part 1

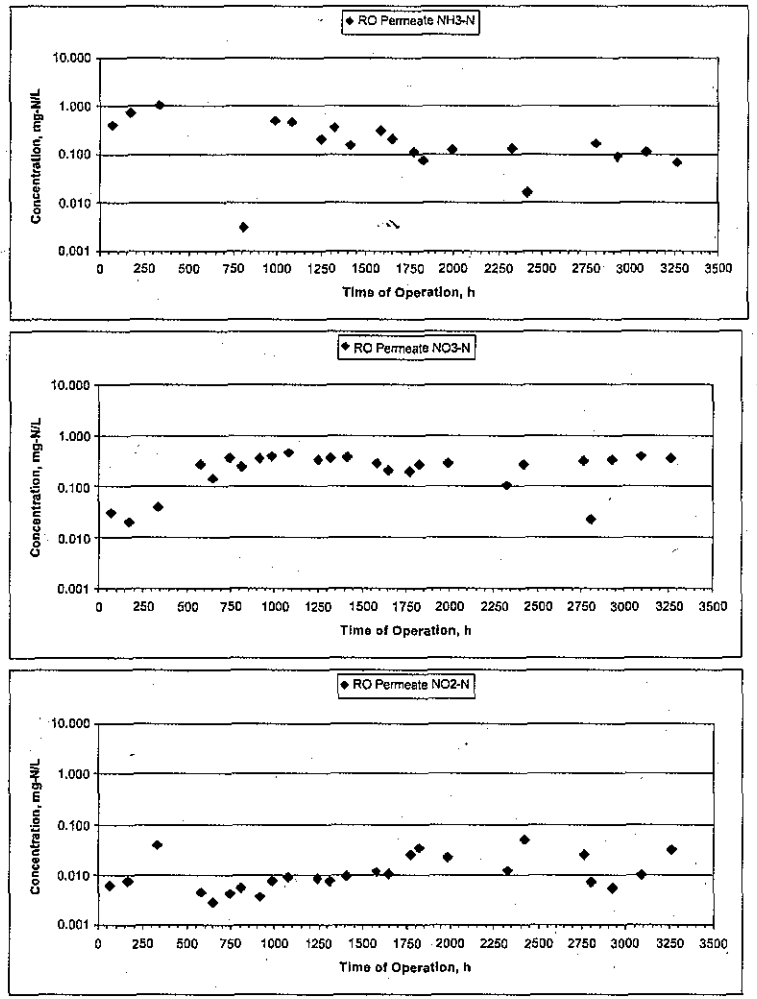


Figure 5-25 Inorganic Nitrogen Species in the Zenon MBR RO Permeate

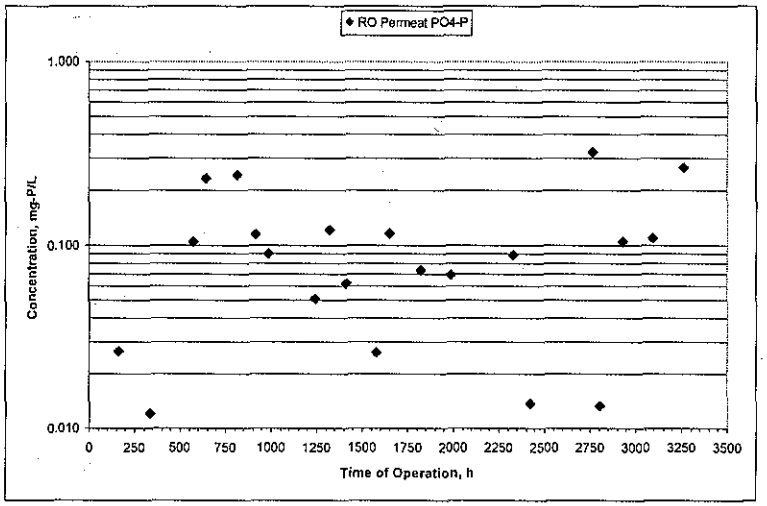


Figure 5-26 Ortho-Phosphate Concentration in the Zenon MBR RO Permeate

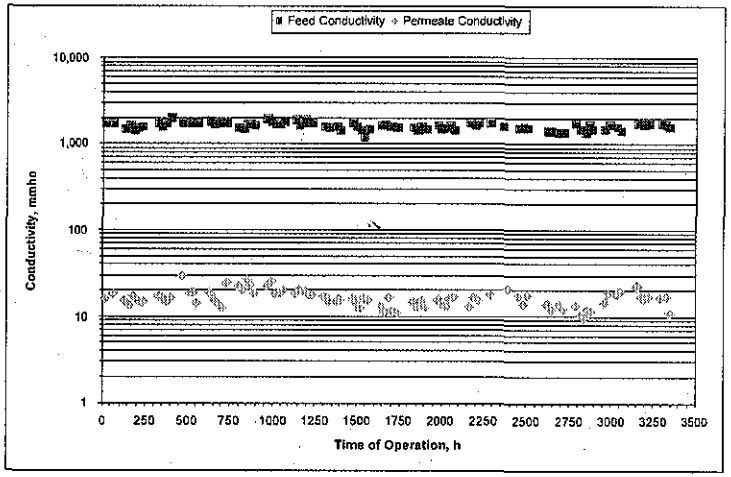


Figure 5-27 Conductivities of the Mitsubishi MBR RO Feed and Permeate During Part 1

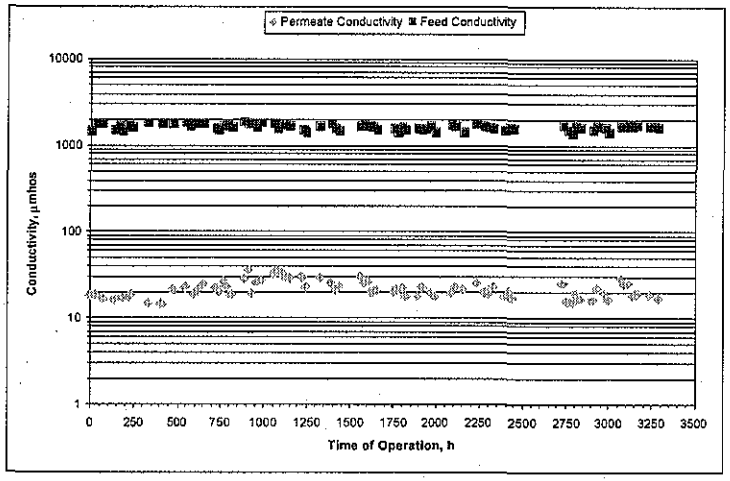


Figure 5-28 Conductivities of the Zenon MBR RO Feed and Permeate Permeate During Part 1

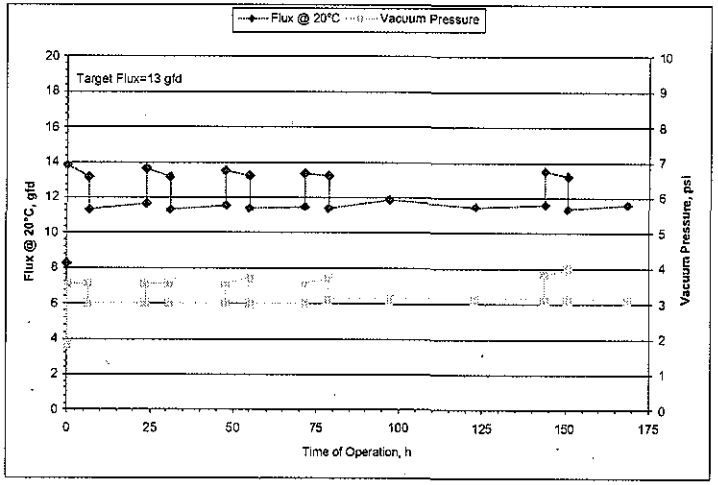
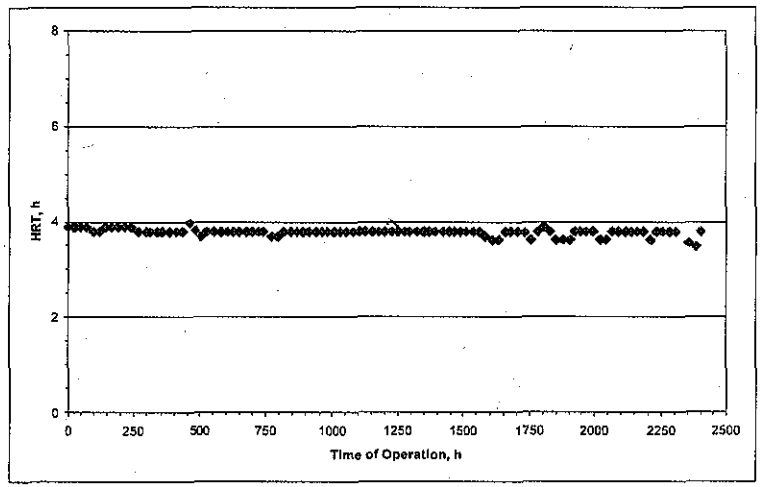


Figure 5-29 Peaking Study for the Mitsubishi MBR During Part 1



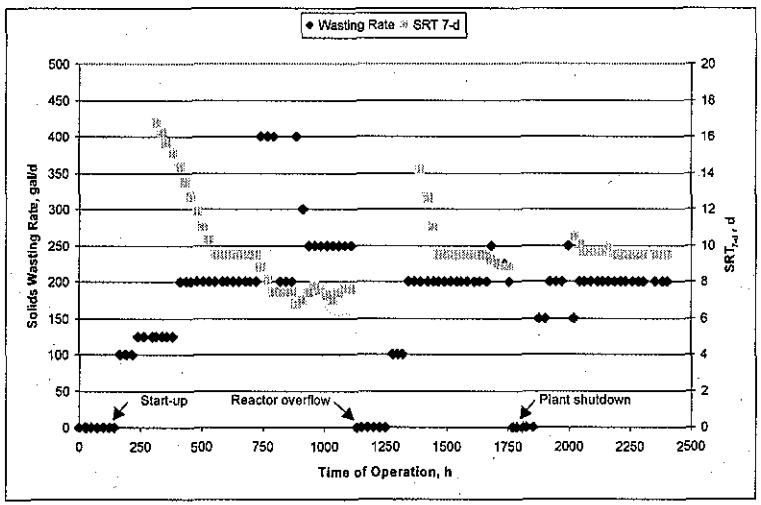


Figure 6-1 SRT and HRT of the Mitsubishi MBR during Part 2

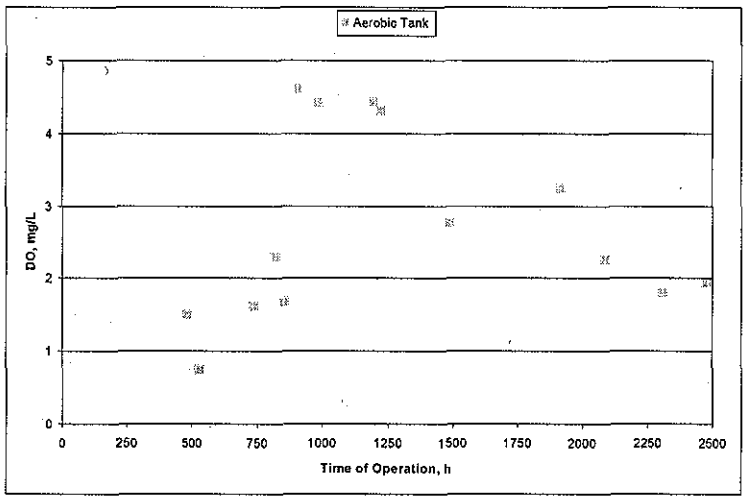


Figure 6-2 DO Concentrations in the Mitsubishi MBR During Part 2

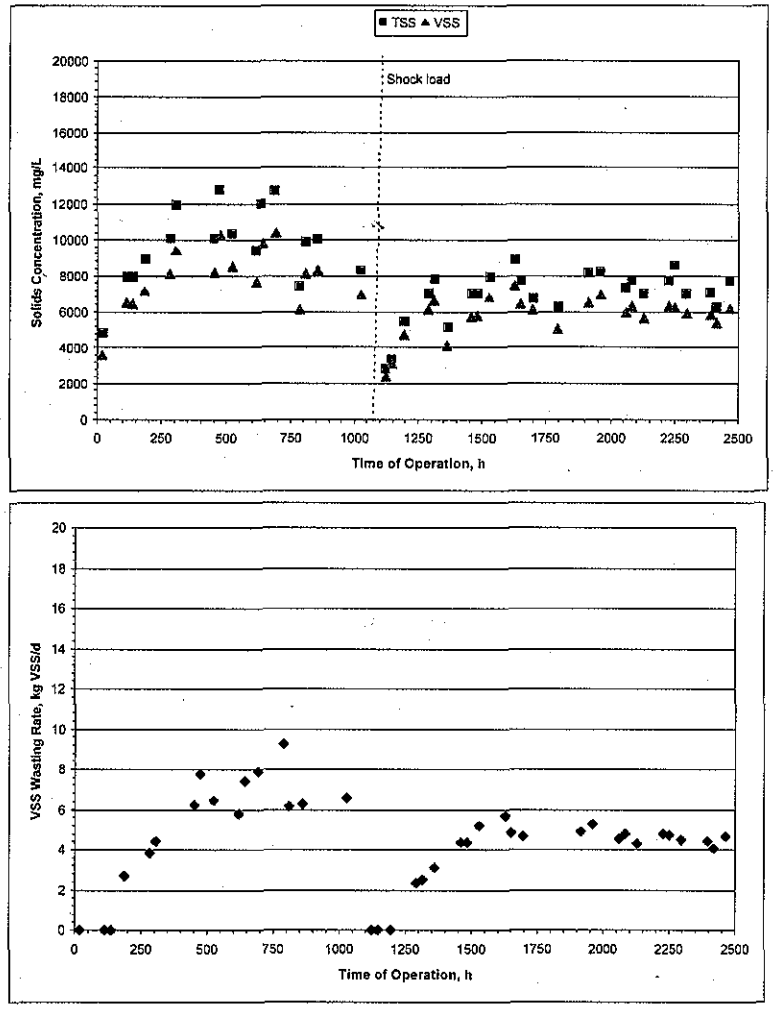


Figure 6-3 Mixed Liquor Solids Concentration for the Mitsubishi MBR During Part 2

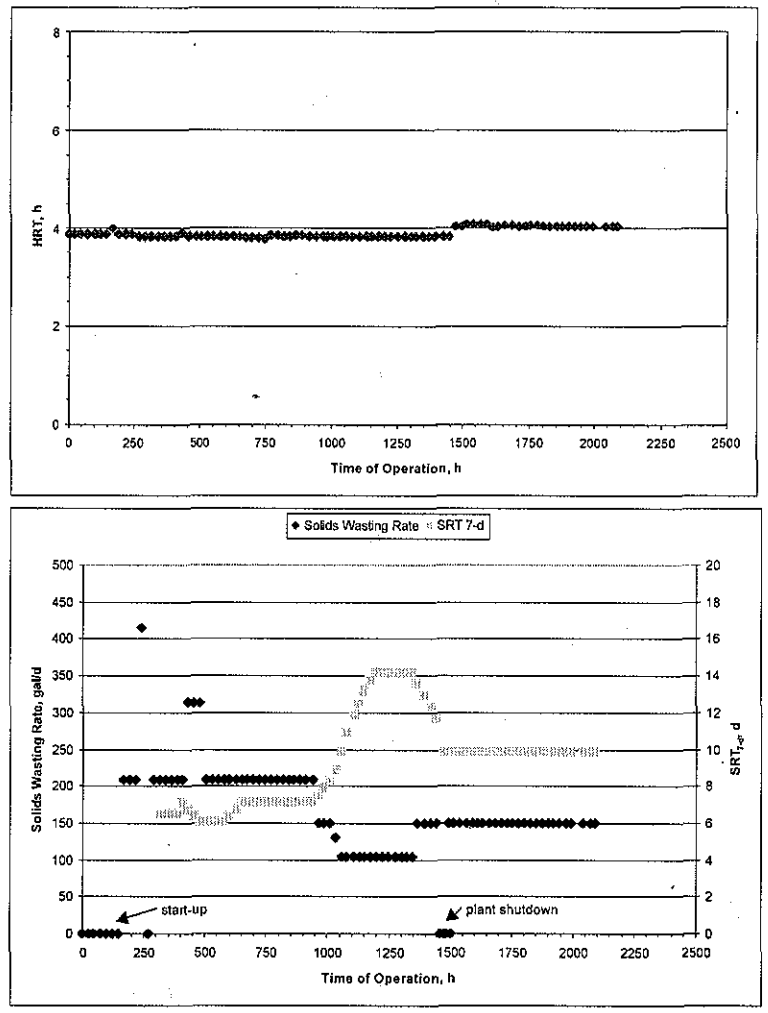


Figure 6-4 SRT and HRT of the Zenon MBR During Part 2

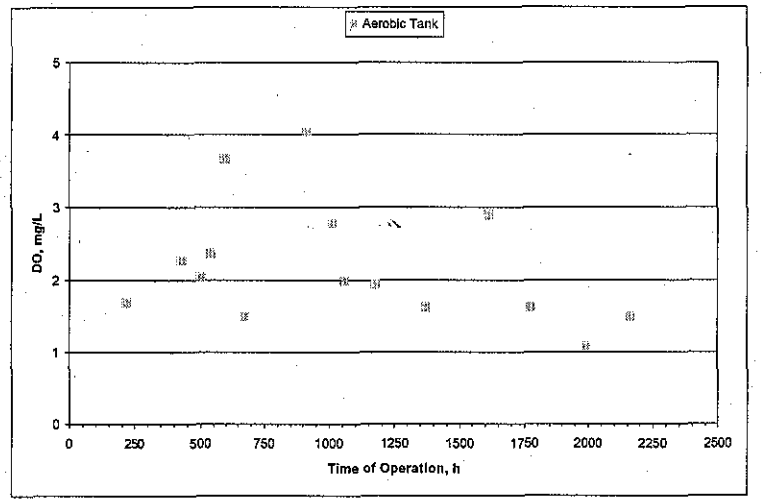
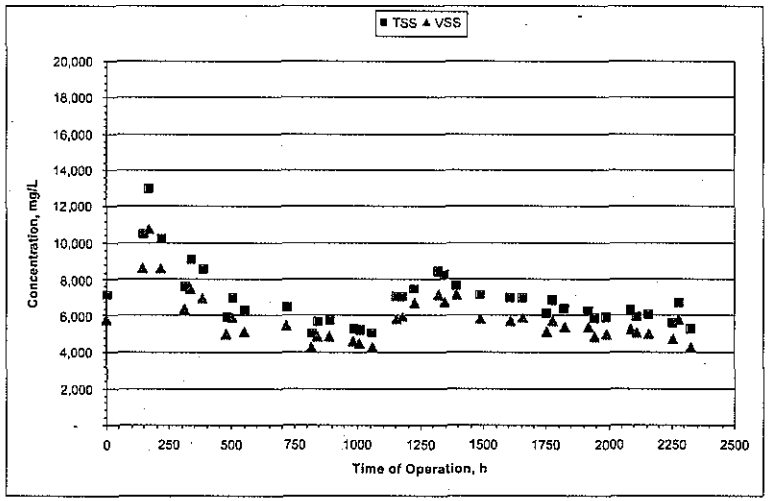


Figure 6-5 DO Concentration in the Zenon MBR During Part 2



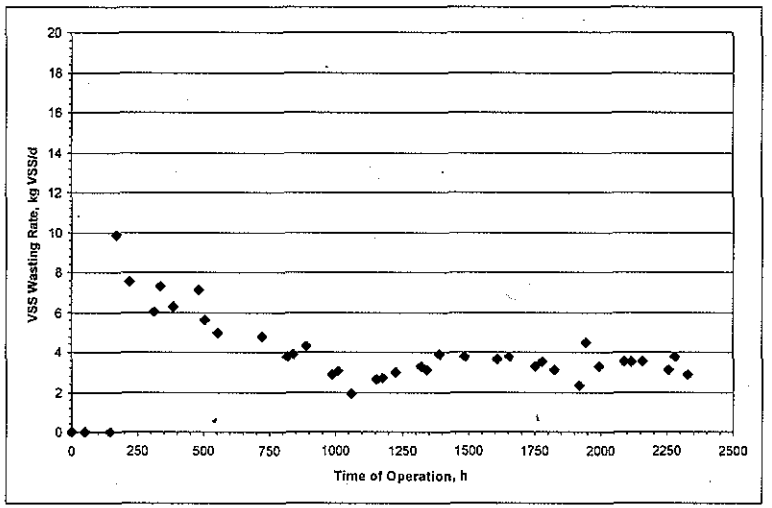


Figure 6-6 Mixed Liquor Solids Data of the Zenon MBR During Part 2

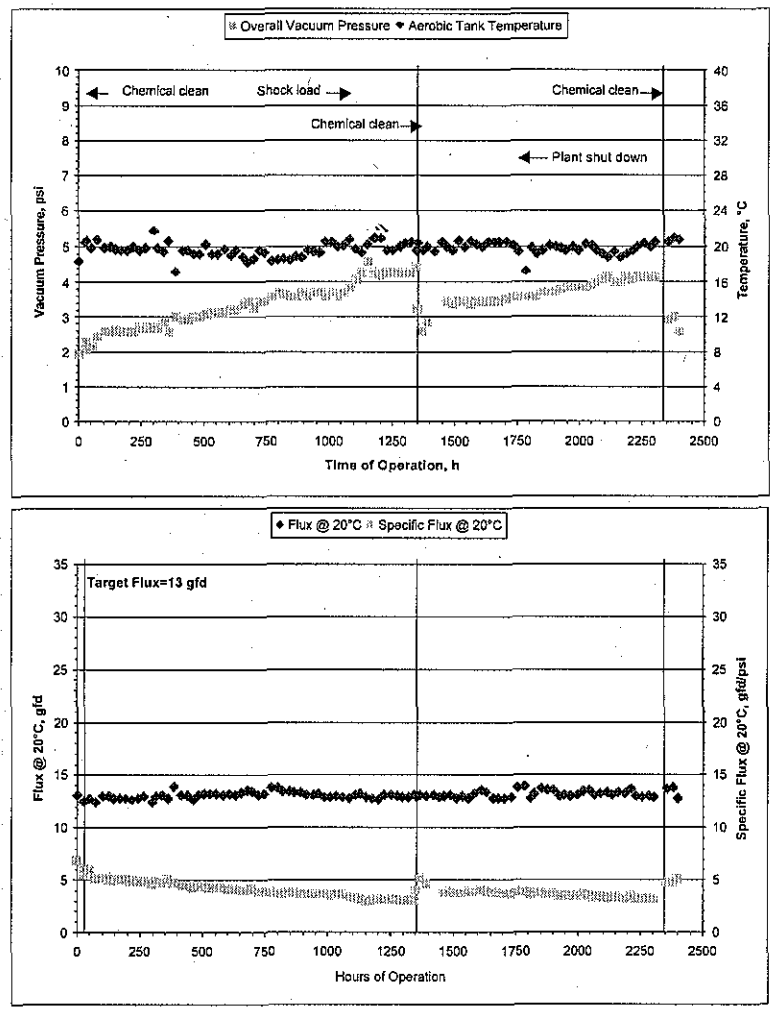


Figure 6-7 Membrane Performance of the Mitsubishi MBR During Part 2

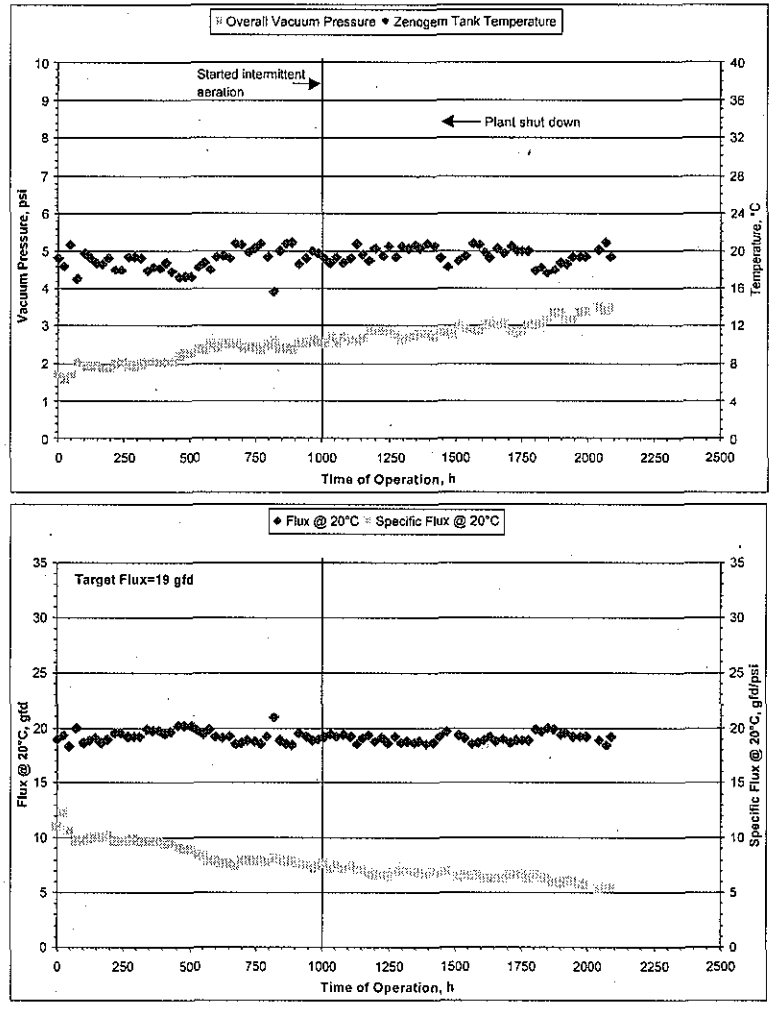


Figure 6-8 Membrane Performance of the Zenon MBR During Part 2

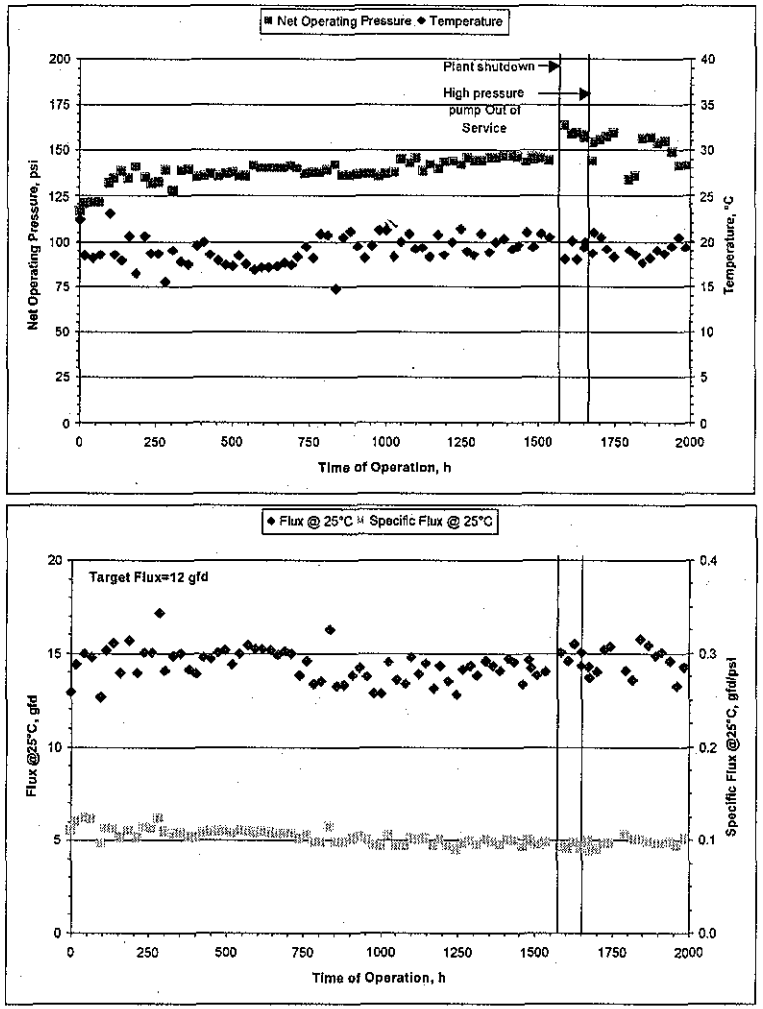


Figure 6-9 Mitsubishi MBR RO Membrane Performance During Part 2

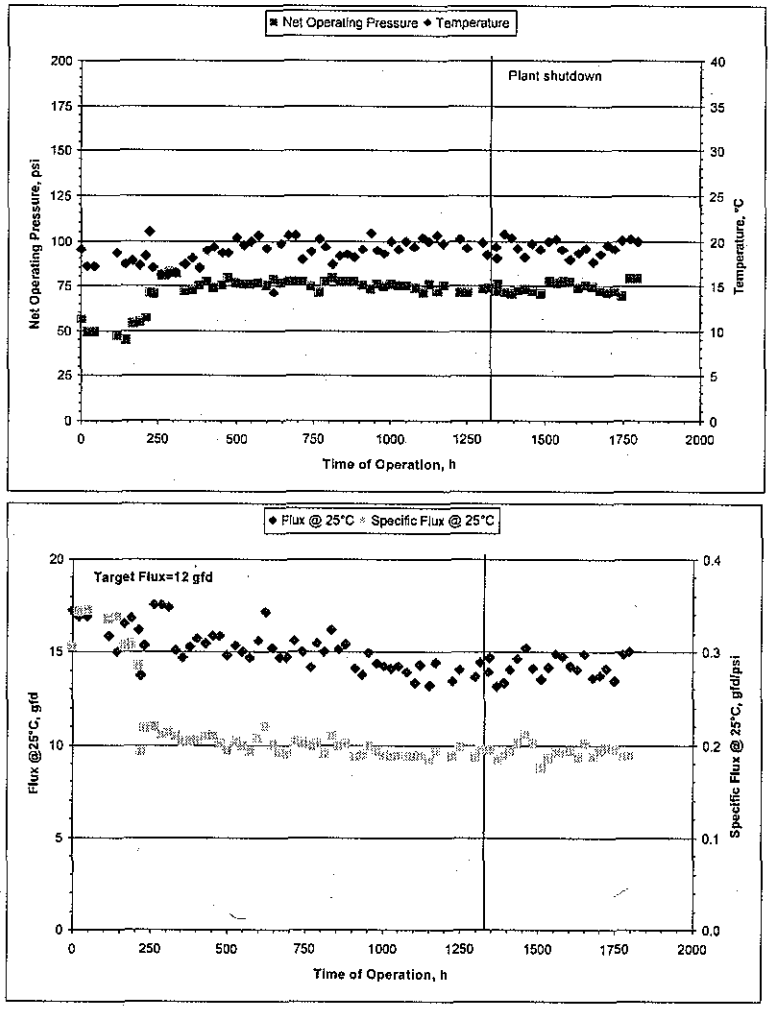


Figure 6-10 Zenon MBR RO Membrane Performance During Part 2

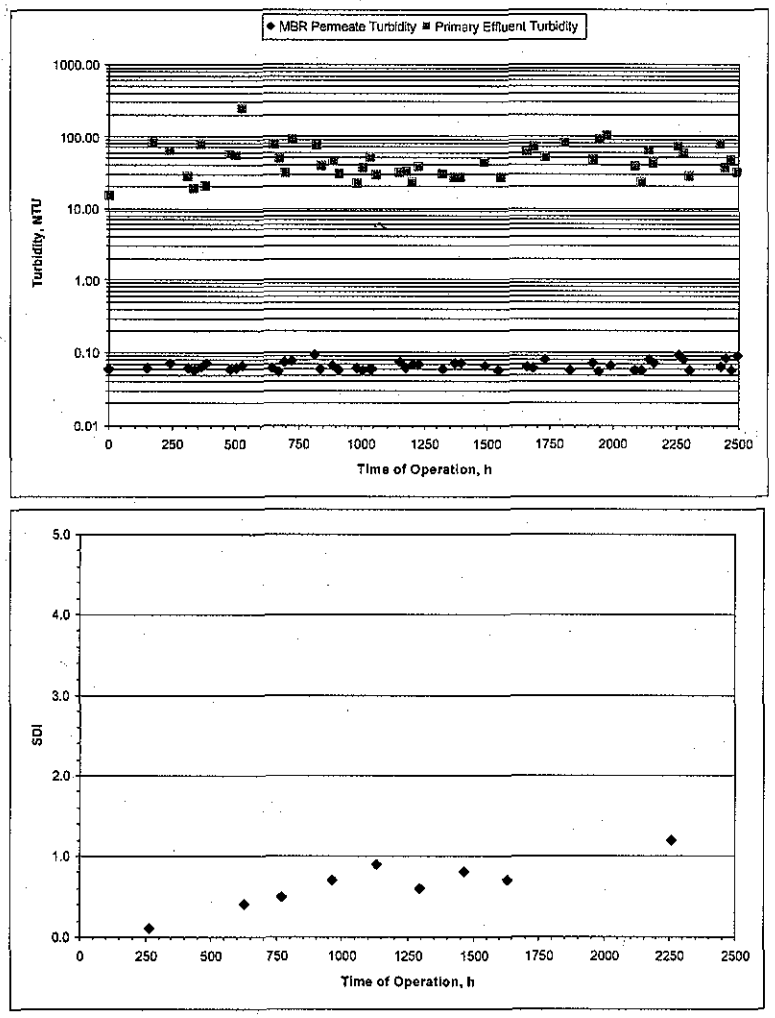


Figure 6-11 Particulate Removal by the Mitsubishi MBR During Part 2

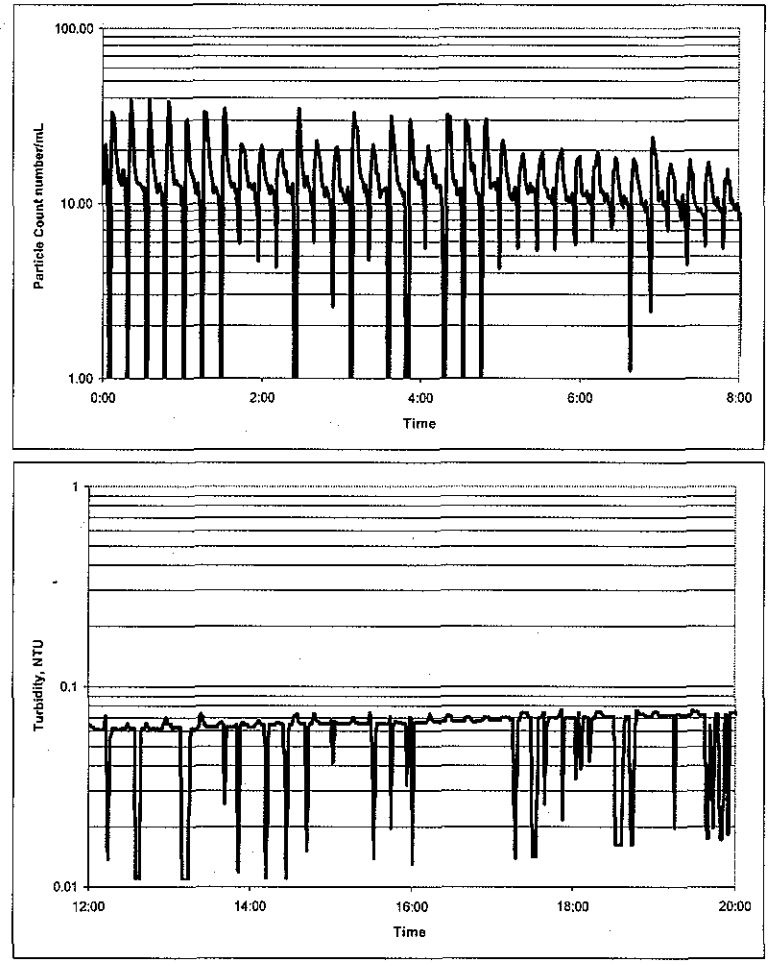


Figure 6-12 On-line Monitoring of the Mitsubishi MBR Permeate During Part 2

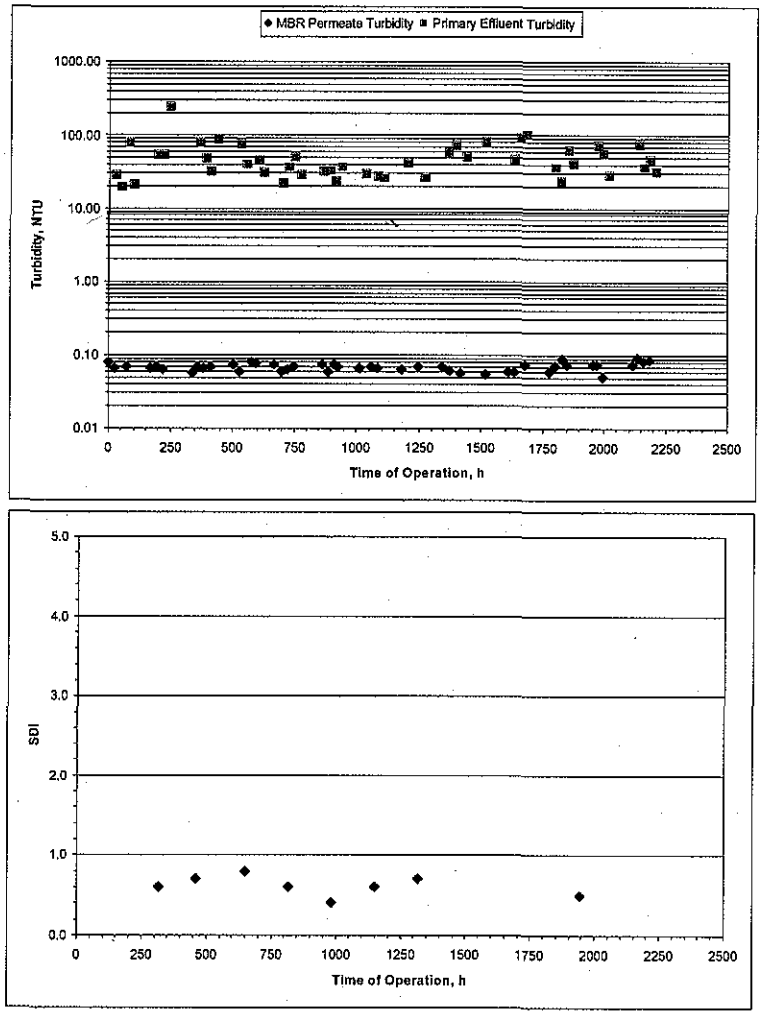


Figure 6-13 Particulate Removal by the Zenon MBR During Part 2

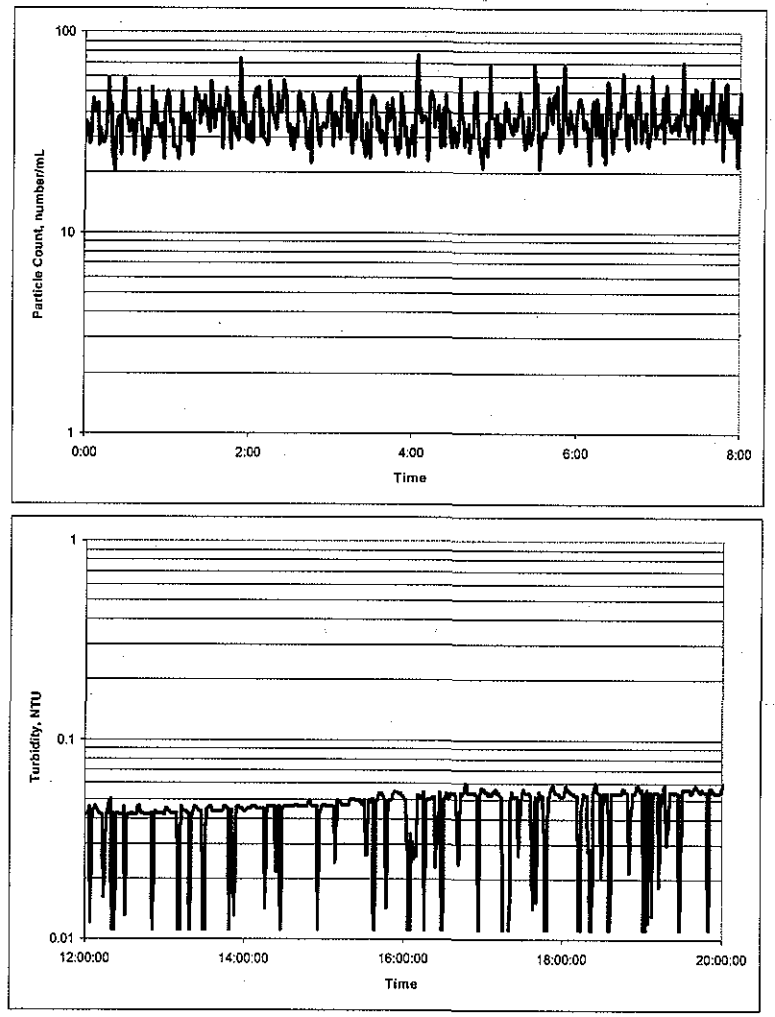


Figure 6-14 On-line Monitoring of the Zenon MBR Permeate During Part 2

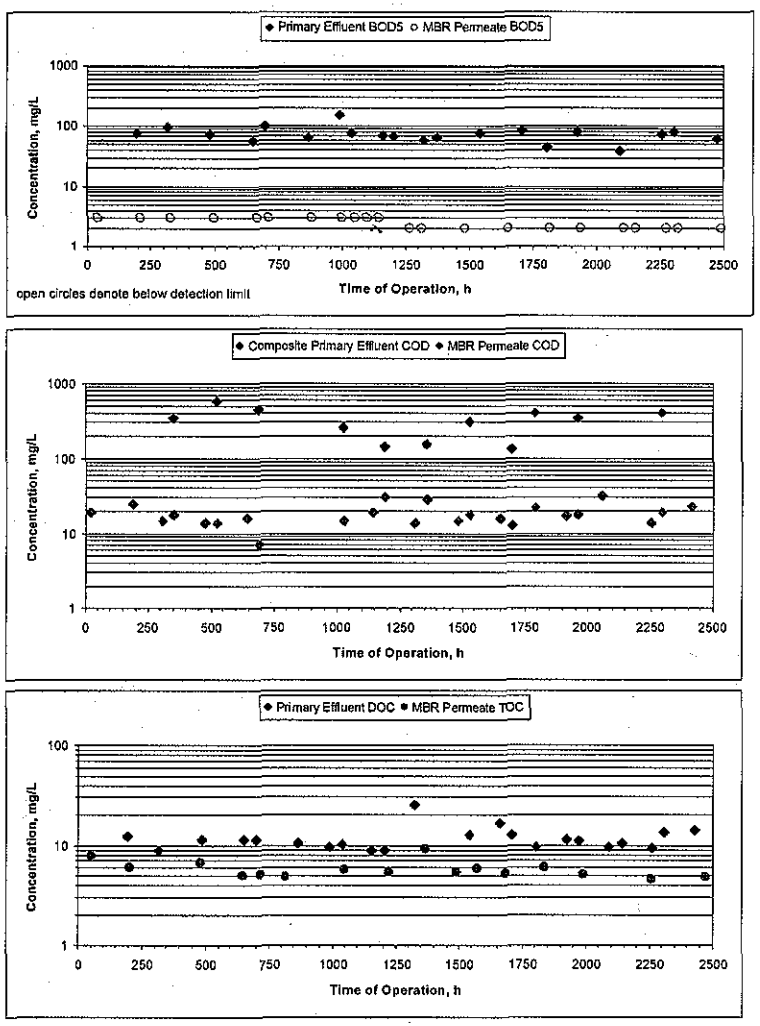


Figure 6-15 Organics Removal by the Mitsubishi MBR During Part 2

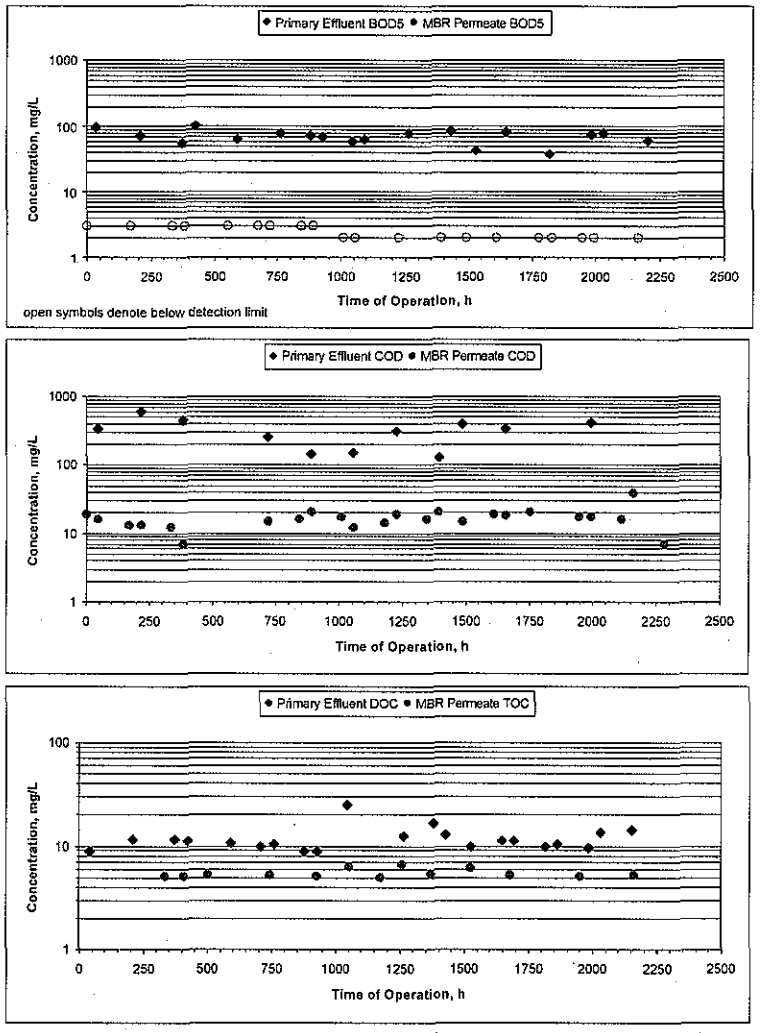


Figure 6-16 Organics Removal by the Zenon MBR During Part 2

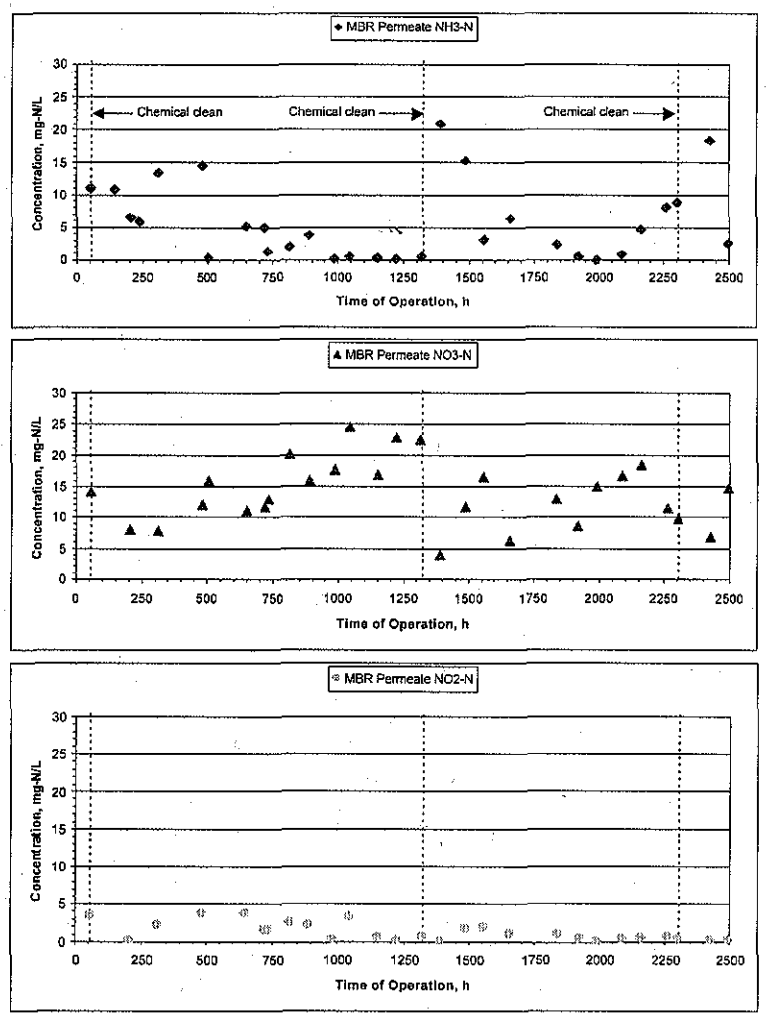


Figure 6-17 Inorganic Nitrogen Species in the Mitsubishi MBR Permeate During Part 2

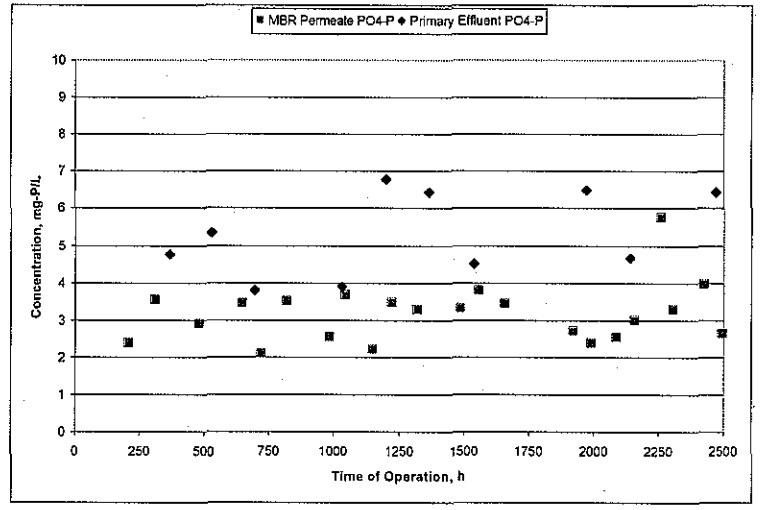


Figure 6-18 Ortho-Phosphate Concentrations in the Mitsubishi MBR During Part 2

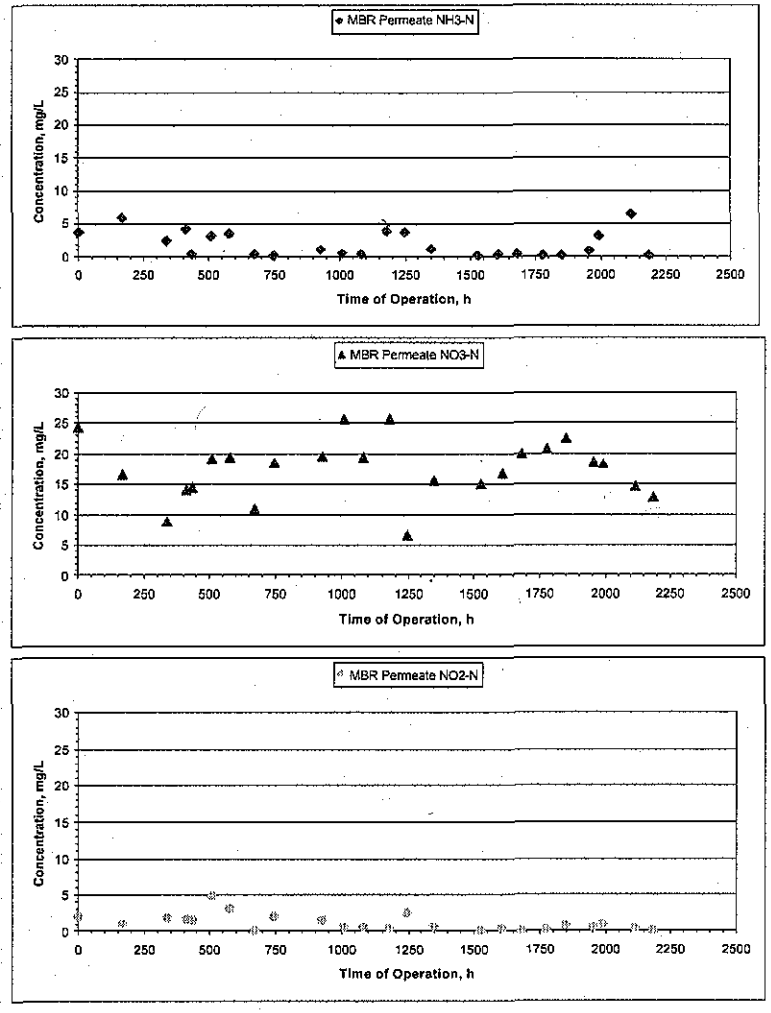


Figure 6-19 Inorganic Nitrogen Species in the Zenon MBR Permeate During Part 2

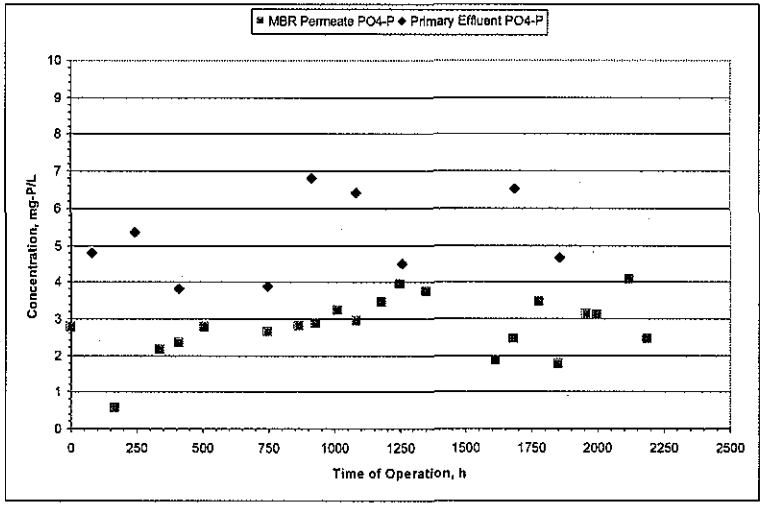


Figure 6-20 Ortho-Phosphate Concentration in the Zenon MBR Permeate During Part 2

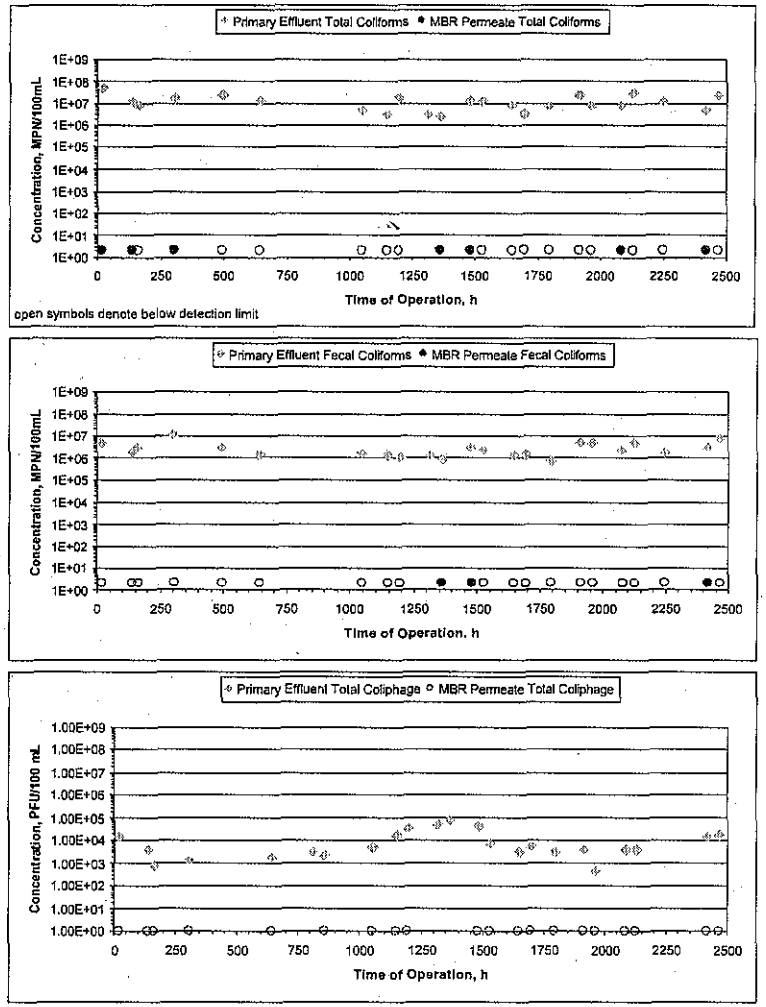


Figure 6-21 Coliform and Coliphage Removal by the Mitsubishi MBR During Part 2

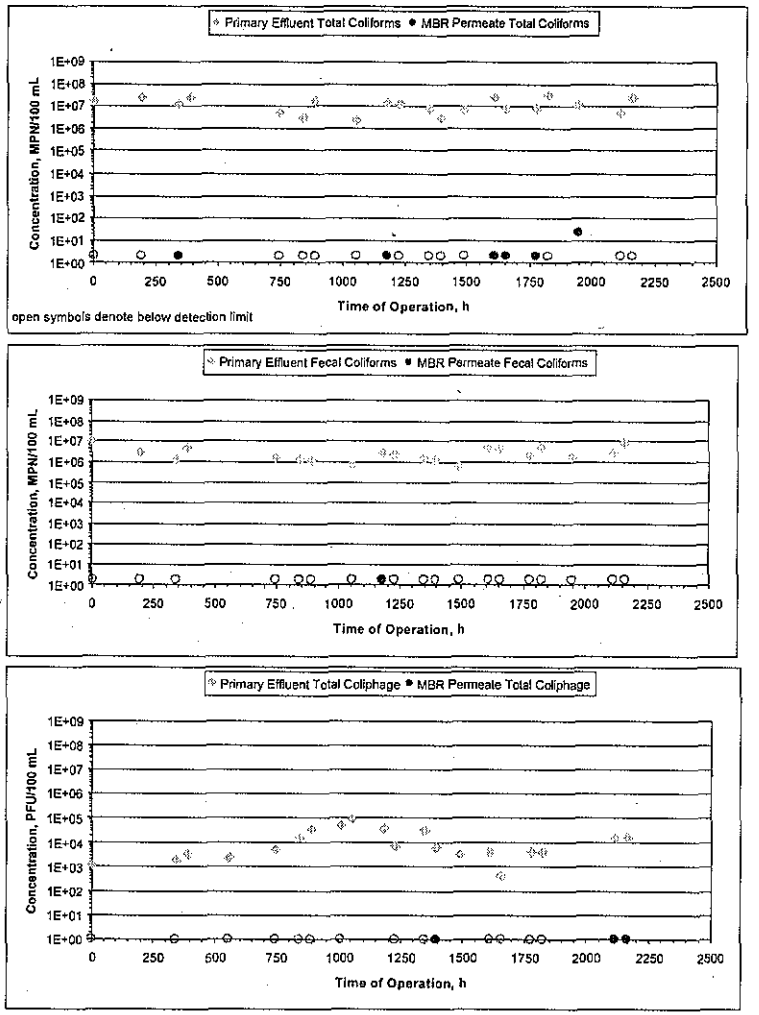


Figure 6-22 Coliform and Coliphage Removal by the Zenon MBR During Part 2

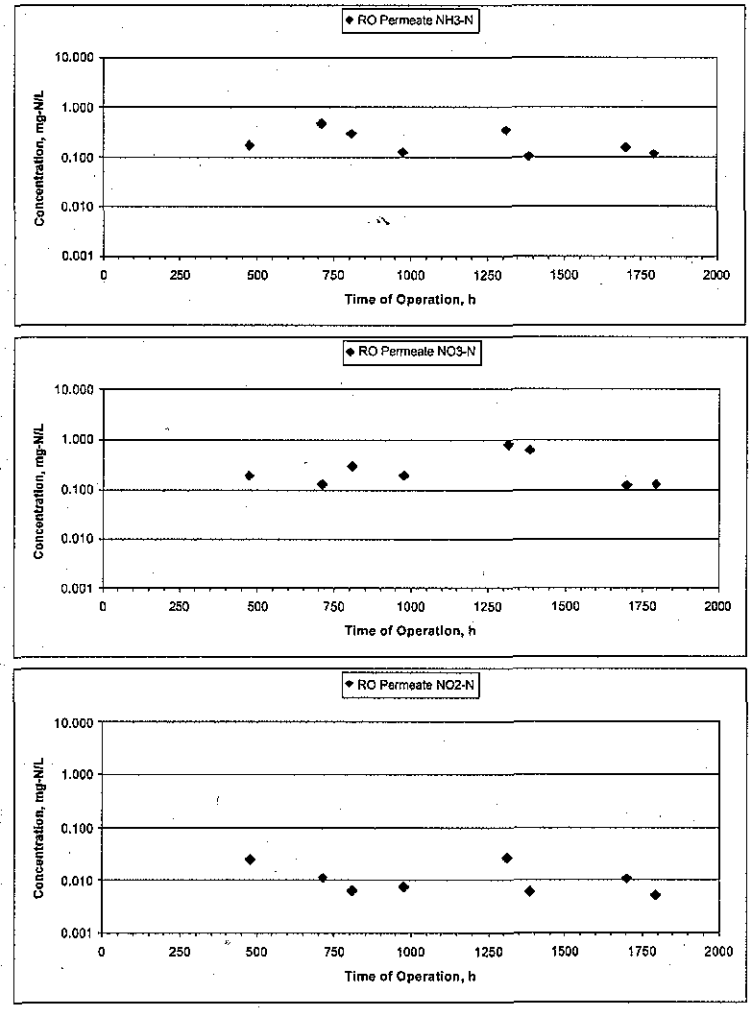


Figure 6-23 Inorganic Nitrogen Removal by the Mitsubishi MBR RO During Part 2

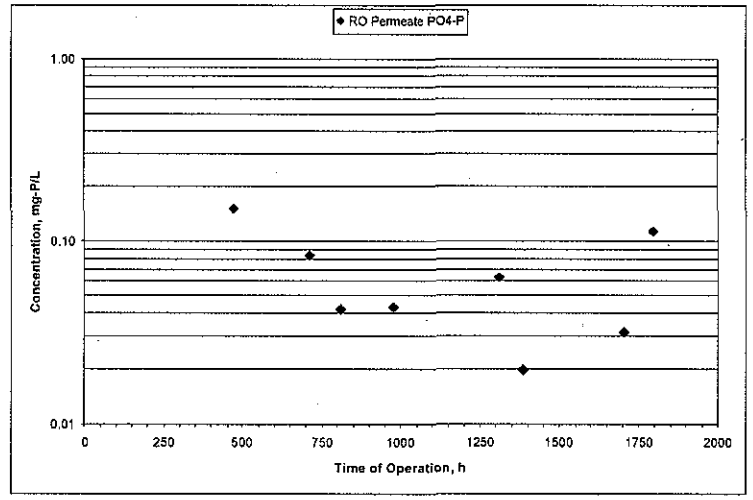


Figure 6-24 Ortho-Phosphate Removal by the Mitsubishi MBR RO During Part 2

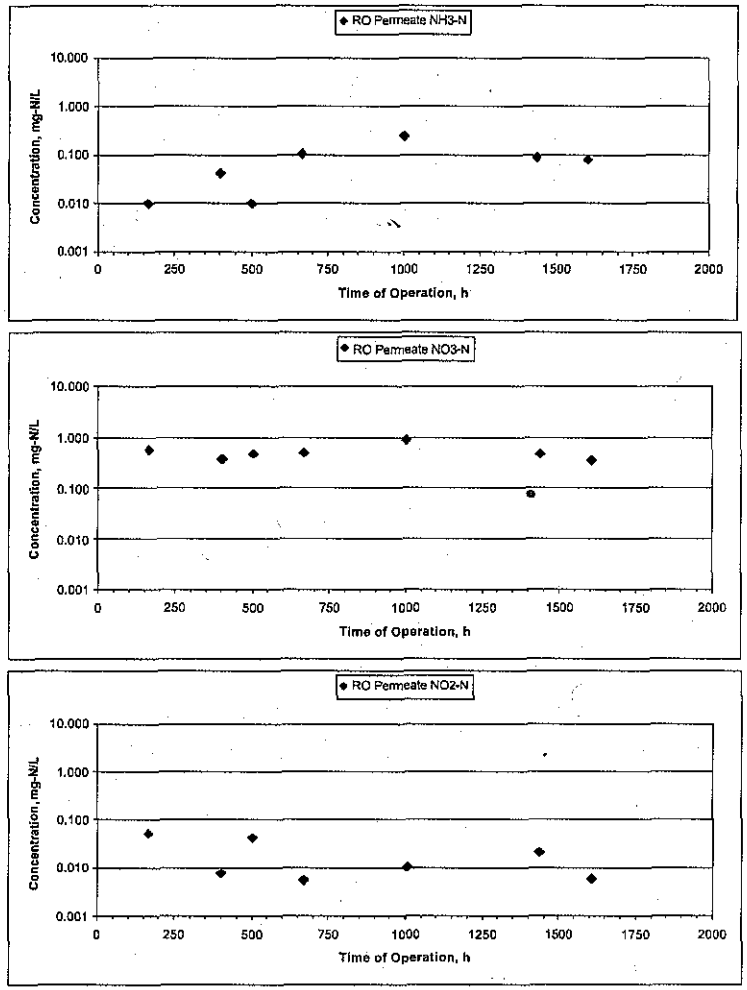


Figure 6-25 Inorganic Nitrogen Species in the Zenon MBR RO Permeate During Part 2

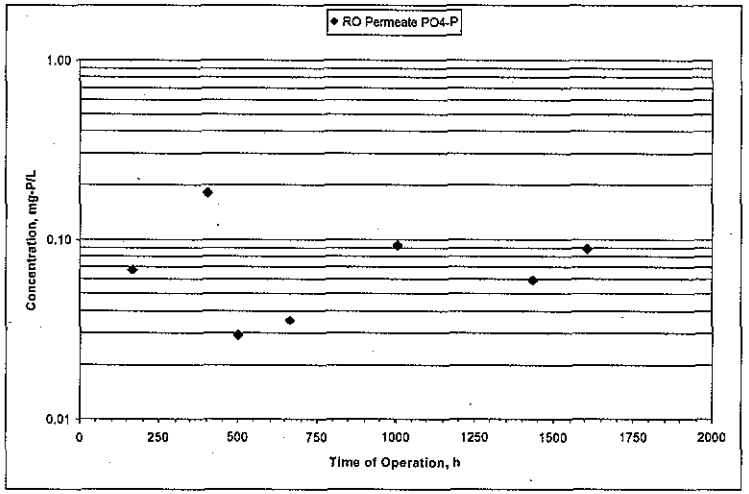


Figure 6-26 Ortho-Phosphate Concentration in the Zenon MBR RO Permeate During Part 2

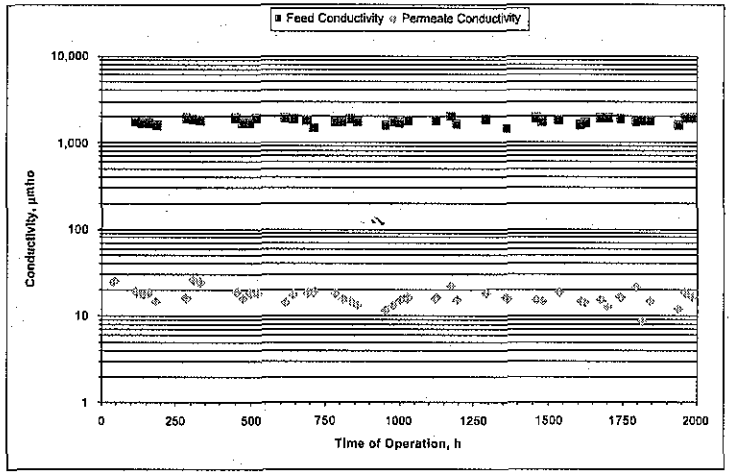


Figure 6-27 Conductivity Profile Across the Mitsubishi MBR RO During Part 2

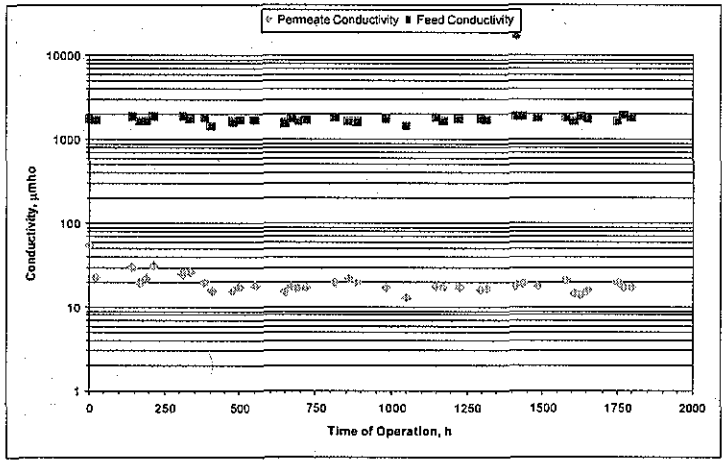


Figure 6-28 Conductivity Profile Across the Zenon MBR RO During Part 2

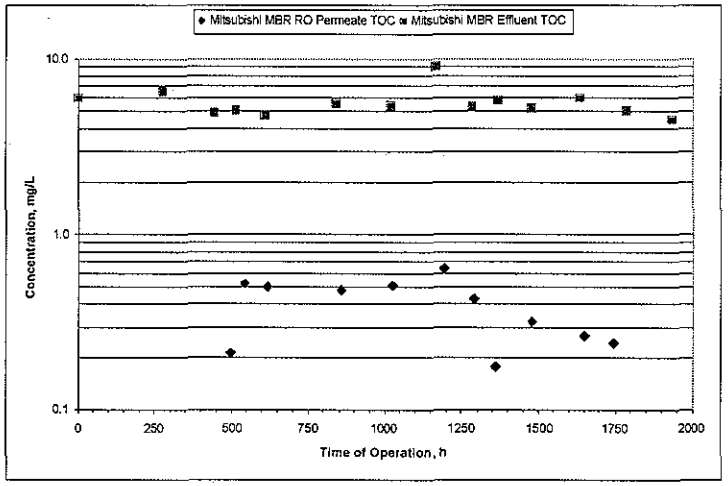


Figure 6-29 TOC Rejection by the Mitsubishi MBR RO During Part 2

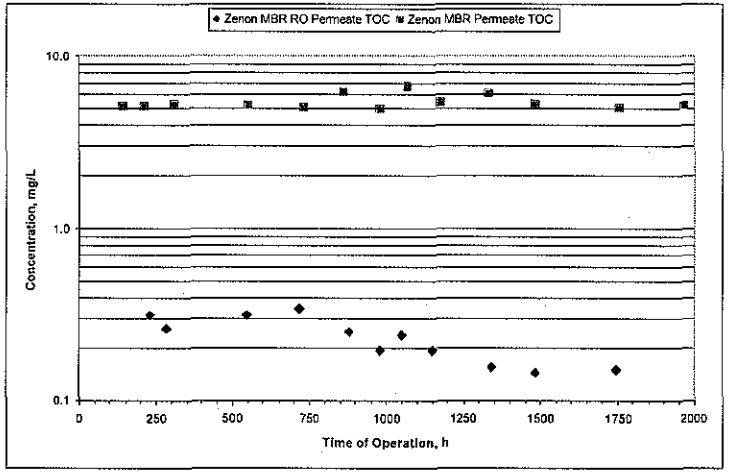


Figure 6-30 TOC Rejection by the Zenon MBR RO During Part 2

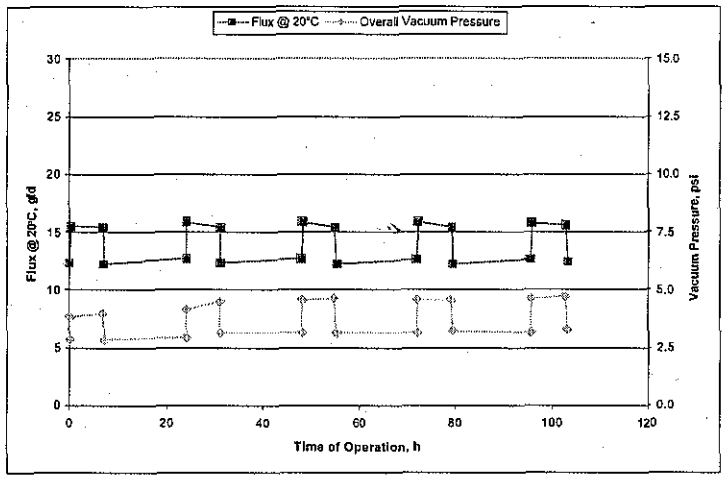


Figure 6-31 Mitsubishi MBR Peaking Study During Part 2

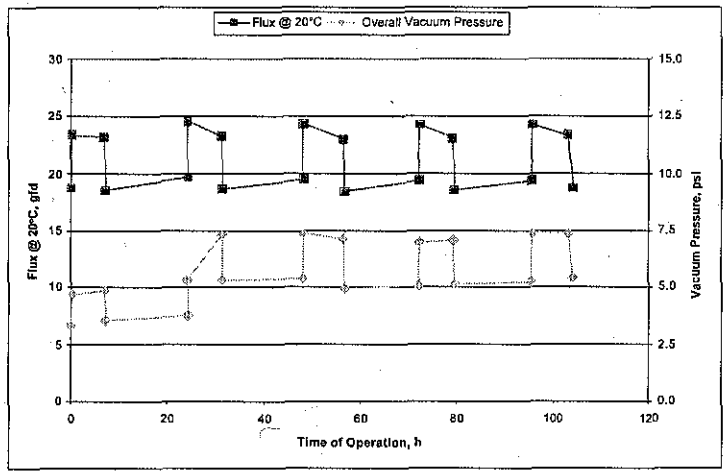


Figure 6-32 Zenon MBR Peaking Study During Part 2

	Zenon MBR			Mitsubishi MBR		
Date	CST (s)	TSS (mg/L)	CST/TSS (s/g/L)	CST (s)	TSS (mg/L)	CST/TSS (s/g/L)
Part 1						
11/11/99	13.6	12900	**1.05**	14.6	5720	**2.55**
11/12/99	14.5	12900	**1.12**	11.3	5720	**1.98**
11/16/99				11.4	5720	**1.99**
Part 2						
01/05/00	11.3	9640	**1.17**	8.3	12720	**0.65**
01/10/00	11.8	8680	**1.36**	9.0	9880	**0.91**
01/21/00	10.1	7160	**1.41**	7.3	8280	**0.88**
01/27/00	9.4	6440	**1.46**	7.8	5440	**1.43**
02/04/00	9.1	8040	**1.13**	11.1	7000	**1.59**
02/07/00	13	8200	**1.59**	8.7	7040	**1.24**
02/15/00	13.1	9520	**1.38**	10.9	6760	**1.61**
03/02/00	7.1	7960	**0.89**	7.6	8240	**0.92**

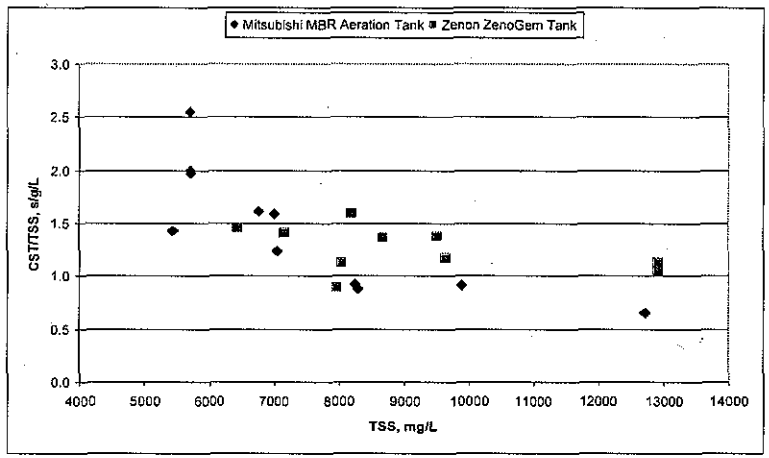


Figure 6-33 CST Results for the MBR Sludge

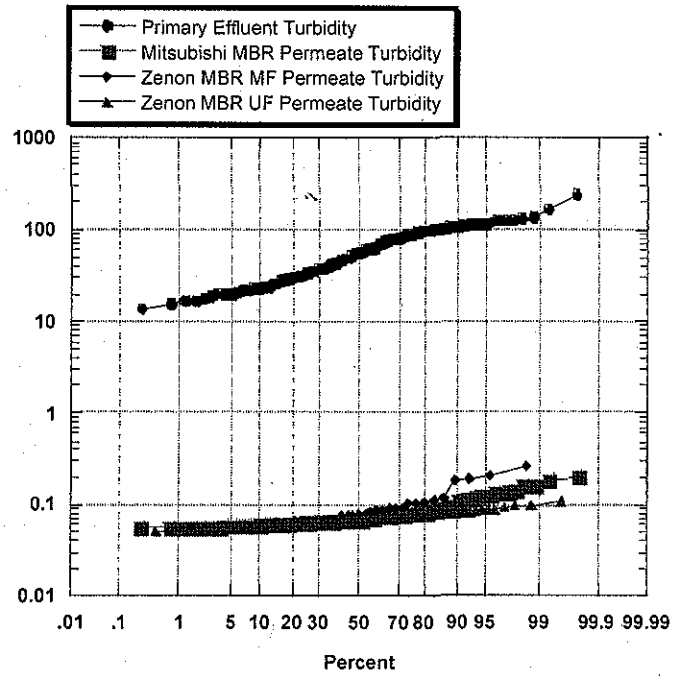


Figure 7-1 Probability Plot of the Turbidity Removal by the MBR Pilot Plants

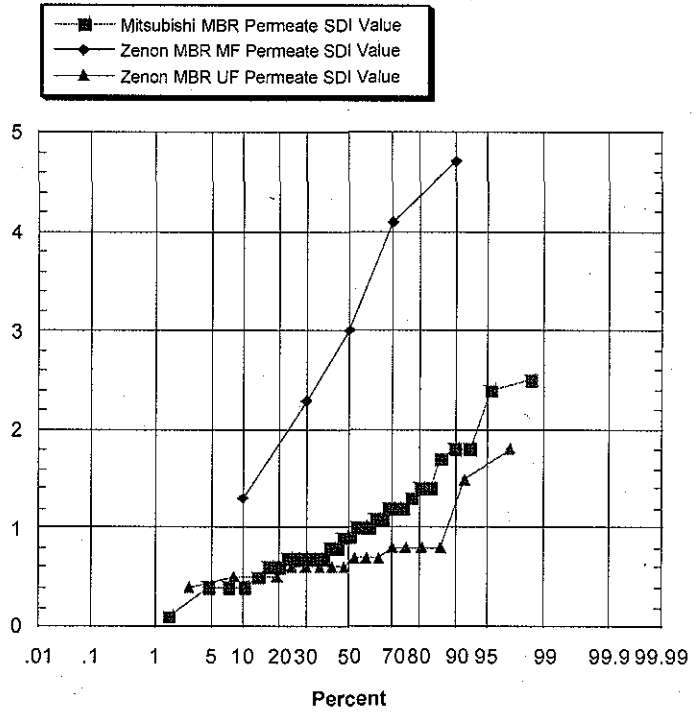


Figure 7-2 Probability Plot of the SDI Values for the MBR Permeate

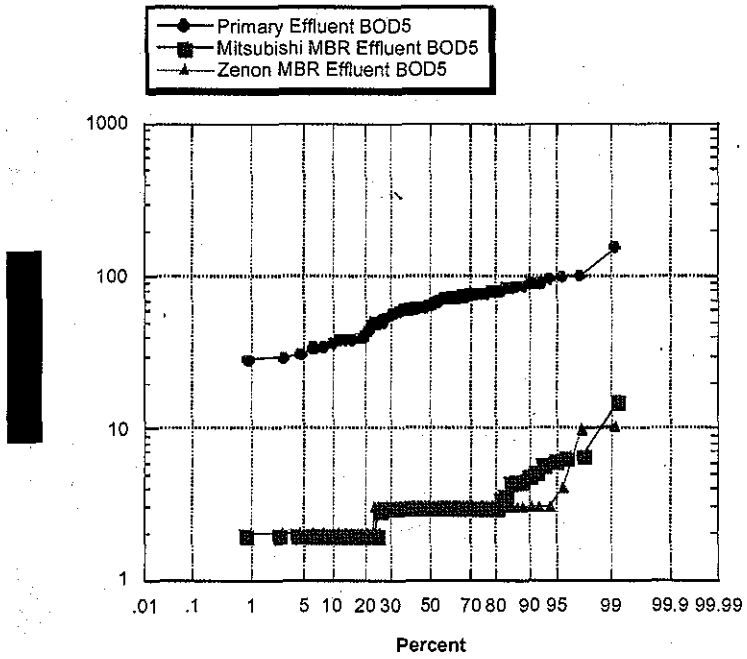


Figure 7-3 Probability Plot of the BOD_5 Removal by the MBR Pilot Plants

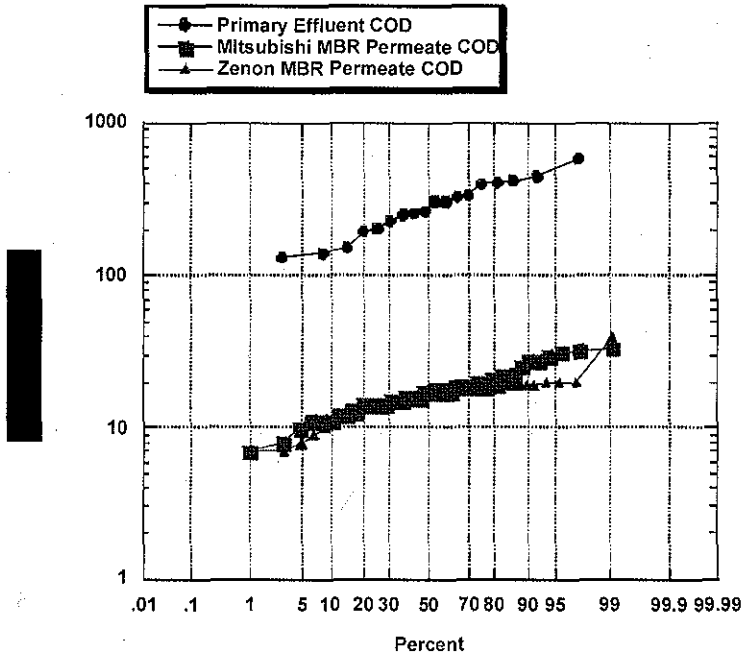


Figure 7-4 Probability Plot of the COD Removal by the MBR Pilot Plants

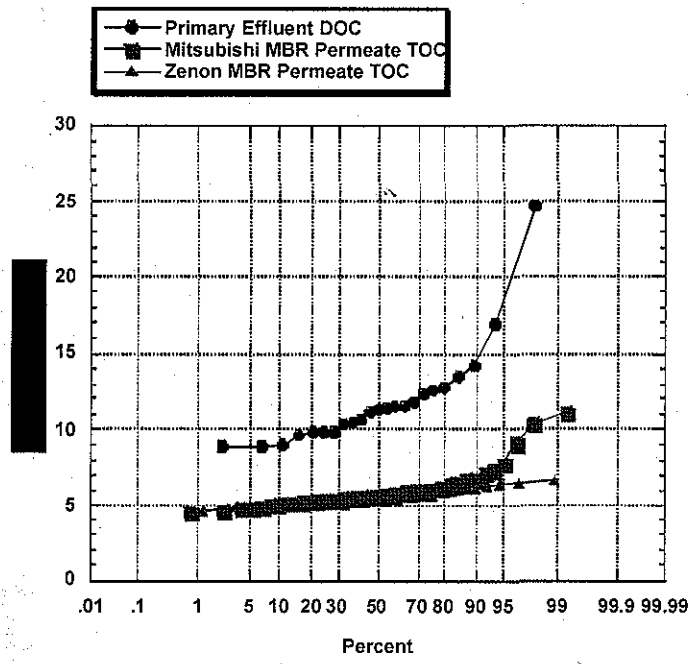


Figure 7-5 Probability Plot of the Organic Carbon Removal by the MBR Pilot Plants

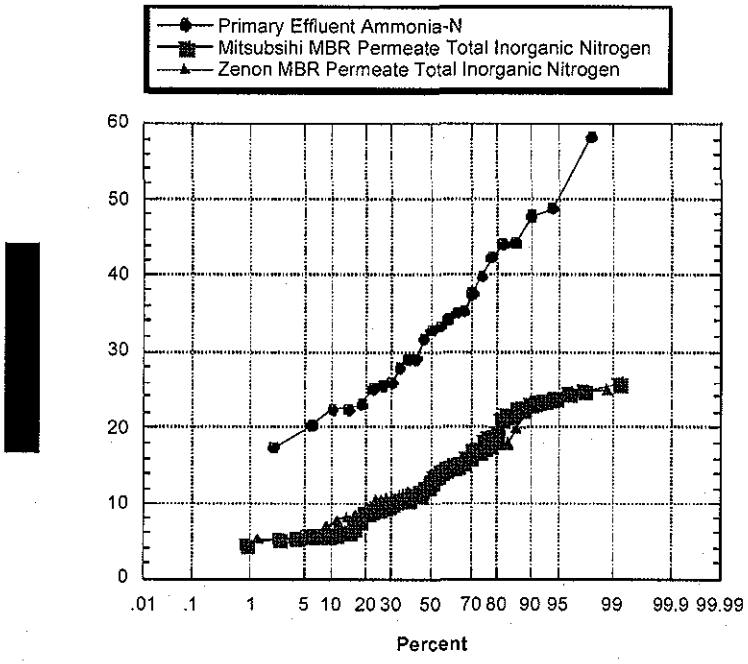


Figure 7-6 Probability Plot of the Inorganic Nitrogen Removal by the MBR Pilot Plants During Part 1

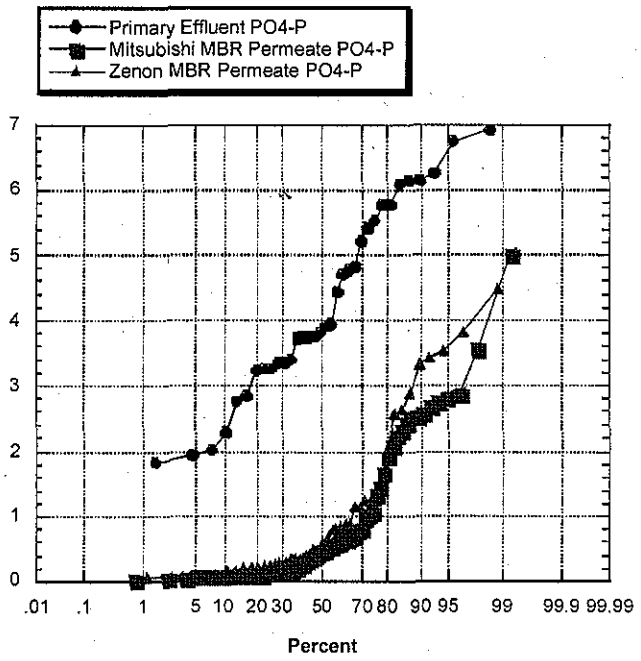


Figure 7-7 Probability Plot of the Ortho-Phosphate Removal by the MBR Pilot Plants During Part 1

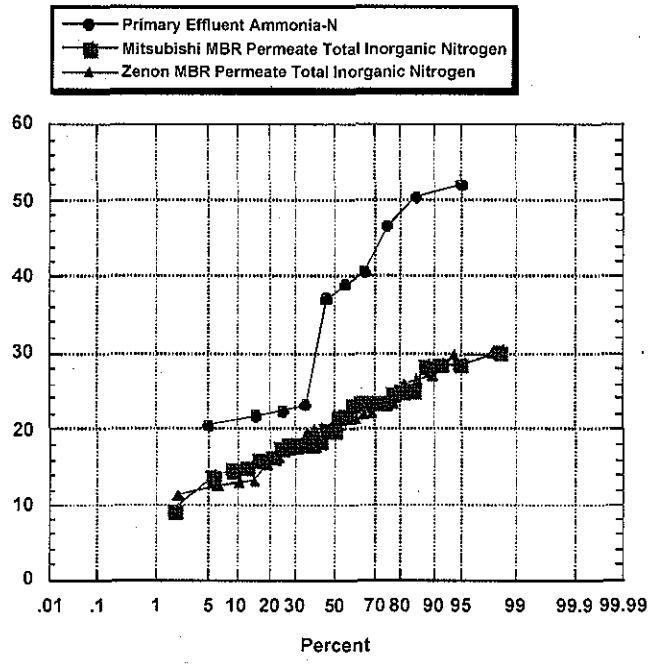


Figure 7-8 Probability Plot of the Inorganic Nitrogen Removal by the MBR Pilot Plants During Part 2

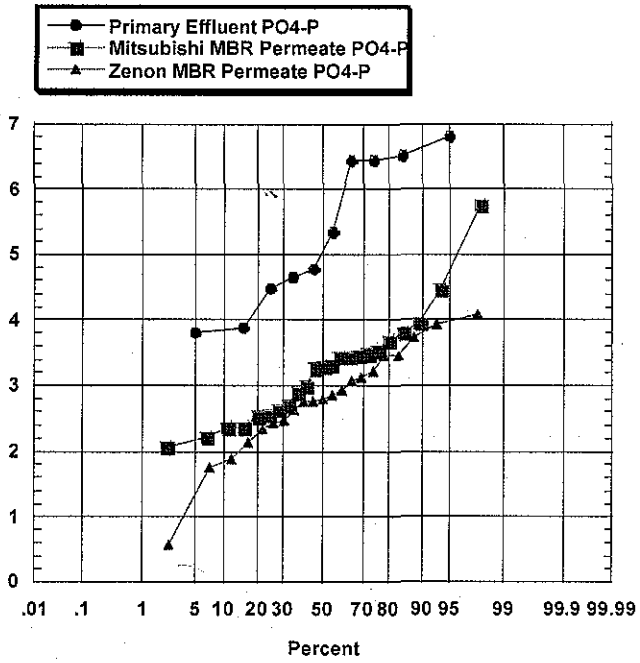


Figure 7-9 Probability Plot of the Ortho-Phosphate Removal by the MBR Pilot Plants During Part 2

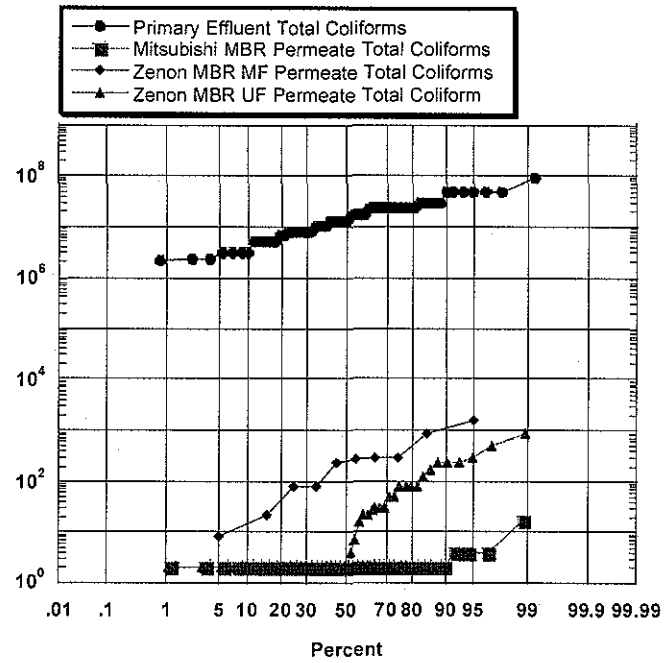


Figure 7-10 Probability Plot of the Total Coliform Removal by the MBR Pilot Plants

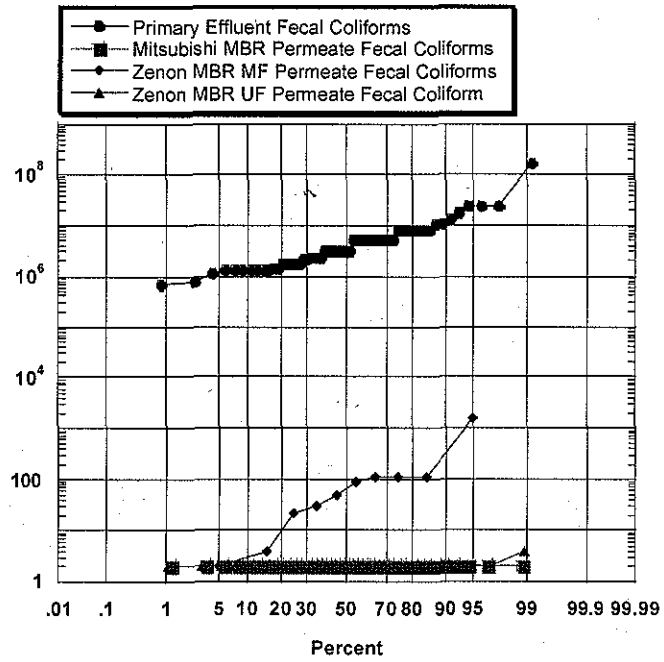


Figure 7-11 Probability Plot of the Fecal Coliform Removal by the MBR Pilot Plants

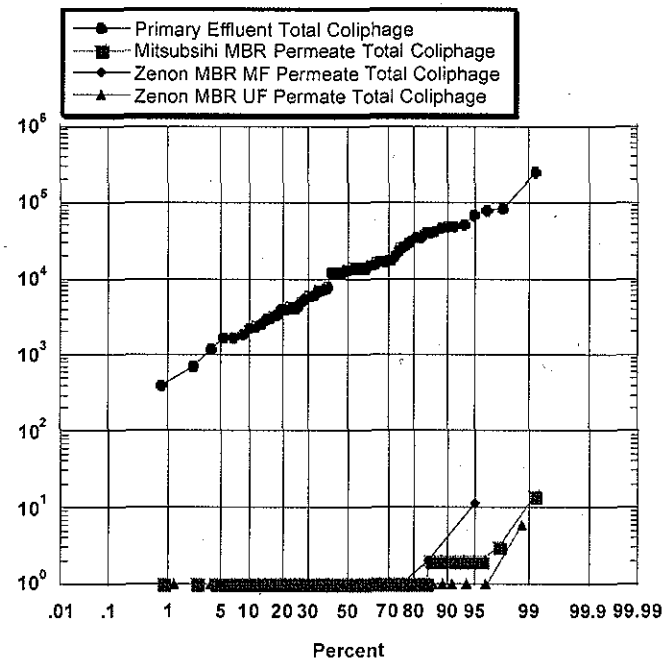


Figure 7-12 Probability Plot of the Total Coliphage Removal by the MBR Pilot Plants

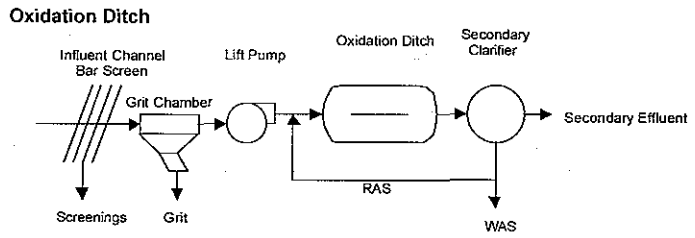


Figure 8-1 Wastewater Installations Producing Secondary Effluent Water

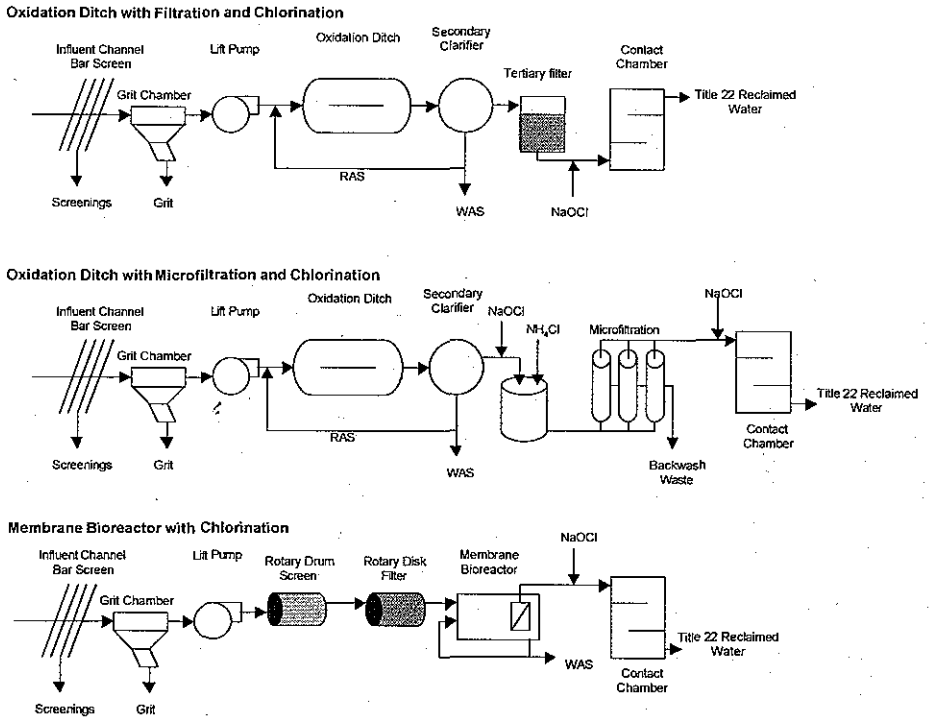


Figure 8-2 Wastewater Installations Producing Title 22 Reclaimed Water

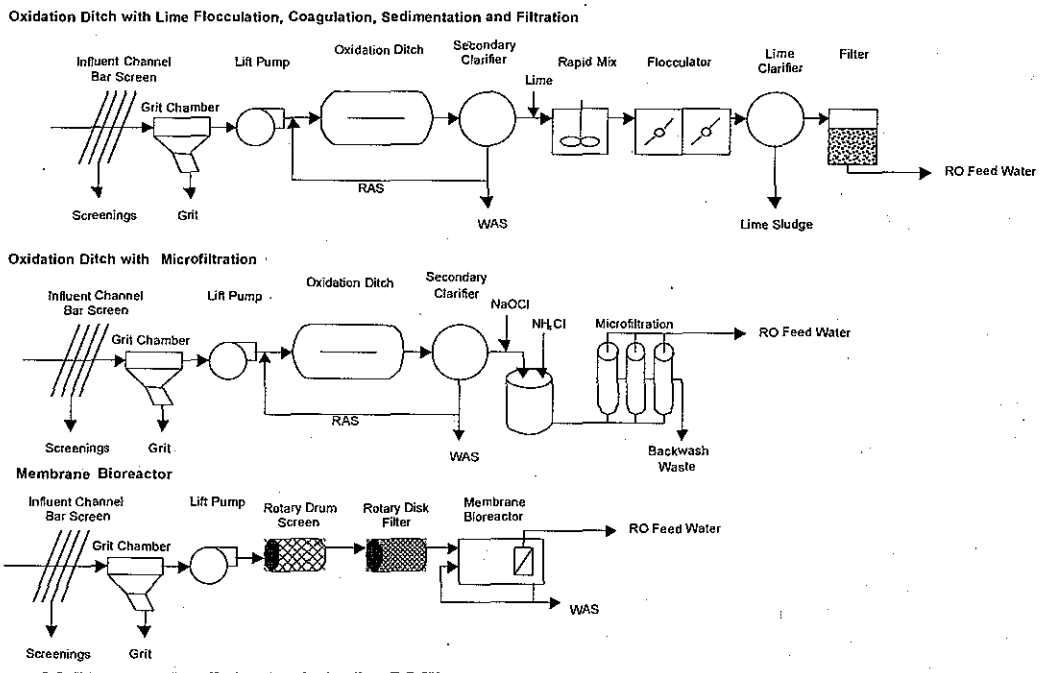


Figure 8-3 Wastewater Installations Producing Pre-RO Water

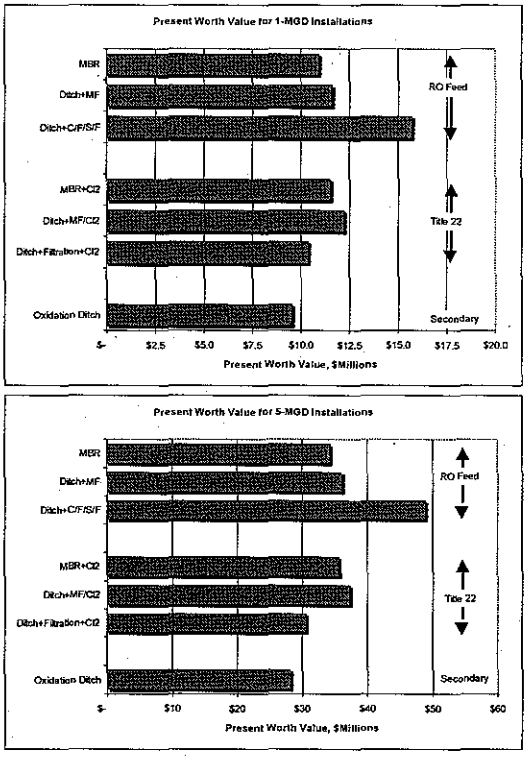


Figure 8-4 Present Worth Value for 1 and 5-MGD Installations Producing Secondary Effluent, Title 22 Water and RO Feed Wate

APPENDIX B

MEMBRANE CHEMICAL CLEANING PROTOCOLS

Mitsubishi MBR In-Line Chemical Cleaning Protocol

Chemical Reagent: NaOCl (effective chlorine concentration: 3,700 mg/L)
Volume of Chemical Reagent: 0.186 L/ft^2 of membrane area

1. Stop the vacuum pump.
2. Place the chemical tank 1 m above the membrane injection port.
3. Connect the chemical tank to the chemical injection port.
4. Open the valve of the chemical tank and chemical injection port, and operate the vacuum pump for 30 s.
5. Stop the vacuum pump.
6. Inject 30 L reagent for 10 min (this was changed to 45 L for 15 min for all cleanings after the initial cleaning).
7. Inject 70 L reagent for 2 h (this was changed to 105 L for 3 h for all cleanings after the initial cleaning).
8. Place the system in normal operation.

Zenon Chlorine Cleaning Protocol

Chemical Reagent: NaOCl (effective chlorine concentration: 2,000 mg/L)
Volume of Chemical Reagent: 1.35 L/ft^2 of membrane area

1. Isolate the ZenoGem tank
2. Drain tank, and hose down until water appears clear
3. Fill with tap water
4. Add chlorine solution to the ZenoGem tank
5. Circulate the cleaning solution through the membrane
6. Close appropriate valves to prevent water from siphoning out through the membrane
7. Allow to soak overnight
8. Drain tank and hose down until there is no chlorine present
9. Put back into service

Zenon Citric Acid Cleaning Protocol

Chemical Reagent: Citric Acid (effective pH = 2.5)

1. Isolate the ZenoGem tank
2. Drain tank, and hose down until water appears clear
3. Fill with tap water
4. Add citric acid solution to the ZenoGem tank
5. Circulate the cleaning solution through the membrane
6. Close appropriate valves to prevent water from siphoning out through the membrane
7. Allow to soak overnight
8. Drain tank and hose down until there is no citric acid present
9. Put back into service

Zenon Maintenance Cleaning Protocol

Chemical Reagent: NaOCl (effective concentration: 200 mg/L)

1. Shut down pilot unit
2. Let the system relax for 5 min
3. Fill the CIP (clean in place) tank with the cleaning solution
4. Put the system in CIP mode
5. Backpulse the system for 2 min at a flow rate of 2 gpm
6. Relax for 3 min
7. Backpulse the system for 1 min
8. Relax for 3 min
9. Repeat steps 7 and 8, 8 times
10. Turn on blower for 10 min
11. Put system back into service

Chemical Reagent: 0.1 gal of NaOH, 0.025 gal of sodium lauryl dodecyl sulfate, pH 11 – 12,

Temperature 30°C

Volume of Chemical Reagent: 0.81 L/ft^2 of membrane area

1. Flush pressure vessels at 5 gpm with RO permeate for several minutes.
2. Circulate the cleaning solution at 5 gpm for 30 min. If the cleaning solution colors becomes turbid, restart with freshly prepared cleaning solution.
3. Check pH of cleaning solution while in circulation. If pH increase by more than 0.5 pH units, add acid (HCl).
4. Turn recirculation pump off and allow the membranes to soak for 1 hour.
5. Circulate the cleaning solution again at 10 gpm for 30 - 60 minutes.
6. Drain and flush cleaning tank.
7. Rinse pressure vessels with RO permeate whose pH has been adjusted to 4.5 - 5.5 using hydrochloric acid (HCl) for several min. The minimum temperature of the rinse water should be 68°F (20°C). Have both permeate and concentrate valves open during flushing. Flushing should be once-through step.
8. Operate the system as normal.

APPENDIX C

Aqua 2000

Aqua 2000 Research Center
14103 Highland Valley Road
Escondido, California 92025

Tel: 619 538 8194
Fax: 619 538 8199

To:	Samer Adham, Ph.D.	**Date:**	June 8, 1999
From:	Rion P. Merlo	**Reference:**	MBR project
Subject:	Bureau of Reclamation QA/ QC		

The Bureau of Reclamation project, Membrane Bioreactors for Water Reclamation, was begun in March of 1999 and is in progress at the Aqua 2000-Research Center in San Pasqual, California. To ensure the accuracy and integrity of data collected, a number of quality assurance and quality control procedures were followed. These procedures are described in this memorandum and represent the quality assurance and quality control checks for the beginning of the project. A subsequent memo will be drafted at the conclusion of the study.

ON-LINE TURBIDIMETERS

Hach 1720C online turbidimeters were used during testing to acquire MBR permeate turbidities at 1 minute intervals. The following procedures were followed to ensure the integrity and accuracy of this data:

- a primary calibration of the on-line turbidimeters was performed at the beginning of the test period and as needed during testing.
- Aquaview + data acquisition software was used to acquire and store turbidity data. Data was stored to the computer database each minute.
- the manufacturer's specified acceptable flow range for these turbidimeters is 250 to 750 mL/min. On-line turbidimeter flows were verified manually with a graduated cylinder and stopwatch once per day (5 times per week).
- on-line turbidities were compared to desktop turbidities when turbidity samples were collected.
- Approximately 50ppm free chlorine solution was pumped through turbidity and particle counter sample lines as needed to clean potential buildup from these lines.

ON-LINE PARTICLE COUNTERS

Hach 1900 WPC light blocking particle counters were used to monitor particles in raw and filtrate waters. These counters enumerate particles in the range 2 to 800 microns.

The particle counters were factory calibrated. Factory calibrations took place in June of 1999. The manufacturer recommends factory calibration on a yearly basis. The following procedures were followed to ensure the integrity and accuracy of the on-line particle data collected:

- the Aquaview software was configured to store particle counts in the following size ranges (2-5 um, 5-10um, 10-15um and >15um). NIST traceable monospheres were purchased from Duke Scientific in the following sizes (2um, 4um, 10um and 20um). Duke monospheres were pumped to the constant head flow controller of each particle counter using a peristaltic pump. The same solution was used for each particle counter.

  The following approximate concentration of each monosphere were present:
  - 2um 10,000/mL
  - 4um 1,000/mL
  - 10um 50/mL
  - 20um 10/mL

  A typical response of the particle counters to this monosphere solution is presented in the attached figure. The figure shows the response of each particle counter with particles grouped into the size ranges of interest.

  - flows through the particle counters were maintained at 200+/- 10 mL/min with constant head devices. Flows were verified on a daily (5 times per week) basis with a graduated cylinder and stop watch. Flows were observed to be extremely consistent (typically within 2 mL/min of the target flow rate).
  - 50 ppm free chlorine was run through particle counters for on an as needed basis to to remove potential buildup.

ONSITE LABORATORY DESKTOP TURBIDIMETER

A Hach 2100N desktop turbidimeter was used to perform onsite turbidity analyses of feed and permeate samples. Readings were recorded in non-ratio operating mode. The following quality assurance and quality control procedures were followed to ensure the integrity and accuracy of onsite laboratory turbidity data:

- weekly primary calibration of turbidimeter according to manufacturer's specification.
- daily secondary standard calibration verification. Three secondary standards (approx. 0.8 NTU, 1.8 NTU and 20 NTU) were recorded after primary calibration and on a daily basis for the remaining 6 days until the next primary calibration.

- Proficiency samples with a turbidty of 0.8 NTU were purchased from a commercial supplier. Two of these samples were analyzed during testing with results of 0.74 and 0.80 NTU.

ONSITE LABORATORY pH METER

An Hach EC20 pH/ISE meter was used to conduct routine pH readings at the pilot facility. The following procedures were followed to ensure the quality of the pH data collected:

- Daily (5 times per week) calibration of the pH meter using at least pH 7 and 10 buffers. The slope obtained after calibration was recorded.
- recording of the temperature of the sample when reading sample pH.

ONSITE LABORATORY CONDUCTIVITY METER

Two dedicated Fisher Scientific digital conductivity meters were used to check the conductivity of the MBR permeates and the RO permeate. One meter is used only for MBR permeate samples and calibrated using a conductivity standard of 951 µmhos. The other conductivity meter is used for RO permeate and was calibrated using a 9.5 µmhos standard.

MEMBRANE BIOREACTOR THERMOMETERS

All thermometers that are used were verified at a normal operating temperature (25-30°C) using an NIST thermometer. The thermometers used to monitor the temperature of the MBRs were all within 5% error. The thermometers used to measure the RO influent water were also verified and within 5% error.

ONSITE PORTABLE DISSOLVED OXYGEN METER

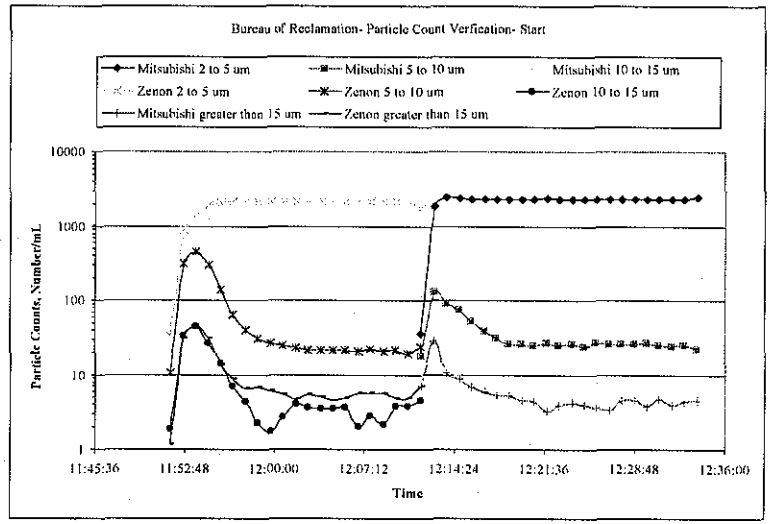
A YSI Model 58 dissolved oxygen meter is used for all DO readings. The DO meter is calibrated before every use according to manufacturer's directions. The membrane and electrolyte solution are replaced as needed.

MEMBRANE SYSTEM PRESSURE GUAGES

Pressure and vacuum gauges supplied with the membrane systems tested were verified against recently purchased grade 3A certified pressure and vacuum gauges. The certified pressure and vacuum gauges were manufactured by Ashcroft and have an accuracy of 0.25% over their range (0-30 psi pressure, 0-30 in Hg vacuum). Where possible, system gauges were removed and tested over the expected range of operating pressures against the verification gauge, using a portable hand pump. The vacuum gauge for the Mitsubishi MBR is a pressure transmitter that has been factory calibrated to an accuracy of ±1%. The calibration report from the manufacturer is on file at the Aqua 2000 Research Center. The vacuum gauge for the Zenon system had an average error less than 5 % over the range of normal operating pressures. The pressure gauges for the RO skids were also within 5% error.

MEMBRANE SYSTEM FLOW RATES

Membrane system flow rates were verified volumetrically. The measured flow rate was compared with flows indicated on rotameters. Measured and indicated flow rates agreed to within 5% for both the Zenon MBR permeate and the Mitsubishi MBR permeate. However, it should be noted that the Mitsubishi MBR error was 4.57%. The combined flow rates, concentrate and permeate, of the two RO skids were checked volumetrically and were both within 5% error.



Aqua 2000

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Tel: 619 538 8194
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To:	Samer Adham, Ph.D.	**Date:**	**June 8, 2000**
From:	Rion P. Merlo	**Reference:**	
Subject:	Bureau of Reclamation QA/ QC		

The pilot testing for the Bureau of Reclamation project, Membrane Bioreactors for Water Reclamation, was completed in March of 2000. To ensure the accuracy and integrity of data collected, a number of quality assurance and quality control procedures were followed as described in the previous memo drafted. This memorandum presents the quality assurance and quality control checks performed at the completion of the project.

ON-LINE PARTICLE COUNTERS

The Aquaview software was configured to store particle counts in the following size ranges (2-5 um, 5-10um, 10-15um and >15um). NIST traceable monospheres were purchased from Duke Scientific in the following sizes (2um, 4um, 10um and 20um). Duke monospheres were pumped to the constant head flow controller of each particle counter using a peristaltic pump. The same solution was used for each particle counter.

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- 4um 1,000/mL
- 10um 50/mL
- 20um 10/mL

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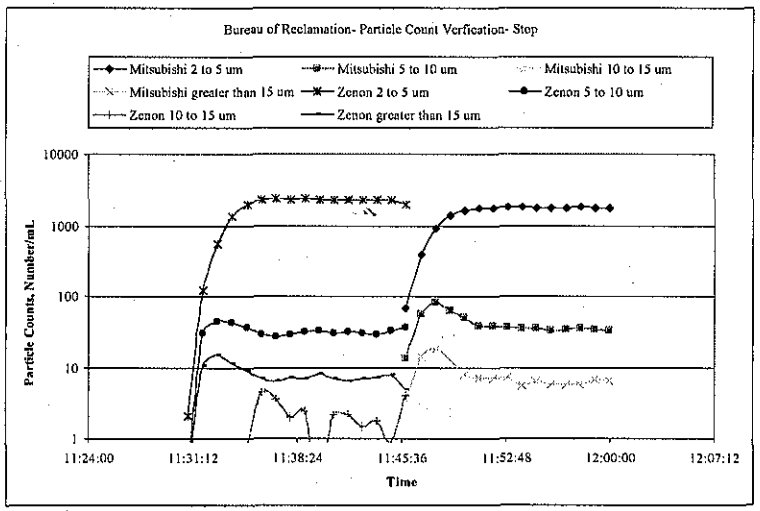
All thermometers that were used were verified at a normal operating temperature (25-30°C) using an NIST thermometer. The thermometers used to monitor the temperature of the MBRs were all within 5% error. The thermometers used to measure the RO influent water were also verified and within 5% error.

MEMBRANE SYSTEM PRESSURE GUAGES

Pressure and vacuum gauges supplied with the membrane systems tested were verified against recently purchased grade 3A certified pressure and vacuum gauges. The certified pressure and vacuum gauges were manufactured by Ashcroft and have an accuracy of 0.25% over their range (0-30 psi pressure, 0-30 in Hg vacuum). Where possible, system gauges were removed and tested over the expected range of operating pressures against the verification gauge, using a portable hand pump. The vacuum gauge for the Mitsubishi MBR is a pressure transmitter that has been factory calibrated to an accuracy of ±1%. The calibration report from the manufacturer is on file at the Aqua 2000 Research Center. The vacuum gauge for the Zenon system had an average error less than 8 percent over the range of normal operating pressures. The pressure gauges for the RO skids were also within 5% error.

MEMBRANE SYSTEM FLOW RATES

Membrane system flow rates were verified volumetrically. The measured flow rate was compared with flows indicated on rotameters. Measured and indicated flow rates agreed to within 6% for both the Zenon MBR permeate and the Mitsubishi MBR permeate. The combined flow rates, concentrate and permeate, of the two RO skids were checked volumetrically and were both within 7% error.


Bureau of Reclamation- Particle Count Verfication- Stop
Mitsubishi 2 to 5 um
Mitsubishi 5 to 10 um
Mitsubishi 10 to 15 um
Mitsubishi greater than 15 um
Zenon 2 to 5 um
Zenon 5 to 10 um
Zenon 10 to 15 um
Zenon greater than 15 um
Particle Counts, Number/mL
10000
1000
100
10
1
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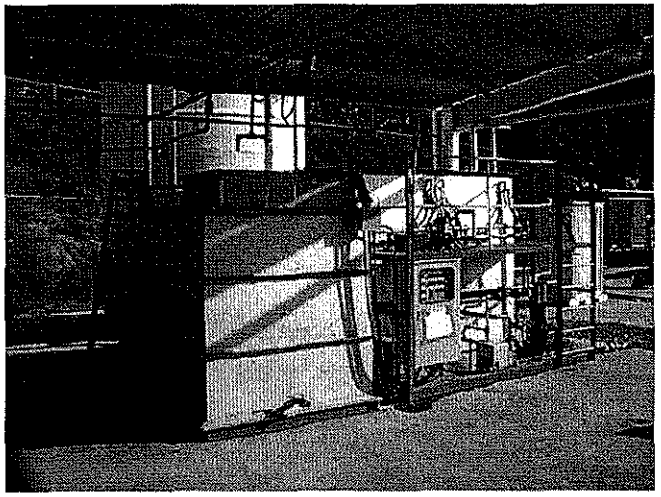
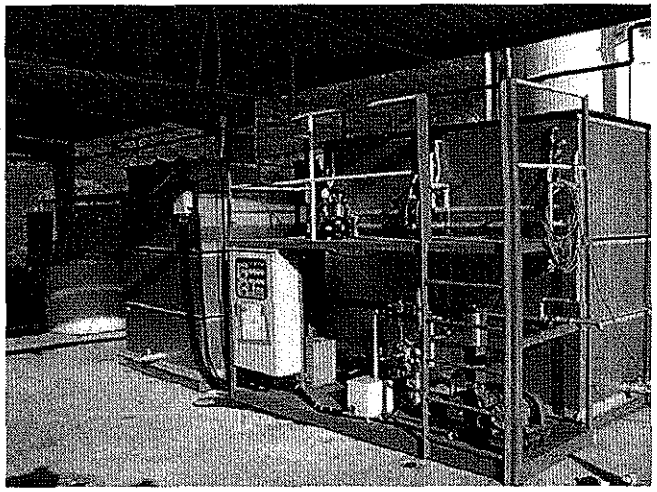
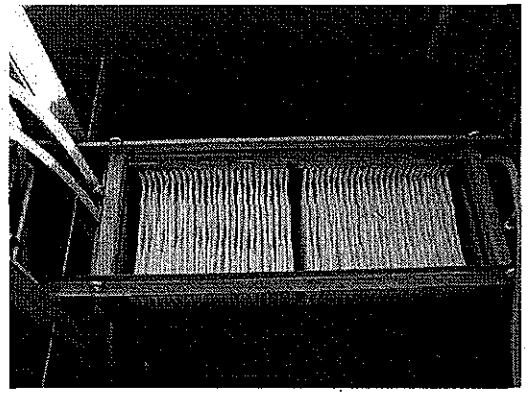
11:31:12
11:38:24
11:45:36
11:52:48
12:00:00
12:07:12
Time

APPENDIX D

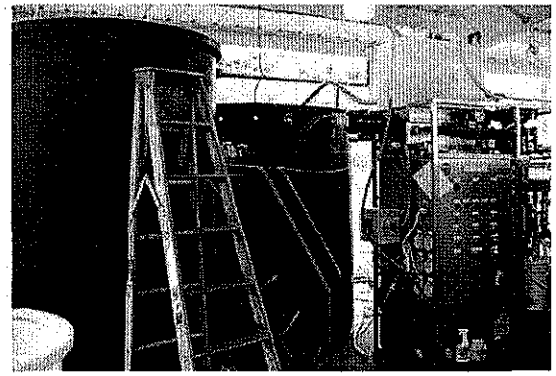




Mitsubishi MBR Pilot Unit

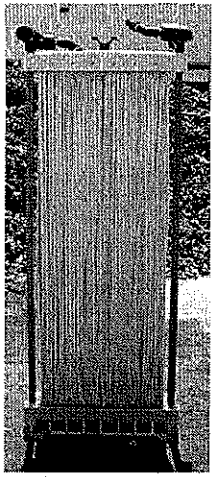


Mitsubishi Sterapore HF Microfilter (top view)



Zenon MBR System With Extra Reactors

Zenon MBR Pilot Unit



Zenon OCP Ultrafilter

EPA/625/R-04/108
September 2004

Guidelines for Water Reuse

U.S. Environmental Protection Agency

Municipal Support Division
Office of Wastewater Management
Office of Water
Washington, DC

Technology Transfer and Support Division
National Risk Management Research Laboratory
Office of Research and Development
Cincinnati, OH

U.S. Agency for International Development
Washington, DC

Notice

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Foreword

In an effort to help meet growing demands being placed on available water supplies, many communities throughout the U.S. and the world are turning to water reclamation and reuse. Water reclamation and reuse offer an effective means of conserving our limited high-quality freshwater supplies while helping to meet the ever growing demands for water.

For many years, effluent discharges have been accepted as an important source for maintaining minimum stream flows. The investment in treatment technologies required to meet restrictive discharge limits has lead an increasing number of industries and communities to consider other uses for their treated wastewater effluents as a means to recover at least a part of this investment. Further, as sources of water supplies have become limited, there has been greater use and acceptance of reclaimed wastewater effluents as an alternative source of water for a wide variety of applications, including landscape and agricultural irrigation, toilet and urinal flushing, industrial processing, power plant cooling, wetland habitat creation, restoration and maintenance, and groundwater recharge. In some areas of the country, water reuse and dual water systems with purple pipe for distribution of reclaimed water have become fully integrated into local water supplies.

The *2004 Guidelines for Water Reuse* examines opportunities for substituting reclaimed water for potable water supplies where potable water quality is not required. It presents and summarizes recommended water reuse guidelines, along with supporting information, as guidance for the benefit of the water and wastewater utilities and regulatory agencies, particularly in the U.S. The document updates the *1992 Guidelines* document by incorporating information on water reuse that has been developed since the 1992 document was issued. This revised edition also expands coverage of water reuse issues and practices in other countries. It includes many new and updated case studies, expanded coverage of indirect potable reuse and industrial reuse issues, new information on treatment and disinfection technologies, emerging chemicals and pathogens of concern, economics, user rates and funding alternatives, public involvement and acceptance (both successes and failures), research activities and results, and sources of further information. It also includes as an updated matrix of state regulations and guidelines, and a list of state contacts. This information should be useful to states in developing water reuse standards, and revising or expanding existing regulations. It should also be useful to planners, consulting engineers and others actively involved in the evaluation, planning, design, operation or maintenance of water reclamation and reuse facilities.

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The full 478-page document is available for download from the U.S. EPA at:

www.epa.gov/ORD/NRMRL/pubs/625r04108/625r04108.pdf

State of California—Health and Human Services Agency

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STATE OF CALIFORNIA
DIVISION OF DRINKING WATER
AND
ENVIRONMENTAL MANAGEMENT

TREATMENT TECHNOLOGY REPORT
FOR
RECYCLED WATER

September 2008

(Replaces January 2007 Report)

This document has been developed to serve as a reference source for those seeking information concerning technologies that have been recognized by the California State Department of Public Health (CDPH) as being acceptable for compliance with treatment requirements of the California Recycled Water Criteria. NOTE: The former California Department of Health Services became the CDPH effective July 1, 2007. This is a "living" document that will be updated periodically as needed. Readers who find errors or omissions should contact Jeff Stone of the CDPH Recycled Water Unit at Jeffrey.Stone@cdph.ca.gov or Brian Bernados at Brian.Bernados@cdph.ca.gov .

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STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC HEALTH
DIVISION OF DRINKING WATER
AND
ENVIRONMENTAL MANAGEMENT

TREATMENT TECHNOLOGY REPORT FOR RECYCLED WATER

September 2008

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Fluidsand (Fluidyne, Corp.)
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Strata-Sand (Ashbrook Corp.)
Micromedia Filtration, Inc.
Nordic (Nordic Water)
Volcano

Other Media Type Filters

Fuzzy Filter (Schreiber LLC)

Membrane Technologies

ZENON
-Cycle-let (Zenon Environmental, Inc.)
-ZeeWeed/Zenogem 500 series
-ZeeWeed 1000 UF
Siemens/Memcor - CMF & CMF-Submerged (0.2 micron-PP and 0.1 micron-PVDF; XP, CP, XS and CS.
-S10V - submerged
-L10V - low pressure
-L20V - low pressure
-M10V - medium pressure
Siemens/Memcor - Polypropylene
-M10B
-M10C
-S10T
U.S. Filter/Jet Tech
-Jet Tech Products-Memjet™
PALL Corporation
-Microza (P/N XUSV-5203)
-Microza (P/N USV-5203, P/N USV-6203 and UNA-620A)
Mitsubishi
Kubota
Ionics
-Norit X-Flow - S225 UF
Koch/Puron
Huber Technologies
Parkson/Dynalift
Ashbrook Simon-Hartley IMAS
METAWATER Co., Ltd. Ceramic Membrane (Formerly 'NGK')

Asahi-Kasei Chemicals Corp. (Asahi-Microza™ MBR)
-MUNC-620A
-MUDC-620A
Norit X-flow (using the SXL225 membrane)
-Norit Xiga™
-Aquaflex™
Hydranautics
-HYDRAcap
DOW Ultrafiltration Membranes

Cloth Media Filters

Aqua-Aerobics - rotating disk
-102 needle felt fabric
-PA-13 nylon pile fabric
-MMK2-13 acrylic pile fabric
-PES-13 woven polyester fabric
Aqua-Aerobics - AquaDiamond™
I. Kruger Products
-Hydrotech Polyester media filter
Nordic Water Cloth-Media Disc Filter
Parkson - Dynadisc
Siemens -40 X
Five Star Cloth-Media Filter

4. DISINFECTION TECHNOLOGIES

Ultraviolet Disinfection-
Trojan Technologies
-UV 4000
-UV 3000
-UV 3000-Plus
Wedeco
-Spectrotherm 33-TAK UV
-LCI - 20L
-TAK 55
-TAK 55 HP
-LBX 1000
-LBX 400
-LBX 90

Aquionics
Ultraguard (Service Systems)
Aquaray (Degremont)
-40 VLS
-40 HO VLS
-3X HO
UltraTech
Quay Technologies

Pasteurization-

Ryan Pasteurization and Power

APPENDIX

'A' - California Department of Health Services Requirements for Demonstration of Reduction of Virus and Bacteria by Filtration and Disinfection

'B' - Memorandum concerning cleaning of UV quartz sleeves

State of California
Department of Public Health
Division of Drinking Water

Treatment Technology Report for Recycled Water

September 2008

1. INTRODUCTION

The purpose of this document is to provide general reference information concerning those treatment technologies that are being utilized for meeting the filtration performance and disinfection requirements for compliance with the California Recycled Water Criteria (Title 22, et. seq.). The information contained herein was generated from a review of files and correspondence of the California State Department of Public Health (CDPH), and discussions with Field Operations Branch District Staff, SWRCB Staff, industry representatives and manufacturers. All referenced reports, letters and other documents are on file with the Department's Recycled Water Unit. This reference document may not reflect all treatment technologies in place in California, but will be updated as additional information is obtained.

The California Water Recycling Criteria (adopted December 2000) define Disinfected Tertiary Recycled Water as a wastewater, which has been oxidized and meets the following:

A. Has been coagulated* and passed through natural undisturbed soils or a bed of filter media pursuant to the following:

1. At a rate that does not exceed 5 GPM/ft^2 in mono, dual or mixed media gravity or pressure filtration systems, or does not exceed 2 GPM/ft^2 in traveling bridge automatic backwash filters; and

2. The turbidity does not exceed any of the following; a daily average of 2 NTU, 5 NTU more than 5% of the time within a 24-hour period, and 10 NTU at any time.

*Note: Coagulation may be waived if the filter effluent does not exceed 2 NTU, the filter influent is continuously measured, the filter influent turbidity does not exceed 5 NTU, and automatically activated chemical addition or diversion facilities are provided in the event filter effluent turbidity exceeds 5 NTU.

OR

B. Has been passed through a micro., nano., or R.O. membrane following which the turbidity does not exceed any of the following: 0.2 NTU more than 5% of the time within a 24-hour period and 0.5 NTU at any time.

AND

C. Has been disinfected by either:

1. A chlorine disinfection process that provides a CT of 450 mg-min/l with a modal contact time of not less than 90 minutes based on peak dry weather flow, or

2. A disinfection process that, when combined with filtration, has been demonstrated to achieve 5-log inactivation of virus.

2. GENERAL GUIDANCE

The following guidance is consistent with the Water Recycling Criteria and will serve as the basis for CDPH review and acceptance of treatment technologies for compliance with the filtration and disinfection requirements of the Criteria.

FILTRATION

Filters meeting the definition of "filtered wastewater" under Section 60301.320 (a&b) outlined in the Water Recycling Criteria are allowed the option of either disinfection approach outlined in Section 60301.230 without additional restrictions or requirements.

The Department considers a properly filtered and disinfected recycled water meeting the turbidity performance and coliform requirements outlined in the criteria to be essentially pathogen free. As noted by Asano et al.[1], "To achieve efficient virus removal or inactivation in tertiary treatment, two major criteria must be met: 1) the effluent must be low in suspended solids and turbidity prior to disinfection to prevent shielding of viruses and chlorine demand, and 2) sufficient disinfectant must be applied to the wastewater." Treatment requirements determined necessary to meet the disinfected tertiary - 2.2 criteria outlined in the Criteria include media filtration to reduce turbidity to less than a daily average of 2 NTU or membrane filtration to reduce turbidity to less than a daily average of 0.2 NTU, and disinfection to ensure a minimum CT of 450 milligram-minutes per liter at all times. This treatment scheme is intended to remove solids (including some pathogens)

and properly prepare the water for effective disinfection in order to achieve an approximately five-log reduction of virus.

However, with respect to many existing technologies, there has yet to be a demonstrated correlation between turbidity and pathogen concentration. The current turbidity performance standards for media and membrane filtration are based on achievable turbidity performance and do not necessarily assure any specific minimum level of pathogen removal. This is a recognized issue in the regulations that is being reviewed by the Department.

Since the Pomona Virus Study[2], biological treatment has introduced additional variables into the picture, as the type of biological treatment can impact the particle size distribution and downstream filter and disinfection performance. However, the integration of these processes, into a process train, are not well understood at this time and must be addressed by industry and regulators. Nevertheless, it remains the intent of the Department to produce an essentially pathogen free effluent by maintaining a 5-log virus removal/inactivation barrier through filtration and disinfection.

Additional information concerning treatment technologies may be found in **Appendix A** (California Department of Health Services-Reduction of Virus and Bacteria by Filtration and Disinfection, October 2001).

It must be recognized that the Title 22 filtration performance requirements, as outlined under Section 60301.320, must be reliably met by all filtration technologies. The Department strongly recommends that recycled water producers develop and implement plant performance optimization plans and make a reasonable effort to minimize effluent turbidity levels. Furthermore, all treatment facilities should be operated in accordance with the manufacturer's recommendations and specific conditions of approval developed by CDPH.

---

1. Asano, T.; Tchobanoglous, G.; and Cooper, R.C (1984), "Significance of Coagulation-Flocculation and Filtration Operations in Wastewater Reclamation and reuse", in Symposium Proceedings, The Future of Water Reuse, Water Reuse Symposium III, San Diego, California, August 26-31, 1984. American Waterworks Association Research Foundation.

2. County Sanitation Districts of Los Angeles County (1977), "Pomona Virus Study, Final Report", Prepared for Calif. State Water Resources Control Board, Sacramento, Calif., and USEPA, Washington, D.C

UV DISINFECTION

UV Disinfection Guidelines were first published in 1993 by the National Water Research Institute (NWRI). Since that time, the field of ultraviolet disinfection has taken great strides forward. As a result of the progress made in understanding the UV disinfection process, the CDPH and the NWRI agreed that it was time to revise and update the guidelines. NWRI and the American Water Works Association Research Foundation (AWWARF) pooled their resources in order to revise the original guidelines, which now cover water recycling and drinking water UV disinfection applications. As a result of these efforts the *"Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse"* were published by NWRI/AWWARF in December 2000 and revised as a Second Edition dated May 2003. CDPH endorses the May 2003 Guidelines and refers to them when evaluating UV disinfection proposals. One major recommendation of the guidelines is that all UV equipment (including previously approved equipment) be tested and validated under these new guidelines before being accepted by the Department. For existing systems approved under earlier guidelines, documentation of compliance with the May 2003 guidelines should be provided when permits issued by the Regional Water Quality Control Boards come up for renewal. It is believed that existing UV disinfection systems that were properly designed should comply with the elements of the revised guidelines. Re-validation of such existing systems is typically performed by bioassays on-site, however alternative methods are being considered by industry. Department approved protocols must be followed in all instances.

The implication of the recommendations contained in the revised guidelines is that even the horizontal low-pressure low intensity UV systems must be validated before they are accepted for a UV disinfection application. Previously accepted UV technologies that were considered to be nonconforming under the 1993 guidelines will also have to be retested using the recommended testing procedure. The UV technologies listed herein include a note indicating whether compliance with the most recent 2003 guidelines has been demonstrated by the manufacturer. Re-validation of such existing systems is typically performed by bioaasays on-site, however alternative methods are being considered by industry. Department approved protocols must be followed in all instances.

Agencies that are in the stages of planning or early design have the most flexibility and should be able to require completion of UV validation testing before they accept delivery of the UV equipment. Therefore, the agency can plan and begin the design work around a given UV system, but not allow delivery of

equipment until validation testing is completed. This will allow comparison of the UV reactor design to the validation test results in order to ensure adequate sizing and performance of the UV system. This could be done as part of design review process, i.e., while the design is not yet complete.

If the design process has been completed and the contract for equipment has been signed, there will be fewer recourses for the utility. However, the utility can require a demonstration of performance or performance guarantee on the equipment for their own protection.

It is important to note that these are only "guidelines" and are therefore not limiting with respect to alternative approaches a manufacturer or project proponent may propose for consideration on a case-by-case basis. It is possible however that future regulations may be based on these guidelines.

Appendix B is an advisory memo dated November 1, 2004 that the Department sent to the Regional Water Quality Control Boards in California concerning the importance of cleaning of UV quartz sleeves and outlines recommendations to help ensure effective disinfection.

PASTEURIZATION DISINFECTION

Use of pasteurization has recently been recognized as an acceptable disinfection method for meeting the inactivation criteria in Title 22. Pilot studies conducted in California in 2006 and 2007 satisfactorily demonstrated the ability of this technology to achieve a minimum 4-log reduction in seeded MS2 coliphage (which is considered to be a conservative reduction equivalent to 5-log poliovirus reduction) under defined minimum contact time and temperature conditions.

(Continued on next page)

3. FILTRATION TECHNOLOGIES

The following technologies have demonstrated their ability to meet the performance objectives of current Water Recycling Criteria (Title 22). The "STATUS" designation gives an indication as to which technologies have been given formal Departmental recognition. For projects proposing a technology which is not listed herein or whose "STATUS" is unknown, a review of the proposal should be conducted by the Recycled Water Unit prior to acceptance.

NOTE: *The Department strongly recommends that when utilities consider a particular filtration technology, they carefully evaluate its appropriateness for their particular water being treated. The net production capacity of some technologies are especially sensitive to assumptions about how much flow can be processed per operating unit or module, and assuming a flow rate that is too high can result in a filtration plant that is too small to meet system capacity requirements. Depending on the treatment process being employed, consideration must be given to solids loading from the secondary treatment process on the filter medium which can have a significant effect on loading/flux rate, TMP, filter run times, backwashing efficiency and other O&M and design elements. These concerns are best addressed by piloting the treatment process being considered to ensure it will meet the required treatment criteria outlined in the Water Recycling Criteria.*

Granular Media Type Filters

Dynasand **Status--Accepted**
Parkson Corporation

Description: Upflow deep bed continuous backwash

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 40	1.30	1.50

Acceptance / Reference:
-Listed in the CDPH Direct Filtration Guidelines (1988)
-Conditional acceptance letter dated 12/1/86 from CDPH
-Conditions of acceptance include: 1) media design specs. as noted above, 2) complete recycling of filter medium every three to four hours.

-Letter dated 4/23/97 from the San Francisco District Office to the Sewerage Agency of South Marin
-Memo dated 7/18/97 from Mike Finn (CDPH) re: two performance studies (S.F. Bureau of water Pollution Control and Sewerage Agency of South Marin)

Comments: Classified as direct filtration.

Installations: Sewerage Agency of Southern Marin (Evaluation outlined in a Pilot Test Final Report for the Agency dated June 1989); San Francisco-Bureau of Water Pollution Control has a pilot unit at the Oceanside WWTP, and others.

WATERLINK SuperSand **Status--Accepted**
Waterlink Separations, Inc.

Description: Upflow deep bed continuous backwash

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 40	1.30	1.50

Acceptance / Reference:
-Conditional acceptance letter dated 1/14/2000 from CDPH.
-Conditions of acceptance include: 1) media design specs. as noted above, 2) complete recycling of filter medium every three to four hours.

-Note: Waterlink holds the patents for the design of the filter approved as the "DynaSand" marketed by Parkson Corp. under licensing agreements. Master file contains all documentation.

Comments: Classified as direct filtration. NOTE: Waterlink was purchased by Parkson Corporation.

Installations: Proposed for Delta Diablo Sanitation District (Pittsburg, CA), Coachella Valley and Escondido.

WESTECH TECHNASAND **Status--Accepted**
Westech Engineering, Inc.

Description: Upflow deep bed continuous backwash

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 40	1.30	1.50

Acceptance / Reference:
-Conditional acceptance letter dated 4/5/2002 from CDPH.
-Conditions of acceptance include: 1) media design specs. as noted above, 2) complete recycling of filter medium every three to four hours.

-Note: Manufacturer has indicated they will warrant the Technasand Filter to meet Title 22 filtration requirements. Same principle as the Parkson Dynasand. Master file contains all documentation.

Comments: Classified as direct filtration.

Installations: Proposed for Carmel Valley Ranch.

US Filter Astrasand **Status--Accepted**
US Filter Davco Products

Description: Upflow deep bed continuous backwash

Media configuration:

Media Depth (meters)	Effective Size (mm)	Uniformity Coefficient
sand: 1.5	1.0-1.5	1.50

Acceptance / Reference:
-Conditional acceptance letter dated 12/5/2005 from CDPH.
-Conditions of acceptance include: 1) media design specs. as noted above, 2) complete recycling of filter media every three to four hours

Comments: Classified as direct filtration.
Installations: Unknown

Centra-flo **Status--Accepted**
Applied Process Technology, Inc

Description: Upflow deep bed continuous backwash

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 40	0.92-0.95	1.50

Acceptance / Reference:
-Conditional acceptance letter dated 3/14/2006 from CDPH.
-Conditions of acceptance include: 1) media design specs. as noted above, 2) complete recycling of filter media every three to four hours

Comments: Classified as direct filtration.

Installations: Unknown

Hydro-Clear **Status--Accepted**
U.S. Filter
Zimpro Environmental, Inc.

Description: Shallow pulsed bed filter

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 10-12	0.45	1.50

Acceptance / Reference:
-Listed in the CDPH Direct Filtration Guidelines (1988)
-Conditional acceptance letter dated 11/17/81 from CDPH.
-Conditions of acceptance include: 1) minimum bed depth of 10-inches of sand with E.S. of 45 mm, 4) at least 6 minutes between pulses and no more than 25 pulses per filter run.
-U.C. Davis Evaluation Report; "Evaluation of the Pulsed-Bed Filter For Wastewater Reclamation in California", 1981.

Comments: Classified as direct filtration

Installations: Moulton Niguel WD, San Luis Obispo, San Clemente, Rancho Murrieta, Fallbrook, and others.

Infilco-Degremont, Inc. **Status--Accepted**
Automatic Backwash (ABW)

Description: shallow bed, traveling bridge

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 11	0.55	1.50

Acceptance / Reference:
-Listed in the CDPH Direct Filtration Guidelines (1988)
-U.C. Davis Evaluation Report; "Evaluation of the Enelco ABW Automatic Backwash Filter For Wastewater Reclamation in California", dated November 1988.

Comments: Loading rate limited to 2 gpm/ft^2; Max. influent turbidity <10 NTU.

Installations: Sacramento County, Sepulveda Water Reclamation, Folsom WWTP, Victor Valley WWRP, LA City-Tillman WRP, Shasta Lake WWTP, and others.

Aqua-Aerobic Systems, Inc. **Status--Accepted**
Automatic backwash filter (AquaABF)

Description: Shallow bed traveling bridge

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
sand: 11	0.55	1.50

Acceptance / Reference:
-Listed in the CDPH Direct Filtration Guidelines (1988)
-U.C. Davis Evaluation Report entitled "Evaluation of the Aqua-Aerobic Automatic Backwash Filter For Wastewater Reclamation in California" dated July 1986.

Comments: Loading rate limited to 2 gpm/ft^2; Max. influent turbidity <10 NTU.

Installations: Unknown

US Filter Gravisand **Status--Accepted**
US Filter Davco Products

Description: Shallow bed traveling bridge

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
anthracite: 6	1.1 - 1.2	1.5
sand: 5	.55 - .65	1.5
support -	.8 - 1.2	1.5

Acceptance / Reference:
-Conditional acceptance letter dated 11/08/05 from CDPH.
-Conditions of acceptance include: 1) media design specs.
As noted above, Loading rate limited to 2 gpm/ft^2; Max. influent turbidity <10 NTU.

Comments:

Installations: Unknown

Tetra Technologies, Inc. **Status--Accepted**
Tetra-Denit.

Description: Tetra Deep Bed-Denitrification Filters

Media configuration:

Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
Silica sand: 48-72	2.2	1.35

Acceptance / Reference:
-Conditional acceptance letter signed by M. Kiado (CDPH) re: LADWP dated 3/17/92
-Letter dated 10/6/97 from Parsons Engineering Science regarding LA-Glendale Water Reclamation Plant pilot study.

Comments: Mono-media granular sand; 4-6 foot depth; intended for direct filtration with chemical addition.

Installations: City of Los Angeles (Glendale WWTP), Lake Arrowhead CSD, Padre Dam MWD, Scotts Valley WD.

Centra-flo
Applied Process Technology **Status--Accepted**

Description: Centra-flo Gravity Sand Filter
Downflow Continuous Wash Filter

Media configuration:

	Media Depth (inches)	Effective Size (mm) (graded)	Uniformity Coefficient
	sand: 40	0.5 - 3.0	1.50

Acceptance: CDPH letter dated January 6, 1999 for landscape irrigation

Comments: Pilot testing conducted at Union Sanitary District's Alvarado WWTP (1994); loading rate up to 4.4 GPM/ft^2.

Installations: Tejon Ranch Development '99 (I-5 @ Tejon Pass)

Fluidsand
Fluidyne Corporation **Status--Accepted**

Description: Fluidyne Fluidsand Filter
Upflow Continuous Backwash Filter

Media configuration:

	Media Depth (inches)	Effective Size (mm) (graded)	Uniformity Coefficient
silica sand:	40	0.8 - 1.0	1.6

Acceptance / Reference:
-Conditional acceptance letter dated 5/03/2000 from CDPH.
-Conditions of acceptance include: 1) media design specs. as noted above, 2) complete recycling of filter medium every three to four hours.
-Engineering Report dated June 9, 1997 submitted by Questa Engrg. for the Canada Woods Reclamation Facility.

Comments: Classified as direct filtration. Designed for waters containing TSS up to 20 mg/l (per manufacturer); Performance data submitted by the manufacturer demonstrates this technology's ability to comply with the turbidity performance standards. Design and operation conceptually similar to Dynasand.

Installations: Tenaya Lodge located in Fish Camp (Evaluated in a "facilities Review" report by Carollo Engineers dated September 1990). Canada Woods Development ('99) in the Monterey area (without CDPH approval). Castanoa Ranch ('99) in San Mateo County.

Hydrasand **Status--Accepted**
Andritz Ruthner, Inc.

Description: Upflow, continuous wash filter

Media configuration:

	Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
silica sand:	40	1.3	1.5

Acceptance / References:
-Conditional acceptance letter dated June 23, 2000 from CDPH.
-Conditions of acceptance include: 1) media design specs. as noted above, 2) complete recycling of filter medium every three to four hours.
-Report available entitled "Microbial Assessment of the Lanai Auxiliary Reclamation Facility to Produce Wastewater Effluent for Unrestricted, Non-potable Reuse" dated October 1998.

Comments: Manufacturer has indicated they will warrant the Hydrasand Filter to meet Title 22 requirements. Same principle as the Parkson DynaSand.

Installations: None in California (proposed for City of Corona), installed in Trumansburg NY and Lanai City, HI.

Strata-Sand
Ashbrook Corporation **Status--Accepted**

Description: Strata-Sand Gravity Sand Filter
Downflow Continuous Wash Filter

Media configuration:

	Media Depth (inches)	Effective Size (mm) (graded)	Uniformity Coefficient
	sand: 40	multi-	AWWA B-100

Acceptance: Conditional acceptance letter dated July 29, 2003 from CDPH.

Comments: Performance report submitted dated June 11, 2003.

Installations: City of Oceanside (San Luis Rey WWTP)

Micromedia Filtration, Inc. **Status--Accepted**

Description: "Cleanstream" Continuous Backwash Up-flow Sand Filter

Media configuration:

	Media Depth (inches)	Effective Size (mm)	Uniformity Coefficient
silica sand:	40	0.9 - 1.3	1.5

Acceptance / References:
-Conditional acceptance letter dated September 26, 2006 from CDPH.
-Conditions of acceptance include: 1) media design specs. as noted above, 2) shall be preceded by a secondary wastewater treatment process that meets the definition of an "oxidized wastewater" in accordance with Section 60301.650.
-Performance evaluations conducted at Las Gallinas Valley Sanitary District and Santa Margarita Water District (Chiquita Water Reclamation Plant).

Comments: Same principle as the Parkson DynaSand.

Installations: Unknown

Nordic Water, Inc. **Status--Accepted**

Description: "Nordic Water Continuous Sand Filter"

Media configuration:

	Media Depth (meters)	Effective Size (mm)	Uniformity Coefficient
silica sand:	1.5	1.0 - 1.5	1.5

Acceptance / References:
-Conditional acceptance letter dated March 7, 2007 from CDPH.
-Conditions of acceptance include: 1) media design specs. as noted above, 2) Maximum loading rate of 5 GPM/FT^2

Comments: Same principle as the Parkson DynaSand.

Installations: Unknown

Volcano ***Status—NOT YET ACCEPTED***

Description: Continuous wash downflow sand filter

Acceptance / References:
-Documentation of CDPH approval does not exist. The Recycled Water Unit has no technical data on this process.

Comments: Future proposals for use of this filtration technology will require an acceptability assessment prior to approval.

Installations: Boulder Creek G.C. (Santa Cruz County), Sierra Heights WWTP (Santa Clarita), Carmel Valley WWTP, Shelter Cove (Humbolt)

Other Media Type Filters

Fuzzy Filter
Schreiber LLC **Status--Accepted**

Description: "Fuzzy Filter"-compressible synthetic fiber filter media - upflow design

Media configuration:

	Media Depth (inches)	Effective Size (")	Uniformity Coefficient
Synthetic: Plastic	30 (variable)	(1.25")	1.50

Media is quasi spherical, highly porous and compressible

Acceptance / Reference:
-Conditional acceptance letter date February 24, 2003 from CDPH.

-Conditions of acceptance include: 1) media design specs. as noted above, 2) filtration rate not to exceed 30 gpm/ft^2, 3) all Title 22 installations shall have design changes as outlined by Schreiber in correspondence dated January 21, 2003 (i.e. - backwash with filtered water, wash outlet below filtered outlet, valving position alarms), 4) individual operations plans shall include recommended operational configurations (i.e. percent compression and loading rate) based on secondary quality.
-Evaluated by U.C. Davis (Report dated September 1996)

Comments: Evaluated at loading rates up to 30 GPM/ft^2; media configuration/porosity/depth varies based on percent compression; water passes through media rather than around media.

Installations: City of Yountville

Membrane Technologies

NOTE: Many of the membranes listed below were originally approved with maximum flux rates based on studies under which performance data was generated. However, references to maximum flux rates are no longer deemed necessary since they become self-limiting from a filter run and operational perspective. If operational parameters (e.g. flux, TMP) adversely impact filtration performance from a turbidity compliance or operational perspectives, process control measures will likely be necessary to reliably insure compliance.

ZENON
Zenon Environmental Services, Inc.

Cycle-Let (Thetford) **Status--Accepted**

Description: Membrane ("Ultra") filtration (originally marketed as Thetford Cycle-Let); complete package unit including pretreatment, biological oxidation, membrane ultra-filtration, GAC and U.V.

Acceptance / References:
-CDPH acceptance memorandum to LARWQCB dated November 12, 1993 regarding the Water Gardens Project.
-Report entitled "Evaluation of the Thetford Cycle-Let Reclamation System's Ability to Meet Title 22, prepared by Engineering-Science, dated August 1991.

-Report entitled "Thetford Systems Inc. Cycle-Let Wastewater Treatment and Recycling System - Water Garden Project, Santa Monica, CA" dated July 1993 prepared by CDM

Comments: Membrane approved has average pore size of .005 micron. Tested on municipal wastewater.

Installations: "Water Gardens" (Santa Monica), Sony Music Campus (Santa Monica).

ZeeWeed / Zenogem 500 Series **Status--Accepted**

Description: Variant of the Cycle-Let, OCP Bio-reactor / Microfiltration process

Acceptance / References:
-Conditional acceptance letter from CDPH dated August 12, 1999
-Draft Final Report "California DHS Certification Testing-for Zenon (ZeeWeed) Membrane" prepared by Montgomery Watson (1/8/99).
-Final Report "Assessing the Ability of Membrane Bioreactor to Meet Existing Water Reuse Criteria (Zenon Environmental, Inc.)" prepared by Montgomery Watson (March 2001).

Comments: Includes 500a, 500b, 500c and 500d membrane systems. Approval based on use of the "OCP" (re-designated to "PVDF-UF" per letter from CDPH dated February 17, 2005) membranes only. Conditions of approval include: membrane integrity tests required. Tested in MBR process with high solids loading.

Installations: Unknown

ZeeWeed 1000 UF **Status--Accepted**

Description: Submerged Hollow Fiber Ultrafiltration Membrane

Acceptance / References:
-Conditional acceptance letter from CDPH for T-22 compliance dated October 12, 2001
-Report entitled "California Department of Health Services Certification Testing For Zenon ZeeWeed 1000 Membrane", prepared by Montgomery Watson (June 2001). This report was prepared for demonstrating compliance with the California Surface Water Treatment Rule.

Comments: Approval based on use of the hollow fiber polymer "ZeeWeed 1000 UF Membrane" with a 0.02 micron nominal pore size.

Conditions of approval require membrane integrity tests required. Tested on raw surface water.

Installations: Unknown

SIEMENS - MEMCOR

Memcor -S10V, L10V and L20V **STATUS -- Accepted**

Description: Siemens Memcor S10V, L10V and L20V polyvinylidene fluoride (PVDF) membrane filtration treatment units with a nominal 0.04 micron pore size. The membranes operate under positive pressure.

Acceptance / References:
-Conditional acceptance letter from CDPH dated 1/10/2000.
-Report submitted by MWH, Consulting Engineers, dated August 2004, outlining study results conducted for compliance with the Surface Water Treatment Rule.
-Updated model numbers for S10V and L10V from Siemens by letter dated August 8, 2007.
L20V conditional acceptance letter from CDPH dated 6/17/2008.

Comments: Membrane integrity test required. Tested on raw surface water at the Aqua De Lejos Water Treatment Plant in Upland, California.

Installations: Unknown

Memcor - M10V **STATUS -- Accepted**

Description: 0.1 micron *Polyvinylidene Fluoride* (PVDF) Hollow Fiber Micro-Filtration - Pressure Filtration

Acceptance / References:
-Conditional acceptance letter from CDPH dated 1/10/2000
-Approved under the SWTR using 0.2 micron membrane.
-Updated model numbers in letter from Siemens by letter dated August 8, 2007.

Comments: Membrane integrity tests required. Tested on raw surface water.

Installations: West Basin MWD, Orange County Water District, City of Livermore, Dublin/San Ramon SD

Memcor - M10B and M10C **STATUS -- Accepted**

Description: 0.2 micron *Polypropylene* Hollow Fiber Micro-Filtration - Pressure Filtration

Acceptance / References:
-Conditional acceptance letter from CDPH dated 1/10/2000
-Approved under the SWTR using 0.2 micron membrane.
-Updated model numbers in letter from Siemens by letter dated August 8, 2007.

Comments: Membrane integrity tests required. Tested on raw surface water.

Installations: West Basin MWD, Orange County Water District, City of Livermore, Dublin/San Ramon SD

Memcor - S10T **STATUS -- Accepted**

Description: 0.2 micron *Polypropylene* Hollow Fiber Micro-Filtration - Submerged/Vacuum Filtration

Acceptance / References:
-Conditional acceptance letter from CDPH dated 1/10/2000
-Updated model numbers in letter from Siemens by letter dated August 8, 2007.

Comments: Membrane integrity tests required. Tested on raw surface water.

Installations: Unknown

U. S. Filter/Jet Tech Products-Memjet^{tm} **STATUS--Accepted**

Description: 0.1 micron *Polyvinylidene Fluoride* (PVDF) Hollow Fiber Micro-Filtration - SBR/Vacuum Filtration

Acceptance / References:
-Conditional acceptance letter from CDPH dated 10/7/2002
-Conditional acceptance letter from CDPH dated 11/18/05 concerning the "B30R' module.

Comments: Membrane integrity tests required. Tested in MBR process with high solids loading.

Installations: Unknown

PALL Corporation **STATUS -- Accepted**

Description: PVDF Hollow Fiber Microza Microfiltration 0.1 micron (P/N XUSV-5203)

Acceptance / References:
-Conditional acceptance letter from CDPH dated 1/10/2000
-Approved for compliance under the SWTR based on report entitled "California Department of Health Services Certification Testing for Pall (Microza) Microfiltration Membrane" prepared by Montgomery-Watson (July 1999).
-Performance study conducted at OCWD Water Factory 21 (SLS Report 7725) "Long-Term Testing of Pall Microza 0.1 um MF System on Secondary Effluent at Water Factory 21, Fountain Valley, CA" (September 23, 1998).

Comments: Membrane integrity tests required. Tested on secondary effluent.

Installations: Unknown

PALL Corporation **STATUS -- Accepted**

Description: Microza Microfiltration using the following:
(P/N USV-5203)
(P/N USV-6203)
(UNA-620A)
(UNA-620A-1)

Acceptance / References:
-Conditional acceptance letters from CDPH dated 7/19/2004.
-Approved for compliance under the SWTR.
-UNA-620A-1 conditional acceptance letter from CDPH dated 1/3/2007.

Comments: Membrane integrity tests required. Tested on raw surface water.

Installations: Unknown

MITSUBISHI
Mitsubishi International Corp. **STATUS -- Accepted**

Description: Mitsubishi Membrane Bioreactor (MBR) Sterapore HF 0.4 micron hollow fiber polyethylene

Acceptance / References:
-Conditional acceptance letter from CDPH dated April 23, 2001
-Report entitled "Assessing the Ability of Membrane Bioreactor to Meet Existing Water Reuse Criteria (Mitsubishi Rayon Co., Ltd.)" prepared by Montgomery-Watson (March 2001).

Comments: Membrane integrity tests required. Tested in MBR process with high solids loading.

Installations: Unknown

KUBOTA Corporation **STATUS -- Accepted**

Description: Kubota Membrane Bioreactor (MBR); Type 510 and Type 515, 0.4 micron chlorinated polyethylene flat sheet membrane

Acceptance / References:
-Conditional acceptance letter for the Type 510 from CDPH dated March 18, 2003, amended April 29, 2004 for higher flux rate. Acceptance of the Type 515 membrane granted by letter dated July 5, 2005.

-Report entitled "Assessing the Ability of the Kubota Membrane Bioreactor to Meet Existing Water Reuse Criteria" prepared by Montgomery-Watson-Harza (February 2003).
-Conditional acceptance letter for the Type 515 from CDPH dated July 5, 2005.
-Report entitled "Equivalency of The Kubota Type 515 and Type 510 Membrane Cartridges" (2005).

Comments: Tested in MBR process with high solids loading.
Installations: Unknown

Ionics, Inc. **STATUS -- Accepted**

Description: Norit X-Flow Hollow Fiber Ultrafiltration 0.05 micron, Polyethersulfone Membrane

Acceptance / References:
-Conditional acceptance letter from CDPH dated 10/21/2003
-Approved for compliance under the SWTR based on report entitled "Draft Final Report, California Department of Health Services Certification Testing for Ionics UF Membrane" prepared by Montgomery-Watson (June 2001).

-Performance study conducted at Gwinnett County, Georgia using secondary effluent; "Membrane Pilot and Demonstration-Scale Treatment for Water Reclamation at Gwinnett County, Georgia" (CH2M HILL, 2001).

Comments: Acceptance specific to the Ionics filtration technology tested using the Norit X-Flow S225, 0.05 micron, polyethersulfone hollow fiber membrane. Membrane integrity tests required. Tested on secondary effluent.

Installations: Unknown

Koch Membrane Systems **STATUS -- Accepted**

Description: Koch Membrane Systems Puron™ Membrane Bioreactor (MBR) utilizing the Polyethersulfone hollow fiber KMS-L1 membrane with nominal 0.05 micron pore size. Submerged membrane operates under vacuum.

Acceptance / References:
-Conditional acceptance letter from CDPH dated May 4, 2006 and amended December 18, 2007 to allow for elongated fiber up to 2.0 meters.
-Report entitled "Assessing the Ability of the Puron™ Membrane Bioreactor to Meet Existing Water Reuse Criteria" prepared by Montgomery-Watson-Harza (March 2006).

Comments: Tested in MBR process with high solids loading.

Installations: Unknown

Huber Technology, Inc. **STATUS -- Accepted**

Description: Huber Vacuum Rotation Membrane VRM® Bioreactor (MBR) utilizing the Polyethersulfone flat sheet NADIR P-150F ultrafiltration membrane with nominal pore size of 0.038 micron. Submerged membrane operates under vacuum.

Acceptance / References:
-Conditional acceptance letter from CDPH dated June 22, 2006.
-Report entitled "Assessing the Ability of the Huber Vacuum Rotation Membrane VRM® Bioreactor and Membrane Clearbox® to Meet Existing Water Reuse Criteria" prepared by Montgomery-Watson-Harza (April 2006).

Comments: Tested in MBR process with high solids loading.

Installations: Unknown

Parkson Corporation **STATUS -- Accepted**

Description: Dynalift™ Membrane Bioreactor (MBR) utilizing external PVDF tubular membranes with a nominal pore size of 0.03 micron. The tubular membranes operates under pressure and are placed externally from the bioreactor.

Acceptance / References:
-Conditional acceptance letter from CDPH dated September 7, 2006.
-Report entitled "Assessing the Ability of the Dynalift™ Membrane Bioreactor to Meet Existing Water Reuse Criteria" prepared by Montgomery-Watson-Harza (July 2006).

Comments: Tested in MBR process with high solids loading.

Installations: Unknown

Ashbrook Simon-Hartley **STATUS -- Accepted**

Description: Ashbrook Simon-Hartley Integrated Membrane Activated Sludge (IMAS) filtration treatment unit utilizing the spiral wound (Spirasep) polyethersulfone ultrafiltration membrane module with nominal 0.05 micron pore size. The membranes operate under vacuum.

Acceptance / References:
-Conditional acceptance letter from CDPH dated January 25, 2007.
-Report submitted entitled "Pilot/Demonstration System" (undated) outlining study results conducted at Eastern Municipal Water District.

Comments: System utilizes separate biological and membrane filtration units but marketed as a package plant.

Installations: Unknown

METAWATER Co., (formerly NGK Insulators) **STATUS -- Accepted**

Description: METAWATER Co., Ltd. Ceramic Membrane Filtration System with a nominal 0.1 micron pore size. The membranes operate under positive pressure.

Acceptance / References:
-Conditional acceptance letter from CDPH dated March 7, 2007. Amendment letter dated August 19, 2008, recognizing ownership change from NGK to METAWATER.
-Report submitted by MWH, Consulting Engineers, dated October 2005, outlining study results conducted for compliance with the Surface Water Treatment Rule.

Comments: Tested on raw surface water at the Aqua De Lejos Water Treatment Plant in Upland, California. Part number for the NGK ceramic membrane tested is 431011.

Installations: Unknown

Asahi-Kasei Chemicals Corporation **STATUS -- Accepted**
Microza & Water Processing Division

Description: Asahi-Microza MUNC-620A and MUDC-620A hollow fiber polyvinylidene fluoride (PVDF) membrane/ bioreactor filtration treatment units with a nominal 0.1 micron pore size. The membranes operate under vacuum. Acceptance has been granted for the following membrane designations: MUNC-620A and MUDC-620A

Acceptance / References:
-Conditional acceptance letter from CDPH dated May 8, 2007 for the hollow fiber MUNC-620A membrane.
-Conditional acceptance letter from CDPH dated July 19, 2007 for the hollow fiber MUDC-620A membrane.
-Report "Assessing the Ability of the Microza™ Membrane Bioreactor to Meet Existing Water Reuse Criteria" submitted by MWH, Consulting Engineers, dated March 2007, outlining study results conducted for compliance with the Water Recycling Criteria. NOTE: This report evaluated the MUNC-620A membrane.
--Report "Assessing the Ability of the Microza™ (MUDC-620A Membrane Bioreactor to Meet Existing Water Reuse Criteria" submitted by MWH, Consulting Engineers, dated June 2007, outlining study results conducted for compliance with the Water Recycling Criteria. NOTE: This report evaluated the MUDC-620A membrane.

Comments: Membrane integrity test required. Tested using an MBR process comprised of an anoxic tank followed by an aerobic tank, followed by the submerged membrane tank.

Installations: Unknown

Norit X-Flow **STATUS -- Accepted**

Description: Norit Xiga™ and Aquaflex™ Membrane Filtration Systems with a nominal 0.025 micron pore size. The membranes operate under positive pressure.

Acceptance / References:
-Conditional acceptance letter from CDPH dated June 1, 2007. This acceptance was based on previous acceptance of this membrane (letter from CDPH dated March 14, 2006) for performance compliance under the California Surface Water Treatment Rule.

Comments: The Xiga configuration is horizontally mounted and the Aquaflex is vertically mounted. Both configurations utilized the SXL-225 hydrophilic polyethersulfone - polyvinylpyrolidine (FSFC) membrane.

Installations: Unknown

Hydranautics **STATUS -- Accepted**

Description: Hydranautics HYDRAcap Ultrafiltration Membrane

Acceptance / References:
-Conditional acceptance letter from CDPH dated April 1, 2008
-Approved for compliance under the SWTR (letter dated October 19, 1999)

Comments: Utilizes a 0.2 micron polyethersulfone hollow fiber membrane.

Installations: Unknown

DOW Ultrafiltration Membranes **STATUS -- Accepted**

Description: Dow Pressurized Ultrafiltration Membrane

Acceptance / References:
-Conditional acceptance letter from CDPH dated September 8, 2008 for recycled water applications.
-Approved for compliance under the SWTR by letter from CDPH dated July 17, 2008.

Comments: Utilizes a 0.03 micron pressure driven polyvinylidene fluoride (PVDF) hollow fiber membrane.

Installations: Unknown

Cloth Filter Technologies

AQUA-AEROBIC Systems, Inc. **Status--Accepted**

NOTE: See *Endnote #1* concerning accepted cloth fabrics

Description: **Submerged Cloth-Media Rotating Disk Filter (Utilizing the 102 needle felt fabric)**

Acceptance / References:
-Conditional acceptance letter from CDPH dated June 29, 2001 and amended September 24, 2002.
-Report entitled "Evaluation of the Aqua-Aerobic Systems Cloth-Media Disk Filter (CMDF) for Wastewater Recycling Applications in California" prepared by UC Davis (March 2001).
-Report entitled "Evaluation of Aqua-Aerobics Systems AquaDisk® Filter Technology at Orange County Water District, Fountain Valley, California" (February 25, 2000).

Comments: Utilizes the "102 needle felt fabric", operates under vacuum. Conditions of acceptance: loading rate not to exceed 6 gpm/ft^2; Acceptance of this technology is contingent on it being complimented with a disinfection process which is compliant with Section 60301.230 (T-22); acceptance limited to the random woven NF-102 needle felt cloth media having openings ranging from 10 to 30 microns and a thickness of 3.8 mm; turbidity performance shall be in accordance with Section 60301.320 (a 2), and Sections 60304 (a) and 60307 (a) (Title 22); Operations plan shall specify minimum FTW cycle following high pressure wash based on displacement of two filtrate volumes and effluent turbidity below 2 NTU; scheduled inspections of cloth conditions; ensure adequate sludge wasting.

Installations: Unknown

ENDNOTE #1: Both the Submerged Cloth Media Rotating Disk (AquaDisk®) and the Submerged Fixed Cloth Media (AquaDiamond®)

designs are acceptable for use with the following CDPH accepted filter fabrics; 102 needle felt fabric, PA-13 nylon pile fabric, MMK2-13 acrylic pile fabric and PES-13 woven polyester fabric.

Description: **Submerged Cloth-Media Rotating Disk Filter (Utilizing the PA-13 nylon pile fabric)**

NOTE: See *Endnote #1* concerning accepted cloth fabrics

Acceptance / References:
-Conditional acceptance letter from CDPH dated May 6, 2002) and amended on September 24, 2002
-Report entitled "Use of PA-13 Pile Fabric, Supplement to: Evaluation of the Aqua-Aerobic Systems Cloth-Media Disk Filter (CMDF) for Wastewater Recycling Applications in California" prepared by UC Davis (February 2002).

Comments: Utilizes the "PA-13 nylon pile fabric", operates under vacuum. Conditions of acceptance: loading rate not to exceed 6 gpm/ft^2; Acceptance of this technology is contingent on it being complimented with a disinfection process which is compliant with Section 60301.230 (T-22); acceptance limited to the PA-13 nylon pile fabric (as tested); turbidity performance shall be in accordance with Section 60301.320 (a 2), and Sections 60304 (a) and 60307 (a) (Title 22); scheduled inspections of cloth conditions; ensure adequate sludge wasting.

Installations: Unknown

ENDNOTE #1: Both the Submerged Cloth Media Rotating Disk (AquaDisk®) and the Submerged Fixed Cloth Media (AquaDiamond®) designs are acceptable for use with the following CDPH accepted filter fabrics; 102 needle felt fabric, PA-13 nylon pile fabric, MMK2-13 acrylic pile fabric and PES-13 woven polyester fabric.

Description: **Submerged Cloth-Media Rotating Disk Filter (Utilizing the MMK2-13 acrylic pile fabric)**

NOTE: See *Endnote #1* concerning accepted cloth fabrics

Acceptance / References:
-Conditional acceptance letter from CDPH dated July 21, 2006.
-Report entitled "Comparative Evaluation of the Aqua-Aerobic Systems, Inc. MMK2-13 Acrylic Pile Filter Media To Meet California's Title 22 Reuse Criteria" (April 2006).

Comments: Utilizes the "MMK2-13 acrylic pile fabric", operates under vacuum. Conditions of acceptance: loading rate not to exceed 6 gpm/ft^2; Acceptance of this technology is contingent on it being complimented with a disinfection process which is compliant with Section 60301.230 (T-22); turbidity performance shall be in accordance with Section 60301.320 (a 2), and Sections 60304 (a) and 60307 (a) (Title 22); scheduled inspections of cloth conditions; ensure adequate sludge wasting.

Installations: Unknown

ENDNOTE #1: Both the Submerged Cloth Media Rotating Disk (AquaDisk®) and the Submerged Fixed Cloth Media (AquaDiamond®) designs are acceptable for use with the following CDPH accepted filter fabrics; 102 needle felt fabric, PA-13 nylon pile fabric, MMK2-13 acrylic pile fabric and PES-13 woven polyester fabric.

Description: **Submerged Cloth-Media Rotating Disk Filter (Utilizing the PES-13 woven polyester pile fabric)**

NOTE: See *Endnote #1* concerning accepted cloth fabrics

Acceptance / References:
- -Conditional acceptance letter from CDPH dated November 14, 2007.
- -Report entitled "Evaluation of the Aqua-Aerobic Systems, Inc. PES-13 Cloth Media Filter for Wastewater Reuse Applications" (September 2007).

Comments: Utilizes the "PES-13 woven polyester fabric". Conditions of acceptance: loading rate not to exceed 6 gpm/ft^2; Acceptance of this technology is contingent on it being complimented with a disinfection process which is compliant with Section 60301.230 (T-22); turbidity performance shall be in accordance with Section 60301.320 (a 2), and Sections 60304 (a) and 60307 (a) (Title 22); scheduled inspections of cloth conditions; ensure adequate sludge wasting.

Installations: Unknown

ENDNOTE #1: Both the Submerged Cloth Media Rotating Disk (AquaDisk®) and the Submerged Fixed Cloth Media (AquaDiamond®) designs are acceptable for use with the following CDPH accepted filter fabrics; 102 needle felt fabric, PA-13 nylon pile fabric, MMK2-13 acrylic pile fabric and PES-13 woven polyester fabric.

Description: **Submerged Fixed Cloth-Media Filter -AquaDiamond® Filtration System (Utilizing NF-102 Needle Felt or the PA-13 Nylon Pile Fabric)**

NOTE: See *Endnote #1* concerning accepted cloth fabrics

Acceptance / References:
- -Conditional acceptance letter from CDPH dated May 12, 2004).
- -Design and process control report on file.

Comments: Same filtration principle as the rotating disk filters noted above but differs in design and operation; operates under vacuum.
Conditions of acceptance: loading rate not to exceed 6 gpm/ft^2; filtration process must be complimented with a disinfection process which is compliant with Section 60301.230 (T-22); acceptance limited to the NF-102 needle felt fabric and the PA-13 nylon pile fabric. Turbidity performance shall be in accordance with Section 60301.320 (a 2), and Sections 60304 (a) and 60307 (a) (Title 22); scheduled inspections of cloth conditions; ensure adequate sludge wasting.

Installations: Unknown

ENDNOTE #1: Both the Submerged Cloth Media Rotating Disk (AquaDisk®) and the Submerged Fixed Cloth Media (AquaDiamond®) designs are acceptable for use with the following CDPH accepted filter fabrics; 102 needle felt fabric, PA-13 nylon pile fabric, MMK2-13 acrylic pile fabric and PES-13 woven polyester fabric.

I. Kruger Inc. **Status--Accepted**

Description: **Cloth-Media Disk Filter - Hydrotech (Utilizing the PET mono-filament filter fabric)**

Acceptance / References:
- -Conditional acceptance letter from CDPH dated October 2, 2003.
- -Report entitled "Evaluation of the Hydrotech Filter for Compliance With Title 22 For Recycled Water Applications" prepared by Water 3 Engineering, Inc. (August 2003).

Comments: Utilizes the PET mono-filament, 2:2 twill weave, 11 micron (+/-2.0) mesh opening, 523.2 (n/inch), 60 micron thickness, wt. rating of 1.48 oz./sq.yd., stabilized finish. Conditions of acceptance: loading rate not to exceed 6 gpm/ft^2;

Acceptance of this technology is contingent on it being complimented with a disinfection process which is compliant with Section 60301.230 (T-22); turbidity performance shall be in accordance with Section 60301.320 (a 2), and Sections 60304 (a) and 60307 (a) (Title 22); scheduled inspections of cloth conditions.

Installations: Unknown

Nordic Water Cloth-Media Disc Filter **Status--Accepted**

Description: **Cloth-Media Disk Filter - Nordic water (Utilizing the Type 20/30 Polyester Fabric Filter)**

Acceptance / References:
-Conditional acceptance letter from CDPH dated March 7, 2008.
-Report entitled "Nordic Water Disc Filter Validation Report" prepared by Eco-Logic Engineering (March 22, 2007).

Comments: Utilizes the Type 20/13 polyester fabric. Conditions of acceptance include: loading rate not to exceed 6 gpm/ft^2; Acceptance of this technology is contingent on it being complimented with a disinfection process which is compliant with Section 60301.230 (T-22); turbidity performance shall be in accordance with Section 60301.320 (a 2), and Sections 60304 (a) and 60307 (a) (Title 22); scheduled inspections of cloth conditions.

Installations: Unknown

Parkson Corporation - DynaDisc **Status--Accepted**

Description: **Submerged Cloth-Media Rotating Disk Filter (Utilizing the PA-13 nylon pile fabric)**

Acceptance / References:
-Conditional acceptance letter from CDPH dated November 5, 2007.
-Report entitled "Parkson DynaDisc™ Cloth Media Filter" dated September 27, 2007.

Comments: Utilizes the "PA-13 nylon pile fabric", operates under vacuum. Conditions of acceptance: loading rate not to exceed 6 gpm/ft^2; Acceptance of this technology is contingent on it being complimented with a disinfection process which is compliant with Section 60301.230 (T-22); acceptance limited to the PA-13 nylon

pile fabric (as tested); turbidity performance shall be in accordance with Section 60301.320 (a 2), and Sections 60304 (a) and 60307 (a) (Title 22); scheduled inspections of cloth conditions; ensure adequate sludge wasting.

Installations: Unknown

Siemens Water Technologies **Status--Accepted**

Description: **Forty X Cloth-Media Disk Filter (Utilizing the PET mono-filament filter fabric)**

Acceptance / References:
-Conditional acceptance letter from CDPH dated June 3, 2008.
-Performance data report for the Forty X Disc Filter submitted to CDPH (May 2008).

Comments: Utilizes the Siemens 11/5, PET (polyester) mono-filament, 2:2 twill weave, 11 micron mesh opening, 523 (n/inch), 60 micron thickness, wt. rating of 1.5 oz./sq.yd., stabilized finish. Conditions of acceptance: loading rate not to exceed 6 gpm/ft^2; Acceptance of this technology is contingent on it being complimented with a disinfection process which is compliant with Section 60301.230 (T-22); turbidity performance shall be in accordance with Section 60301.320 (a 2), and Sections 60304 (a) and 60307 (a) (Title 22); scheduled inspections of cloth conditions.

Installations: Unknown

Five Star Filtration **Status--Accepted**

Description: **Five Star Cloth-Media Disk Filter (Utilizing the "Yellow Jersey Knit Fabric"**

Acceptance / References:
-Conditional acceptance letter from CDPH dated September 12, 2008.
-Title 22 Validation Testing Report dated August 1, 2008 submitted to CDPH.

Comments: Utilizes the Yellow Jersey Knit Fabric (20% acrylic/80% polyester face, 100% polyester backing yarn, acrylic latex back coating). Conditions of acceptance: loading rate not to exceed 6 gpm/ft^2; Acceptance of this technology is contingent on it being complimented with a disinfection process which is

compliant with Section 60301.230 (T-22); turbidity performance shall be in accordance with Section 60301.320 (a 2), and Sections 60304 (a) and 60307 (a) (Title 22); scheduled inspections of cloth conditions.

Installations: Unknown

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4. DISINFECTION TECHNOLOGIES

Gaseous chlorine or hypochlorite are the most commonly used disinfectants, however alternative technologies are recognized as being acceptable including UV, Ozone and Pasteurization.

ULTRAVIOLET DISINFECTION

Trojan Technologies, Inc.

Description:	UV 4000 (Medium Pressure/ Low Intensity)	**Status—Accepted***
	UV 3000 (Low Pressure/ Low Intensity)	" **
	UV 3000+ (Low Pressure/ High Output)	" ***

Acceptance/References:
- -Conditional acceptance letter from CDPH dated September 8, 1995 for UV4000.
- -Conditional acceptance letter from CDPH dated July 3, 2003 for UV 3000+ (including modified end-of-lamp-life factor of 0.82). Amended October 30, 2003; October 24, 2005 (concerning lamp spacing), October 5, 2006 (concerning sleeve fouling factor of 0.95).
- -"Trojan System UV4000 UV Disinfection Pilot Study. Riverside, California", May 1995
- -"Equivalency of the Trojan System UV4000 and System UV3000 in Meeting California Wastewater Reclamation Criteria at Pacifica, California", June 1994
- -"Technical Review: Ultraviolet Disinfection of Wastewater to California Wastewater Reclamation Criteria (Title 22, Division 4, Chapter 3, of the California Code of Regulations) Using Trojan Technologies' System UV4000 (High Intensity UV Lamp Technology", August 1995.

Comments: Acceptance for the UV4000 conditioned on 1) continuous monitoring/recording of filter effluent turbidity (pre UV), daily coliform monitoring (disinfected effluent) and 3) provide UV dose of at least 100 mW-sec/cm^2 under worst operating

conditions at peak daily instantaneous flow with a minimum of three banks in operation and a UV dose of at least 140 mW-sec/cm2 with a minimum of four banks in operation, subject to all of the conditions indicated in the NWRI Guidelines.

Installations: City of Pacifica, City of Vallejo, Central Contra Costa S.D., City of Corona, City of San Diego (South Bay WRF), Western Riverside RWF, Olivenhain WD, City of Santa Rosa

***Acceptance granted under the outdated 1993 NWRI Guidelines. Compliance with the May 2003 NWRI/AWWARF Guidelines has not been demonstrated.**

****Acceptance granted under the December 2000 NWRI/AWWARF Guidelines.**

*****Acceptance granted under the May 2003 NWRI/AWWARF Guidelines.**

Wedeco **Status—Accepted***

-Specktrotherm 33-TAK UV

Description: (Low pressure/High Intensity)

Acceptance/References
- -Conditional acceptance letter dated 3-31-98 from CDPH and follow-up letter dated 5/21/99 transferring approval from Aquafine to Wedeco).
- -Tested at OCWD as the AWES-Spectrotherm TAK UV System

Comments: Currently marketed as the PCI-Wedeco Spectrotherm 33 TAK UV System. Requires UV dose of 160 mWs/cm^2 at max. week flow, 120 mWs/cm^2 at peak flow (max. day), and an average of $\geq$160 mWs/cm^2 and conform to NWRI Guidelines.

Installations: Leucadia CWD(proposed)

***Acceptance granted under the outdated 1993 NWRI Guidelines. Compliance with the May 2003 NWRI/AWWARF Guidelines has not been demonstrated.**

Wedeco - LCI-20L **Status—Accepted***

Description: (Low pressure/High Intensity)
Model LCI-20L

Acceptance/ References
-Conditional acceptance letter from CDPH dated 2-23-99 for Tejon Ranch.
-Report entitled "Ultraviolet Dose Bioassay of the Ideal Horizons Horizontal Lamp Disinfection System" by HydroQual, Inc. (September 1998).

Comments:

Installations: Tejon Ranch Development (I-5 @ Tejon Pass)

***Acceptance granted under the outdated 1993 NWRI Guidelines. Compliance with the May 2003 NWRI/AWWARF Guidelines has not been demonstrated.**

Wedeco - TAK 55 **Status—Accepted****

Description: (Low pressure/High Intensity/open channel)
TAK 55

Acceptance/References
-Conditional acceptance letter dated 12-4-01 from CDPH.
-Report entitled "Wedeco-Ideal Horizons Low-Pressure, High Intensity Ultraviolet Disinfection System Pilot Study at Orange County Water District" by CH2M Hill (November 2000)
-Revised end-of-lamp age factor for SLR 32143 HP lamp modified from 0.91 to 0.88 at 10,074 hours per letter from CDPH dated May 19, 2005.

Comments:
Installations: Unknown
****Acceptance granted under the December 2000 NWRI/AWWARF Guidelines.**

Wedeco - TAK 55HP **Status—Accepted*****

Description: (Low pressure/High Output/open channel)
TAK 55HP

Acceptance/References
-Conditional acceptance letter dated 11-24-03 from CDPH.
-Report entitled "Wedeco Ultraviolet Technologies TAK 55HP Validation Report by Carollo Engineers (October 2003).
-Revised end-of-lamp age factor for SLR 32143 HP lamp modified from 0.91 to 0.88 at 10,074 hours per letter from CDPH dated May 19, 2005.

Comments:

Installations: Unknown

*****Acceptance granted under the May 2003 NWRI/AWWARF Guidelines.**

Wedeco - LBX 1000 **Status—Accepted*****

Description: (Low pressure/High Output/closed vessel)
LBX 1000

Acceptance/References
-Conditional acceptance letter dated 12-14-07 from CDPH.
-Report entitled "LBX 1000 UV Disinfection System Validation Report" by Carollo Engineers (December 2007).

Comments: -Acceptance letter addresses 10 conditions (see letter for more details).
-Tested on potable water; therefore acceptance is limited to membrane filtered effluent per NWRI.
-This system has a 65.5-cm chamber and forty 330-w LPHO lamps applicable for flow rates ranging from 0.58 to 3.51 MGD (403 to 2,438 GPM) at UTVs ranging from 54 to 77 percent, and sensor intensities ranging from 1.9 to 7.5 mW/cm^2.

Installations: Unknown

*****Acceptance granted under the May 2003 NWRI/AWWARF Guidelines.**

Wedeco - LBX 400 **Status—Accepted*****

Description: (Low pressure/High Output/closed vessel)
LBX 400

Acceptance/References
-Conditional acceptance letter dated 8-14-08 from CDPH.
-Report entitled "LBX UV Disinfection System Validation Report" by Carollo Engineers (July 2008).
-Tested on potable water; therefore acceptance is limited to membrane filtered effluent per NWRI.
-This system has a 38.1-cm chamber and sixteen 330-w LPHO lamps applicable for flow rates ranging from 0.25 to 1.37 MGD (174 to 951 GPM) at UTVs ranging from 46 to 75 percent, and sensor intensities ranging from 2.8 to 9.2 mW/cm^2.

Comments: Acceptance letter addresses 11 conditions (see letter for more details).

Installations: Unknown

*****Acceptance granted under the May 2003 NWRI/AWWARF Guidelines.**

Wedeco - LBX 90 **Status—Accepted*****

Description: (Low pressure/High Output/closed vessel)
LBX 90

Acceptance/References
-Conditional acceptance letter dated 8-21-08 from CDPH.
-Report entitled "LBX UV Disinfection System Validation Report" by Carollo Engineers (July 2008).
-Tested on potable water; therefore acceptance is limited to membrane filtered effluent per NWRI.
-This system has a 20.8-cm chamber and four 330-w LPHO lamps applicable for flow rates ranging from 0.037 to 0.432 MGD (26 to 300 GPM) at UTVs ranging from 55.6 to 77 percent, and sensor intensities ranging from 2.1 to 8.0 mW/cm^2.

Comments: Acceptance letter addresses 11 conditions (see letter for more details).

Installations: Unknown

*****Acceptance granted under the May 2003 NWRI/AWWARF Guidelines.**

Aquionics, Inc. **Status—Accepted***

Description: (Medium Pressure/In-line)

Acceptance/Reference:
-Conditional acceptance letter dated 2-28-00 from CDPH.
-CH2M Hill, "Aquionics Medium Pressure, High-Intensity Ultraviolet Disinfection System Pilot Study at Orange County Water District" by CH2M Hill (May 1999)

Comments:

Installations: Unknown

***Acceptance granted under the outdated 1993 NWRI Guidelines. Compliance with the May 2003 NWRI/AWWARF Guidelines has not been demonstrated.**

Service Systems International, Ltd. **Status—Accepted***

ULTRAGUARD UV System

Description: (Open Channel/Low Pressure/High Intensity/vert. lamp)

Acceptance/Reference:
-Conditional acceptance letter dated 2-1-00 from CDPH.
-Report: Chen, C. L.; El Jacj, Z; Kuo, J., "UV Inactivation of Bacteria and Coliphages in Tertiary Effluent Using Low-Pressure High-Intensity Lamps", November 18, 1999, County Sanitation Districts of Los Angeles County.

Comments:

Installations: Unknown

***Acceptance granted under the outdated 1993 NWRI Guidelines. Compliance with the May 2003 NWRI/AWWARF Guidelines has not been demonstrated.**

Aquaray - Degremont

Aquaray 40 VLS **Status—Accepted*****

Description: Vertical lamp/low Pressure/low intensity

Acceptance: Conditional acceptance letter dated 10/24/97.

Comments: Evaluation memo dated 4/30/97 from CDPH concerning transmittance restriction be set at >55%.

Installations: Scotts Valley, Town of Windsor, Dublin/San Ramon CSD

*****Acceptance granted under the May 2003 NWRI/AWWARF Guidelines.**

Aquaray 40 HO VLS **Status—Accepted*****

Description: Vertical lamp/low Pressure/high intensity

Acceptance: Conditional acceptance letter dated 10/24/03 with subsequent correspondence dated 2/23/04, 4/13/04, 10/04/06 and 1/12/07.

Comments: Evaluation memo dated 4/30/97 from CDPH concerning transmittance restriction be set at >55%.

Installations: Unknown

*****Acceptance granted under the May 2003 NWRI/AWWARF Guidelines.**

Aquaray 3X HO **Status—Accepted*****

Description: Horizontal lamp/low Pressure/high intensity

Acceptance: Two conditional acceptance letters (one is a cover letter, the second is the actual acceptance letter) dated May 30, 2008.

Comments: -Acceptance letter addresses 24 conditions (see letter for more detail).
-This system has dimensions of 0.74-m wide, 0.91-m long and 2.25 m in height, inclusive of top enclosure. There are thirty-six 160-W LPHO Amalgam lamps in a staggered six by six array oriented vertical to the flow in an open channel. An air scrub sleeve cleaning system is typically provided.
-applicable for flow rates ranging from 2 to 12 MGD at UVTs ranging from 55 to 75 percent, lamp current ranging from 2.8 to 4.5 amps, and Effective Output (EO) ranging from 0.42 to 1.00.
-Testing was performed using both granular media and membrane-filtered effluent. Two similar operating equations were developed with different constants for granular media filtration or membrane filtration.

Installations: Unknown

*****Acceptance granted under the May 2003 NWRI/AWWARF Guidelines.**

UltraTech Systems

Terminator **Status—Accepted***

Description: Vertical/Low Pressure/Low Intensity

Acceptance/References
-Conditional acceptance letter dated October 23, 2000 from CDPH
-Report entitled "Ultraviolet Dose Bioassay of the Ultratech Systems Vertical Lamp Disinfection System (65% Transmittance)" by HydroQual, Inc. (February 2000).

Comments:

Installations: Unknown

***Acceptance granted under the outdated 1993 NWRI Guidelines. Compliance with the May 2003 NWRI/AWWARF Guidelines has not been demonstrated.**

Quay Technologies, Ltd.
OCS 6000 Microwave UV **Status—Accepted*****

Description: Electrodeless UV lamps

Acceptance/References
-Conditional acceptance letter dated June 8, 2007 from CDPH
-Report entitled "Quay Technologies, Ltd. OCS 6000 Microwave UV Validation Report" by Carollo Engineers (September 2006).

Comments: Piloted at City of Roseville. Instead of utilizing electrodes, microwave energy is generated by magnetrons and directed through wave guides into the quartz lamp sleeves containing the gas filling. The directed microwave energy excites the argon atoms, which in turn excite the mercury atoms to produce radiation.

Installations: Unknown

*****Acceptance granted under the May 2003 NWRI/AWWARF Guidelines.**

PASTEURIZATION

Ryan Pasteurization and Power

Description: Pasteurization disinfection process

Acceptance/References
-Conditional acceptance letter dated July 25, 2007 from CDPH
-Report entitled "RP&P Wastewater Pasteurization System Validation Report" by Carollo Engineers (July 2007).
-Conditions of acceptance include (see acceptance letter for more detail): 1) Pasteurization temperatures must ≥180 degrees F with temperature maintained continuously for a minimum of 10 seconds, 2) Upon completion of construction and prior to operation, the minimum contact time and temperature must be demonstrated to the Department, spanning a range of flow from the low flow to the high flow, with two intermediate flow points 3), For new installations, a 6-

point bioassay must be performed on the pasteurization unit using seeded MS2 coliphage, 4) The accuracy and repeatability of the on-line temperature probes (thermocouples) must be demonstrated, 5) On-line monitoring of flow and temperature must be implemented in a manner similar to that documented in the July 2007 report from Carollo Engineers. The temperature throughout the cross-section of the vessel should be uniform, 6) All future proposals shall employ the operational and maintenance criteria outlined under Section 6.3 of the July 2007 report from Carollo Engineers, and 7) Ryan Pasteurization must be preceded by filters meeting the definition of "filtered wastewater" under CCR, Title 22, Section 60301.320 (a & b) or those demonstrating equivalency under Section 60320.5 ("Other Methods of Treatment") outlined in the Water Recycling Criteria. Additionally, CDPH recommends that pilot testing of pasteurization prior to design be conducted to document any impacts from a water quality that is different from the water quality documented in the July 2007 report from Carollo Engineers.

Comments: Pilot studies were conducted at the City of Santa Rosa's Laguna Wastewater Treatment Plant.

Installations: Unknown

See: Appendix A
Appendix B

APPENDIX A

Recognized Filtration and Disinfection Technologies
For Recycled Water

CALIFORNIA DEPARTMENT OF HEALTH SERVICES
REDUCTION OF VIRUS AND BACTERIA BY FILTRATION AND DISINFECTION
(October 2001)

Title 22 of the California Code of Regulations (Recycled Water Criteria) requires extensive treatment of wastewater that is to be used for irrigation of parks and playgrounds or for spray irrigation of food crops. Recycled water for such irrigation is to be oxidized, filtered, and disinfected. Section 60301.320 defines filtered wastewater and Section 60301.230 defines disinfected tertiary recycled water. Additionally, Section 60320.5 allows for "other methods of treatment" provided they are found acceptable to the Department.

Treatment equivalent to that stipulated in sections 60301.320 and 60301.230 is prescribed to greatly reduce the concentration of viable enteric viruses in wastewater. Such a reduction makes it very unlikely that a person would contaminate his hands with a virus when touching a surface wet with reclaimed water. Enteric viruses are excreted by individuals with an intestinal virus infection. They can cause incapacitating disease states in susceptible persons. Those disease states include meningitis, hepatitis, and others.

Capability of Treatment That Sections 60301.320 and 60301.230 Cite

The County Sanitation Districts of Los Angeles County (CSDLAC, 1977) determined the capability of treatment that sections 60301.320 and 60301.230 cite, to reduce the concentration of viable virus in activated sludge effluent. CSDLAC added laboratory-cultured poliovirus and 150 milligrams of alum coagulant per liter of the activated sludge effluent and passed it through pilot-scale treatment facilities comprised of a clarifier and a sand filter to meet the turbidity limits that section 60301.320 cites in the definition of filtered wastewater: turbidity shall not exceed 2 turbidity units as a daily average and shall not exceed 5 turbidity units more than five percent of the time. Filter effluent was chlorinated in a chamber with a two-hour theoretical contact period and a 90-minute actual, modal contact period.

Such treatment reduced the concentration of virus plaque-forming units to 1/100,000th of the concentration in wastewater upstream from the filter, when the chlorine residual was at least 5 milligrams per liter and at least sufficient to reduce the concentration of total coliform bacteria to less than 2 per hundred milliliters. Sections 60301.320 and 60301.230 require that disinfection shall limit the concentrations of total coliform bacteria in the effluent so that the median of consecutive daily samples does not exceed 2.2 per hundred milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed.

Equivalent Treatment By Granular Media Bed Filtration and Disinfection

Section 60320.5 of Title 22 allows the regulatory agency to accept processes other than those that Sections 60301.320 and 60301.230 cite if the applicant demonstrates to the satisfaction of DHS that the other processes will assure an equal degree of treatment. DHS deems other treatment equivalent to that cited in sections 60301.320 and 60301.230 when: (1) a proponent demonstrates that the proposed alternative treatment consistently reduces the concentration of viable virus to a level 1/100,000th of the concentration of seeded virus in influent to the filter; and (2) the proponent will provide reliability features equivalent to those that Title 22 cites, and will comply with all other applicable stipulations of Title 22.

Past demonstrations are sufficient to allow DHS to accept the combination of granular media bed filtration and disinfection of oxidized wastewater as equivalent to treatment that sections 60301.320 and 60301.230 cite, when the following four conditions are obtained:

(1) coagulant is added when the turbidity of the oxidized wastewater (i.e. secondary effluent) exceeds 5 NTU for more than 15 minutes (or exceeds 10 NTU at any time) upstream from the filter;

(2) the turbidity of filter effluent does not exceed a daily average of 2 NTU, 5 NTU more than 5 percent of the time, and 10 NTU at any time;

(3) the concentration of viable total coliform bacteria in the final effluent does not exceed 2.2 per hundred milliliters as a median in samples taken in seven consecutive days, and does not exceed 23 per hundred milliliters in more than one sample in a 30-day period; and

(4) the disinfection process complies with (a) or (b) below:

(a) if chlorination is used it provides a CT (chlorine concentration times modal contact time) value not less than 450 milligram-minutes per liter at all times with a modal contact time at least 90 minutes at the peak daily flow rate; or

(b) if ultraviolet light irradiation is used, the design and operation of the UV light disinfection process complies with the stipulations of the NWRI/AWWARF document cited below under the heading References Cited.

Demonstration With Other Filtration and Disinfection Processes

The particle size distribution (PSD) of secondary sewage treatment effluent filtered by a membrane, cloth, or similar medium will differ significantly from that of effluent of a granular media bed filter, insofar as PSD affects the effectiveness of the downstream disinfection process. The term "size distribution" refers to the number of particles per milliliter in each of several specific ranges of sizes. Polycarbonate membrane laboratory filters with pore sizes of 12, 8, 5, 3, 1, and 0.1 micron can be used (Levine, et al., 1985; NCC, 1984), with minimal equipment requirements. A particle counter can be used to determine PSD for the following size ranges, in microns: 1.2 to 2, 2 to 5, 5 to 10, 10 to 20, 20 to 50, 50 to 100, 100 to 200, and larger than 200 (Stahl et al., 1994).

If a filter other than a granular media bed filter is proposed to be used and the use of reclaimed water requires equivalence with treatment that section 60301.320 or 60301.230 cites, the proponent must undertake a demonstration to show DHS what operating conditions guarantee that the filter and disinfection process will consistently reduce the concentration of virus to 1/100,000th of the virus concentration in wastewater upstream from the filter and limit the concentration of total coliform bacteria to comply with concentrations that sections 60303 and 60313(b) cite. The demonstration will involve operation of the filter and disinfection process under the following conditions:

- the filter receives the type of wastewater from which recycled water is proposed to be produced;

- the range of qualities of wastewater received by the filter includes qualities that are expected to occur when recycled water is produced, and are the most challenging to the

effectiveness of the filter and disinfection process (e.g., concentration of suspended solids is at the maximum);

- laboratory-grown viruses are added to the wastewater upstream from the filter;
- samples are taken upstream from the filter and downstream from the disinfection process for determination of numbers of plaque-forming units of virus per volume of sample;
- samples are taken of wastewater upstream and immediately downstream from the filter for determination of concentration of total suspended solids;
- turbidity of the filter effluent is continuously measured by a continuous recording turbidimeter;
- samples of disinfected effluent are taken for determination of the concentration of total coliform bacteria;
- additionally if disinfection is by chlorination, samples are taken of wastewater upstream from the filter for determination of concentration of ammonia and samples of disinfected effluent are taken for determination of concentration of chlorine residual;
- additionally if disinfection is by UV irradiation, fluid transmittance at 254 nm (% T) and flow rate of filter effluent are continuously measured and recorded;
- The greatest appropriate time between backwashes, or other actions that renew filter yield or efficacy, is determined by experiment, with turbidity of filter effluent allowed to range as high as needed for economically practicable treatment (but not to exceed 2 NTU as a daily average, 5 NTU more than 5 percent of the time, or 10 NTU at any time); and

A test run is comprised of one continuous operation between two consecutive backwashes (or other actions that renew filter yield or efficacy). A demonstration shall have at least three test runs during which the quality and/or flow rate of influent to the filter is most challenging for the disinfection process.

Qualities most challenging to UV disinfection might include high concentration of suspended solids, high turbidity and low transmittance. Qualities most challenging to chlorine disinfection might include high concentration of suspended solids, high turbidity and high chlorine demand.

If the proponent wants to propose a CT value or minimum chlorine contact time that differs from that cited above under the heading Equivalent Treatment By Granular Media Bed Filtration and Disinfection, or a UV dose that differs from what the NWRI/AWWARF Guidelines cite, the proponent shall perform as many test runes as necessary to construct a dose-response curve for virus reduction. The curve shall show the required value(s) of such parameters at which the concentration of viable viruses in the disinfected effluent is reduced to 1/100,000TH of the concentration in the influent to the filter.

During each test run, viruses shall be added to wastewater in numbers sufficient to determine whether the concentration in disinfected effluent is less than 1/100,000th of the concentration in wastewater upstream from the filter. The viruses added to wastewater upstream from the filter shall be F-specific bacteriophage MS2, polio virus, or other virus that is at least as resistant to disinfection as polio virus. F-specific bacteriophage MS2 is a strain of a specific type of virus that infects coliform bacteria that is traceable to the American Type Culture Collection (ATCC 15597B1) and is grown on lawns of E. coli (ATCC 15597). Chlorine residual in samples of chlorinated effluent taken for determination of concentrations of virus plaque-forming units and total coliform bacteria shall be neutralized with a reducing agent approved by DHS, when those samples are taken.

The proponent shall submit to DHS a proposed protocol for all work to be undertaken in the demonstration. The proponent will undertake the demonstration only pursuant to a protocol DHS has approved.

The demonstration must identify operating conditions that consistently achieve that virus reduction and compliance with the above-cited limits on the concentration of total coliform bacteria. The regulatory agency will cite those operating conditions and will stipulate that they will be maintained.

The combination of a filtration process and a separate disinfection process provides multiple barriers to limit the concentration of viable viruses somewhat when the other malfunctions. DHS will not accept filtration alone, or disinfection alone, as complying with Title 22.

REFERENCES CITED

Levine, A.D., Tchobanoglous, G., and Asano, T., "characterization of the Size Distribution of Contaminants in Wastewater: Treatment and Reuse Implications," Journal Water Pollution Control Federation, July 1985, pages 805-816.

NCC (Nuclepore Corporation Catalog), "Innovations in Membrane Filtration," Pleasanton, California, 1984.

National Water Research Institute / American Waterworks Association Research Foundation), Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse, December 2000. That document is available for purchase from National Water Research Institute, P.O. Box 20865, Fountain Valley, CA 92728-0865, telephone (714) 378-3278.

Stahl, J.F., Kuo, J.F., Chen, C., and Horvath, R.W., "Evaluation of Four Different Tertiary Filtration Plants for Turbidity Control", presented at 65th Annual Conference of Water Environment Federation, September 20-24, 1992, New Orleans (paper published in November/December 1994 issue of the Journal of the Water Environment Federation).

APPENDIX B

State of California | Department of Health Services

Memorandum

Date: November 1, 2004

To: Regional Water Quality Control Boards Executive Officers

From: David P. Spath, Ph.D., P.E., Chief
Division of Drinking Water and
Environmental Management
1616 Capitol Avenue, MS 7400
449-5577

Subject: Cleaning of UV Quartz Sleeves

In recent years the use of ultraviolet (UV) radiation for disinfection of recycled water has increased significantly. As a relatively new technology for wastewater disinfection the Department of Health Services has been attempting to learn more about the operation of these UV facilities at recycled water plants. It has recently come to our attention that at some recycled water plants these UV facilities may be operated in a manner that could significantly compromise the disinfection treatment barrier. Specifically, we have been advised that these recycled water plants are following the practice of using the detection of coliform organisms in the treated effluent as a basis for determining how frequently to clean the quartz sleeves that protect the UV lamps. As the appropriate regulatory agency we are requesting that the Regional Water Quality Control Boards (RWQCB) look into this situation. In addition, we are recommending that the RWQCBs establish a more conservative set of requirements for all recycled water plants practicing UV disinfection to ensure that an appropriate disinfection treatment barrier is achieved. The following provides a brief discussion of the issue including background information, the problem that exists and our recommended requirements.

Background

Cleaning the quartz sleeves of a UV system is critical to ensuring the proper functioning of a UV system. Because the UV lamp is surrounded by a quartz sleeve, any coating on the surface of the quartz sleeve will reduce the transmission of UV into the wastewater thereby reducing the quantity of UV reaching or penetrating the wastewater for the purpose of disinfection. Unless this reduction in UV transmission is compensated for in the design and operation of the UV facility, the UV disinfection barrier can and will be reduced (compromised) concomitantly, i.e., the amount of disinfection being delivered will not be sufficient to meet minimum dose delivery requirement.

The National Water Research Institute (NWRI)/American Water Works Association Research Foundation (AWWARF) UV disinfection guidelines recognize this issue and recommend a 0.8 sleeve fouling factor be used in the design of UV systems. This increases the minimum dose delivery requirement in a linear manner, increasing the number of lamps required to achieve the minimum delivered dose during operation with the realization that quartz sleeve fouling is a never ending process.

Unless the UV system is operated using a sensor on the outside of a quartz sleeve for controlling the delivered dose, one does not know when or how much of an impact fouling has on UV dose delivery. Therefore, the delivered dose requirement is increased by the quartz sleeve-fouling factor to account for quartz sleeve fouling over time. While this accounts for quartz sleeve fouling in the design of the system, this approach assumes the quartz sleeve never exceeds a level of fouling that would reduce the UV dose delivery by 20 percent at any time. Such an approach is fine as long as the UV transmission through the quartz sleeve is not reduced by more than 20 percent. Unfortunately in actual operation, unless the quartz sleeve fouling rate has been established, one does not know when the limits of this fouling factor have been exceeded.

What the NWRI/AWWARF guidelines do not establish is the frequency with which the quartz sleeves should be cleaned to remove any scale or film that has been deposited on the sleeve. This is not a deficiency of the guidelines, but a reflection of inexact science and incomplete understanding of the nature of quartz sleeve fouling.

Problem

The problem that has resulted is that some water recycling plants may be using the presence of coliform organisms in the treated effluent as an indicator to determine when the quartz sleeves should be cleaned. In our opinion this is problematic. The recycled water coliform limit for filtered secondary effluent was established at a time when chlorination was used almost exclusively to provide disinfection. This limit along with requirements for total chlorine residual and contact time was established to ensure effective inactivation of viral pathogens. UV radiation, while very effective at inactivating coliform bacteria, is a much less effective viricide than chlorine. Therefore, the quantity of UV needed to meet the coliform discharge limits of less than 2.2/100mL is significantly less than the minimum dose delivery to inactivate viruses, as required in the NWRI/AWWARF UV Disinfection Guidelines.

The guidelines call for a minimum UV dose delivery requirement of 100 mJ/cm^2 for standard media filtered secondary effluents. Typical coliform concentrations in media filtered secondary effluents run about 10^4-10^6 MPN/100mL. The minimum UV delivered dose needed to achieve a 4 to 6 log reduction of coliforms is about 10-20 mJ/cm^2. Since 4 to 6 logs of inactivation should reduce the coliforms to nondetectable levels, this means that if coliforms are being detected the dose delivery in the system is probably around 10-20 mJ/cm^2 which is 5 to 10 times below the minimum dose delivery

recommended by the UV guidelines as the minimum needed for an effective disinfection barrier.

Recommended Requirements

Based on the preceding discussion we are recommending the following requirements be established by the RWQCBs:

Include a provision in permits for water recycling treatment plants employing UV disinfection that requires the water recycling plant operator to establish quartz sleeve cleaning frequencies that ensure the minimum required UV dose delivery is consistently met.

Include a provision in water-recycling permits that requires water recycling plant operators use a fixed cleaning frequency to define the quartz sleeve cleaning intervals, and not use the presence of coliform organisms in the treated effluent as a factor to determine cleaning intervals. Because the water quality parameters for establishing fouling rates are not known and because of the site-to-site variability in wastewater quality, the Department further recommends that such cleaning frequencies be established on a site-specific basis.

Include a provision in water-recycling permits that specifies the minimum delivered UV dose that must be maintained (as recommended by the NWRI/AWWARF UV Disinfection Guidelines), in addition to the coliform standard.

If you have any questions concerning this matter, please contact Dr. Rick Sakaji with this Department at (510) 849-5050.

C\Treatment Technologies\Recycled Water Technology Listing 09-08

APPENDIX B

WASTE MANAGEMENT

REPORT

PHASE I ENVIRONMENTAL SITE ASSESSMENT

MARSH LANDING GENERATING STATION
WATER AND GAS SUPPLY LINEARS
MIRANT MARSH LANDING, LLC
CONTRA COSTA COUNTY, CALIFORNIA

Prepared for

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URS Project No. 28067344

February 2009

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CERTIFICATION OF RESULTS

This report has been prepared for the exclusive use of Mirant Marsh Landing, LLC (Mirant), its affiliates, lenders, and insurers. URS Corporation (URS) acknowledges that Mirant, its affiliates, lenders, and insurers, may rely on this report in connection with financing, insuring, and acquiring the proposed alignments. Photocopying of this document, in part or in whole, by parties other than those designated by Mirant, or use of this document for purposes other than it is intended, is prohibited. Anyone relying upon this report is subject to the same limitations and conditions as the Client and this report. In addition, this report is time dependent, and use or reliance upon said report after 180 days from the date of the report is limited to the circumstances described in ASTM 1527 Standard Practice for Environmental Site Assessments.

Respectfully submitted this 11th day of February 2009.

URS Corporation

Erik Skov P.G., C.H.G.
Senior Geologist

Marianne Gibbons, REA
Senior Environmental Scientist

EXECUTIVE SUMMARY

URS conducted a site reconnaissance and document review as part of a Phase I Environmental Site Assessment (ESA) for the proposed water linear and gas linear alignments for the proposed Marsh Landing Generating Station (MLGS) located in unincorporated Contra Costa County, California. URS has performed this Phase I ESA in conformance with the scope and limitations of American Society for Testing and Materials (ASTM) Practice E 1527. The Phase I ESA was accomplished by, and limited to, review of an existing Phase I ESA document, a site reconnaissance, limited review of hydrogeological literature, review of historical information for the proposed alignments, a review of federal, state, and local agency lists, and contact with governmental agencies.

Any exceptions to, or deletions from, this practice are described in Sections 1.2 and 1.3 of this report. The assessment was conducted by URS in response to authorization by Mirant California, LLC. The report was prepared by the following:

Erik Skov: Senior Geologist
Phone: (415) 243-3845
Fax: (415) 882-9261

Marianne Gibbons: Senior Environmental Scientist
Phone: (415) 243-3724
Fax: (415) 652-3233

Mr. Skov has over 20 years of experience conducting Phase I ESA and Phase II site investigation and remedial activities, and has prepared many Phase I ESAs throughout the state of California. A copy of Mr. Skov's resume is presented in Appendix A of this report.

Ms. Gibbons has over 6 years of experience conducting Phase I ESA and Phase II site investigation and remedial activities, and has prepared Phase I ESAs throughout the state of California. A copy of Ms. Gibbons' resume is presented in Appendix A of this report.

The focus of the Phase I ESA was to identify Recognized Environmental Conditions (RECs) that may exist along the linear alignments associated with construction of the MLGS. This includes areas where chemicals were processed, stored, and handled. The format and content of this Phase I ESA is in accordance with the ASTM Standard Practice for Environmental Site Assessments: Phase I Site Assessment Process E-1527, which defines RECs as "the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property." A brief summary of URS' findings regarding potential environmental concerns along the proposed alignments is presented below.

Figure 1 shows the general location of the project. Figure 2 shows the linear alignments in relation to the proposed MLGS site. The water linear will consist of two 10-inch water pipelines that run between MLGS and a proposed water treatment plant that will be constructed at the Delta Diablo Sanitation District's Bridgehead Lift Station (DDSD BLS). One line will supply treated water to MLGS and the other will discharge process waste and sanitary wastewater back to DDSD BLS. The total length of the water linear is approximately 4,800 feet long, of which approximately 1,000 feet is within the proposed MLGS project site boundary. This portion of the water linear was covered in the Phase I ESA for the MLGS project prepared by URS in 2008. The remaining portion of the water linear is comprised of three different sections, the Contra Costa Power Plant (CCPP) section that runs through a portion of the existing CCPP property, the Wilbur Corridor that traverses Wilbur Avenue and the DDSD BLS section that will be located on the BLS. For the purposes of this report, the water linear is referred to as the CCPP section, the Wilbur Avenue Corridor (Wilbur Corridor) section, and the DDSD BLS section. The DDSD BLS section also includes the footprint of the proposed wastewater treatment facility.

The underground gas linear will run east from the MLGS gas compressor enclosure through the CCPP site to an existing gas transmission line (Line 400) adjacent and east of the Pacific Gas and Electric (PG&E) Gateway Generating Station (GGS). The total length of the gas linear is approximately 2,100 feet. Approximately one third of the pipeline length is located within the MLGS property, one third within the CCPP property, and one third within CCPP's existing easement through PG&E's GGS property. For the purposes of this report, the gas linear alignment will be referred to as the gas linear. This Phase I ESA focuses on the approximately 1,400 feet of gas linear between the MLGS site boundary and the connection to Line 400. The remaining 700 feet of the gas linear within the MLGS property was covered in the 2008 URS Phase I prepared for the MLGS project.

Based on the results of the Phase I ESA and communication with on-site management, the following RECs have been identified along the proposed alignments:

- The CCPP section of the proposed water linear alignment runs adjacent to above-ground storage tanks (ASTs) within the southwestern portion of the CCPP property. Previous investigation work has indicated the presence of a small area on the southern portion of the CCPP section, along an access road adjacent to ASTs, that was identified as having remedial issues associated with petroleum hydrocarbon contamination in groundwater.

OTHER SOURCES OF POTENTIAL IMPACT

With the exception of the RECs identified in the previous Phase I ESA (URS, 2008) for the proposed MLGS (Section 5.0), URS did not identify any other RECs associated with the Wilbur

Corridor or DDSD BLS sections of the water linear alignment. Three areas of groundwater contamination were identified adjacent to or in the vicinity of the gas linear on the CCPP site.

RECOMMENDATIONS

URS recommends soil sampling be conducted along the CCPP section of the proposed water linear alignment in areas along the access road. This soil sampling will be performed with the site investigation activities associated with the construction of the MLGS. Additionally, areas identified previously as potentially having remedial issues within the CCPP section of the proposed water linear alignment should be appropriately remediated, if required, prior to construction of this section of the water linear.

1.0 INTRODUCTION

This report summarizes the results of a Phase I Environmental Site Assessment (ESA) for the proposed water linear and gas linear alignments associated with the construction of the Marsh Landing Generating Station (MLGS) in unincorporated Contra Costa County, California. For the purposes of this report, the water linear is comprised of three sections referred to as the Contra Costa Power Plant (CCPP) section, Wilbur Avenue Corridor (Wilbur Corridor) section, and the Delta Diablo Sanitation District Bridgehead Lift Station (DDSD BLS section). For the purposes of this report, the gas linear will be referred to as gas linear.

1.1 PURPOSE AND SCOPE OF WORK

The purpose of the Phase I ESA was to identify Recognized Environmental Conditions (RECs) that may exist along the proposed linear alignments. This includes areas where there could have been a release to the subsurface that has not been identified. The American Society for Testing and Materials (ASTM) guidance document *ASTM Standards on Environmental Site Assessments for Commercial Real Estate*, Designation E 1527, defines RECs as "the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property." The extent of research to identify RECs is limited by the scope of services discussed below.

The scope of services for this ESA is in general conformance with the ASTM Standard Practice for a Phase I ESA (ASTM E 1527), and included the following elements:

- Review of pertinent, readily available documents and maps regarding local geologic and hydrogeologic conditions.
- Review and interpretation of selected historical aerial photographs of the proposed alignments and vicinity for selected years back to the property's first developed use or 1940, whichever is earlier, provided by Environmental Data Resources, Inc. (EDR) of Milford, Connecticut.
- Review and interpretation of available archival topographic maps, aerial photographs, and historical land use maps (e.g., Sanborn Fire Insurance maps) for the proposed alignments and vicinity provided by EDR. These were reviewed for information regarding historical land use at the proposed alignments that could have involved the manufacture, generation, use, storage and/or disposal of petroleum products or hazardous materials/wastes.

- Review of available documents regarding past and/or current property development provided by Mirant, or which reside in URS' San Francisco office library.

- A reconnaissance survey of the proposed linear alignments and surrounding areas to make visual observations of existing conditions and activities along the proposed linear alignments and in the vicinity. The reconnaissance of the proposed linear alignments was focused on the major areas where potentially hazardous substances are stored and processed, as well as power plant operation locations.

- Interviews with the owner, property manager, or other personnel identified as being knowledgeable of past tenants and environmental practices involving petroleum products and hazardous materials/wastes along the proposed linear alignments.

- Review of county, state, and U.S. Environmental Protection Agency (U.S. EPA) lists of known or potential hazardous waste sites or landfills, and sites currently under investigation for environmental violations located in the vicinity of the proposed linear alignments within the search radius specified in ASTM E 1527, including:

  - U.S. EPA National Priorities (Federal Superfund) List (NPL) (1 mile)
  - U.S. EPA Delisted NPL List (½-mile radius)
  - U.S. EPA Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) and CERCLIS No Further Remedial Action Planned (NFRAP) Lists (1/2-mile radius)
  - U.S. EPA Emergency Response Notification System (ERNS) List (property)
  - U.S. EPA Resource Conservation and Recovery Act (RCRA) List (property and adjoining)
  - U.S. EPA RCRA Corrective Action (CORRACTS) Treatment, Storage, and Disposal (TSD) Facilities List (1-mile radius)
  - U.S. EPA Inventory of Open Dumps (1/2-mile radius) (U.S. EPA 1985)
  - U.S. EPA Institutional and Engineering Controls databases (property and adjoining)
  - U.S. EPA Brownfields Sites
  - U.S. EPA Listing of Tribal Underground Storage Tanks (UST) Sites
  - U.S. EPA Listing of Tribal Leaking Underground Storage Tank (LUST) Sites
  - Applicable local and state agency lists.

- Telephone inquiries to applicable municipal, county, and state regulatory agencies for information regarding environmental permits, environmental violations or incidents, and/or status of enforcement actions along the proposed linear alignments.

- Preparation of this report for the proposed linear alignments describing the research performed, and presenting URS' findings, conclusions, and professional opinions regarding the potential for environmental contamination. Our report includes the following, as appropriate:

  – Geologic and Hydrogeologic Setting
  – Site-Specific Reconnaissance Observations
  – Current and Historical Land Use
  – Agency List Document Review
  – Results of Limited Visual Asbestos Survey
  – Reported or Suspected Hazardous Materials
  – Site-Specific Findings and Recommendations
  – References
  – Site Locations and Site Plan Maps
  – Supporting Documentation.

1.2 SPECIAL TERMS AND CONDITIONS

This assessment was performed in accordance with the ASTM Standard Practice for Environmental Site Assessments, E 1527. There were no exceptions or deletions to the ASTM Standard Practice for Environmental Site Assessments, E 1527.

1.3 LIMITATIONS AND EXCEPTIONS OF ENVIRONMENTAL SITE ASSESSMENT

URS has prepared this ESA in accordance with the contract scope of work, using reasonable efforts to attempt to identify areas of potential liability associated with RECs along the proposed linear alignments. URS' services in the development of this report were conducted, within the limits prescribed by the Agreement, in a manner consistent with that level of care and skill ordinarily exercised by members of the same professions currently practicing in the same locality under similar conditions, and no other guaranty, warranty, or representation, either express or implied, is included or intended herein. Unless limited sampling or physical testing of materials was expressly provided for in the scope of work, the conclusions in this report were based solely on a visual review of the proposed linear alignments, and on readily available records, interviews, and other secondary sources. URS has made no independent investigation of the accuracy of these secondary sources, and has assumed them to be accurate and complete. URS

does not warrant the accuracy or completeness of information provided by secondary sources. URS does not warrant that contamination that may exist within the proposed linear alignment has been discovered, that the proposed alignment areas are suitable for any particular purpose, or that the proposed alignments are clean or free of liability. Any cost estimates are based on general comparisons with past projects of similar scope and size, and actual cost or design-phase estimates may vary substantially from these estimates.

This report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings of this assessment. Opinions and recommendations presented in this report apply to proposed linear alignments' conditions and features, as they existed at the time of the site reconnaissance, and those reasonably foreseeable. They cannot necessarily apply to conditions and features of which URS is unaware and has not had an opportunity to evaluate.

2.0 SITE DESCRIPTION

Please refer to Figure 2 – Site Plan, and Appendix B – Site Photographs, for further information regarding the proposed linear alignments and adjoining properties.

2.1 LOCATION

The CCPP section of the water linear is located within the existing CCPP site. The Contra Costa County Assessor's Office indicates the CCPP has been assigned County Assessor's Parcel Number (APN) 051-031-014. CCPP is located on Section 16, Township 2 North, Range 2 East, on the U.S. Geological Survey (USGS) Antioch North Topographic Quadrangle Map.

The Wilbur Corridor section of the water linear carries multiple APNs, and is located within the City of Antioch, Contra Costa County.

The DDSD BLS section of the water linear is located within the northern portion of an existing 3.4-acre facility on Bridgehead Road in the City of Antioch, Contra Costa County. The Contra Costa County Assessor's Office indicates the DDSD BLS site has been assigned APN 051-051-023 and APN 051-051-024.

The proposed gas linear is located within the CCPP property and the Pacific Gas and Electric Company (PG&E) Gateway Generating Station (GGS). The GGS is located at 3225 Wilbur Avenue. The Contra Costa County Assessor's Office indicates the GGS site has been assigned APN 051-031-015.

2.2 SITE AND VICINITY CHARACTERISTICS

Mr. Erik Skov (URS) and Ms. Marianne Gibbons (URS) conducted a reconnaissance of the proposed linear alignments and vicinity on January 13, 2009. Mr. Chuck Hicklin, Project Manager for Mirant, accompanied Ms. Gibbons and Mr. Skov during the site reconnaissance of portions of the linear alignments located on the CCPP site. Mr. Tim Roa of DDSD provided access to the BLS but did not accompany URS during the site reconnaissance.

The proposed MLGS project is located within the current CCPP property on Wilbur Avenue within unincorporated Contra Costa County, California, adjacent to the City of Antioch. The proposed 27-acre MLGS site is situated on the southern side of the San Joaquin River, and is bounded by the CCPP to the east; the PG&E Switchyard and CCPP to the south; vacant, formerly industrial development property to the west; and the retired CCPP Units 1, 2, 3, and 4, the operating water treatment system for power plant Units 6 and 7, and the Units 1 through 5 discharge channel to the north. The CCPP section of the proposed water linear runs from the MLGS site along of the access road in the western portion of the existing CCPP (Figure 2). This section of the proposed linear alignment is approximately 1,200 feet long.

The Wilbur Corridor section of the proposed water linear is situated south of the CCPP and runs west-to-east along Wilbur Avenue to just west of Bridgehead Road and the Bridgehead Lift Station (Figure 2). The corridor is bound by PG&E property and several addresses of industrial, commercial, and residential nature to the north and south. This section of the proposed linear alignment is approximately 3,600 feet long.

The DDSD BLS section of the proposed water linear is bounded by Bridgehead Road to the east, Wilbur Avenue to the north, Highway 160 to the west, as well as a small piece of undeveloped land and railroad tracks to the south. For the proposed MLGS project, DDSD will construct a new satellite treatment facility within the northern portion of the DDSD BLS property (on approximately 1.7 acres of the 3.4-acre property). As part of previous DDSD construction activities, this portion of the property has been rough graded. On the southern portion of the DDSD BLS property there are several facilities associated with the lift station, including a large emergency wastewater storage tank, that were constructed by DDSD in 2008.

The proposed gas linear is located within the existing CCPP property and an existing CCPP easement across the GGS property. The adjacent areas to the gas linear are industrial and commercial. The gas linear is approximately 1,400 feet long between the proposed MLGS property boundary and the connection to the gas transmission line.

2.3 DESCRIPTIONS OF STRUCTURES, ROADS, OTHER IMPROVEMENTS ON THE PROPOSED LINEAR ALIGNMENTS

The CCPP section of the water linear consists of approximately 1,200 feet of unpaved road. This section of the water linear is located entirely within the CCPP property adjacent to existing aboveground storage tanks that were used to store Number 6 fuel oil.

The Wilbur Corridor section consists of approximately 3,600 feet of paved roadway. The areas to the north and south of the Wilbur Corridor section are improved with multiple industrial, commercial, and minor structures. Additionally, there are likely several underground utilities such as water, sewer etc., located beneath the Wilbur Corridor.

DDSD BLS is an existing facility. The southern portion of the DDSD BLS is improved with an Emergency Wastewater Storage Tank, two Pump Stations, an Odor Control Soil Bed, and a Transmission Tower. The northern portion of the DDSD BLS site, where the proposed wastewater treatment facility will be located, is disturbed and unvegetated and has no above-ground structures. There are likely underground conveyance lines associated with the BLS located beneath the surface of the DDSD BLS section.

The gas linear runs along previously graded, disturbed, or paved areas of the CCPP and GGS properties.

2.3.1 Potable Water Supply

There are no potable water users located within the proposed linear alignments. The City of Antioch supplies potable water to the surrounding area. The water supply line is believed to run along or under Wilbur Avenue.

2.3.2 Heating/Cooling Systems

There are no heating/cooling systems located within the proposed linear alignments.

2.3.3 Sanitary Waste Disposal

There is no sanitary waste disposal located within the proposed linear alignments.

2.4 CURRENT USES OF THE PROPOSED ALIGNMENTS

The CCPP section of the proposed water linear is currently an access road for the CCPP and is located entirely within the CCPP property.

The Wilbur Corridor section of the proposed water linear is along Wilbur Avenue (a Contra Costa County Road). The land use along the Wilbur Corridor area is primarily industrial and commercial. Monterey Mechanical Company, a commercial light-industrial property is located at 3665 Wilbur Avenue. CEMEX, a cement company, consisting of parking and storage areas, is located at 3600 Wilbur Avenue. Multiple Marina structures used for boating activities in the San Joaquin River are located to the north of the Wilbur Corridor. Kie-Con, a concrete facility, is located at 3551 Wilbur Avenue. GWF Power Systems, a power facility, is located at 3400 Wilbur Avenue.

The DDSD BLS section of the proposed water linear is a previously graded and disturbed portion of the DDSD BLS property. The southern portion of the property is improved with a lift station for sanitary sewage.

The proposed gas linear alignment is currently a paved area with some dirt shoulder areas running through the CCPP property and the existing CCPP easement through the GGS property.

2.5 PAST USES OF THE PROPOSED ALIGNMENTS

Based on a review of historical information, the CCPP section of the proposed water linear and the proposed gas linear were developed as a power plant in 1952-1953. Prior to 1952, these areas were undeveloped.

Based on review of historical information for the Wilbur Corridor, the areas were developed in the 1950s.

Based on review of historical information provided by EDR, DDSD BLS was not developed until approximately 1993.

2.6 CURRENT AND PAST USES OF ADJOINING PROPERTIES

The area surrounding the proposed alignments is currently and has historically been used mainly for industrial, light industrial, commercial, and residential purposes.

2.7 PHYSICAL SETTING

The proposed alignments are situated at an approximate elevation of 10 feet above mean sea level (msl). According to information contained in the EDR database report, a portion of the adjacent properties near the San Joaquin River are located within the 100-year flood zone. Mapped wetlands indicated on the National Wetlands Inventory Maps are located on a portion of the PG&E property adjacent to the CCPP site. The topographic gradient is to the northeast, towards the San Joaquin River.

2.7.1 Geology

The proposed alignments are located in the San Joaquin River delta within the Coast Range physiographic province. Fill material and deltaic deposits are located in the areas of the proposed alignments. Although fill material, which is approximately up to 6 feet thick and consists mainly of silty sand from nearby sources, is located throughout the proposed alignment areas, a majority of the fill material is located at the northeastern portion of the proposed alignments. Beneath the silty sand is an approximately 125- to 140-foot-thick aquifer comprised of fine to coarse-grained sand with lenses of clay, silt, and peat, which can range from 1 to 15 feet thick. The layer beneath this aquifer is called the Montezuma Formation, which is an approximately 1,200-foot thick layer of clay, sand, and gravel mixture.

2.7.2 Hydrogeology

The aquifer beneath the proposed alignments is composed of fine to coarse-grained sands and thin layers of clay silt and peat. The thin layers become thicker as they approach the northeastern portion of the proposed alignments and the San Joaquin River. The thin layers are less permeable, thereby causing perched water conditions in some areas.

The depth to groundwater ranges from 6 to 10 feet below ground surface (bgs). In some areas along the alignments the depths fluctuate with tidal influences from San Francisco Bay that affect water levels in the San Joaquin River, as well as from seasonal forces. The direction of groundwater flow is north-northwest towards the San Joaquin River.

3.0 RECORDS REVIEW

URS has reviewed federal, state, and local database records for the proposed alignment areas and surrounding properties. These records provide information on whether hazardous substances, wastes or petroleum products have been improperly handled, stored, or disposed of on, or adjacent to, the proposed linear alignments.

3.1 FEDERAL AND STATE REGULATORY AGENCY RECORDS REVIEW

The federal and state records review was accomplished through a computer database search of facilities, which appear on a series of government lists. The database search for the proposed alignments and surrounding properties was performed for URS by EDR. A copy of the regulatory agency database report, dated January 14, 2009, is included in Appendix C.

Through the database review, URS can identify and locate facilities based on information submitted to government environmental agencies. In some cases, the location information is misleading or incorrect. URS conducted a windshield survey of an area approximately 1/8 mile in radius around the proposed alignments to identify and locate facilities, such as industrial and commercial operations which are suspected of using significant quantities of hazardous substances, wastes, or petroleum products. In this way, URS is better able to establish the risk posed to the proposed alignments by surrounding properties. For the purposes of this Phase I ESA, only facilities that have been identified as release sites within 1/8 mile of the proposed alignments are discussed in this analysis. A summary of properties identified through the review is provided in Table 4-1. Definitions for the acronyms and abbreviations listed below are contained in Appendix C of this report.

The CCPP section is located on the CCPP. The CCPP is located at 3201 Wilbur Avenue and is listed on several databases including: CERCLIS NFRAP, RCRA SQG, RCRA – TSDF, RAATS, RCRA CORRACTS, RCRA non-CORRACTS TSD, AST, CA WDS, and Contra Costa County Site List. There are several historical violations listed for the CCPP site.

The Wilbur Corridor has a number of sites that appear on several databases including: HAZNET, FINDS, CA WDS, Contra Costa County Site List, AST, RCRIS-TSD, RCRIS-LQG, CERC-NFRAP, CORRACTS, RAATS, and EMI.

The DDSD BLS does not appear in any of the databases searched. There are two LUST sites and a SLIC site within 1/8 mile of the DDSD BLS. One LUST site at 3215 East 18th (the Peckham Property) in Antioch was closed by the lead agency in January of 1997. This site had a very low potential for affecting the soil or groundwater beneath the DDSD BLS. Another LUST site within 1/8 mile of the DDSD is at 6000 Bridgehead Road (DuPont Antioch Works), and is currently an open remediation case. However, because this site is downgradient from the DDSD BLS and a few hundred feet away, there is a low probability that this site has affected the soil

Table 4-1
Summary of Federal and State Regulatory Agency Records Review

Federal or State List	Does Site Appear on List	Surrounding Area Search Radius *	Number of Sites Within Search Radius
The CERCLIS-No Further Remedial Action Planned (NFRAP) database identifies sites that have been removed from CERCLIS after an initial investigation because no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration	No	Site and adjacent properties	2
Resource Conservation and Recovery Act (RCRA) Corrective Action Plan (CORRACTS) RCRA TSD facilities ordered to implement corrective actions	No	1.0 mile	2
Resource Conservation and Recovery Information System – Treatment, Storage or Disposal Facilities (RCRIS-TSD)	No	0.5 mile	2
RCRA Registered Large and Small Quantity Generators of Hazardous Waste (LQG/SQG)	No	Site and adjacent properties	3
Emergency Response Notification System (ERNS)	No	Site only	2
Tracks administrative cases and pesticide enforcement actions and compliance with FIFRA (FTTS and HIST FTTS)	No	0.25 mile	0
Facility index system/facility registry system contains both facility information and pointers to other sources of information (FINDS)	No	0.25 mile	1
RAATS	No	0.25 mile	0
State Water Board database of sites suspected of containing hazardous substances where cleanup has not been completed (Toxic Pits)	No	1.25 mile	2
Sites that have been issued waste discharge requirements (CA WDS)	No	0.25 mile	1
Waste Management Unit Database provided by the State Water Resources Control Board (SWRCB) that tracks and inventories waste management units (WMUDS/SWAT)	No	0.75 mile	1
Hazardous Wastes & Substances Sites List (Cortese)	No	0.75 mile	3
Leaking Storage Tanks (LUST)	No	0.75 mile	4
California Spills, Leaks, Investigation and Cleanup Cost Recovery Listing (CA SLIC)	No	0.75 mile	3
State underground storage tank sites listing (UST)	No	0.5 mile	1
Sites with registered aboveground storage tanks (AST)	No	0.5 mile	2
Contra Costa County Site List	No	0.5 mile	13
California Hazardous Materials Incident Report System (CHMIRS)	No	Site only	2
State Voluntary Investigation and Cleanup Program list (VCP)	No	0.75 mile	0
Tracks hazardous waste manifests from facilities (HAZNET)	No	0.25 mile	2
Emission Inventory Index (EMI)	No	0.25 mile	0
DTSC database identifies sites that have known contamination or sites for which there may be reasons to investigate further (Envirostor)	No	1.25 mile	6

* indicates the distance measured from the proposed alignments that was included in the database record search

and/or groundwater beneath the DDSD BLS site. There is one open SLIC case site at the PG&E Natural Gas Distribution Terminal located at 5900 Bridgehead Road, Oakley, California. The distribution terminal is upgradient of the DDSD BLS site. A release of condensate from a AST located at the facility contaminated soil and groundwater. A removal action was completed to remove source material from the soil. Three groundwater monitoring wells were installed at the facility. When monitored in March 2008 the downgradient well (MW-1) contained a concentration of Total Petroleum Hydrocarbons (TPH) as diesel (TPH-d) of 110 µg/L (parts per billion). No TPH or other related constituents were detected in the soil samples analyzed from the boring for MW-1. Based on the data generated to date, there is no indication that groundwater contamination at the PG&E site has affected groundwater beneath the DDSD BLS.

The gas linear alignment does not appear in any of the database searches. However, it is adjacent to the CCPP (see above) and the PG&E GGS. The PG&E GGS is located at 3225 Wilbur Avenue and appears in three of the databases searched, including: RCRA-SQG, FINDS, and the Contra Costa County Site List. No violations have been found to date for this address.

Unmapped Sites

Unmapped sites are sites that have been identified within the database report but not mapped because of inadequate or erroneous Geocode information. The EDR database report identified 25 unmapped sites. Of these, three are associated with the CCPP property, and named PG&E or Contra Costa; however, one of the PG&E orphan sites is actually a Southern California site. Twenty-two of the referenced sites are located in the City of Antioch; however, not enough information was provided to give the exact location. The sites that could not be located are provided in the EDR report in Appendix C.

3.2 LOCAL REGULATORY AGENCY REVIEW

During the performance of an ESA, federal, state, and local regulatory agencies having jurisdiction over the proposed alignments are contacted to obtain the following information: the status of relevant environmental permits; whether there have been any notices of violations or other similar correspondence from such agencies; whether any corrective action or remediation is planned, is taking place, or has been completed at the proposed alignments; whether there have been any reported violations or complaints that the proposed alignments are not in compliance with environmental laws, regulations, or standards and whether the proposed alignments are under investigation for such noncompliance; whether the proposed alignments are listed on available regulatory databases; and whether there is other pertinent documentation on file with such regulatory agencies regarding the proposed alignments or surrounding properties of concern. Regulatory agencies contacted and a summary of the information obtained from these agencies are provided below.

- **U.S. EPA Region IX** was contacted on January 26, 2009 regarding files for the proposed alignments. To date, no response has been received from the U.S. EPA.

- **Cal-EPA Department of Toxic Substances Control (DTSC)** was contacted on January 20, 2009 regarding files for the proposed alignments. A phone call from the DTSC contact confirmed that they cannot look up files that only have assessor's parcel numbers. As of January 28, 2009, there has been no response from the DTSC regarding the site at 3225 or 3201 Wilbur Avenue. Files for the 3201 Wilbur Avenue site were reviewed as part of the previous Phase I ESA for the MLGS.

- **Regional Water Quality Control Board-Central Valley Region (RWQCB)** files for the CCPP were reviewed as part of the URS Phase I ESA for the MLGS. The RWQCB did not respond indicating that they have files for the proposed alignments.

- **State Regional Water Quality Control Board Geotracker** database was searched on January 27, 2009 regarding public records for the proposed alignments. No documentation for the proposed alignment was located on Geotracker.

- **Contra Costa County Hazardous Materials Program** was contacted January 20, 2009 regarding a request to search public records for the proposed alignments. As of January 28, 2009, there has been no response from the county Hazardous Materials Program.

- **Contra Costa County Fire Protection District** was contacted January 26, 2009 regarding a request to search the public records for the proposed alignments. The Fire Protection District indicated they do not have any records available for review.

- **Contra Costa County Environmental Health** was contacted regarding a file review for 3223 Wilbur Avenue, APN 051-051-023 and APN 051-051-024 for the proposed alignments. To date, no response has been received.

- **Bay Area Air Quality Management District (BAAQMD)** was contacted regarding a request to search the public records for discharge permits for the proposed linear alignments. The district indicated that they could not access data that have no address. They did have one file on record for 3225 Wilbur Avenue, discussed below.

  One permit is on file with the BAAQMD involving a power boiler with a source type listed as fuel combustion, dated September 2008.

3.3 HISTORICAL USE INFORMATION

3.3.1 Aerial Photograph Review

Aerial photographs of the proposed linear alignments and vicinity provided by EDR were reviewed, and the results are discussed below. Copies of the aerial photographs are provided in Appendix C.

1939 The vicinity of the proposed alignments appears to be undeveloped land with orchards and some agricultural fields. To the south is a rail line. Wilbur Avenue appears to be present but not in its current status.

1952 The CCPP appears adjacent to the CCPP section of the proposed water linear alignment and to the north and south of the gas linear. Observed on the power plant site are five bulk ASTs, a switchyard, power generation units, a parking area, and what appear to be small office buildings located to the east of the ASTs and north of the power-generation units. The power-generation units appear to have several stacks. The Wilbur Avenue corridor has undeveloped fields and orchards, while the DDSD BLS site is completely undeveloped. The southern portion of the CCPP site appears to be undeveloped. Further south, there appears to be farmland and some undeveloped areas.

To the north are the San Joaquin River and a pier extending out into the River from the power-generation units. East of the proposed alignments is undeveloped land. Northeast of the proposed alignments, there appears to be a marina and undeveloped land. West of the proposed alignments, there appears to be an industrial facility. More orchards appear to the southwest.

1958 The CCPP appears to be completed. The vicinity of the proposed alignments appears unchanged.

1965 Only the southeastern portion of the CCPP, a small section of Wilbur Avenue, and an area to the south along the rail line are visible on this aerial photograph. Another section has been added to the switchyard. The land to the south appears to be an orchard.

1971 The vicinity of the proposed gas linear alignments appears to have a square pond located south of the power generation unit. It is assumed that this is the former Boiler Chemical Cleaning Wash Pond. The remainder of the vicinity appears relatively unchanged from the 1965 aerial photo.

1984 Three larger ASTs and one small AST appear at the CCPP to the south and southeast of the original ASTs. An area to the south of the switchyard appears to be under construction. The property to the west of the CCPP facility appears to have several new developments, including several ASTs, ponds, storage areas, and buildings. An AST appears to the south of the adjacent property to the west, across Wilbur Avenue. The area approximately 1/3 mile to the south and southwest appears to be developed with residences. A highway appears to the southeast and east. Commercial developments and areas that appear to be under construction are observed to the east. The DDSD BLS site area appears to be graded but still undeveloped.

1993 No significant changes are observed in the vicinity of the proposed alignments. There appears to be two or three buildings or trailers on the southern end of the DDSD BLS site. The surrounding vicinity appears to have some further development, including additional residences to the southeast.

1998 No significant changes are observed in the vicinity of the proposed alignments.

2005 No significant changes are observed along the majority of the proposed linear alignment corridor; however, there appears to be some new construction under way at the CCPP. The DDSD BLS still appears to be mostly undeveloped.

No additional information was revealed during review of the aerial photos provided by EDR.

3.3.2 Historical Sanborn Map Review

URS contracted with EDR to conduct a search of Sanborn Fire Insurance Rate Maps for coverage, including the proposed alignments. Sanborn Fire Insurance Rate Maps were not available for the proposed alignments.

3.3.3 Historical Topographic Maps

Topographic maps for the proposed alignments and the surrounding area provided by EDR were reviewed, and are provided in Appendix C. A summary of the historical topographic maps is presented below for the years 1908, 1918, 1953, 1968, and 1978.

1908 With the exception of Wilbur Avenue, the proposed alignment areas appear undeveloped. The San Joaquin River is located to the north and north-northwest of the proposed alignments. What appears to be Wilbur Avenue and the Atchison, Topeka and Santa Fe Railway line appear to the south of the CCPP section. Two cemeteries appear further to the south. The DDSD BLS section is

undeveloped but appears to be used for agricultural purposes. The City of Antioch, located to the west of the proposed alignments, is developed.

1918 The vicinity of the proposed alignments appears relatively unchanged from the 1908 topographic map. However, the name Marsh Landing does appear to the east of the proposed alignments near the end of the unpaved/unfinished road.

1953 The CCPP is now developed with five ASTs bordered by large berms, a large structure northeast of the ASTs, several paved roads, several power lines that cross the Wilbur Avenue section of the proposed water alignment from the south. The Wilbur Avenue section is bordered to the south by agricultural land and to the north by the CCPP and more agricultural land. The area to the west of the CCPP section is undeveloped. There is what appears to be an access road located to the east of the CCPP section. The DDSD BLS section is agricultural land. The area to the west of the proposed alignments appears to be developed with three structures. Further west are a tower and a sand pit. Several small structures appear to the east of the CCPP. There are several small structures that appear to be residences to the southwest of the proposed alignments.

1968 New structures appear around the original structure at the CCPP. Several new structures appear on the adjacent property to the west of the power plant. Two marinas appear to the east of the CCPP. Two piers are located at the northern boundary of the CCPP near the original structure. A drive-in theater appears to the southeast adjacent to a trailer park and surrounded by orchards. The alignment areas remain essentially unchanged for the 1953 photo.

1978 A new large structure appears to the east of the original power plant block. Three larger bulk ASTs appear to the south of the original five ASTs and to the adjacent west of the CCPP section of the water linear alignment. A smaller AST appears to the east of the three new ASTs. Additional ASTs and water tanks appear to the west of the CCPP on the adjacent property. Additional rail lines and rail spurs also appear to the west of the power plant. Two large structures appear to the south of the rail lines southwest of the proposed alignments. East Antioch has been developed, and there appears to be a residential area developed. Highway 160 has been developed, and runs between the drive-in theater and the trailer park. The DDSD BLS section no longer appears to be agricultural land but remains undeveloped. The vicinity of the proposed alignments has developed into a mixture of industrial, commercial, and residential areas. Much of the agricultural land uses that appeared in previous topographic maps have diminished in size.

3.3.4 History of Proposed Alignments Use

A review of aerial photographs, historical topographic maps, a previous Phase I ESA prepared for the proposed MLGS, and interviews with individuals knowledgeable with the proposed alignments indicate the area in the vicinity of the CCPP section of the proposed water linear alignment has been used as a power plant from approximately 1952 to the present. The Wilbur Corridor has been present as far back as 1908 and has had agricultural, commercial, and industrial uses developed to the north and south over the years. The DDSD BLS was used as agricultural land from at least 1953 until it appeared as undeveloped land in 1978.

4.0 SITE RECONNAISSANCE AND INTERVIEWS

4.1 INTERVIEWS

Mr. Erik Skov (URS) and Ms. Marianne Gibbons (URS) conducted a reconnaissance of the proposed alignments and surrounding area vicinity on January 13, 2009. Mr. Chuck Hicklin, Project Manager for Mirant, accompanied Mr. Skov and Ms. Gibbons during the site reconnaissance of the CCPP section of the water linear and the entire gas linear as was available to answer questions regarding this portion of the linears. As indicated previously, Mr. Tim Roa of the DDSD provided URS with access to the DDSD BLS section of the alignment but was not present during the site reconnaissance. Weather conditions at the time of the reconnaissance were clear skies, with no weather-induced limitations to URS' site reconnaissance.

4.2 HAZARDOUS SUBSTANCES AND WASTES IN CONNECTION WITH IDENTIFIED USES

4.2.1 Water Linear

CCPP Section

No hazardous substances or wastes were observed along the CCPP section of the proposed water linear alignment, which runs along an access road adjacent to large fuel oil ASTs.

Wilbur Corridor Section

URS did not observe any hazardous substances or wastes located along the Wilbur Corridor section of the water linear.

DDSD BLS Section

URS did not observe any hazardous substances or wastes along the DDSD BLS section of the water linear.

4.2.2 Gas Linear

URS did not observe any hazardous substances or wastes located along the gas linear alignment.

4.3 HAZARDOUS SUBSTANCE CONTAINERS AND UNIDENTIFIED SUBSTANCE CONTAINERS

4.3.1 Water Linear

CCPP Section

URS did not observe any hazardous or unidentified substance containers along the proposed CCPP section of the linear alignment.

Wilbur Corridor Section

URS did not observe any hazardous or unidentified substance containers located along the Wilbur Corridor section of the proposed water linear alignment.

DDSD BLS Section

URS did not observe any hazardous or unidentified substance contains along the DDSD BLS Section of the proposed water linear.

4.3.2 Gas Linear

URS did not observe any hazardous or unidentified substance containers located along the proposed gas linear alignment.

4.4 STORAGE TANKS

4.4.1 Underground Storage Tanks

Water Linear

CCPP Section

URS did not observe any evidence of underground storage tanks (USTs) along the CCPP section of the proposed water linear alignment.

Wilbur Corridor Section

URS did not observe evidence of USTs along the Wilbur Corridor section of the proposed water linear alignment.

DDSD BLS Section

URS did not observe evidence of USTs at the DDSD BLS section of the proposed water alignment.

Gas Linear

URS did not observe evidence of USTs along the proposed gas linear alignment.

4.4.2 Aboveground Storage Tanks

Water Linear

CCPP Section

The CCPP section of the proposed water linear runs from the MLGS boundary south to Wilbur Avenue. This section of the proposed alignment runs adjacent to fuel oil ASTs along an access

road in the southwestern portion of the CCPP property. During the site reconnaissance, no visible surface staining was observed along the CCPP section of the proposed water linear alignment.

Wilbur Corridor Section

URS did not observe ASTs along the Wilbur Corridor section of the proposed water linear alignment.

DDSD BLS Section

URS did not observe ASTs along the DDSD BLS section of the proposed water linear alignment. There are two diesel fuel ASTs located on the southern portion of the BLS.

Gas Linear

URS did not observe ASTs along the proposed gas linear alignment. There are three aqueous ammonia ASTs located on the CCPP south of the gas linear.

4.5 POLYCHLORINATED BIPHENYLS

4.5.1 Water Linear

CCPP Section

URS did not observe suspect PCB containing equipment along the CCPP section of the proposed water linear.

Wilbur Corridor Section

URS did not observe suspect PCB containing equipment along the Wilbur Corridor section of the proposed water linear alignment.

DDSD BLS Section

URS did not observe suspect PCB containing equipment at the DDSD BLS section of the proposed water linear alignment. Two wet transformers, one associated with the BLS and one at the Antioch pump house located near the northeastern potion of the DDSD BLS section, were observed during the site reconnaissance. However, based on the age of construction of the BLS (post 1984), it is unlikely the transformers contain PCBs.

4.5.2 Gas Linear

URS did not observe suspect PCB containing equipment along the gas linear alignment. There are several large transformers associated with the retired CCPP Units 1 through 5 located north of the gas linear alignment.

4.6 INDICATION OF SOLID WASTE DISPOSAL

4.6.1 Water Linear

CCPP Section

URS did not observe any evidence of solid waste disposal along the CCPP section of the proposed water linear alignment.

Wilbur Corridor Section

With the exception of some minor debris along the roadside, URS did not observe any evidence of solid waste disposal along the Wilbur Corridor section of the proposed water alignment.

DDSD BLS Section

URS did not observe any evidence of solid waste disposal along the DDSD BLS section of the proposed water linear alignment.

4.6.2 Gas Linear

URS did not observe any evidence of solid waste disposal along the gas linear alignment.

4.7 PROCESS MATERIALS AND WASTES

4.7.1 Water Linear

CCPP Section

Based on observations made during the site reconnaissance, there are no process materials or wastes generated along the CCPP section of the proposed water linear.

Wilbur Corridor Section

URS did not observe the generation of process materials or wastes along the Wilbur Corridor section of the proposed water linear alignment.

DDSD BLS Section

URS did not observe the generation of process materials or wastes at the DDSD BLS section of the proposed water linear alignment.

4.7.2 Gas Linear

URS did not observe the generation of process materials or wastes along the gas linear alignment.

4.8 SITE WASTE CONTAINMENT OR DEPOSITS

4.8.1 Water Linear

CCPP Section

URS observed no evidence of dumping or burying of solid or hazardous wastes along the CCPP section of the proposed water linear alignment.

Wilbur Corridor Section

URS observed no evidence of dumping or burying of solid or hazardous wastes along the Wilbur Corridor section of the proposed water linear alignment.

DDSD BLS Section

URS observed no evidence of dumping or burying of solid or hazardous wastes on the DDSD BLS Section of the proposed water linear alignment.

4.8.2 Gas Linear

URS observed no evidence of dumping or burying of solid or hazardous wastes along the gas linear alignment.

4.9 OTHER ENVIRONMENTAL CONSTRAINTS

4.9.1 Drains and Sumps

No drains or sumps were observed along the CCPP or Wilbur Corridor sections of the proposed alignment. A rock lined storm drain was observed at the DDSD BLS along the northeastern portion of the property.

4.10 EVIDENCE OF CESSPOOLS

4.10.1 Water Linear

CCPP Section

URS observed no evidence of cesspools along the CCPP section of the proposed water linear alignment

Wilbur Corridor Section

URS observed no evidence of cesspools along the Wilbur Corridor section of the proposed water linear alignment.

DDSD BLS Section

URS observed no evidence of cesspools at the DDSD BLS section of the proposed water linear alignment.

4.10.2 Gas Linear

URS observed no evidence of cesspools along the proposed gas linear alignment.

4.11 STRESSED VEGETATION AND STAINED SOILS

4.11.1 Water Linear

CCPP Section

URS observed no evidence of stained soil, stressed vegetation, or other indications of contamination along the CCPP section of the proposed water linear alignment during the reconnaissance.

Wilbur Corridor Section

URS observed no evidence of discolored soil, stressed vegetation, or other indications of contamination along the Wilbur Corridor section of the proposed water linear alignment during the site reconnaissance.

DDSD BLS Section

URS observed no evidence of discolored soil, stressed vegetation, or other indications of contamination at the DDSD BLS during the site reconnaissance.

4.11.2 Gas Linear

URS observed no evidence of discolored soil, stressed vegetation, or other indications of contamination along the gas linear alignment during the site reconnaissance.

4.12 WELLS

4.12.1 Water Linear

CCPP Section

URS did not observe any monitoring wells along the CCPP section of the proposed water linear alignment during the site reconnaissance.

Wilbur Corridor Section

URS did not observe any monitoring wells along the Wilbur Corridor section of the proposed water linear alignment. URS observed one monitoring well located at GWF Power Systems located at 3400 Wilbur Avenue. The observed monitoring well was located several hundred feet to the south of the Wilbur Corridor. No records associated with the monitoring well were identified at the time of issue of this report.

DDSD BLS Section

URS observed one monitoring well located at the southeastern entrance of the DDSD BLS. No records associated with the monitoring well were identified at the time of issue of this report.

4.12.2 Gas Linear

URS did not observe any monitoring wells along the gas linear alignment during the site reconnaissance. URS observed one monitoring well located north of the proposed gas linear alignment near the existing CCPP Units 6 and 7 stack. According to Mirant personnel, this monitoring well was used in a previous site investigation and is no longer active.

4.13 OIL AND GAS WELLS

4.13.1 Water Linear

CCPP Section

No oil or gas wells were observed in the vicinity of the CCPP section of the proposed water linear alignment during the site reconnaissance.

Wilbur Corridor Section

No oil or gas wells were observed along Wilbur Corridor section of the proposed water linear alignment during the site reconnaissance.

DDSD BLS Section

No oil or gas wells were observed at the DDSD BLS during the site reconnaissance.

4.13.2 Gas Linear

No oil or gas wells were observed along the gas linear alignment during the site reconnaissance.

4.14 POTENTIAL WETLANDS ISSUES

According to the information provided by EDR, obtained from the United States Fish and Wildlife Service, National Wetland Inventory Map, there are no wetlands present along the water and gas linear alignments.

4.14.1 Flood Zone

According to the information provided by EDR, the proposed alignments are not located within a mapped flood zone. Areas north of the proposed alignments, located adjacent to the San Joaquin River, are located within the 100-year flood zone.

4.15 RADON

URS reviewed the Area Radon Information for Contra Costa County, California provided by EDR. According to the information presented in the EDR report, the U.S. EPA Radon Zone for this zip code in Contra Costa County is 2 (i.e., indoor air average >= 2 picoCuries per liter (pCi/L) and <=4 pCi/L of air).

5.0 PREVIOUS REPORTS

As part of this Phase I ESA URS reviewed a previous Phase I ESA for the site, prepared by URS in 2008, to accompany the Application for Certification (AFC) for the proposed MLGS. The MLGS site will occupy approximately 27 acres of the existing CCPP property. A copy of the text and figures for the previous Phase I ESA is provided in Appendix D of this report.

A review of existing documentation for the URS 2008 Phase I ESA for the MLGS indicated there are several areas of the CCPP that may potentially require remediation. The areas in the vicinity or within the proposed water and gas linear alignments that may require remediation are shown on Figures 3 and 4. The nature of the identified areas that may require remedial activities is petroleum hydrocarbons in groundwater.

6.0 SUMMARY AND CONCLUSIONS

URS conducted a site reconnaissance and document review as part of a Phase I Environmental Site Assessment (ESA) for the proposed water linear and gas linear alignments associated with the construction of the Marsh Landing Generating Station. URS has performed this Phase I ESA in conformance with the scope and limitations of ASTM Practice E 1527. The Phase I ESA was accomplished by, and limited to, review of existing Phase I ESA and Phase II site investigation documents, a site reconnaissance, a limited review of hydrological literature, review of proposed alignment history, a review of federal, state, and local agency lists, and contact with governmental agencies.

Any exceptions to, or deletions from, this practice were described in Sections 1.2 and 1.3 of this report.

Based on the results of the Phase I ESA and communication with CCPP on-site management, the following RECs have been identified along the proposed alignments:

- The CCPP section of the proposed water linear alignment runs adjacent to ASTs within the southwestern portion of the CCPP property. Previous investigation work has indicated that a small area on the southern portion of the CCPP section, along an access road adjacent to ASTs, has remedial issues associated with petroleum hydrocarbon contamination in groundwater (Figure 3).

Other Sources of Potential Impact

With the exception of the RECs identified in the previous Phase I ESA (URS, 2008) for the proposed MLGS (Section 5.0), URS did not identify any other RECs associated with the Wilbur Corridor or DDSD BLS sections of the water linear alignment. Three areas of groundwater contamination were identified adjacent to or in the vicinity of the gas linear on the CCPP site.

7.0 RECOMMENDATIONS

URS recommends soil sampling be conducted along the CCPP section of the proposed water linear alignment, south of the proposed MLGS, in areas along the existing CCPP access road where there is no data to assess soil and groundwater quality. This sampling activity should be performed concurrently with the sampling activities associated with the MLGS site. Additionally, areas identified previously as potentially having remedial issues within the CCPP section of the proposed water linear alignment should be appropriately remediated, if required, prior to construction of this section of the water linear.

8.0 REFERENCES

American Society for Testing and Materials (ASTM) 2000, "Standard Practice for Environmental Site Assessments": Phase I Environmental Site Assessment Process," ASTM Designation E1527.

Environmental Data Resources Inc., (EDR) 2007. Aerial Photographs, Marsh Landing. Inquiry Number 2398575.5. January 14, 2009.

Environmental Data Resources Inc., (EDR) 2007. Historical Topographic Map Report. Inquiry Number 2398575.4. January 14, 2009.

Environmental Data Resources Inc., (EDR) 2007. The EDR Radius Map with GeoCheck, Inquiry Number 2398575.2s. January 14, 2009.

Roa, 2009. Personal Communication between Tim Roa of DDSD and Erik Skov of URS Corporation.

URS, 2008. *Phase I Environmental Site Assessment, Contra Costa Power Plant, Antioch, California.* May.

Figures

Source:
Topo USA 5.0, 2004; www.delorme.com

N

0 7
Scale in Miles

SITE VICINITY MAP

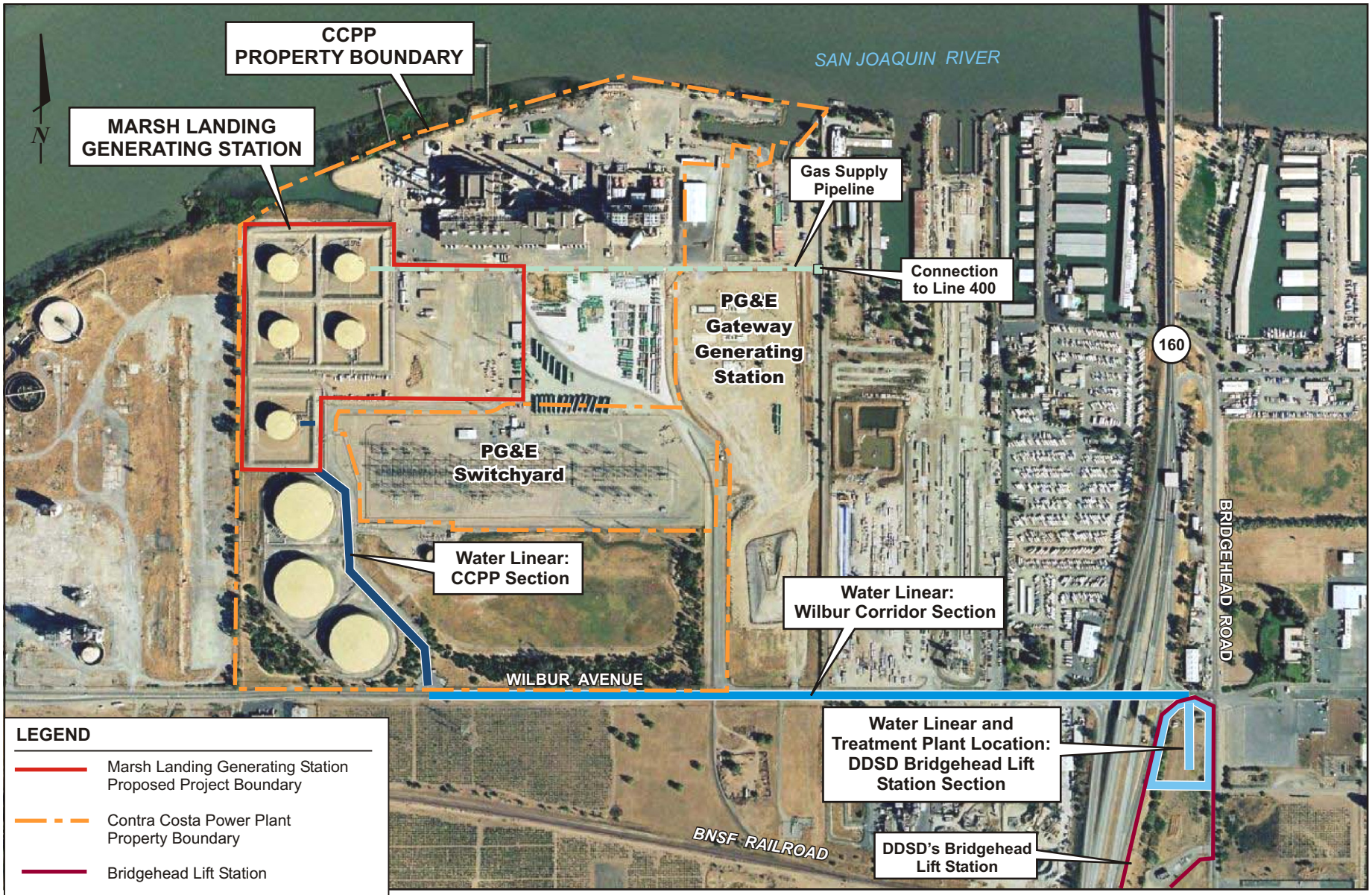
Phase I ESA
Marsh Landing Generating Station
Water and Gas Supply Linears
Mirant Marsh Landing, LLC
Contra Costa County, California

February 2009
28067344

URS

FIGURE 1

2/10/09 vsa ..T:\Mirant Contra Costa-Marsh Landing\Graphics\Phase 1 ESA_Feb09\Fig 1_svm.cdr



LEGEND

- Marsh Landing Generating Station Proposed Project Boundary
- Contra Costa Power Plant Property Boundary
- Bridgehead Lift Station
- Gas Supply Pipeline

Water Supply and Discharge Pipeline Linear

- CCPP Section
- Wilbur Corridor Section
- DDSD Bridgehead Lift Station Section

Source of Aerial:
Google Earth 2006

0 500 1000
Approximate Scale in Feet

SITE PLAN

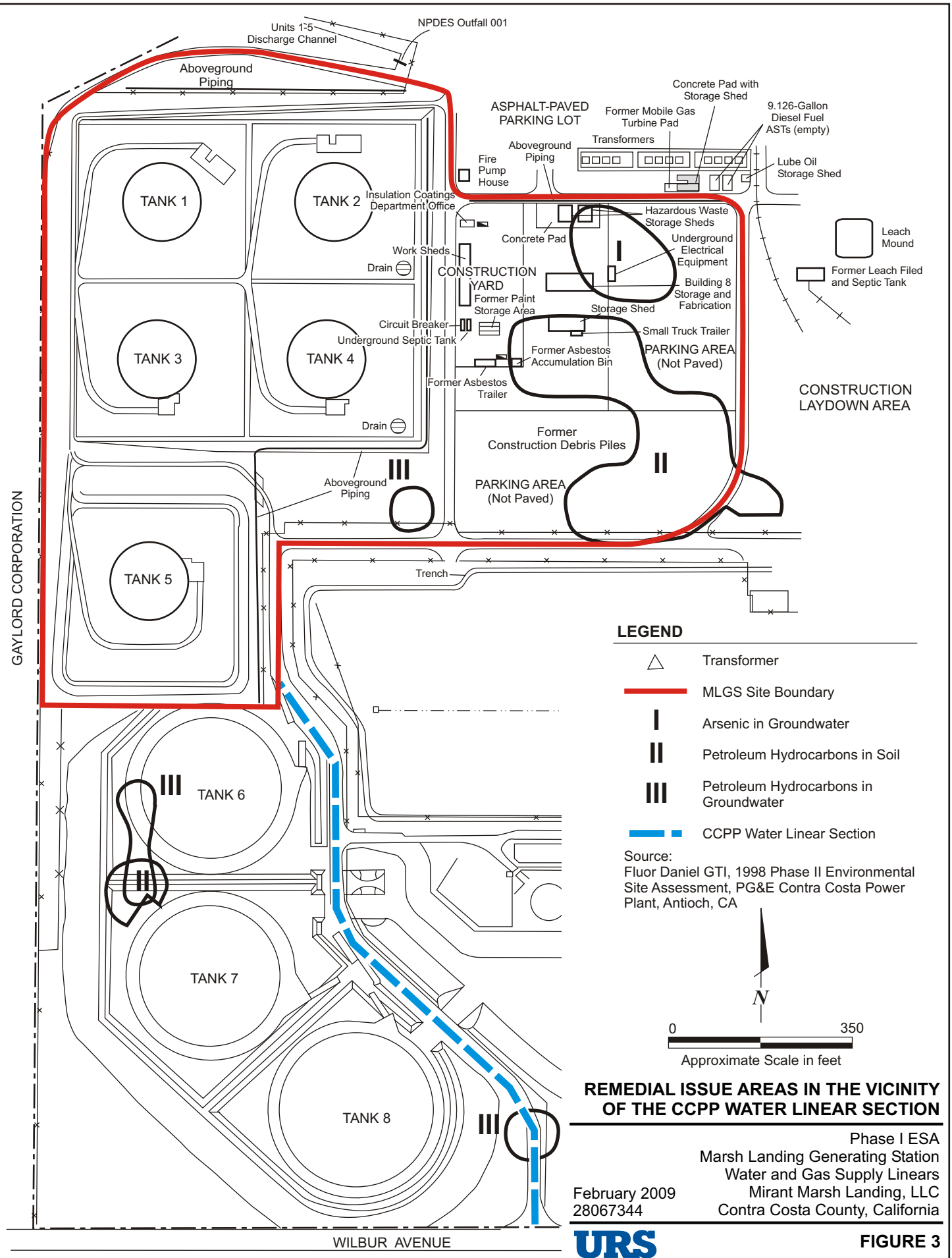
Phase I ESA
Marsh Landing Generating Station
Water and Gas Supply Linears
Mirant Marsh Landing, LLC
Contra Costa County, California

February 2009
28067344

URS

FIGURE 2

2/10/09 vsa ..T:\Mirant Contra Costa-Marsh Landing\Graphics\Phase 1 ESA_Feb 09\Fig 2_site plan.cdr



REMEDIAL ISSUE AREAS IN THE VICINITY OF THE CCPP WATER LINEAR SECTION

Phase I ESA
Marsh Landing Generating Station
Water and Gas Supply Linears
Mirant Marsh Landing, LLC
Contra Costa County, California

February 2009
28067344

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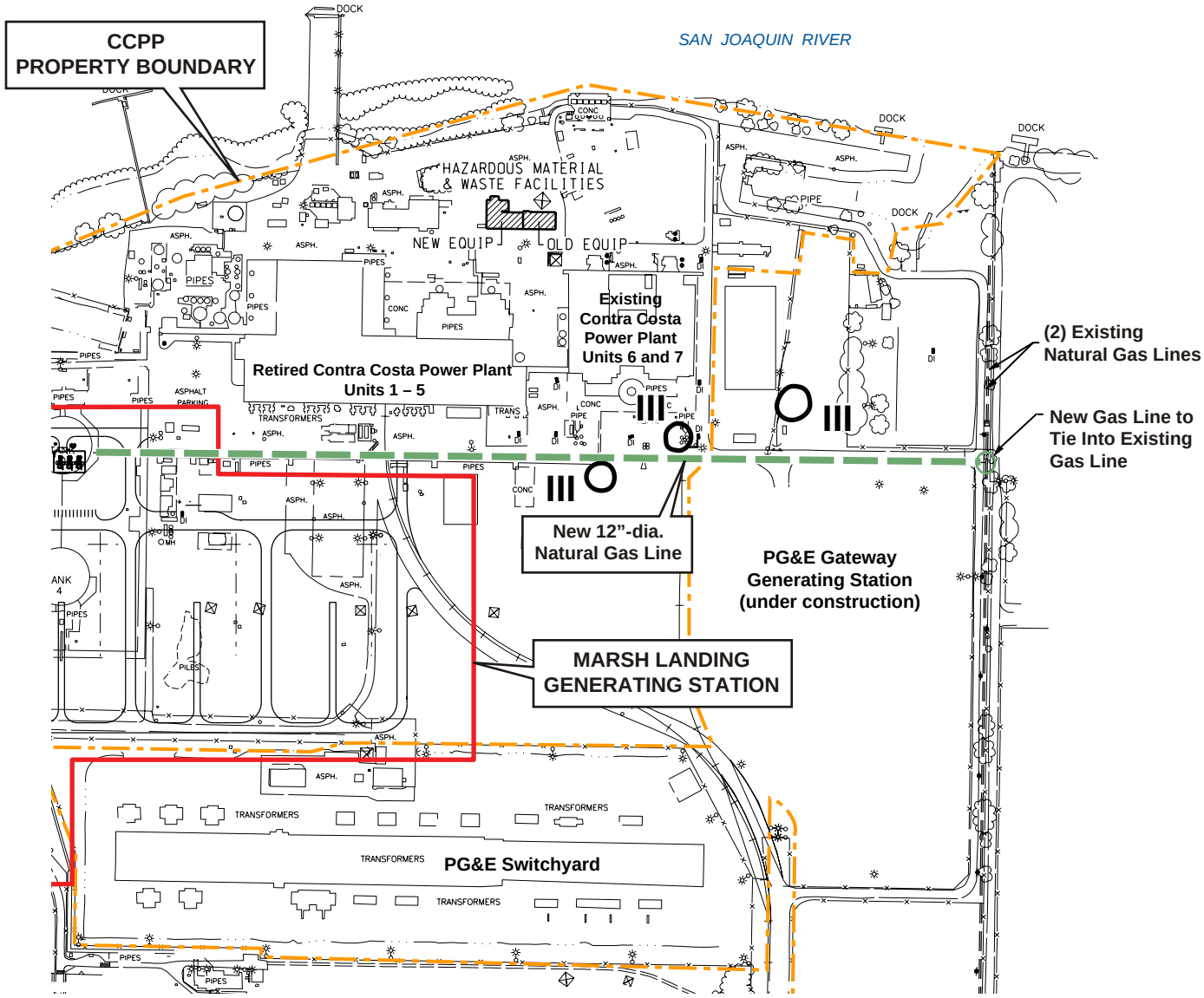
FIGURE 3

2/10/09 vs..T:\Mirant Contra Costa\Graphics\Phase 1 ESA_Feb 09\Fig 3_remedial_water lin.cdr



LEGEND

- MLGS Site Boundary
- III Petroleum Hydrocarbons in Groundwater
- Gas Linear Section

N

0 200 400 600

Scale in Feet
1" = 400'

REMEDIAL ISSUE AREAS IN THE VICINITY OF THE GAS LINEAR SECTION

Phase I ESA
Marsh Landing Generating Station
Water and Gas Supply Linears
Mirant Marsh Landing, LLC
Contra Costa County, California

February 2009
28067344

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FIGURE 4

Sources:

1. Fluor Daniel GTI, 1998 Phase II Environmental Site Assessment, PG&E Contra Costa Power Plant, Antioch, CA

2. CH2MHill Lockwood Greene; General Arrangement Marsh Landing Generating Station, Combined Cycle Siemens Flex 10s & Simple Cycle Layout; Drawing No: MR-GA-ML-01-10 (Rev. C, 04/18/08)

2/10/09 vsa ..\T:\Mirant Contra Costa-Marsh Landing\Graphics\Phase 1 ESA_Feb09\Fig 4_remedial_gas lin.ai

Appendix A

Résumés for Erik Skov and Marianne Gibbons

URS

Erik Skov, P.G. C.H.G.

Project Manager

Areas of Expertise

- Site Characterization and Remediation
- Remedial Investigation/Feasibility Studies
- RAP preparation
- Facility Closures
- Extensive subsurface soil/groundwater investigation experience
- Due Diligence/Environmental Auditing

Years of Experience

- With URS: 20 Years
- With Other Firms: 0 Years

Education

- B.A./Geology/1988/Humboldt State University

Registration/Certification

- California State Registered Geologist/#7470
- California State Certified Hydrogeologist/No. HG 892

Specialized Training

- 40-Hour Hazardous Waste Operations Training
- 8-Hour Annual Review
- 8-Hour Supervisors Training Course
- First Aid/CPR
- LPS Training

Overview

Mr. Skov has over 20 years of experience providing hazardous waste management services, including subsurface investigations involving extensive soil and groundwater sampling, monitoring well design and installation, aquifer testing, data interpretation, reporting, and remedial action plan preparation and implementation. He also participates in engineering geology studies, including siting investigations for hospitals, municipal landfills, and natural gas pipelines; and provides data input for slope stability investigations.

Project Specific Experience

Project Manager, Golden Eagle Refinery, Groundwater Investigation, [Martinez, California], Phillips Petroleum: Responsible for additional groundwater characterization activities and refinement of the hydrogeologic model associated with a major release of pure MTBE from an underground pipeline at the refinery, as well as the O&M of the groundwater extraction and treatment system associated with the release cleanup.

Task Manager, Sediment Sampling Program, Tosco Avon Refinery, Martinez, California, Joint Environmental Investigation and Remediation Committee: Sediment sampling program to support the Human Health and Ecological Risk Assessment (HHERA). Tasks included interfacing with the ecological risk assessor to identify sampling locations at appropriate areas based on initial environmental data, planning sampling activities and coordinating with the JEIRC Project Manager and refinery Area Operators to obtain entrance and work permits for certain areas of the refinery, and supervising and participating in the sampling effort under the oversight of the U.S. EPA.

Project Manager, Facility Closures, [Union City and Fremont, California], Crown Cork & Seal Company: Managed work for closure of two facilities — a two-piece beverage can manufacturing (wet operation) facility, and a sanitary food can (dry operation) facility. The wet operation used atomized petroleum and synthetic hydrocarbons for cooling and lubrication. Work included preparation of a Facility Closure Plan, including compilation of an operation history of the facility; decontamination of the building interior, decontamination and removal of excess equipment, and reuse or disposal of all hazardous materials and hazardous wastes at the site. Prepared a Post-Closure Report. Subsequent to facility closure, a groundwater investigation was conducted to delineate the extent of a chlorinated hydrocarbon plume and a field scale pilot study was conducted to assess the potential for enhanced bio-degradation using a hydrogen release compound. Routine groundwater monitoring has been ongoing at the facility since 2000.

A Facility Closure Plan was prepared for the dry operation, which was similar to the other facility, but also included abatement of asbestos from drying ovens. Prepared a Post Closure Report for the removal of the ovens, equipment, and hazardous waste and materials. The data from the facility closure investigation was used to conduct an impact assessment and prepare a RAP, which included the excavation of soil impacted with petroleum hydrocarbons and chlorinated solvents from a leaking underground storage tank. Routine groundwater monitoring has been ongoing at the facility since 2001.

Analyst, Superfund Sites Remedial Investigations, [California], Cal-EPA Department of Toxic Substances Control: Conducted remedial investigations for several Superfund sites in California. Work included extensive soil and groundwater sampling, monitoring well installation, aquifer testing, data reduction and interpretation, and report preparation.

Project Manager/Technical Lead, Pharmaceutical Manufacturing Plant Remedial Action Plan, [Sydney, Australia], International Division of Merck: Project involved the excavation and bioremediation of 10,000 m^3 of soil contaminated with dichlorobenzene at a manufacturing plant in Sydney, Australia. Also designed and constructed a groundwater extraction sump and conducted a field scale pilot test of a granular activated carbon remediation system. Responsibilities included overseeing field activities, QA/QC of field validation sampling and laboratory analytical results, managing and updating budgets and schedules, monthly cost tracking, data review and interpretation, client contact, and interaction with New South Wales Environment Protection Authority and local Council.

Technical Lead, Port Costa Refinery, [Port Costa, California]: Compiled historical data from several different sources and reviewed existing data at an abandoned bulk terminal facility to assess current site conditions and plan additional characterization work to develop an exit strategy. The former Port Costa oil storage and shipping terminal included aboveground storage tanks, a wharf, a railcar loading rack and a drainage pond. Petroleum hydrocarbons were observed issuing into the Carquinez Strait from a stormwater culvert, prompting the U.S. EPA to issue a Unilateral Order.

U.S. Technical Lead working with URS Paris office to conduct a site characterization at a former Chevron Chemical Company agricultural chemical plant located in Port de Bouc, France. Responsibilities included interfacing with a multi disciplinary project team to develop a scope of work to address the requirements of newly promulgated French regulations. Also responsible for developing the Quality Assurance Project Plan (QAPP) for the initial phase of the project.

Task Manager and Lead Geologist, [Pascagoula, Mississippi], Chevron Pascagoula Refinery: Prepared an update of the geologic site model for inclusion in the RFI for the refinery. Data from all previous site investigations and current RFI investigations were combined to develop the updated geologic site model.

URS

Erik Skov

Project Manager, Automobile Manufacturing Plant Site Remediation, [Sydney, Australia], Ford Motor Company: Responsible for oversight of field excavation and remediation activities on a site in Australia containing soils contaminated with hydrocarbons. Performed QA/QC of excavation, soil remediation, validation sampling, and laboratory results. Reviewed and interpreted data., monitored project costs and interfaced with regulatory agencies in New South Wales.

Project Manager/Technical Lead, Site Characterization, [Site Characterization], ICI Paints: Managed site characterization of a former paint manufacturing facility. Prepared an investigation work plan for regulatory agency approval, formulated a remedial strategy, and developed site mitigation plan. Subsequent to approval of the site mitigation plan, developed a detailed design for construction of a clean fill cap and issued bid package to potential construction contractors.

Task Leader, Colusa Power Plant Project AFC and Permitting, [Colusa County, California], Mirant Corporation: Managed the data collection and presentation for the Waste Handling section of an AFC for a 500 MW gas-fired combined-cycle generation facility in Colusa County, California. Responsibilities included identifying and quantifying potential waste streams associated with the construction and operation of the power plant, determining the applicable Laws, Ordnances, Regulations, and Standards (LORS) governing waste generated at the facility, and evaluating the potential impacts and mitigation measures to be implemented during construction and management activities.

Task Leader, San Gabriel Generating Station Power Plant Project Application for Certification and Permitting, Mirant Corporation. Lead the data collection and preparation of the Waste Handling section of an Application for Certification, a CEQA compliant document, for a nominal 850 MW gas-fired combined-cycle generation facility in San Bernardino County. Responsibilities included identifying and quantifying potential waste streams associated with the construction and operation of the power plant, determining the applicable Laws, Ordnances, Regulations, and Standards governing waste generated at the facility, and evaluating the potential impacts and mitigation measures to be implemented during construction and management activities.

Technical Support, Potrero Power Plant AFCs and Permitting, [San Francisco, California], Mirant Corporation: Provided technical support in the areas of waste management, hazardous materials generation and handling, site investigation, and compliance with local regulatory standards for a 540 MW natural-gas-fired combined-cycle plant located in San Francisco.

Task Leader, Proposed Bridgeview Power Plant Project AFC and Permitting, [Contra Costa County, California], TransCanada: Managed the data collection and presentation for the Waste Handling section of an AFC for a combined-cycle generation facility in Contra Costa County, California. Responsibilities included identifying and quantifying potential waste streams associated with the construction and

operation of the power plant, determining the applicable Laws, Ordnances, Regulations, and Standards (LORS) governing waste generated at the facility, and evaluating the potential impacts and mitigation measures to be implemented during construction and management activities.

Project Manager and Field Coordinator, Stanford Linear Accelerator (SLAC), [Stanford, California], Stanford Land Management Company: Managed and participated in the data review and collection of information relating to radiological and non-radiological contamination present at the SLAC facility in Palo Alto, California. The objective of the work was to conduct a detailed review of available data, combined with our experience on similar projects, to develop as detailed order of magnitude cost estimates for the dismantling and demolition of the SLAC facility after facility closure. The cost estimates included providing costs for a reconnaissance level survey, a characterization level survey, and dismantling and demolition costs given a number of different scenarios from the results of the characterization level survey.

Project Manager/Task Leader, Richmond Parkway Project, [Richmond, California], Bechtel: Responsible for technical work to address environmental issues along the Parkway alignment. Developed the scope for environmental sampling, generated schedules and budgets, tracked monthly project costs, managed project staff and equipment, reviewed and interpreted data, prepared reports, and interacted with regulatory agencies.

Project Manager, General Environmental Services Contract, [Bay Area, California], BART: Responsible for various aspects of work under the general contract. Reviewed documents, prepared Work Directive Proposals, and managed soil and groundwater investigations of properties along and adjacent to BART's expansion lines.

Team Member and Technical Lead, EIS, [Sydney, Australia], U.S./ Australian Energy Consortium: A project team preparing an Environmental Impact Statement (EIS) for the construction of a gas-fired cogeneration plant on a hazardous waste site in Botany, New South Wales. Responsible for the evaluation and preparation of the geology, hydrogeology, and environmental construction management and mitigation section of the EIS. Issues included the impact of the power plant construction on the distribution of subsurface contamination and the mitigation measures to be implemented to address the impacts. Subsequent to the submission of the EIS, presented with a panel of other experts at a Commission of Inquiry called by the Minister for Urban Development, in support of the Development Application for the construction of the cogeneration plant.

Project Manager, Site Remediation Monitoring, [Santa Rosa, California], Optical Coating Laboratory Incorporated: Ongoing remediation and quarterly monitoring. OCLI manufactured thin film coatings for glass surfaces for the high tech industry. The process used chlorinated solvents in the cleaning process prior to the application of the

thin film. Waste solvent was released from the site and contaminated several groundwater bearing units beneath the site. Interim remedial measures, including the design and installation of a groundwater extraction system and stacked column air stripper were undertaken. Routine liaison and reporting to the North Coast Regional Water Quality Control Board was required throughout the project.

Project Manager, Greyhound Bus Depot Investigation, [Santa Rosa, California], Greyhoun0d: Project Manager and lead investigator for an alleged release of diesel fuel and gasoline from the former Greyhound Bus Depot in downtown Santa Rosa. The project involved close interaction with the North Coast Regional Water Quality Control Board as it involved multiple release sites in close proximity to one another that were impacting the storm drain along B Street.

Field Technical Coordinator, Site Investigation, Palo Alto, California, Hewlett-Packard: Tasks included coordinating field activities for five concurrent source-specific investigations. Work included extensive cone penetration testing, in situ groundwater sampling, soil vapor survey, soil sampling, groundwater sampling, geophysical logging, monitoring well installation, and aquifer testing. Contributing author of Remedial Investigation Report.

Project Manager, Site Investigation, [Palo Alto], Hewlett-Packard: Managed a source-specific investigation as part of a large RI/FS. Responsibilities included design and implementation of field investigation activities, quarterly budget and schedule generation, monthly cost tracking, personnel and equipment management, stratigraphic and chemical data review and interpretation. Contributing author of Remedial Investigation Report.

Project Manager, Sydney Harbor Casino Environmental Surveillance Project, [Sydney, Australia], Leighton Construction Management: Managed environmental surveillance of a former coal-fired power station. Coordinated onsite environmental surveillance and monitoring activities. Developed recommendations for waste handling and disposal to minimize potential impacts on the project schedule. Prepared reports detailing results of monitoring and surveillance activities. Participated in monthly environmental management meetings with contractors and regulatory agencies.

Project Manager and Technical Lead, [New South Wales, Australia], North Power: Site investigations and continued groundwater monitoring and investigations for two former coal fired power stations located in northern New South Wales.

Project Manager for a soil and groundwater investigation to characterize contamination associated with a major copper smelting operation in Port Kembla, NSW. Responsible for development of the technical approach and implementation of the subsurface investigation to delineate the extent of a copper sulphate plume in groundwater beneath the site.

Erik Skov

Audit Team Member [New South Wales, Australia]: Conducted due diligence audits for the coal and coke industry. Have participated in audits for three coal mines and two cokeries. Responsible for evaluating and identifying soil and groundwater contamination issues related to the operation of the facilities and the associated potential liabilities associated with acquisition or divestment of the operations.

Project Manager for site remediation of hydrocarbon-contaminated soil at a former automobile manufacturing plant in Sydney. Responsible for oversight of field excavation and remediation activities, QA/QC of excavation and soil remediation validation sampling and laboratory results, data review and interpretation, cost tracking, and client contact and interaction with New South Wales regulatory agencies.

Field Task Manager for conducting a Remedial Investigation for metals contamination at a conduit-plating facility in Pittsburgh, California. Work included extensive soils and surface water sampling, field coordination of biota investigation and air sampling, data analysis and interpretation, and report preparation.

Field Manager for the Implementation of a Remedial Action Plan for mitigating an extensive subsurface release of diesel fuel at a lumber remanufacturing facility in Stockton, California. Tasks included excavation oversight, perimeter safety monitoring, bioremediation cell construction and pre-screening of excavated soil using Thin Layer Chromatography techniques to determine diesel fuel concentrations.

Geology and Engineering Geology

Senior Geologist, George's River Pipeline Project, [Sydney, Australia], Australian Gas and Light Company: Conducted a geologic investigation for the siting and installation of a natural gas pipeline beneath the George's River in Sydney, New South Wales. The study was conducted to determine if any of the structural features present in the rock formation would inhibit the use of directional drilling techniques.

Assisted in the geologic investigation of a proposed hospital site in Northern California. Work included test pit logging and subsurface interpretation.

Assisted in fault study for a proposed landfill site in Northern California. Work included trench siting and logging.

Assisted in slope stability investigation on a large fill area for a resort on the island of Guam. Work included the installation of slope inclinometers, standpipes and pneumatic piezometers under adverse working conditions.

Conducted design review of engineering recommendations for residences damaged or destroyed by the October 1989 Loma Prieta Earthquake. This FEMA funded oversight program was administered by the Santa Cruz County Earthquake Recovery Division.

URS

Erik Skov

Publications

G.W. Nyland, M.G. Hayter and E. Skov, "Contamination Investigations in Western Sydney – Examples of the Need to Look a Little Deeper," Collected Case Studies in Engineering Geology, Hydrogeology and Environmental Geology, Third Series. Geological Society of Australia, Environmental, Engineering and Hydrogeology Specialist Group (EEHSG).

Contributing Author, Feature Article – Construction of the Sydney Harbor Casino, Australian Construction & Engineering Review, 1st Quarterly Publication, 1998.

CONTACT INFORMATION

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URS

Marianne K. Gibbons, REA I

Senior Scientist

Areas of Expertise

Superfund Investigations
Remedial Investigations
Preliminary Assessments
Brownfield Redevelopment
CERCLA EE/CA
Due Diligence
Water Quality
QA/QC
Procurement
Emergency Response

Years of Experience

6 Years

Education

B.S./Environmental Science/ University of San Francisco

Certification/Training

ICS level 200
40-hour OSHA HAZWOPER, Refreshed annually.
OSHA Site Supervisor
Confined Space Entry- Supervisor and Rescue Training
Fundamentals of Groundwater Movement and Groundwater Sampling
Nielson Environmental Field School, April 2002
NITON Radiation Safety & Monitoring, Measurement Technology, and Machine Maintenance of the NITON XRF Spectrum Analyzer
AHERA Asbestos Supervisor Training
AHERA Asbestos Building Contractor/Inspector Training
Adult Cardio Pulmonary Resuscitation (CPR)
Standard First Aid Training

Overview

Ms.Gibbons is a senior scientist with over 6 years of experience in the environmental consulting industry. Project experience includes managing and performing Phase I Environmental Site Assessments (ESAs), Brownfield site assessments, Phase II subsurface investigations utilizing direct-push, hollow-stem, and solid-stem augers, surface soil sampling, surface water sampling and analysis, groundwater contouring, groundwater purging and sampling, monitoring well installation, abandonment, development and sampling, and technical report writing, including development of site-specific Health and Safety Plans (HASPs), and sampling analysis plans (SAPs). Ms. Gibbons has performed stockpile soil sampling for waste profiling and removal; underground storage tank (UST) removals, and other tasks associated with construction observation and large-scale remediation projects.

Project Specific Experience

Project Manager, Brownfields Investigation, United States Environmental Protection Agency, Jackson, CA. Conducted a Brownfields assessment of a former gold mine in Jackson, California. Project tasks included use of GPS equipment for locating soil sample locations, hand auger soil sample collection, and proper chain-of custody documentation. This TBA was conducted in response to a federal grant awarded to the City of Jackson for redevelopment. The TBA was performed at the site to assess potential sources of contamination at the site, and to ultimately determine the concentration and extent of contaminants of potential concern (COPCs) in the proposed public use area. Additionally, the geophysical assessment was performed to establish if buried debris and subsurface voids that could create a safety hazard are present in the proposed public use area.

Project Manager, Pinoleville Pomo Nation, U.S. Environmental Protection Agency, Ukiah, California. Ms. Gibbons conducted a Targeted Brownfields Assessment (TBA) at the Pinoleville Pomo Nation Site under the U.S. EPA Brownfields program. The Pinoleville Pomo Nation is currently used as an administrative, educational, and storage facility for the Pinoleville Pomo Nation. This TBA included a geophysical survey, soil sampling, groundwater sampling, and preparation of this TBA report, which evaluates whether contaminants of concern exist at the site.

URS conducted a combined Phase I ESA and Phase II ESA Targeted Brownfields Assessment (TBA) on the two parcels located at 500 Pinoleville Drive in Ukiah, Mendocino County, California. This TBA was performed in response to a Brownfields Grant Application submitted by the Pinoleville Pomo Nation.

URS

Marianne K. Gibbons

Phase I and Phase II ESAs
Conducted over seventy Phase I ESAs for property transfers and numerous Phase II ESAs. These projects included historical research into property use and adjacent properties, identification of past or present hazardous chemical use or storage, review of regulatory agency files, and preparation of reports summarizing findings following ASTM Standards. Implemented sampling plans based on site history for soil sampling investigations, interpreted analytical results, and provided recommendations for further action. The TBA was performed at the site to assess potential sources of contamination at the site, and to ultimately determine the concentration and extent of contaminants of potential concern (COPCs) in the proposed public use area. Additionally, the geophysical assessment was performed to establish if buried debris and subsurface voids that could create a safety hazard are present in the proposed public use area.

Groundwater Monitoring

Performed and coordinated tasks associated with several groundwater monitoring programs including those for the Presidio Trust, City of San Mateo, and several corporations in the San Francisco Bay Area. Project work included creation of health and safety plans, field sampling (levels D, C & B) for a variety of constituents (including metals, VOCs and petroleum constituents), coordination of purge water disposal, laboratory coordination, review of laboratory data, groundwater contouring, and report preparation.

Oversaw the abandonment of multiple groundwater monitoring wells at sites throughout the San Francisco Bay Area including both monitoring and extraction wells. Project work involved obtaining permits, coordinating with local oversight agencies, and abandonment of wells by over-drilling using a hollow stem auger or by pressure grouting.

Team 9 Superfund Technical Assistance and Response Team Emergency Response Services, U.S. Environmental Protection Agency. Services entail a broad range of emergency response, planning, and technical support activities under a Superfund Technical Assistance and Response Team (START) as-needed contract.

Secondary Responder, Superfund Technical Assistance and Response Team Emergency Response Services, U.S. Environmental Protection Agency. Responded to emergencies including mercury spills, natural disasters and spills. Responsibilities during emergency responses included project management and oversight; preparation of sampling plans for air, water, product, biota, and soil; conducting air monitoring in hazardous environments with a variety of monitoring equipment; sampling various media; preparing response-specific health and safety plans; and providing technical assistance to the U.S. Environmental Protection Agency's On Scene Coordinators. Response activities were performed in Level D, C, and B personal.

Appendix B

Site Photographs

URS

PHOTOGRAPHIC LOG

Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
1

Direction Photo Taken:

Northeast

Description:

Contra Costa Power Plant. View of out of service Units 1 through 5 and associated block transformers.

Photo No.
2

Direction Photo Taken:

East

Description:

View to the east along the proposed gas linear alignment Contra Costa Power Plant is on left and Gateway Generating Station is on right.

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
3

Direction Photo Taken:

West

Description:

View to the west along gas linear alignment.

Photo No.
4

Direction Photo Taken:

South

Description:

View of PG&E Switchyard.

URS	PHOTOGRAPHIC LOG

Mirant Marsh Landing, LLC	Phase I Environmental Site Assessment Marsh Landing Generating Station Water and Gas Supply Linears Contra Costa County, CA	URS Job No. 28067344 **Date:** 1/13/09

Photo No. **5**

Direction Photo Taken:

Down

Description:

Units 6 and 7 ammonia and potable water supply lines.

Photo No. **6**

Direction Photo Taken:

South

Description:

Aqueous ammonia aboveground storage tanks for CCPP Units 6 & 7 and GGS.

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
7

Direction Photo Taken

Down

Description:

Monitoring well located on CCPP near stack for Units 6 and 7 north of the gas linear alignment.

Photo No.
8

Direction Photo Taken:

East

Description:

PG&E low pressure gas lines near eastern end of gas linear alignment.

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
9

Direction Photo Taken:

East

Description:

Signage for the eastern entrance to the PG&E Gateway Generating Station

Photo No.
10

Direction Photo Taken:

South

Description:

Northeastern boundary of the Gateway Generating Station. PG&E high pressure gas line (Line 400) runs along eastern side of generating station.

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
11

Direction Photo Taken:

West

Description:

View of gas linear alignment from eastern boundary looking west.

Photo No.
12

Direction Photo Taken:

Northwest

Description:

Tank Farm located at proposed location of the MLGS.

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
13

Direction Photo Taken:

NA

Description:

Former soil boring located in roadway adjacent to ASTs along southern portion of the CCPP section of the water linear.

Photo No.
14

Direction Photo Taken:

West

Description:

West entrance to CCPP on Wilbur Avenue. Location of intersection of CCPP section and Wilbur Corridor of water linear alignment.

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
15

Direction Photo Taken:

South

Description:

PG&E-owned land located south of Wilbur Avenue. Currently used as vineyard.

Photo No.
16

Direction Photo Taken:

East

Description:

View to the east of the Wilbur Corridor section taken from the west end of the corridor.

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
17

Direction Photo Taken:

North

Description:

View of the proposed water treatment plant area looking north from Bridgehead Lift Station.

Photo No.
18

Direction Photo Taken:

North

Description:

Looking north along the eastern boundary of the Bridgehead Lift Station

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
19

Direction Photo Taken:

South

Description:

2,000 gallon diesel fuel aboveground storage tank located at Bridgehead Lift Station.

Photo No.
20

Direction Photo Taken:

Northeast

Description:

Odor Control Soil Bed at Bridgehead Lift Station facing Bridgehead Road

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
21

Direction Photo Taken:

South

Description:

Pump Station and adjacent undeveloped property to the south of Bridgehead Lift Station.

Photo No.
22

Direction Photo Taken:

Southeast

Description:

500 gallon diesel fuel aboveground storage tank located at the Bridgehead Lift Station.

URS		PHOTOGRAPHIC LOG
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
23

Direction Photo Taken:

Northwest

Description:

Emergency Wastewater Storage Tank, Bridgehead Lift Station

Photo No.
24

Direction Photo Taken:

South

Description:

Southern view along Bridgehead Road from Bridgehead Lift Station

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
25

Direction Photo Taken:

North

Description:

Northern view along Bridgehead Road from Bridgehead Lift Station

Photo No.
26

Direction Photo Taken
South

Description:

Stormwater collection drain along eastern side of Bridgehead Lift Station and proposed treatment facility area.

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
27

Direction Photo Taken:

North

Description:

Intersection of Wilbur Avenue and Bridgehead Road

Photo No.
28

Direction Photo Taken:

Down

Description:

Monitoring well located at the southeastern boundary of Bridgehead Lift Station adjacent to Bridgehead Road

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
29

Direction Photo Taken:

East

Description:

View of Bridgehead Road, facing east from Bridgehead Lift Station.

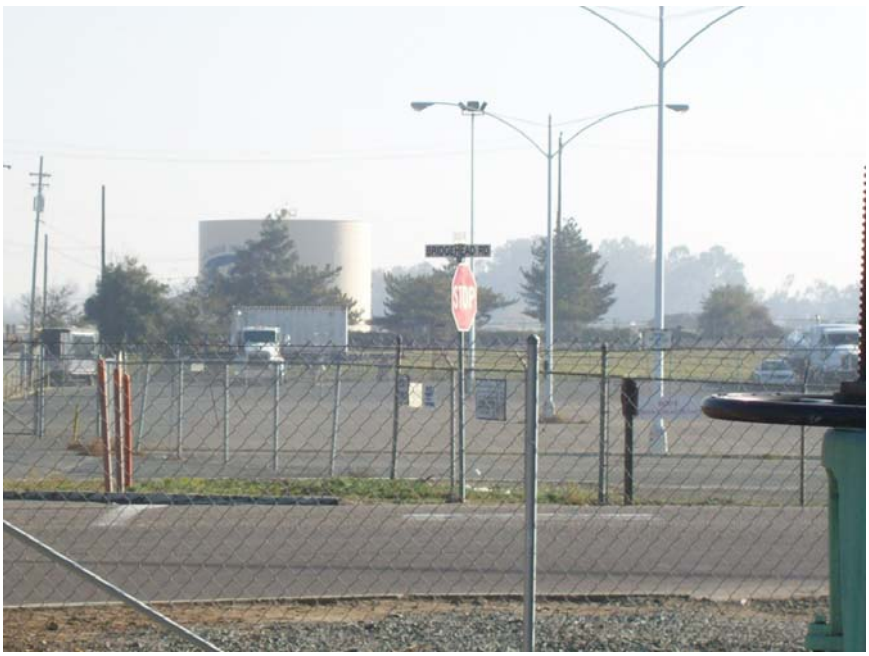


Photo No.
30

Direction Photo Taken:

East

Description:

PG&E Natural Gas Terminal, 5900 Bridgehead Road

URS		PHOTOGRAPHIC LOG
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
31

Direction Photo Taken:

East

Description:

PG&E Natural Gas Terminal, 5900 Bridgehead Road

Photo No.
32

Direction Photo Taken:

East

Description:

Monterey Mechanical Company, 3665 Wilbur Avenue along the Wilbur Corridor.

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
33

Direction Photo Taken:

North

Description:

Monterey Mechanical Company, 3665 Wilbur Avenue along the Wilbur Corridor.

Photo No.
34

Direction Photo Taken:

East

Description:

CEMEX, 3600 Wilbur Avenue along the Wilbur Corridor.

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
35

Direction Photo Taken
Northwest

Description:

Lloyd's Holiday Harbor, 415 Fleming Lane, east of the CCPP and north of Wilbur Corridor

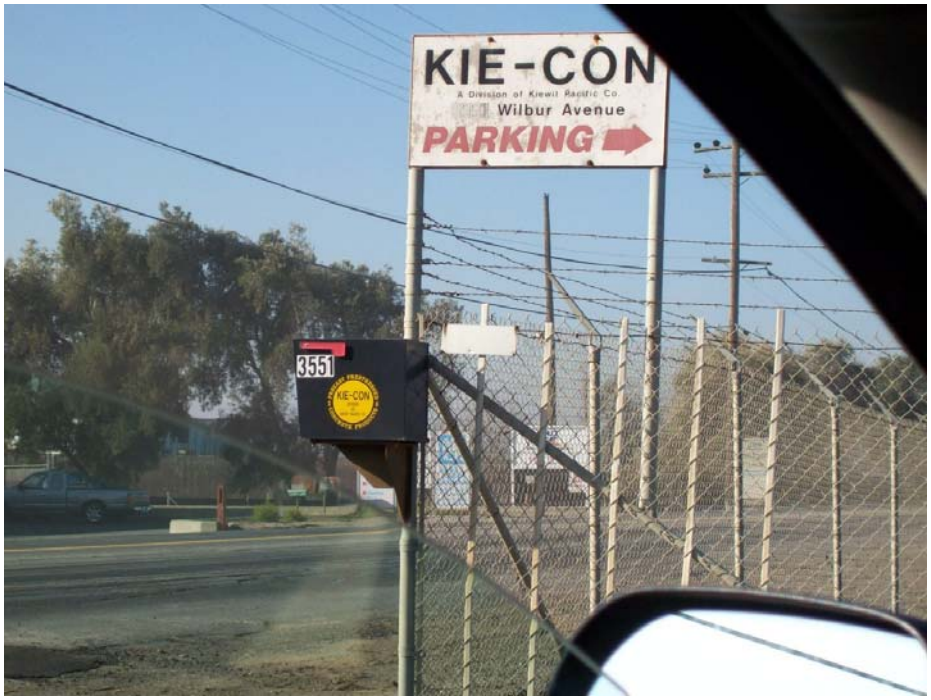
Photo No.
36

Direction Photo Taken:

Southwest

Description:

KIE-Con, 3551 Wilbur Avenue along the Wilbur Corridor.



URS		PHOTOGRAPHIC LOG
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No.
37

Direction Photo Taken:

West

Description:

Michael M. Clement Corporation, 3500 Wilbur Avenue along the Wilbur Corridor.

Photo No.
38

Direction Photo Taken:

South

Description:

GWF Power Systems, 3400 Wilbur Avenue along the Wilbur Corridor.

URS	PHOTOGRAPHIC LOG	
Mirant Marsh Landing, LLC	**Phase I Environmental Site Assessment** **Marsh Landing Generating Station** **Water and Gas Supply Linears** **Contra Costa County, CA**	**URS Job No. 28067344** **Date:** 1/13/09

Photo No. **39**	
Direction Photo Taken: Northeast	
Description: Monitoring well located near the plant entrance of GWF Power Systems, 3400 Wilbur Avenue	

Appendix C

EDR Database Report

Marsh Landing
Wilbur Avenue
Antioch, CA 94509

Inquiry Number: 2398575.2s
January 14, 2009

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
Toll Free: 800.352.0050
www.edrnet.com

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Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-05) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

WILBUR AVENUE
ANTIOCH, CA 94509

COORDINATES

Latitude (North):	38.012300 - 38˚ 0' 44.3''
Longitude (West):	121.758400 - 121˚ 45' 30.2''
Universal Tranverse Mercator:	Zone 10
UTM X (Meters):	608995.8
UTM Y (Meters):	4207701.5
Elevation:	13 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	38121-A7 ANTIOCH NORTH, CA
Most Recent Revision:	1978
East Map:	38121-A6 JERSEY ISLAND, CA
Most Recent Revision:	1978
Southeast Map:	37121-H6 BRENTWOOD, CA
Most Recent Revision:	1978
South Map:	37121-H7 ANTIOCH SOUTH, CA
Most Recent Revision:	1980

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from: 2006, 2005

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

EXECUTIVE SUMMARY

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL ..... National Priority List
Proposed NPL ..... Proposed National Priority List Sites
NPL LIENS ..... Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ..... National Priority List Deletions

Federal CERCLIS list

CERCLIS ..... Comprehensive Environmental Response, Compensation, and Liability Information System

Federal RCRA generators list

RCRA-LQG ..... RCRA - Large Quantity Generators
RCRA-CESQG ..... RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

US ENG CONTROLS ..... Engineering Controls Sites List
US INST CONTROL ..... Sites with Institutional Controls

State- and tribal - equivalent NPL

RESPONSE ..... State Response Sites

State and tribal landfill and/or solid waste disposal site lists

SWF/LF ..... Solid Waste Information System

State and tribal leaking storage tank lists

INDIAN LUST ..... Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

INDIAN UST ..... Underground Storage Tanks on Indian Land

State and tribal voluntary cleanup sites

INDIAN VCP ..... Voluntary Cleanup Priority Listing
VCP ..... Voluntary Cleanup Program Properties

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS ..... A Listing of Brownfields Sites

EXECUTIVE SUMMARY

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9 ..... Torres Martinez Reservation Illegal Dump Site Locations
ODI ..... Open Dump Inventory
SWRCY ..... Recycler Database
HAULERS ..... Registered Waste Tire Haulers Listing
INDIAN ODI ..... Report on the Status of Open Dumps on Indian Lands

Local Lists of Hazardous waste / Contaminated Sites

US CDL ..... Clandestine Drug Labs
HIST Cal-Sites ..... Historical Calsites Database
SCH ..... School Property Evaluation Program
Toxic Pits ..... Toxic Pits Cleanup Act Sites
CDL ..... Clandestine Drug Labs

Local Lists of Registered Storage Tanks

HIST UST ..... Hazardous Substance Storage Container Database

Local Land Records

LIENS 2 ..... CERCLA Lien Information
LUCIS ..... Land Use Control Information System
LIENS ..... Environmental Liens Listing
DEED ..... Deed Restriction Listing

Records of Emergency Release Reports

HMIRS ..... Hazardous Materials Information Reporting System
LDS ..... Land Disposal Sites Listing
MCS ..... Military Cleanup Sites Listing

Other Ascertainable Records

RCRA-NonGen ..... RCRA - Non Generators
DOT OPS ..... Incident and Accident Data
DOD ..... Department of Defense Sites
FUDS ..... Formerly Used Defense Sites
CONSENT ..... Superfund (CERCLA) Consent Decrees
ROD ..... Records Of Decision
UMTRA ..... Uranium Mill Tailings Sites
MINES ..... Mines Master Index File
TRIS ..... Toxic Chemical Release Inventory System
TSCA ..... Toxic Substances Control Act
FTTS ..... FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
HIST FTTS ..... FIFRA/TSCA Tracking System Administrative Case Listing
SSTS ..... Section 7 Tracking Systems
ICIS ..... Integrated Compliance Information System
PADS ..... PCB Activity Database System
MLTS ..... Material Licensing Tracking System
RADINFO ..... Radiation Information Database
RAATS ..... RCRA Administrative Action Tracking System

EXECUTIVE SUMMARY

CA BOND EXP. PLAN..... Bond Expenditure Plan
Notify 65..... Proposition 65 Records
DRYCLEANERS..... Cleaner Facilities
WIP..... Well Investigation Program Case List
EMI..... Emissions Inventory Data
INDIAN RESERV..... Indian Reservations
SCRD DRYCLEANERS..... State Coalition for Remediation of Drycleaners Listing
PWS..... Public Water System Data

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants..... EDR Proprietary Manufactured Gas Plants

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Federal CERCLIS NFRAP site List

CERC-NFRAP: Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

A review of the CERC-NFRAP list, as provided by EDR, and dated 12/03/2007 has revealed that there are 2 CERC-NFRAP sites within approximately 0.625 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
E. I. DUPONT DE NEMOURS & CO	***6000 BRIDGEHEAD RD***	***E 1/4 - 1/2 (0.415 mi.)***	***G26***	***38***

Lower Elevation	Address	Direction / Distance	Map ID	Page
CONTRA COSTA POWER PLANT	***3201 WILBUR AVENUE***	***NW 1/4 - 1/2 (0.269 mi.)***	***E20***	***28***

EXECUTIVE SUMMARY

Federal RCRA CORRACTS facilities list

CORRACTS: CORRACTS is a list of handlers with RCRA Corrective Action Activity. This report shows which nationally-defined corrective action core events have occurred for every handler that has had corrective action activity.

A review of the CORRACTS list, as provided by EDR, and dated 09/11/2008 has revealed that there are 2 CORRACTS sites within approximately 1.125 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
E. I. DUPONT DE NEMOURS & CO	***6000 BRIDGEHEAD RD***	***E 1/4 - 1/2 (0.415 mi.)***	***G26***	***38***

Lower Elevation	Address	Direction / Distance	Map ID	Page
CONTRA COSTA POWER PLANT	***3201 WILBUR AVENUE***	***NW 1/4 - 1/2 (0.269 mi.)***	***E20***	***28***

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

A review of the RCRA-TSDF list, as provided by EDR, and dated 09/10/2008 has revealed that there are 2 RCRA-TSDF sites within approximately 0.625 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
E. I. DUPONT DE NEMOURS & CO	***6000 BRIDGEHEAD RD***	***E 1/4 - 1/2 (0.415 mi.)***	***G26***	***38***

Lower Elevation	Address	Direction / Distance	Map ID	Page
CONTRA COSTA POWER PLANT	***3201 WILBUR AVENUE***	***NW 1/4 - 1/2 (0.269 mi.)***	***E20***	***28***

Federal RCRA generators list

RCRA-SQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

A review of the RCRA-SQG list, as provided by EDR, and dated 09/10/2008 has revealed that there are 3 RCRA-SQG sites within approximately 0.375 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
PACIFIC GAS AND ELECTRIC CO GA	3225 WILBUR AVE	W 0 - 1/8 (0.017 mi.)	A1	7
P G AND E CONTRA COSTA SWITCH	***3201 B WILBUR AVE***	***E 1/8 - 1/4 (0.204 mi.)***	***D18***	***24***

Lower Elevation	Address	Direction / Distance	Map ID	Page
CONTRA COSTA POWER PLANT	***3201 WILBUR AVENUE***	***NW 1/4 - 1/2 (0.269 mi.)***	***E20***	***28***

EXECUTIVE SUMMARY

Federal ERNS list

ERNS: The Emergency Response Notification System records and stores information on reported releases of oil and hazardous substances. The source of this database is the U.S. EPA.

A review of the ERNS list, as provided by EDR, and dated 12/31/2007 has revealed that there are 2 ERNS sites within approximately 0.125 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
3307 WILBER AVE	3307 WILBER AVE	E 0 - 1/8 (0.071 mi.)	B7	12
3307 WILBOR AVE	3307 WILBOR AVE	E 0 - 1/8 (0.071 mi.)	B9	13

State- and tribal - equivalent CERCLIS

ENVIROSTOR: The Department of Toxic Substances Control's (DTSC's) Site Mitigation and Brownfields Reuse Program's (SMBRP's) EnviroStor database identifes sites that have known contamination or sites for which there may be reasons to investigate further. The database includes the following site types: Federal Superfund sites (National Priorities List (NPL)); State Response, including Military Facilities and State Superfund; Voluntary Cleanup; and School sites. EnviroStor provides similar information to the information that was available in CalSites, and provides additional site information, including, but not limited to, identification of formerly-contaminated properties that have been released for reuse, properties where environmental deed restrictions have been recorded to prevent inappropriate land uses, and risk characterization information that is used to assess potential impacts to public health and the environment at contaminated sites.

A review of the ENVIROSTOR list, as provided by EDR, and dated 08/25/2008 has revealed that there are 6 ENVIROSTOR sites within approximately 1.125 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DUPONT DE NEMOURS & CO INC Status: Refer: RCRA	6000 BRIDGEHEAD ROAD	E 1/4 - 1/2 (0.416 mi.)	G29	69
EAST MILL Status: Active	***2603 WILBUR AVENUE***	***W 1/2 - 1 (0.634 mi.)***	***H36***	***84***
INDUSTRIAL LOT WITH RAILROAD S Status: Certified	***2600 WILBUR AVENUE***	***W 1/2 - 1 (0.637 mi.)***	***H37***	***94***
WEST MILL Status: Active	***2301 WILBUR AVENUE***	***W 1/2 - 1 (0.914 mi.)***	***38***	***98***
OAKLEY ROAD METERING SITE Status: Refer: RWQCB	OAKLEY RD. / PHILLIPS	S 1 - 2 (1.008 mi.)	39	103
ALMOND ORCHARD Status: Certified	***2101 E. 18TH STREET***	***WSW 1 - 2 (1.101 mi.)***	***40***	***104***

State and tribal leaking storage tank lists

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the State Water Resources Control Board Leaking Underground Storage Tank Information System.

A review of the LUST list, as provided by EDR, and dated 11/04/2008 has revealed that there are 4

LUST sites within approximately 0.625 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
E.I. DUPONT DE NEMOURS & CO. Status: Open - Remediation	***6000 BRIDGEHEAD RD***	***E 1/4 - 1/2 (0.416 mi.)***	***G28***	***67***
NEW BRIDGE MARINA Status: Open - Remediation	***6325 BRIDGEHEAD RD***	***ENE 1/4 - 1/2 (0.472 mi.)***	***32***	***80***
PECKHAM PROPERTY Status: Completed - Case Closed	***3215 18TH ST E***	***SSW 1/2 - 1 (0.522 mi.)***	***34***	***81***

Lower Elevation	Address	Direction / Distance	Map ID	Page
LAURITZEN YACHT HARBOR LLC Status: Completed - Case Closed	***115 LAURITZEN LANE***	***ENE 1/2 - 1 (0.597 mi.)***	***35***	***82***

SLIC: SLIC Region comes from the California Regional Water Quality Control Board.

A review of the SLIC list, as provided by EDR, and dated 11/04/2008 has revealed that there are 3 SLIC sites within approximately 0.625 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DUPONT CHEMICAL CO., ANTIOCH W Facility Status: Open - Remediation	6000 BRIDGEHEAD ROAD	E 1/4 - 1/2 (0.416 mi.)	G27	66
DUPONT CHEMICAL CO., ANTIOCH W	***6000 BRIDGEHEAD RD***	***E 1/4 - 1/2 (0.416 mi.)***	***G30***	***71***
PG&E ANTIOCH NATURAL GAS TERMI Facility Status: Open - Site Assessment	5900 BRIDGEHEAD ROAD	ESE 1/4 - 1/2 (0.472 mi.)	33	81

State and tribal registered storage tank lists

UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the State Water Resources Control Board's Hazardous Substance Storage Container Database.

A review of the UST list, as provided by EDR, and dated 11/04/2008 has revealed that there is 1 UST site within approximately 0.375 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
SAN JOAQUIN YACHT HARBOR	***3307 WILBUR AVE***	***E 0 - 1/8 (0.071 mi.)***	***B8***	***12***

AST: The Aboveground Storage Tank database contains registered ASTs. The data come from the State Water Resources Control Board's Hazardous Substance Storage Container Database.

A review of the AST list, as provided by EDR, and dated 11/01/2007 has revealed that there are 2 AST sites within approximately 0.375 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
WILBUR EAST POWER PLANT	3400 WILBUR AVE.	ESE 1/8 - 1/4 (0.137 mi.)	C12	15

Lower Elevation	Address	Direction / Distance	Map ID	Page
CONTRA COSTA POWER PLANT	***3201 WILBUR AVENUE***	***NW 1/4 - 1/2 (0.269 mi.)***	***E20***	***28***

EXECUTIVE SUMMARY

ADDITIONAL ENVIRONMENTAL RECORDS

Local Lists of Landfill / Solid Waste Disposal Sites

WMUDS/SWAT: The Waste Management Unit Database System is used for program tracking and inventory of waste management units. The source is the State Water Resources Control Board.

A review of the WMUDS/SWAT list, as provided by EDR, and dated 04/01/2000 has revealed that there is 1 WMUDS/SWAT site within approximately 0.625 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
E.I. DUPONI DE NEMOURS & CO.	***6000 BRIDGEHEAD RD***	***E 1/4 - 1/2 (0.416 mi.)***	***G31***	***74***

Local Lists of Registered Storage Tanks

CA FID UST: The Facility Inventory Database contains active and inactive underground storage tank locations. The source is the State Water Resource Control Board.

A review of the CA FID UST list, as provided by EDR, and dated 10/31/1994 has revealed that there is 1 CA FID UST site within approximately 0.375 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
ANTIOCH MARINA	***L ST***	***ESE 1/4 - 1/2 (0.329 mi.)***	***25***	***37***

SWEEPS UST: Statewide Environmental Evaluation and Planning System. This underground storage tank listing was updated and maintained by a company contacted by the SWRCB in the early 1990's. The listing is no longer updated or maintained. The local agency is the contact for more information on a site on the SWEEPS list.

A review of the SWEEPS UST list, as provided by EDR, and dated 06/01/1994 has revealed that there is 1 SWEEPS UST site within approximately 0.375 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
ANTIOCH MARINA	***L ST***	***ESE 1/4 - 1/2 (0.329 mi.)***	***25***	***37***

Records of Emergency Release Reports

CHMIRS: The California Hazardous Material Incident Report System contains information on reported hazardous material incidents, i.e., accidental releases or spills. The source is the California Office of Emergency Services.

A review of the CHMIRS list, as provided by EDR, and dated 12/31/2007 has revealed that there are 2 CHMIRS sites within approximately 0.125 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
Not reported	3400 WILBER AVE	E 0 - 1/8 (0.068 mi.)	B5	10
Not reported	3307 WILBER AVE.	E 0 - 1/8 (0.071 mi.)	B10	13

Other Ascertainable Records

FINDS: The Facility Index System contains both facility information and "pointers" to other sources of information that contain more detail. These include: RCRIS; Permit Compliance System (PCS); Aerometric Information Retrieval System (AIRS); FATES (FIFRA [Federal Insecticide Fungicide Rodenticide Act] and TSCA Enforcement System, FTTS [FIFRA/TSCA Tracking System]; CERCLIS; DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes); Federal Underground Injection Control (FURS); Federal Reporting Data System (FRDS); Surface Impoundments (SIA); TSCA Chemicals in Commerce Information System (CICS); PADS; RCRA-J (medical waste transporters/disposers); TRIS; and TSCA. The source of this database is the U.S. EPA/NTIS.

A review of the FINDS list, as provided by EDR, and dated 10/30/2008 has revealed that there is 1 FINDS site within approximately 0.125 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
PACIFIC GAS AND ELECTRIC CO GA	3225 WILBUR AVE	W 0 - 1/8 (0.017 mi.)	A3	9

CA WDS: California Water Resources Control Board - Waste Discharge System.

A review of the CA WDS list, as provided by EDR, and dated 06/19/2007 has revealed that there is 1 CA WDS site within approximately 0.125 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
SPORTSMAN YACHT CLUB HARBOR	3301 WILBUR AVE	E 0 - 1/8 (0.068 mi.)	B6	11

Cortese: The sites for the list are designated by the State Water Resource Control Board (LUST), the Integrated Waste Board (SWF/LS), and the Department of Toxic Substances Control (Cal-Sites). This listing is no longer updated by the state agency.

A review of the Cortese list, as provided by EDR, and dated 04/01/2001 has revealed that there are 3 Cortese sites within approximately 0.625 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
E.I. DUPONT DE NEMOURS & CO.	***6000 BRIDGEHEAD RD***	***E 1/4 - 1/2 (0.416 mi.)***	***G28***	***67***
NEW BRIDGE MARINA	***6325 BRIDGEHEAD RD***	***ENE 1/4 - 1/2 (0.472 mi.)***	***32***	***80***
PECKHAM PROPERTY	***3215 18TH ST E***	***SSW 1/2 - 1 (0.522 mi.)***	***34***	***81***

CONTRA COSTA CO. SITE LIST: Lists includes sites from the Underground Tank Program, Hazardous Waste Generator Program & Business Plan 12185 Program

A review of the CONTRA COSTA CO. SITE LIST list, as provided by EDR, and dated 09/03/2008 has revealed that there are 13 CONTRA COSTA CO. SITE LIST sites within approximately 0.375 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
PG&E GATEWAY GENERATING STATIO	3225 WILBUR AVE	W 0 - 1/8 (0.017 mi.)	A2	9
SAN JOAQUIN YACHT HARBOR	***3307 WILBUR AVE***	***E 0 - 1/8 (0.071 mi.)***	***B8***	***12***
RIVER MARINE REPAIR	***450 FLEMING LN***	***ENE 0 - 1/8 (0.089 mi.)***	***B11***	***14***
GWF POWER SYSTEMS LP	***3400 WILBUR AVENUE***	***ESE 1/8 - 1/4 (0.137 mi.)***	***C13***	***15***
EAST BAY WELDING SUPPLY, INC	3500 WILBUR AVE #D	E 1/8 - 1/4 (0.151 mi.)	C14	21
RAMROCK LEASING & EQUIPMENT CO	***3500 WILBUR AVE***	***E 1/8 - 1/4 (0.151 mi.)***	***C15***	***21***

EXECUTIVE SUMMARY

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
F T G CONSTRUCTION MATERIALS,	3500 WILBUR AVE	E 1/8 - 1/4 (0.151 mi.)	C16	22
KIE-CON A DIVISION OF KIEWIT P	***3551 WILBUR AVE***	***E 1/8 - 1/4 (0.202 mi.)***	***D17***	***22***
ANTIOCH ROCK & READY MIX	***3600 WILBUR AVE***	***E 1/8 - 1/4 (0.230 mi.)***	***D19***	***27***
NORMAN P OLSEN JR WELDING	3660 WILBUR AVE	E 1/4 - 1/2 (0.274 mi.)	F23	36
JACK MANNIE	***3665 WILBUR AVE***	***E 1/4 - 1/2 (0.275 mi.)***	***F24***	***36***

Lower Elevation	Address	Direction / Distance	Map ID	Page
MIRANT DELTA, LLC CONTRA COSTA	3201 WILBUR AVE #A	NW 1/4 - 1/2 (0.269 mi.)	E21	36
PG&E CONTRA COSTA SWITCHYARD	3201 WILBUR AVE #B	NW 1/4 - 1/2 (0.269 mi.)	E22	36

HAZNET: The data is extracted from the copies of hazardous waste manifests received each year by the DTSC. The annual volume of manifests is typically 700,000-1,000,000 annually, representing approximately 350,000-500,000 shipments. Data from non-California manifests & continuation sheets are not included at the present time. Data are from the manifests submitted without correction, and therefore many contain some invalid values for data elements such as generator ID, TSD ID, waste category, & disposal method. The source is the Department of Toxic Substance Control is the agency

A review of the HAZNET list, as provided by EDR, and dated 12/31/2006 has revealed that there are 2 HAZNET sites within approximately 0.125 miles of the target property.

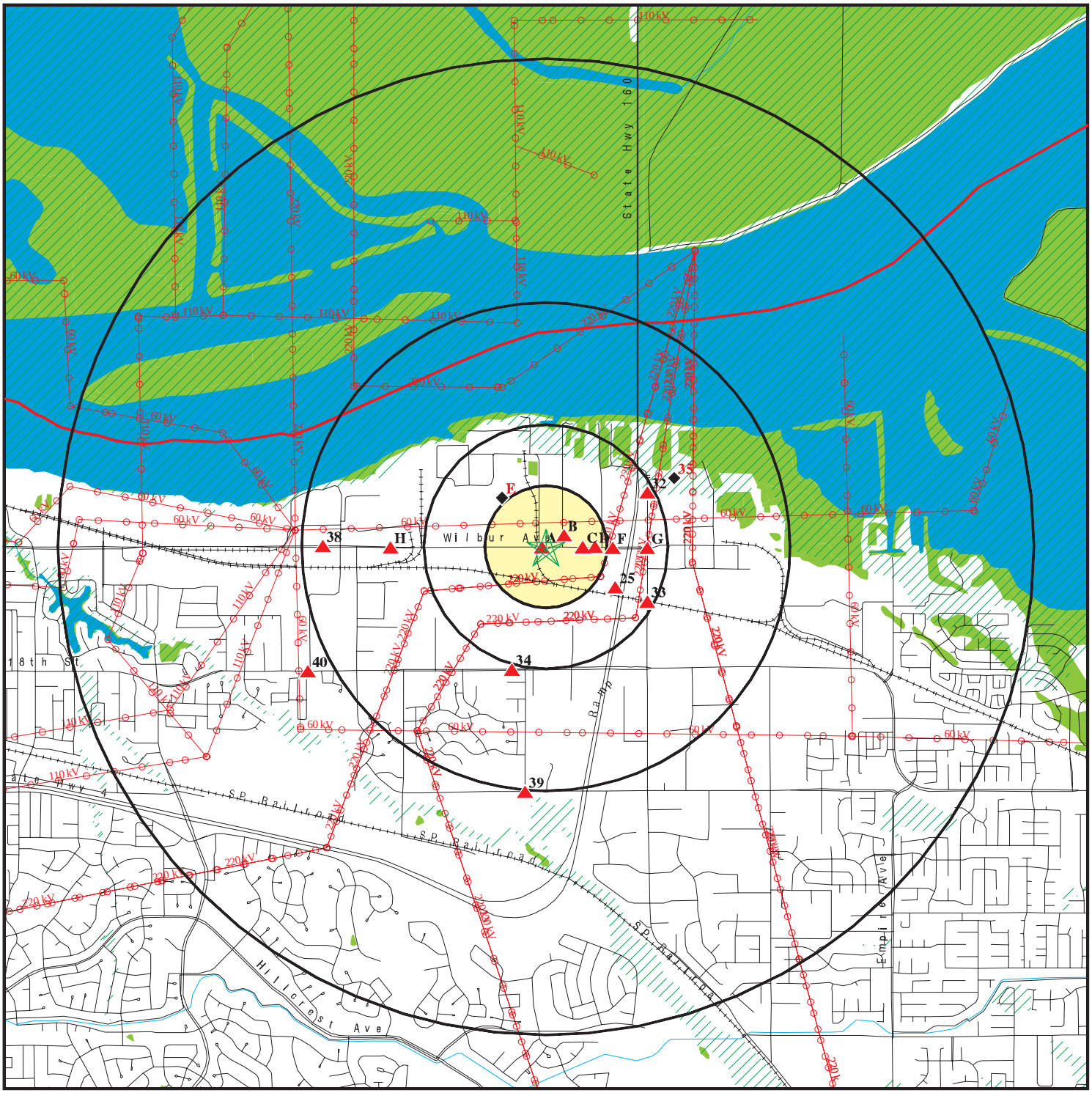
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DILLINGHAM CONSTRUCTION	3302 WILBUR AVE	E 0 - 1/8 (0.017 mi.)	A4	9
RIVER MARINE REPAIR	***450 FLEMING LN***	***ENE 0 - 1/8 (0.089 mi.)***	***B11***	***14***

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

Site Name	Database(s)
SAN JOAQUIN YACHT HARBOR	SWEEPS UST
SHERMAN ISL. DEHYDRATOR-ODORAN	SWEEPS UST
BRIDGEHEAD TRUCK STOP	HIST UST, SWEEPS UST
LLOYD'S HOLIDAY HARBOR	SWEEPS UST
2616 CARPENTERIA DRIVE	CDL
1651 DRIVE IN AVE/BRIDGEHEAD S	CDL
1137 MISSION DRIVE (MOTORHOME	CDL
2208 SYCAMORE DRIVE APT #27	CDL
CAMINO DIABLO RD. WEST OF VASC	CHMIRS, EMI
ABANDONED DRUM/ANTIOCH	CERC-NFRAP
ANTIOCH DSPL SITE	CERC-NFRAP
INDUSTRIAL LOT WITH TANK	VCP, ENVIROSTOR
FIBREBOARD CORPORATION	HIST UST
SHERMAN ISL. DEHYDRATOR-ODORAN	HIST UST
CHEVRON 93801	HAZNET
PG&E ANTIOCH MAINT STATION	HAZNET
OLD SCHOOL AUTO WORKS	HAZNET
CALIFORNIA ORGANICS	FINDS, RCRA-NonGen
DALLAS RANCH MIDDLE SCHOOL	SCH, ENVIROSTOR
BRIDGEHEAD TRUCK STOP	CONTRA COSTA CO. SITE LIST
CHEVRON SS# 96946	CONTRA COSTA CO. SITE LIST
LINCOLN PROPERTIES	CONTRA COSTA CO. SITE LIST
REBELLO RACING	CONTRA COSTA CO. SITE LIST
PACIFIC GAS & ELECTRIC COMPANY	CONTRA COSTA CO. SITE LIST, ENVIROSTOR
PACIFIC GAS AND ELECTRIC CO, A	EMI

OVERVIEW MAP - 2398575.2s



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- County Boundary
- Power transmission lines
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- Areas of Concern

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Marsh Landing	CLIENT: URS Corporation
ADDRESS: Wilbur Avenue Antioch CA 94509	CONTACT: Kirk Martin INQUIRY #: 2398575.2s
LAT/LONG: 38.0123 / 121.7584	DATE: January 14, 2009 12:52 pm

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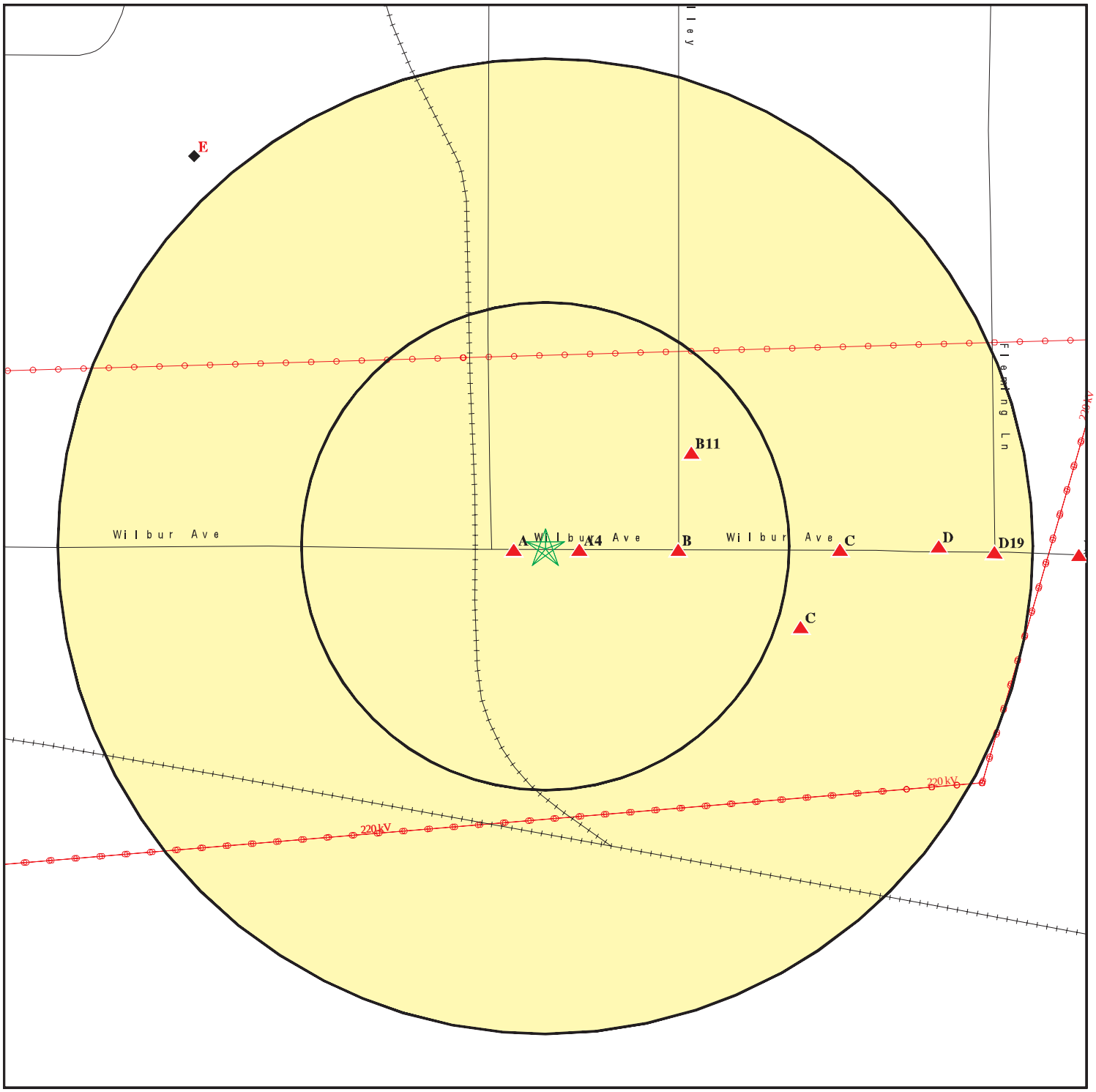
DETAIL MAP - 2398575.2s



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites

0 1/16 1/8 1/4 Miles

- Indian Reservations BIA
- Power transmission lines
- Oil & Gas pipelines
- 100-year flood zone
- 500-year flood zone
- Areas of Concern

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LAT/LONG: 38.0123 / 121.7584	DATE: January 14, 2009 12:52 pm

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MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL		1.125	0	0	0	0	0	0
Proposed NPL		1.125	0	0	0	0	0	0
NPL LIENS		0.125	0	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL		1.125	0	0	0	0	0	0
Federal CERCLIS list								
CERCLIS		0.625	0	0	0	0	NR	0
Federal CERCLIS NFRAP site List								
CERC-NFRAP		0.625	0	0	2	0	NR	2
Federal RCRA CORRACTS facilities list								
CORRACTS		1.125	0	0	2	0	0	2
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF		0.625	0	0	2	0	NR	2
Federal RCRA generators list								
RCRA-LQG		0.375	0	0	0	NR	NR	0
RCRA-SQG		0.375	1	1	1	NR	NR	3
RCRA-CESQG		0.375	0	0	0	NR	NR	0
Federal institutional controls / engineering controls registries								
US ENG CONTROLS		0.625	0	0	0	0	NR	0
US INST CONTROL		0.625	0	0	0	0	NR	0
Federal ERNS list								
ERNS		0.125	2	NR	NR	NR	NR	2
State- and tribal - equivalent NPL								
RESPONSE		1.125	0	0	0	0	0	0
State- and tribal - equivalent CERCLIS								
ENVIROSTOR		1.125	0	0	1	3	2	6
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF		0.625	0	0	0	0	NR	0
State and tribal leaking storage tank lists								
LUST		0.625	0	0	2	2	NR	4
SLIC		0.625	0	0	3	0	NR	3
INDIAN LUST		0.625	0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
State and tribal registered storage tank lists								
UST		0.375	1	0	0	NR	NR	1
AST		0.375	0	1	1	NR	NR	2
INDIAN UST		0.375	0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
INDIAN VCP		0.625	0	0	0	0	NR	0
VCP		0.625	0	0	0	0	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS		0.625	0	0	0	0	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
DEBRIS REGION 9		0.625	0	0	0	0	NR	0
ODI		0.625	0	0	0	0	NR	0
WMUDS/SWAT		0.625	0	0	1	0	NR	1
SWRCY		0.625	0	0	0	0	NR	0
HAULERS		0.125	0	NR	NR	NR	NR	0
INDIAN ODI		0.625	0	0	0	0	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US CDL		0.125	0	NR	NR	NR	NR	0
HIST Cal-Sites		1.125	0	0	0	0	0	0
SCH		0.375	0	0	0	NR	NR	0
Toxic Pits		1.125	0	0	0	0	0	0
CDL		0.125	0	NR	NR	NR	NR	0
Local Lists of Registered Storage Tanks								
CA FID UST		0.375	0	0	1	NR	NR	1
HIST UST		0.375	0	0	0	NR	NR	0
SWEEPS UST		0.375	0	0	1	NR	NR	1
Local Land Records								
LIENS 2		0.125	0	NR	NR	NR	NR	0
LUCIS		0.625	0	0	0	0	NR	0
LIENS		0.125	0	NR	NR	NR	NR	0
DEED		0.625	0	0	0	0	NR	0
Records of Emergency Release Reports								
HMIRS		0.125	0	NR	NR	NR	NR	0
CHMIRS		0.125	2	NR	NR	NR	NR	2
LDS		0.125	0	NR	NR	NR	NR	0
MCS		0.125	0	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA-NonGen		0.375	0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Target Property	Search Distance (Miles)	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
DOT OPS		0.125	0	NR	NR	NR	NR	0
DOD		1.125	0	0	0	0	0	0
FUDS		1.125	0	0	0	0	0	0
CONSENT		1.125	0	0	0	0	0	0
ROD		1.125	0	0	0	0	0	0
UMTRA		0.625	0	0	0	0	NR	0
MINES		0.375	0	0	0	NR	NR	0
TRIS		0.125	0	NR	NR	NR	NR	0
TSCA		0.125	0	NR	NR	NR	NR	0
FTTS		0.125	0	NR	NR	NR	NR	0
HIST FTTS		0.125	0	NR	NR	NR	NR	0
SSTS		0.125	0	NR	NR	NR	NR	0
ICIS		0.125	0	NR	NR	NR	NR	0
PADS		0.125	0	NR	NR	NR	NR	0
MLTS		0.125	0	NR	NR	NR	NR	0
RADINFO		0.125	0	NR	NR	NR	NR	0
FINDS		0.125	1	NR	NR	NR	NR	1
RAATS		0.125	0	NR	NR	NR	NR	0
CA BOND EXP. PLAN		1.125	0	0	0	0	0	0
CA WDS		0.125	1	NR	NR	NR	NR	1
Cortese		0.625	0	0	2	1	NR	3
CONTRA COSTA CO. SITE LIST		0.375	3	6	4	NR	NR	13
Notify 65		1.125	0	0	0	0	0	0
DRYCLEANERS		0.375	0	0	0	NR	NR	0
WIP		0.375	0	0	0	NR	NR	0
HAZNET		0.125	2	NR	NR	NR	NR	2
EMI		0.125	0	NR	NR	NR	NR	0
INDIAN RESERV		1.125	0	0	0	0	0	0
SCRD DRYCLEANERS		0.625	0	0	0	0	NR	0
PWS		TP	NR	NR	NR	NR	NR	0
EDR PROPRIETARY RECORDS								
EDR Proprietary Records								
Manufactured Gas Plants		1.125	0	0	0	0	0	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

A1 West < 1/8 0.017 mi. 87 ft. | **PACIFIC GAS AND ELECTRIC CO GATEWAY GENE** | **RCRA-SQG** | **1010562237**
3225 WILBUR AVE | **CAR000188565**
ANTIOCH, CA 94509

Site 1 of 4 in cluster A

Relative: Equal

Actual: 13 ft.

RCRA-SQG:

Date form received by agency:	11/07/2007
Facility name:	PACIFIC GAS AND ELECTRIC CO GATEWAY GENE
Facility address:	3225 WILBUR AVE ANTIOCH, CA 94509
EPA ID:	CAR000188565
Mailing address:	PO BOX 7640 SAN FRANCISCO, CA 94120
Contact:	ANGEL B ESPIRITU
Contact address:	PO BOX 7640 SAN FRANCISCO, CA 94120
Contact country:	US
Contact telephone:	925-459-7212
Contact email:	ABE4@PGE.COM
EPA Region:	09
Classification:	Small Small Quantity Generator
Description:	Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:

Owner/operator name:	PACIFIC GAS AND ELECTRIC CO
Owner/operator address:	77 BEALE ST SAN FRANCISCO, CA 94105
Owner/operator country:	US
Owner/operator telephone:	Not reported
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	01/03/2007
Owner/Op end date:	Not reported

Owner/operator name:	PACIFIC GAS AND ELECTRIC CO
Owner/operator address:	Not reported Not reported
Owner/operator country:	Not reported
Owner/operator telephone:	Not reported
Legal status:	Private
Owner/Operator Type:	Operator
Owner/Op start date:	01/03/2007
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No

PACIFIC GAS AND ELECTRIC CO GATEWAY GENE (Continued) **1010562237**

Used oil fuel burner:	No
Used oil processor:	No
User oil refiner:	No
Used oil fuel marketer to burner:	No
Used oil Specification marketer:	No
Used oil transfer facility:	No
Used oil transporter:	No
Off-site waste receiver:	Commercial status unknown

Hazardous Waste Summary:

Waste code: D001
Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

Waste code: D002
Waste name: A WASTE WHICH HAS A PH OF LESS THAN 2 OR GREATER THAN 12.5 IS CONSIDERED TO BE A CORROSIVE HAZARDOUS WASTE. SODIUM HYDROXIDE, A CAUSTIC SOLUTION WITH A HIGH PH, IS OFTEN USED BY INDUSTRIES TO CLEAN OR DEGREASE PARTS. HYDROCHLORIC ACID, A SOLUTION WITH A LOW PH, IS USED BY MANY INDUSTRIES TO CLEAN METAL PARTS PRIOR TO PAINTING. WHEN THESE CAUSTIC OR ACID SOLUTIONS BECOME CONTAMINATED AND MUST BE DISPOSED, THE WASTE WOULD BE A CORROSIVE HAZARDOUS WASTE.

Waste code: D003
Waste name: A MATERIAL IS CONSIDERED TO BE A REACTIVE HAZARDOUS WASTE IF IT IS NORMALLY UNSTABLE, REACTS VIOLENTLY WITH WATER, GENERATES TOXIC GASES WHEN EXPOSED TO WATER OR CORROSIVE MATERIALS, OR IF IT IS CAPABLE OF DETONATION OR EXPLOSION WHEN EXPOSED TO HEAT OR A FLAME. ONE EXAMPLE OF SUCH WASTE WOULD BY WASTE GUNPOWDER.

Waste code: D009
Waste name: MERCURY

Waste code: D035
Waste name: METHYL ETHYL KETONE

Waste code: F003
Waste name: THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NON-HALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NON-HALOGENATED SOLVENTS, AND, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005, AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Waste code: F005
Waste name: THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE, CARBON DISULFIDE, ISOBUTANOL, PYRIDINE, BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS

PACIFIC GAS AND ELECTRIC CO GATEWAY GENE (Continued) **1010562237**

CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NON-HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Violation Status: No violations found

A2
West
< 1/8
0.017 mi.
87 ft.

PG&E GATEWAY GENERATING STATION **CONTRA COSTA CO. SITE LIST** **S108407520**
3225 WILBUR AVE **N/A**
ANTIOCH, CA

Site 2 of 4 in cluster A

Relative:
Equal

Actual:
13 ft.

CONTRA COSTA CO. SITE LIST:

Region:	CONTRA COSTA
Facility ID:	773723
Tier:	Not reported
Program Status:	HWG, Hmmp
Generator Fee Item:	No
Inactive Date:	Not reported

A3
West
< 1/8
0.017 mi.
87 ft.

PACIFIC GAS AND ELECTRIC CO GATEWAY GENERATING STATION **FINDS** **1010705946**
3225 WILBUR AVE **110032962293**
ANTIOCH, CA 94509

Site 3 of 4 in cluster A

Relative:
Equal

Actual:
13 ft.

FINDS:
Other Pertinent Environmental Activity Identified at Site

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

A4
East
< 1/8
0.017 mi.
91 ft.

DILLINGHAM CONSTRUCTION **HAZNET** **S106085849**
3302 WILBUR AVE **N/A**
ANTIOCH, CA 94509

Site 4 of 4 in cluster A

Relative:
Equal

Actual:
13 ft.

HAZNET:

Gepaid:	CAC002469807
Contact:	JAMES LAMEL
Telephone:	9257796614
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	3302 WILBUR AVE
Mailing City,St,Zip:	ANTIOCH, CA 945090000
Gen County:	Contra Costa
TSD EPA ID:	Not reported
TSD County:	99
Waste Category:	Contaminated soil from site clean-ups

DILLINGHAM CONSTRUCTION (Continued) **S106085849**

Disposal Method: Disposal, Land Fill
Tons: 0.25
Facility County: Not reported

B5 **CHMIRS** **S105658246**
East **3400 WILBER AVE** **N/A**
< 1/8 **ANTIOCH, CA 94598**
0.068 mi.
359 ft. **Site 1 of 7 in cluster B**

Relative:
Higher

Actual:
14 ft.

CHMIRS:
OES Incident Number: 98-0190
OES notification: 1/14/199804:53:31 PM
OES Date: Not reported
OES Time: Not reported
Incident Date: Not reported
Date Completed: Not reported
Property Use: Not reported
Agency Id Number: Not reported
Agency Incident Number: Not reported
Time Notified: Not reported
Time Completed: Not reported
Surrounding Area: Not reported
Estimated Temperature: Not reported
Property Management: Not reported
Special Studies 1: Not reported
Special Studies 2: Not reported
Special Studies 3: Not reported
Special Studies 4: Not reported
Special Studies 5: Not reported
Special Studies 6: Not reported
More Than Two Substances Involved?: Not reported
Resp Agncy Personel # Of Decontaminated: Not reported
Responding Agency Personel # Of Injuries: Not reported
Responding Agency Personel # Of Fatalities: Not reported
Others Number Of Decontaminated: Not reported
Others Number Of Injuries: Not reported
Others Number Of Fatalities: Not reported
Vehicle Make/year: Not reported
Vehicle License Number: Not reported
Vehicle State: Not reported
Vehicle Id Number: Not reported
CA/DOT/PUC/ICC Number: Not reported
Company Name: Not reported
Reporting Officer Name/ID: Not reported
Report Date: Not reported
Comments: Not reported
Facility Telephone: Not reported
Waterway Involved: Yes
Waterway: In-Plant storm drain
Spill Site: Not reported
Cleanup By: Reporting Party
Containment: Not reported
What Happened: Not reported
Type: Not reported
Measure: Not reported
Other: Not reported
Date/Time: Not reported

(Continued) **S105658246**

Year:	1998
Agency:	GWF Power Systems Co
Incident Date:	1/14/199812:00:00 AM
Admin Agency:	Contra Costa County Health Services Dept.
Amount:	Not reported
Contained:	Yes
Site Type:	Industrial Plant
E Date:	Not reported
Substance:	Lube Oil
Quantity Released:	Not reported
BBLS:	0
Cups:	0
CUFT:	0
Gallons:	100
Grams:	0
Pounds:	0
Liters:	0
Ounces:	0
Pints:	0
Quarts:	0
Sheen:	0
Tons:	0
Unknown:	0
Description:	Not reported
Evacuations:	0
Number of Injuries:	0
Number of Fatalities:	0
Description:	Purifier system malfunctioned and pumped out of tank onto ground and into on-site storm drain system to on-site collection pond. Leak stopped, booms placed on drains, absorbants used on collection basins & blocked drains into ponds.

B6 **SPORTSMAN YACHT CLUB HARBOR** **CA WDS** **S106100787**
East **3301 WILBUR AVE** **N/A**
< 1/8 **ANTIOCH, CA 94509**
0.068 mi.
359 ft. **Site 2 of 7 in cluster B**

Relative:
Higher

Actual:
14 ft.

CA WDS:

Facility ID:	Sacramento-San Joaquin Delta 07NC00010
Facility Type:	Other - Does not fall into the category of Municipal/Domestic, Industrial, Agricultural or Solid Waste (Class I, II or III)
Facility Status:	Active - Any facility with a continuous or seasonal discharge that is under Waste Discharge Requirements.
NPDES Number:	Not reported
Subregion:	0
Facility Telephone:	9257531444
Facility Contact:	CARL RASMUSSEN
Agency Name:	SPORTSMAN YACHT CLUB INC
Agency Address:	3301 WILBUR AVE
Agency City,St,Zip:	ANTIOCH 94509
Agency Contact:	CARL RASMUSSEN
Agency Telephone:	9256827585
Agency Type:	Private
SIC Code:	0
SIC Code 2:	Not reported
Primary Waste:	Not reported
Primary Waste Type:	Not reported

SPORTSMAN YACHT CLUB HARBOR (Continued) **S106100787**

Secondary Waste: Not reported
Secondary Waste Type: Not reported
Design Flow: 0
Baseline Flow: 0
Reclamation: Not reported
POTW: Not reported
Treat To Water: Moderate Threat to Water Quality. A violation could have a major adverse impact on receiving biota, can cause aesthetic impairment to a significant human population, or render unusable a potential domestic or municipal water supply. Awsthetic impairment would include nuisance from a waste treatment facility.
Complexity: Category C - Facilities having no waste treatment systems, such as cooling water dischargers or thosewho must comply through best management practices, facilities with passive waste treatment and disposal systems, such as septic systems with subsurface disposal, or dischargers having waste storage systems with land disposal such as dairy waste ponds.

B7 **3307 WILBER AVE** **ERNS** **2005615587**
East **3307 WILBER AVE** **N/A**
< 1/8 **ANTIOCH, CA**
0.071 mi.
375 ft. **Site 3 of 7 in cluster B**

Relative:
Higher

Click this hyperlink while viewing on your computer to access additional ERNS detail in the EDR Site Report.

Actual:
14 ft.

B8 **SAN JOAQUIN YACHT HARBOR** **UST** **U003784300**
East **3307 WILBUR AVE** **CONTRA COSTA CO. SITE LIST** **N/A**
< 1/8 **ANTIOCH, CA 94509**
0.071 mi.
375 ft. **Site 4 of 7 in cluster B**

Relative:
Higher

Actual:
14 ft.

UST:
Global ID: 13955
Latitude: 38.01229
Longitude: -121.75691
Case Type: PERMITTED UNDERGROUND STORAGE TANK (UST)

CONTRA COSTA CO. SITE LIST:
Region: CONTRA COSTA
Facility ID: 770119
Tier: Not reported
Program Status: UST, Hmmp
Generator Fee Item: No
Inactive Date: 10/12/2006

B9 **3307 WILBOR AVE** **ERNS** **2004745662**
East **3307 WILBOR AVE** **N/A**
< 1/8 **ANTIOCH, CA**
0.071 mi.
375 ft. **Site 5 of 7 in cluster B**

Relative:
Higher

Click this hyperlink while viewing on your computer to access additional ERNS detail in the EDR Site Report.

Actual:
14 ft.

B10 **CHMIRS** **S108404080**
East **3307 WILBER AVE.** **N/A**
< 1/8 **ANTIOCH, CA**
0.071 mi.
375 ft. **Site 6 of 7 in cluster B**

Relative:
Higher

Actual:
14 ft.

CHMIRS:

OES Incident Number:	05-4066
OES notification:	7/10/200507:41:20 AM
OES Date:	Not reported
OES Time:	Not reported
Incident Date:	Not reported
Date Completed:	**Not reported**
Property Use:	Not reported
Agency Id Number:	Not reported
Agency Incident Number:	Not reported
Time Notified:	Not reported
Time Completed:	Not reported
Surrounding Area:	Not reported
Estimated Temperature:	Not reported
Property Management:	Not reported
Special Studies 1:	Not reported
Special Studies 2:	Not reported
Special Studies 3:	Not reported
Special Studies 4:	Not reported
Special Studies 5:	Not reported
Special Studies 6:	Not reported
More Than Two Substances Involved?:	Not reported
Resp Agncy Personel # Of Decontaminated:	Not reported
Responding Agency Personel # Of Injuries:	Not reported
Responding Agency Personel # Of Fatalities:	Not reported
Others Number Of Decontaminated:	Not reported
Others Number Of Injuries:	Not reported
Others Number Of Fatalities:	Not reported
Vehicle Make/year:	Not reported
Vehicle License Number:	Not reported
Vehicle State:	Not reported
Vehicle Id Number:	Not reported
CA/DOT/PUC/ICC Number:	Not reported
Company Name:	Not reported
Reporting Officer Name/ID:	Not reported
Report Date:	Not reported
Comments:	Not reported
Facility Telephone:	Not reported
Waterway Involved:	Not reported
Waterway:	Harbor
Spill Site:	Not reported
Cleanup By:	None
Containment:	Not reported
What Happened:	Not reported
Type:	Not reported

(Continued) **S108404080**

Measure:	Not reported
Other:	Not reported
Date/Time:	Not reported
Year:	2005
Agency:	NRC
Incident Date:	7/9/200512:00:00 AM
Admin Agency:	Contra Costa County Health Services Dept.
Amount:	Not reported
Contained:	Unknown
Site Type:	Ship/Harbor/Port
E Date:	Not reported
Substance:	Non release
Quantity Released:	Not reported
BBLS:	0
Cups:	0
CUFT:	0
Gallons:	0.000000
Grams:	0
Pounds:	0
Liters:	0
Ounces:	0
Pints:	0
Quarts:	0
Sheen:	0
Tons:	0
Unknown:	0
Description:	Not reported
Evacuations:	0
Number of Injuries:	0
Number of Fatalities:	0
Description:	Per fax from the NRC: The vessel sank in the harbor, non-release.

B11 **RIVER MARINE REPAIR** **HAZNET** **S102259887**
ENE **450 FLEMING LN** **CONTRA COSTA CO. SITE LIST** **N/A**
< 1/8 **ANTIOCH, CA 94509**
0.089 mi.
469 ft. **Site 7 of 7 in cluster B**

Relative:
Higher

Actual:
14 ft.

HAZNET:

Gepaid:	CAL000025656
Contact:	RICHARD T. CONFETTI
Telephone:	0000000000
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	450 FLEMING LN
Mailing City,St,Zip:	ANTIOCH, CA 945090000
Gen County:	7
TSD EPA ID:	CAT080013352
TSD County:	Los Angeles
Waste Category:	Unspecified organic liquid mixture
Disposal Method:	Recycler
Tons:	0.4587
Facility County:	7

CONTRA COSTA CO. SITE LIST:

Region:	CONTRA COSTA
Facility ID:	770926

RIVER MARINE REPAIR (Continued) **S102259887**

Tier: Not reported
Program Status: HWG
Generator Fee Item: No
Inactive Date: Not reported

C12
ESE
1/8-1/4
0.137 mi.
724 ft.

WILBUR EAST POWER PLANT **AST** **A100110435**
3400 WILBUR AVE. **N/A**
ANTIOCH, CA 94509

Site 1 of 5 in cluster C

Relative:
Higher

Actual:
18 ft.

AST:
Owner: GWF POWER SYSTEMS CO., INC.
Total Gallons: 46500

C13
ESE
1/8-1/4
0.137 mi.
724 ft.

GWF POWER SYSTEMS LP **HAZNET** **1001610577**
3400 WILBUR AVENUE **CONTRA COSTA CO. SITE LIST** **N/A**
ANTIOCH, CA 94509 **EMI**

Site 2 of 5 in cluster C

Relative:
Higher

Actual:
18 ft.

HAZNET:
Gepaid: CAL000025353
Contact: GWF BAY AREA INC/MAN GEN PART
Telephone: 0000000000
Facility Addr2: Not reported
Mailing Name: Not reported
Mailing Address: 4300 RAILROAD AVE
Mailing City,St,Zip: PITTSBURG, CA 945656006
Gen County: 7
TSD EPA ID: CAD009452657
TSD County: San Mateo
Waste Category: Other organic solids
Disposal Method: Disposal, Land Fill
Tons: .0500
Facility County: 7

Gepaid: CAL000025353
Contact: GWF BAY AREA INC/MAN GEN PART
Telephone: 0000000000
Facility Addr2: Not reported
Mailing Name: Not reported
Mailing Address: 4300 RAILROAD AVE
Mailing City,St,Zip: PITTSBURG, CA 945656006
Gen County: 7
TSD EPA ID: CAD059494310
TSD County: Santa Clara
Waste Category: Unspecified oil-containing waste
Disposal Method: Disposal, Other
Tons: 1.0000
Facility County: 7

Gepaid: CAL000025353
Contact: GWF BAY AREA INC/MAN GEN PART
Telephone: 0000000000
Facility Addr2: Not reported

GWF POWER SYSTEMS LP (Continued) **1001610577**

Mailing Name: Not reported
Mailing Address: 4300 RAILROAD AVE
Mailing City,St,Zip: PITTSBURG, CA 945656006
Gen County: 7
TSD EPA ID: CAD059494310
TSD County: Santa Clara
Waste Category: Organic liquids with metals Alkaline solution (pH <UN-> 12.5) with metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc)
Disposal Method: Disposal, Other
Tons: .0624
Facility County: 7

Gepaid: CAL000025353
Contact: GWF BAY AREA INC/MAN GEN PART
Telephone: 0000000000
Facility Addr2: Not reported
Mailing Name: Not reported
Mailing Address: 4300 RAILROAD AVE
Mailing City,St,Zip: PITTSBURG, CA 945656006
Gen County: 7
TSD EPA ID: CAD980887418
TSD County: 1
Waste Category: Waste oil and mixed oil
Disposal Method: Recycler
Tons: 5.0331
Facility County: 7

Gepaid: CAL000025353
Contact: GWF BAY AREA INC/MAN GEN PART
Telephone: 0000000000
Facility Addr2: Not reported
Mailing Name: Not reported
Mailing Address: 4300 RAILROAD AVE
Mailing City,St,Zip: PITTSBURG, CA 945656006
Gen County: 7
TSD EPA ID: CAT000646117
TSD County: Kings
Waste Category: Fly ash, bottom ash, and retort ash
Disposal Method: Disposal, Land Fill
Tons: 132.4850
Facility County: 7

Click this hyperlink while viewing on your computer to access
72 additional CA_HAZNET: record(s) in the EDR Site Report.

CONTRA COSTA CO. SITE LIST:
Region: CONTRA COSTA
Facility ID: 771388
Tier: Not reported
Program Status: HWG, Hmmp, AGT, ARP
Generator Fee Item: No
Inactive Date: Not reported

EMI:

GWF POWER SYSTEMS LP (Continued) **1001610577**

Year:	1990
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	19
Reactive Organic Gases Tons/Yr:	3
Carbon Monoxide Emissions Tons/Yr:	81
NOX - Oxides of Nitrogen Tons/Yr:	52
SOX - Oxides of Sulphur Tons/Yr:	78
Particulate Matter Tons/Yr:	11
Part. Matter 10 Micrometers & Smllr Tons/Yr:	6

Year:	1993
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	0
Reactive Organic Gases Tons/Yr:	0
Carbon Monoxide Emissions Tons/Yr:	0
NOX - Oxides of Nitrogen Tons/Yr:	0
SOX - Oxides of Sulphur Tons/Yr:	0
Particulate Matter Tons/Yr:	7
Part. Matter 10 Micrometers & Smllr Tons/Yr:	5

Year:	1995
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	24
Reactive Organic Gases Tons/Yr:	20
Carbon Monoxide Emissions Tons/Yr:	37
NOX - Oxides of Nitrogen Tons/Yr:	32
SOX - Oxides of Sulphur Tons/Yr:	26
Particulate Matter Tons/Yr:	13
Part. Matter 10 Micrometers & Smllr Tons/Yr:	10

Year:	1996
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911

GWF POWER SYSTEMS LP (Continued) **1001610577**

Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	24
Reactive Organic Gases Tons/Yr:	20
Carbon Monoxide Emissions Tons/Yr:	37
NOX - Oxides of Nitrogen Tons/Yr:	32
SOX - Oxides of Sulphur Tons/Yr:	26
Particulate Matter Tons/Yr:	13
Part. Matter 10 Micrometers & Smllr Tons/Yr:	10

Year:	1997
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	24
Reactive Organic Gases Tons/Yr:	20
Carbon Monoxide Emissions Tons/Yr:	38
NOX - Oxides of Nitrogen Tons/Yr:	33
SOX - Oxides of Sulphur Tons/Yr:	27
Particulate Matter Tons/Yr:	13
Part. Matter 10 Micrometers & Smllr Tons/Yr:	10

Year:	1998
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	18
Reactive Organic Gases Tons/Yr:	15
Carbon Monoxide Emissions Tons/Yr:	28
NOX - Oxides of Nitrogen Tons/Yr:	24
SOX - Oxides of Sulphur Tons/Yr:	19
Particulate Matter Tons/Yr:	9
Part. Matter 10 Micrometers & Smllr Tons/Yr:	7

Year:	1999
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	20
Reactive Organic Gases Tons/Yr:	3
Carbon Monoxide Emissions Tons/Yr:	31

GWF POWER SYSTEMS LP (Continued) **1001610577**

NOX - Oxides of Nitrogen Tons/Yr:	27
SOX - Oxides of Sulphur Tons/Yr:	22
Particulate Matter Tons/Yr:	7
Part. Matter 10 Micrometers & Smllr Tons/Yr:	3

Year:	2000
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	20
Reactive Organic Gases Tons/Yr:	3
Carbon Monoxide Emissions Tons/Yr:	31
NOX - Oxides of Nitrogen Tons/Yr:	27
SOX - Oxides of Sulphur Tons/Yr:	22
Particulate Matter Tons/Yr:	7
Part. Matter 10 Micrometers & Smllr Tons/Yr:	3

Year:	2001
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4931
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Y
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	25
Reactive Organic Gases Tons/Yr:	4
Carbon Monoxide Emissions Tons/Yr:	40
NOX - Oxides of Nitrogen Tons/Yr:	34
SOX - Oxides of Sulphur Tons/Yr:	27
Particulate Matter Tons/Yr:	9
Part. Matter 10 Micrometers & Smllr Tons/Yr:	4

Year:	2002
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	23
Reactive Organic Gases Tons/Yr:	3
Carbon Monoxide Emissions Tons/Yr:	37
NOX - Oxides of Nitrogen Tons/Yr:	32
SOX - Oxides of Sulphur Tons/Yr:	25
Particulate Matter Tons/Yr:	2
Part. Matter 10 Micrometers & Smllr Tons/Yr:	1

Year:	2003

GWF POWER SYSTEMS LP (Continued) **1001610577**

County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	23
Reactive Organic Gases Tons/Yr:	3
Carbon Monoxide Emissions Tons/Yr:	36
NOX - Oxides of Nitrogen Tons/Yr:	32
SOX - Oxides of Sulphur Tons/Yr:	25
Particulate Matter Tons/Yr:	8
Part. Matter 10 Micrometers & Smllr Tons/Yr:	4

Year:	2004
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	23.6
Reactive Organic Gases Tons/Yr:	3.4386857
Carbon Monoxide Emissions Tons/Yr:	36.904
NOX - Oxides of Nitrogen Tons/Yr:	32.353
SOX - Oxides of Sulphur Tons/Yr:	25.536
Particulate Matter Tons/Yr:	8.271
Part. Matter 10 Micrometers & Smllr Tons/Yr:	4.121632

Year:	2005
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	25.788
Reactive Organic Gases Tons/Yr:	3.7323926
Carbon Monoxide Emissions Tons/Yr:	40.269
NOX - Oxides of Nitrogen Tons/Yr:	34.891
SOX - Oxides of Sulphur Tons/Yr:	28.687
Particulate Matter Tons/Yr:	8.947
Part. Matter 10 Micrometers & Smllr Tons/Yr:	4.441032

Year:	2006
County Code:	7
Air Basin:	SF
Facility ID:	3981
Air District Name:	BA
SIC Code:	4911
Air District Name:	BAY AREA AQMD

GWF POWER SYSTEMS LP (Continued) **1001610577**

Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	25.378
Reactive Organic Gases Tons/Yr:	3.6855196
Carbon Monoxide Emissions Tons/Yr:	39.59
NOX - Oxides of Nitrogen Tons/Yr:	34.24
SOX - Oxides of Sulphur Tons/Yr:	27.438
Particulate Matter Tons/Yr:	8.812
Part. Matter 10 Micrometers & Smllr Tons/Yr:	4.3721

C14 **EAST BAY WELDING SUPPLY, INC** **CONTRA COSTA CO. SITE LIST** **S102259984**
East **3500 WILBUR AVE #D** **N/A**
1/8-1/4 **ANTIOCH, CA**
0.151 mi.
797 ft. **Site 3 of 5 in cluster C**

Relative:
Higher

Actual:
15 ft.

CONTRA COSTA CO. SITE LIST:

Region:	CONTRA COSTA
Facility ID:	707757
Tier:	Not reported
Program Status:	Hmmp
Generator Fee Item:	No
Inactive Date:	Not reported

C15 **RAMROCK LEASING & EQUIPMENT CO INC** **HAZNET** **S102259983**
East **3500 WILBUR AVE** **CONTRA COSTA CO. SITE LIST** **N/A**
1/8-1/4 **ANTIOCH, CA 94509**
0.151 mi.
797 ft. **Site 4 of 5 in cluster C**

Relative:
Higher

Actual:
15 ft.

HAZNET:

Gepaid:	CAL000240145
Contact:	MICHAEL KIZER/OPERATIONS MGR
Telephone:	2093344038
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	PO BOX 1508
Mailing City,St,Zip:	LODI, CA 952411508
Gen County:	Contra Costa
TSD EPA ID:	Not reported
TSD County:	Santa Clara
Waste Category:	Oil/water separation sludge
Disposal Method:	Recycler
Tons:	1.14
Facility County:	Not reported

CONTRA COSTA CO. SITE LIST:

Region:	CONTRA COSTA
Facility ID:	707684
Tier:	Not reported
Program Status:	HWG, Hmmp
Generator Fee Item:	No
Inactive Date:	Not reported

C16 East 1/8-1/4 0.151 mi. 797 ft. | **F T G CONSTRUCTION MATERIALS, INC** | **CONTRA COSTA CO. SITE LIST** | **S105954610** | **N/A**

3500 WILBUR AVE
ANTIOCH, CA

Site 5 of 5 in cluster C

Relative: Higher

Actual: 15 ft.

CONTRA COSTA CO. SITE LIST:

Region:	CONTRA COSTA
Facility ID:	773264
Tier:	Not reported
Program Status:	HWG, Hmmp
Generator Fee Item:	No
Inactive Date:	Not reported

D17 East 1/8-1/4 0.202 mi. 1065 ft. | **KIE-CON A DIVISION OF KIEWIT PACIFIC** | **HAZNET** | **S103973160** | **CONTRA COSTA CO. SITE LIST** | **N/A** | **CA WDS**

3551 WILBUR AVE
ANTIOCH, CA 94509

Site 1 of 3 in cluster D

Relative: Higher

Actual: 15 ft.

HAZNET:

Gepaid:	CAL000058713
Contact:	FARSHAD MAZLOOM/PROJECT ENGR
Telephone:	9257549494
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	3551 WILBUR AVE
Mailing City,St,Zip:	ANTIOCH, CA 945090000
Gen County:	Contra Costa
TSD EPA ID:	CA0000084517
TSD County:	Sacramento
Waste Category:	Aqueous solution with less than 10% total organic residues
Disposal Method:	Transfer Station
Tons:	0.08
Facility County:	Not reported

Gepaid:	CAL000058713
Contact:	FARSHAD MAZLOOM/PROJECT ENGR
Telephone:	9257549494
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	3551 WILBUR AVE
Mailing City,St,Zip:	ANTIOCH, CA 945090000
Gen County:	Contra Costa
TSD EPA ID:	CA0000084517
TSD County:	Sacramento
Waste Category:	Aqueous solution with less than 10% total organic residues
Disposal Method:	Transfer Station
Tons:	0.08
Facility County:	Not reported

Gepaid:	CAL000058713
Contact:	FARSHAD MAZLOOM/PROJECT ENGR
Telephone:	9257549494
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	3551 WILBUR AVE
Mailing City,St,Zip:	ANTIOCH, CA 945090000
Gen County:	Contra Costa
TSD EPA ID:	CAD980887418

KIE-CON A DIVISION OF KIEWIT PACIFIC (Continued) **S103973160**

TSD County:	Alameda
Waste Category:	Unspecified oil-containing waste
Disposal Method:	H14
Tons:	0.05
Facility County:	7

Gepaid:	CAC001361072
Contact:	JERRY LUCZENCZYN
Telephone:	5107549494
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	3551 WILBUR AVE
Mailing City,St,Zip:	ANTIOCH, CA 945090000
Gen County:	7
TSD EPA ID:	CAD009466392
TSD County:	7
Waste Category:	Other empty containers 30 gallons or more
Disposal Method:	Recycler
Tons:	5.0000
Facility County:	7

Gepaid:	CAL000058713
Contact:	SCOTT SWEAT
Telephone:	9257549494
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	3551 WILBUR AVE
Mailing City,St,Zip:	ANTIOCH, CA 945090000
Gen County:	Contra Costa
TSD EPA ID:	Not reported
TSD County:	Los Angeles
Waste Category:	Other organic solids
Disposal Method:	Disposal, Land Fill
Tons:	0.17
Facility County:	Not reported

Click this hyperlink while viewing on your computer to access
11 additional CA_HAZNET: record(s) in the EDR Site Report.

CONTRA COSTA CO. SITE LIST:

Region:	CONTRA COSTA
Facility ID:	709494
Tier:	Not reported
Program Status:	HWG, Hmmp
Generator Fee Item:	No
Inactive Date:	Not reported

CA WDS:

Facility ID:	5S 07I001940
Facility Type:	Industrial - Facility that treats and/or disposes of liquid or semisolid wastes from any servicing, producing, manufacturing or processing operation of whatever nature, including mining, gravel washing, geothermal operations, air conditioning, ship building and repairing, oil production, storage and disposal operations, water pumping.
Facility Status:	Active - Any facility with a continuous or seasonal discharge that is

KIE-CON A DIVISION OF KIEWIT PACIFIC (Continued) **S103973160**

	under Waste Discharge Requirements.
NPDES Number:	CAS000001 The 1st 2 characters designate the state. The remaining 7 are assigned by the Regional Board
Subregion:	0
Facility Telephone:	9257549494
Facility Contact:	JERRY LUCZENCZYN
Agency Name:	KIE-CON INC
Agency Address:	5000 Marsh Dr
Agency City,St,Zip:	Concord 945205322
Agency Contact:	STEVE FOSTER
Agency Telephone:	9256863030
Agency Type:	Private
SIC Code:	0
SIC Code 2:	Not reported
Primary Waste:	Not reported
Primary Waste Type:	Not reported
Secondary Waste:	Not reported
Secondary Waste Type:	Not reported
Design Flow:	0
Baseline Flow:	0
Reclamation:	Not reported
POTW:	Not reported
Treat To Water:	Minor Threat to Water Quality. A violation of a regional board order should cause a relatively minor impairment of beneficial uses compared to a major or minor threat. Not: All nurds without a TTWQ will be considered a minor threat to water quality unless coded at a higher Level. A Zero (0) may be used to code those NURDS that are found to represent no threat to water quality.
Complexity:	Category C - Facilities having no waste treatment systems, such as cooling water dischargers or thosewho must comply through best management practices, facilities with passive waste treatment and disposal systems, such as septic systems with subsurface disposal, or dischargers having waste storage systems with land disposal such as dairy waste ponds.

D18
East
1/8-1/4
0.204 mi.
1077 ft.

P G AND E CONTRA COSTA SWITCH YARD
3201 B WILBUR AVE
ANTIOCH, CA 94509

RCRA-SQG **1001815515**
FINDS **CAR000054718**
HAZNET

Site 2 of 3 in cluster D

Relative:
Higher

Actual:
15 ft.

RCRA-SQG:

Date form received by agency:	07/22/1999
Facility name:	P G AND E CONTRA COSTA SWITCH YARD
Facility address:	3201 B WILBUR AVE ANTIOCH, CA 94509
EPA ID:	CAR000054718
Mailing address:	1919 WEBSTER ST 5TH FLOOR OAKLAND, CA 946122997
Contact:	ALAN LEUNG
Contact address:	1919 WEBSTER ST 5TH FLOOR OAKLAND, CA 946122997
Contact country:	US
Contact telephone:	(510) 874-2501
Contact email:	Not reported
EPA Region:	09
Classification:	Small Small Quantity Generator
Description:	Handler: generates more than 100 and less than 1000 kg of hazardous

P G AND E CONTRA COSTA SWITCH YARD (Continued) **1001815515**

waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:

Owner/operator name:	PAC GAS AND ELECTRIC CO
Owner/operator address:	77 BEALE ST B 24 A SAN FRANCISCO, CA 94105
Owner/operator country:	Not reported
Owner/operator telephone:	(925) 779-6657
Legal status:	Private
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	Unknown
Mixed waste (haz. and radioactive):	Unknown
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	Unknown
Furnace exemption:	Unknown
Used oil fuel burner:	No
Used oil processor:	No
User oil refiner:	No
Used oil fuel marketer to burner:	No
Used oil Specification marketer:	No
Used oil transfer facility:	No
Used oil transporter:	No
Off-site waste receiver:	Commercial status unknown

Hazardous Waste Summary:

Waste code: D000
Waste name: Not Defined

Waste code: D001
Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

Waste code: D002
Waste name: A WASTE WHICH HAS A PH OF LESS THAN 2 OR GREATER THAN 12.5 IS CONSIDERED TO BE A CORROSIVE HAZARDOUS WASTE. SODIUM HYDROXIDE, A CAUSTIC SOLUTION WITH A HIGH PH, IS OFTEN USED BY INDUSTRIES TO CLEAN OR DEGREASE PARTS. HYDROCHLORIC ACID, A SOLUTION WITH A LOW PH, IS USED BY MANY INDUSTRIES TO CLEAN METAL PARTS PRIOR TO PAINTING. WHEN THESE CAUSTIC OR ACID SOLUTIONS BECOME CONTAMINATED AND MUST BE DISPOSED, THE WASTE WOULD BE A CORROSIVE HAZARDOUS WASTE.

P G AND E CONTRA COSTA SWITCH YARD (Continued) **1001815515**

Waste code: D003
Waste name: A MATERIAL IS CONSIDERED TO BE A REACTIVE HAZARDOUS WASTE IF IT IS NORMALLY UNSTABLE, REACTS VIOLENTLY WITH WATER, GENERATES TOXIC GASES WHEN EXPOSED TO WATER OR CORROSIVE MATERIALS, OR IF IT IS CAPABLE OF DETONATION OR EXPLOSION WHEN EXPOSED TO HEAT OR A FLAME. ONE EXAMPLE OF SUCH WASTE WOULD BY WASTE GUNPOWDER.

Waste code: D006
Waste name: CADMIUM

Waste code: D008
Waste name: LEAD

Waste code: D009
Waste name: MERCURY

Waste code: F002
Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE, TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE, CHLOROBENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROBENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2-TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE LISTED IN F001, F004, OR F005, AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Waste code: F005
Waste name: THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE, CARBON DISULFIDE, ISOBUTANOL, PYRIDINE, BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NON-HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Violation Status: No violations found

FINDS:
Other Pertinent Environmental Activity Identified at Site

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

HAZNET:
Gepaid: CAR000054718
Contact: PACIFIC GAS & ELECT CO A LEUNG
Telephone: 5104372562
Facility Addr2: Not reported
Mailing Name: Not reported
Mailing Address: 4801 OAKPORT ST BLDG 2
Mailing City,St,Zip: OAKLAND, CA 946010000

P G AND E CONTRA COSTA SWITCH YARD (Continued) **1001815515**

Gen County: Contra Costa
TSD EPA ID: AZ0000337360
TSD County: 99
Waste Category: Polychlorinated biphenyls and material containing PCB's
Disposal Method: Treatment, Incineration
Tons: 0.08
Facility County: Not reported

Gepaid: CAR000054718
Contact: PACIFIC GAS & ELECT CO A LEUNG
Telephone: 5104372562
Facility Addr2: Not reported
Mailing Name: Not reported
Mailing Address: PO BOX 7640
Mailing City,St,Zip: SAN FRANCISCO, CA 941050000
Gen County: Contra Costa
TSD EPA ID: CAD009452657
TSD County: San Mateo
Waste Category: Aqueous solution with less than 10% total organic residues
Disposal Method: Recycler
Tons: 0.04
Facility County: 7

Gepaid: CAR000054718
Contact: PAC GAS AND ELECTRIC CO
Telephone: 0000000000
Facility Addr2: Not reported
Mailing Name: Not reported
Mailing Address: 1919 WEBSTER ST 5TH FLOOR
Mailing City,St,Zip: OAKLAND, CA 946120000
Gen County: 7
TSD EPA ID: CAT000646117
TSD County: Kings
Waste Category: Polychlorinated biphenyls and material containing PCB's
Disposal Method: Transfer Station
Tons: .2259
Facility County: 7

D19 **ANTIOCH ROCK & READY MIX** **CONTRA COSTA CO. SITE LIST** **1005288352**
East **3600 WILBUR AVE** **CA WDS** **N/A**
1/8-1/4 **ANTIOCH, CA 94509**
0.230 mi.
1215 ft. **Site 3 of 3 in cluster D**

Relative:
Higher

Actual:
15 ft.

CONTRA COSTA CO. SITE LIST:
Region: CONTRA COSTA
Facility ID: 741914
Tier: Not reported
Program Status: HWG, Hmmp, AGT
Generator Fee Item: No
Inactive Date: Not reported

CA WDS:
Facility ID: 5S 07I017542
Facility Type: Industrial - Facility that treats and/or disposes of liquid or semisolid wastes from any servicing, producing, manufacturing or processing operation of whatever nature, including mining, gravel

ANTIOCH ROCK & READY MIX (Continued) **1005288352**

	washing, geothermal operations, air conditioning, ship building and repairing, oil production, storage and disposal operations, water pumping.
Facility Status:	Active - Any facility with a continuous or seasonal discharge that is under Waste Discharge Requirements.
NPDES Number:	CAS000001 The 1st 2 characters designate the state. The remaining 7 are assigned by the Regional Board
Subregion:	0
Facility Telephone:	9257542717
Facility Contact:	HAYCOX MIKE
Agency Name:	ANTIOCH ROCK & READY MIX
Agency Address:	3600 Wilbur Ave
Agency City,St,Zip:	Antioch 945098536
Agency Contact:	HAYCOX MIKE
Agency Telephone:	9257542717
Agency Type:	Private
SIC Code:	0
SIC Code 2:	Not reported
Primary Waste:	Not reported
Primary Waste Type:	Not reported
Secondary Waste:	Not reported
Secondary Waste Type:	Not reported
Design Flow:	0
Baseline Flow:	0
Reclamation:	Not reported
POTW:	Not reported
Treat To Water:	Minor Threat to Water Quality. A violation of a regional board order should cause a relatively minor impairment of beneficial uses compared to a major or minor threat. Not: All nurds without a TTWQ will be considered a minor threat to water quality unless coded at a higher Level. A Zero (0) may be used to code those NURDS that are found to represent no threat to water quality.
Complexity:	Category C - Facilities having no waste treatment systems, such as cooling water dischargers or thosewho must comply through best management practices, facilities with passive waste treatment and disposal systems, such as septic systems with subsurface disposal, or dischargers having waste storage systems with land disposal such as dairy waste ponds.

E20
NW
1/4-1/2
0.269 mi.
1421 ft.

Relative:
Lower

Actual:
10 ft.

CONTRA COSTA POWER PLANT
3201 WILBUR AVENUE
ANTIOCH, CA 94509

Site 1 of 3 in cluster E

RCRA-SQG **1000196257**
RCRA-TSDF **CAT080011489**
RAATS
CORRACTS
AST
CERC-NFRAP
CA WDS

RCRA-SQG:

Date form received by agency:	02/13/2006
Facility name:	CONTRA COSTA POWER PLANT
Facility address:	3201 WILBUR AVENUE ANTIOCH, CA 94509
EPA ID:	CAT080011489
Mailing address:	PO BOX 1687 ANTIOCH, CA 94509
Contact:	ANDREA F RICCI
Contact address:	Not reported Not reported

CONTRA COSTA POWER PLANT (Continued) **1000196257**

Contact country: Not reported
Contact telephone: (925) 427-3554
Contact email: ANDREA.RICCI@MIRANT.COM
EPA Region: 09
Land type: Private
Classification: TSDF
Description: Handler is engaged in the treatment, storage or disposal of hazardous waste
TSD commencement date: Not reported

Owner/Operator Summary:
Owner/operator name: MIRANT DELTA, LLC
Owner/operator address: Not reported
Not reported
Owner/operator country: US
Owner/operator telephone: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: 04/16/1999
Owner/Op end date: Not reported

Owner/operator name: MIRANT DELTA, LLC
Owner/operator address: PO BOX 1687
ANTIOCH, CA 94509
Owner/operator country: US
Owner/operator telephone: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 04/16/1999
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No
Off-site waste receiver: Commercial status unknown

Historical Generators:
Date form received by agency: 02/13/2006
Facility name: CONTRA COSTA POWER PLANT
Classification: Large Quantity Generator

Date form received by agency: 04/12/2001
Facility name: CONTRA COSTA POWER PLANT

CONTRA COSTA POWER PLANT (Continued) **1000196257**

Classification: Large Quantity Generator

Date form received by agency: 04/15/1999
Facility name: CONTRA COSTA POWER PLANT
Classification: Large Quantity Generator

Date form received by agency: 09/01/1996
Facility name: CONTRA COSTA POWER PLANT
Classification: Large Quantity Generator

Date form received by agency: 02/22/1996
Facility name: CONTRA COSTA POWER PLANT
Classification: Large Quantity Generator

Date form received by agency: 03/29/1994
Facility name: CONTRA COSTA POWER PLANT
Site name: PG&E CONTRA COSTA POWER PLANT
Classification: Large Quantity Generator

Date form received by agency: 04/11/1990
Facility name: CONTRA COSTA POWER PLANT
Site name: PG&E CONTRA COSTA POWER PLANT
Classification: Large Quantity Generator

Date form received by agency: 08/18/1980
Facility name: CONTRA COSTA POWER PLANT
Classification: Large Quantity Generator

Date form received by agency: 08/18/1980
Facility name: CONTRA COSTA POWER PLANT
Classification: Large Quantity Generator

Biennial Reports:

Last Biennial Reporting Year: 2005

Annual Waste Handled:

Waste code: D001
Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.
Amount (Lbs): 1142

Waste code: D002
Waste name: A WASTE WHICH HAS A PH OF LESS THAN 2 OR GREATER THAN 12.5 IS CONSIDERED TO BE A CORROSIVE HAZARDOUS WASTE. SODIUM HYDROXIDE, A CAUSTIC SOLUTION WITH A HIGH PH, IS OFTEN USED BY INDUSTRIES TO CLEAN OR DEGREASE PARTS. HYDROCHLORIC ACID, A SOLUTION WITH A LOW PH, IS USED BY MANY INDUSTRIES TO CLEAN METAL PARTS PRIOR TO PAINTING. WHEN THESE CAUSTIC OR ACID SOLUTIONS BECOME CONTAMINATED AND MUST BE DISPOSED, THE WASTE WOULD BE A CORROSIVE HAZARDOUS WASTE.
Amount (Lbs): 1126

Waste code: D006

CONTRA COSTA POWER PLANT (Continued) **1000196257**

Waste name: CADMIUM
Amount (Lbs): 3574

Waste code: D007
Waste name: CHROMIUM
Amount (Lbs): 338

Waste code: D008
Waste name: LEAD
Amount (Lbs): 145

Waste code: D009
Waste name: MERCURY
Amount (Lbs): 7

Corrective Action Summary:

Event date: 12/01/1986
Event: CA029EP

Event date: 12/01/1986
Event: CA049PA

Event date: 12/01/1986
Event: CA049SI

Event date: 12/01/1986
Event: CA Prioritization, Facility or area was assigned a low corrective action priority.

Event date: 12/01/1986
Event: CA074LO

Event date: 02/24/1989
Event: CA022

Facility Has Received Notices of Violations:

Regulation violated: F - 264.140-150.H
Area of violation: TSD - Financial Requirements
Date violation determined: 06/24/1992
Date achieved compliance: 10/13/1992
Violation lead agency: EPA
Enforcement action: Not reported
Enforcement action date: Not reported
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: Not reported
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 02/23/1989
Date achieved compliance: 08/05/1991
Violation lead agency: State

CONTRA COSTA POWER PLANT (Continued) **1000196257**

Enforcement action: WRITTEN INFORMAL
Enforcement action date: 04/05/1989
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.90-94.F
Area of violation: TSD IS-Ground-Water Monitoring
Date violation determined: 12/08/1987
Date achieved compliance: 01/18/1988
Violation lead agency: State
Enforcement action: STATE TO EPA ADMINISTRATIVE REFERRAL
Enforcement action date: 03/27/1989
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.90-94.F
Area of violation: TSD IS-Ground-Water Monitoring
Date violation determined: 12/08/1987
Date achieved compliance: 01/18/1988
Violation lead agency: State
Enforcement action: FINAL 3008(H) I.S. CA ORDER
Enforcement action date: 09/15/1989
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: EPA
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 11/24/1987
Date achieved compliance: 01/18/1988
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/08/1988
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 11/25/1986
Date achieved compliance: 08/05/1991
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL

CONTRA COSTA POWER PLANT (Continued) **1000196257**

Enforcement action date: 08/12/1987
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Evaluation Action Summary:

Evaluation date: 06/24/1992
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: TSD - Financial Requirements
Date achieved compliance: 10/13/1992
Evaluation lead agency: EPA Contractor/Grantee

Evaluation date: 09/27/1991
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 02/23/1989
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 08/05/1991
Evaluation lead agency: State

Evaluation date: 02/16/1989
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 12/08/1987
Evaluation: GROUNDWATER MONITORING EVALUATION
Area of violation: TSD IS-Ground-Water Monitoring
Date achieved compliance: 01/18/1988
Evaluation lead agency: State

Evaluation date: 11/24/1987
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 01/18/1988
Evaluation lead agency: State

Evaluation date: 11/09/1987
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 11/25/1986
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 08/05/1991
Evaluation lead agency: State

CONTRA COSTA POWER PLANT (Continued) **1000196257**

CORRACTS:

EPA ID: CAT080011489
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 12/1/1986
Action: CA075LO - CA Prioritization, Facility or area was assigned a low corrective action priority
NAICS Code(s): 221112
Fossil Fuel Electric Power Generation
Original schedule date: Not reported
Schedule end date: Not reported

AST:
Owner: MIRANT DELTA LLC
Total Gallons: 5942916

CERC-NFRAP:
Site ID: 0902670
Federal Facility: Not a Federal Facility
NPL Status: Not on the NPL
Non NPL Status: NFRAP

CERCLIS-NFRAP Site Contact Name(s):
Contact Name: Matt Mitguard
Contact Tel: (415) 972-3096
Contact Title: Site Assessment Manager (SAM)

Contact Name: Nuria Muniz
Contact Tel: (415) 972-3811
Contact Title: Site Assessment Manager (SAM)

CERCLIS-NFRAP Site Alias Name(s):
Alias Name: PG&E
Alias Address: SW 1 1/4 SEC 16 T2N R2E
ANTIOCH, CA 94509
Site Description: Not reported

CERCLIS-NFRAP Assessment History:
Action: DISCOVERY
Date Started: Not reported
Date Completed: 10/01/1979
Priority Level: Not reported

Action: RESOURCE CONSERVATION AND RECOVERY ACT FACILITY ASSESSMENT
Date Started: Not reported
Date Completed: 09/25/1986
Priority Level: Not reported

Action: PRELIMINARY ASSESSMENT
Date Started: Not reported
Date Completed: 12/01/1986
Priority Level: Low

Action: SITE INSPECTION

CONTRA COSTA POWER PLANT (Continued) **1000196257**

Date Started: Not reported
Date Completed: 12/01/1986
Priority Level: High

Action: SITE INSPECTION
Date Started: Not reported
Date Completed: 10/11/1991
Priority Level: NFRAP (No Futher Remedial Action Planned

Action: ARCHIVE SITE
Date Started: Not reported
Date Completed: 10/11/1991
Priority Level: Not reported

CA WDS:
Facility ID: 5S 07I016482
Facility Type: Industrial - Facility that treats and/or disposes of liquid or semisolid wastes from any servicing, producing, manufacturing or processing operation of whatever nature, including mining, gravel washing, geothermal operations, air conditioning, ship building and repairing, oil production, storage and disposal operations, water pumping.
Facility Status: Active - Any facility with a continuous or seasonal discharge that is under Waste Discharge Requirements.
NPDES Number: CAS000001 The 1st 2 characters designate the state. The remaining 7 are assigned by the Regional Board
Subregion: 0
Facility Telephone: 9257796500
Facility Contact: STEVE BAUMAN
Agency Name: MIRANT DELTA LLC
Agency Address: 3201 WILBUR AVE
Agency City,St,Zip: ANTIOCH 945090024
Agency Contact: STEVEN BAUMAN
Agency Telephone: 9257796500
Agency Type: ?
SIC Code: 0
SIC Code 2: Not reported
Primary Waste: Not reported
Primary Waste Type: Not reported
Secondary Waste: Not reported
Secondary Waste Type: Not reported
Design Flow: 0
Baseline Flow: 0
Reclamation: Not reported
POTW: Not reported
Treat To Water: Minor Threat to Water Quality. A violation of a regional board order should cause a relatively minor impairment of beneficial uses compared to a major or minor threat. Not: All nurds without a TTWQ will be considered a minor threat to water quality unless coded at a higher Level. A Zero (0) may be used to code those NURDS that are found to represent no threat to water quality.
Complexity: Category C - Facilities having no waste treatment systems, such as cooling water dischargers or thosewho must comply through best management practices, facilities with passive waste treatment and disposal systems, such as septic systems with subsurface disposal, or dischargers having waste storage systems with land disposal such as dairy waste ponds.

E21
NW
1/4-1/2
0.269 mi.
1421 ft.

MIRANT DELTA, LLC CONTRA COSTA POWER PLANT
3201 WILBUR AVE #A
ANTIOCH, CA

CONTRA COSTA CO. SITE LIST

S105455140
N/A

Site 2 of 3 in cluster E

Relative:
Lower

Actual:
10 ft.

CONTRA COSTA CO. SITE LIST:

Region:	CONTRA COSTA
Facility ID:	735376
Tier:	X
Program Status:	HWG, Hmmp, ARP
Generator Fee Item:	No
Inactive Date:	Not reported

E22
NW
1/4-1/2
0.269 mi.
1421 ft.

PG&E CONTRA COSTA SWITCHYARD
3201 WILBUR AVE #B
ANTIOCH, CA

CONTRA COSTA CO. SITE LIST

S104310620
N/A

Site 3 of 3 in cluster E

Relative:
Lower

Actual:
10 ft.

CONTRA COSTA CO. SITE LIST:

Region:	CONTRA COSTA
Facility ID:	772860
Tier:	Not reported
Program Status:	HWG, Hmmp
Generator Fee Item:	No
Inactive Date:	Not reported

F23
East
1/4-1/2
0.274 mi.
1444 ft.

NORMAN P OLSEN JR WELDING
3660 WILBUR AVE
ANTIOCH, CA

CONTRA COSTA CO. SITE LIST

S105455141
N/A

Site 1 of 2 in cluster F

Relative:
Higher

Actual:
19 ft.

CONTRA COSTA CO. SITE LIST:

Region:	CONTRA COSTA
Facility ID:	707546
Tier:	Not reported
Program Status:	Hmmp
Generator Fee Item:	No
Inactive Date:	Not reported

F24
East
1/4-1/2
0.275 mi.
1452 ft.

JACK MANNIE
3665 WILBUR AVE
ANTIOCH, CA 94509

HAZNET
CONTRA COSTA CO. SITE LIST

S104569627
N/A

Site 2 of 2 in cluster F

Relative:
Higher

Actual:
19 ft.

HAZNET:

Gepaid:	CAC002112760
Contact:	JACK MANNIE
Telephone:	9257571531
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	311 W 5TH ST
Mailing City,St,Zip:	ANTIOCH, CA 945090000
Gen County:	7

JACK MANNIE (Continued) **S104569627**

TSD EPA ID: CAD009466392
TSD County: 7
Waste Category: Other empty containers 30 gallons or more
Disposal Method: Recycler
Tons: 1.15
Facility County: 7

Gepaid: CAC002112760
Contact: JACK MANNIE
Telephone: 9257571531
Facility Addr2: Not reported
Mailing Name: Not reported
Mailing Address: 311 W 5TH ST
Mailing City,St,Zip: ANTIOCH, CA 945090000
Gen County: 7
TSD EPA ID: CAL000161743
TSD County: Santa Clara
Waste Category: Waste oil and mixed oil
Disposal Method: Transfer Station
Tons: 0.7297
Facility County: 7

CONTRA COSTA CO. SITE LIST:
Region: CONTRA COSTA
Facility ID: 771211
Tier: Not reported
Program Status: UST, Hmmp
Generator Fee Item: No
Inactive Date: 1/21/1999

25
ESE
1/4-1/2
0.329 mi.
1740 ft.

ANTIOCH MARINA **CA FID UST** **S101580979**
L ST **SWEEPS UST** **N/A**
ANTIOCH, CA 94509

Relative:
Higher

Actual:
28 ft.

CA FID UST:
Facility ID: 07001119
Regulated By: UTNKI
Regulated ID: Not reported
Cortese Code: Not reported
SIC Code: Not reported
Facility Phone: Not reported
Mail To: Not reported
Mailing Address: P O BOX
Mailing Address 2: Not reported
Mailing City,St,Zip: ANTIOCH 94509
Contact: Not reported
Contact Phone: Not reported
DUNs Number: Not reported
NPDES Number: Not reported
EPA ID: Not reported
Comments: Not reported
Status: Inactive

SWEEPS UST:
Status: Not reported

ANTIOCH MARINA (Continued) **S101580979**

Comp Number:	70644
Number:	Not reported
Board Of Equalization:	44-002380
Ref Date:	Not reported
Act Date:	Not reported
Created Date:	Not reported
Tank Status:	Not reported
Owner Tank Id:	Not reported
Swrcb Tank Id:	07-000-070644-000001
Actv Date:	Not reported
Capacity:	10000
Tank Use:	M.V. FUEL
Stg:	PRODUCT
Content:	DIESEL
Number Of Tanks:	2

Status:	Not reported
Comp Number:	70644
Number:	Not reported
Board Of Equalization:	44-002380
Ref Date:	Not reported
Act Date:	Not reported
Created Date:	Not reported
Tank Status:	Not reported
Owner Tank Id:	Not reported
Swrcb Tank Id:	07-000-070644-000002
Actv Date:	Not reported
Capacity:	10000
Tank Use:	M.V. FUEL
Stg:	PRODUCT
Content:	REG UNLEADED
Number Of Tanks:	Not reported

G26 **E. I. DUPONT DE NEMOURS & CO** **RCRA-SQG** **1000111309**
East **6000 BRIDGEHEAD RD** **FINDS** **CAD009151671**
1/4-1/2 **ANTIOCH, CA 94509** **RCRA-TSDF**
0.415 mi. **CORRACTS**
2194 ft. **Site 1 of 6 in cluster G** **CERC-NFRAP**
HIST UST

Relative:
Higher

Actual:
20 ft.

RCRA-SQG:

Date form received by agency:	02/15/2002
Facility name:	E. I. DUPONT DE NEMOURS & CO
Facility address:	6000 BRIDGEHEAD ROAD OAKLEY, CA 94561
EPA ID:	CAD009151671
Mailing address:	BRIDGEHEAD ROAD OAKLEY, CA 94561
Contact:	CAROL A MALLING
Contact address:	Not reported Not reported
Contact country:	Not reported
Contact telephone:	(925) 706-0460
Contact email:	CAROL.A.MALLING-1@USA.DUPONT.COM
EPA Region:	09
Land type:	Private
Classification:	TSDF
Description:	Handler is engaged in the treatment, storage or disposal of hazardous

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

waste
TSD commencement date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: Unknown
Transporter of hazardous waste: Unknown
Treater, storer or disposer of HW: No
Underground injection activity: Unknown
On-site burner exemption: Unknown
Furnace exemption: Unknown
Used oil fuel burner: Unknown
Used oil processor: Unknown
User oil refiner: Unknown
Used oil fuel marketer to burner: Unknown
Used oil Specification marketer: Unknown
Used oil transfer facility: Unknown
Used oil transporter: Unknown
Off-site waste receiver: Commercial status unknown

Historical Generators:
Date form received by agency: 02/15/2002
Facility name: E. I. DUPONT DE NEMOURS & CO
Classification: Large Quantity Generator

Date form received by agency: 10/12/2000
Facility name: E. I. DUPONT DE NEMOURS & CO
Site name: E. I. DU PONT DE NEMOURS & CO
Classification: Large Quantity Generator

Date form received by agency: 03/04/1999
Facility name: E. I. DUPONT DE NEMOURS & CO
Site name: E. I. DU PONT DE NEMOURS & CO
Classification: Large Quantity Generator

Date form received by agency: 09/01/1996
Facility name: E. I. DUPONT DE NEMOURS & CO
Site name: E I DUPONT DE NEMOURS & CO INC
Classification: Large Quantity Generator

Date form received by agency: 03/14/1996
Facility name: E. I. DUPONT DE NEMOURS & CO
Site name: E. I. DU PONT DE NEMOURS & CO.
Classification: Large Quantity Generator

Date form received by agency: 03/29/1994
Facility name: E. I. DUPONT DE NEMOURS & CO
Site name: E I DUPONT DENEMOURS & CO
Classification: Large Quantity Generator

Date form received by agency: 02/26/1992
Facility name: E. I. DUPONT DE NEMOURS & CO
Site name: E I DUPONT DE NEMOURS & COMPAN
Classification: Large Quantity Generator

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Date form received by agency: 02/25/1991
Facility name: E. I. DUPONT DE NEMOURS & CO
Site name: E I DUPONT DE NEMOURS & CO INC
Classification: Large Quantity Generator

Date form received by agency: 04/11/1990
Facility name: E. I. DUPONT DE NEMOURS & CO
Site name: E.I. DUPONT DE NEMOURS & CO. INC.
Classification: Large Quantity Generator

Corrective Action Summary:

Event date: 01/01/1983
Event: RFI Imposition

Event date: 01/10/1983
Event: RFI Workplan Approved

Event date: 02/20/1984
Event: RFI Approved

Event date: 01/28/1985
Event: Stabilization Measures Implemented, Primary measure is source removal and/or treatment (e.g., soil or waste excavation, in-situ soil treatment, off-site treatment).

Event date: 03/01/1985
Event: CA049SI

Event date: 09/25/1985
Event: Stabilization Construction Completed

Event date: 08/24/1988
Event: CA049PA

Event date: 11/23/1988
Event: CA074HI

Event date: 11/23/1988
Event: CA029WQ

Event date: 11/23/1988
Event: CA049RE

Event date: 11/23/1988
Event: CA Prioritization, Facility or area was assigned a high corrective action priority.

Event date: 06/18/1990
Event: CA036WQ

Event date: 06/30/1993
Event: RFA Completed, Assessment was an RFA.

Event date: 06/30/1994
Event: Stabilization Measures Implemented, Groundwater extraction and treatment (e.g., to achieve groundwater containment, to achieve MCL).

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Event date: 01/01/1995
Event: Igration of Contaminated Groundwater under Control, Yes, Migration of Contaminated Groundwater Under Control has been verified. Based on a review of information contained in the EI determination, it has been determined that migration of contaminated groundwater is under control at the facility. Specifically, this determination indicates that the migration of contaminated groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the existing area of contaminated groundwater. This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

Event date: 01/01/1995
Event: Current Human Exposures under Control, Yes, Current Human Exposures Under Control has been verified. Based on a review of information contained in the EI determination, current human exposures are expected to be under control at the facility under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

Event date: 02/10/1995
Event: Stabilization Measures Evaluation,This facility is not amenable to stabilization activity at the present time for reasons other than 1- it appears to be technically infeasible or inappropriate (NF) or 2- there is a lack of technical information (IN). Reasons for this conclusion may be the status of closure at the facility, the degree of risk, timing considerations, the status of corrective action work at the facility, or other administrative considerations.

Event date: 10/08/1997
Event: CA210WB

Event date: 10/08/1997
Event: Igration of Contaminated Groundwater under Control, Unacceptable migration of contaminated groundwater is observed or expected.

Event date: 10/08/1997
Event: Stabilization Measures Evaluation,This facility is amenable to stabilization activity based on the status of corrective action work at the facility, technical factors, the degree of risk, timing considerations and administrative considerations.

Event date: 01/10/2001
Event: Current Human Exposures under Control, Yes, Current Human Exposures Under Control has been verified. Based on a review of information contained in the EI determination, current human exposures are expected to be under control at the facility under current and reasonably expected conditions. This determination will be re-evaluated when the Agency/State becomes aware of significant changes at the facility.

Event date: 01/10/2001
Event: Igration of Contaminated Groundwater under Control, Unacceptable migration of contaminated groundwater is observed or expected.

Event date: 12/12/2003

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Event: RFI Workplan Received

Event date: 06/29/2004
Event: RFI Workplan Received

Event date: 07/09/2004
Event: RFI Workplan Approved

Event date: 07/26/2004
Event: RFI Workplan Approved

Event date: 05/04/2005
Event: Igration of Contaminated Groundwater under Control, Yes, Migration of Contaminated Groundwater Under Control has been verified. Based on a review of information contained in the EI determination, it has been determined that migration of contaminated groundwater is under control at the facility. Specifically, this determination indicates that the migration of contaminated groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the existing area of contaminated groundwater. This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

Event date: 05/04/2005
Event: Igration of Contaminated Groundwater under Control, Yes, Migration of Contaminated Groundwater Under Control has been verified. Based on a review of information contained in the EI determination, it has been determined that migration of contaminated groundwater is under control at the facility. Specifically, this determination indicates that the migration of contaminated groundwater is under control, and that monitoring will be conducted to confirm that contaminated groundwater remains within the existing area of contaminated groundwater. This determination will be re-evaluated when the Agency becomes aware of significant changes at the facility.

Event date: 08/23/2007
Event: RFI Workplan Approved

Event date: 10/31/2007
Event: CA805

Event date: 12/28/2007
Event: RFI Supplemental Information Requested By Agency

Event date: 01/08/2008
Event: RFI Approved

Event date: 01/25/2008
Event: CA805

Event date: 02/12/2008
Event: CA805

Event date: Not reported
Event: CA03191

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Facility Has Received Notices of Violations:

Regulation violated:	Not reported
Area of violation:	TSD - Financial Requirements
Date violation determined:	08/24/2007
Date achieved compliance:	09/07/2007
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	08/28/2007
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	FR - 264.190-201.J
Area of violation:	TSD - General
Date violation determined:	05/14/1996
Date achieved compliance:	06/14/1996
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	05/14/1996
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	FR - 262.30-34.C
Area of violation:	Generators - General
Date violation determined:	05/14/1996
Date achieved compliance:	05/14/1996
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	05/14/1996
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

Regulation violated:	FR - 262.50-60
Area of violation:	Generators - General
Date violation determined:	05/14/1996
Date achieved compliance:	05/14/1996
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	05/14/1996
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Regulation violated: FR - 264.10-18.B
Area of violation: TSD - General
Date violation determined: 09/28/1994
Date achieved compliance: 09/28/1994
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 10/04/1994
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 09/28/1994
Date achieved compliance: 09/28/1994
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 10/04/1994
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.190-201.J
Area of violation: TSD - General
Date violation determined: 09/28/1994
Date achieved compliance: 11/03/1994
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 10/04/1994
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 262.50-60
Area of violation: Generators - General
Date violation determined: 09/28/1994
Date achieved compliance: 11/03/1994
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 10/04/1994
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.190-201.J

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Area of violation: TSD - General
Date violation determined: 02/03/1994
Date achieved compliance: 11/03/1994
Violation lead agency: State
Enforcement action: INITIAL 3008(A) COMPLIANCE
Enforcement action date: 06/30/1994
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 200000
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 262.50-60
Area of violation: Generators - General
Date violation determined: 02/03/1994
Date achieved compliance: 11/03/1994
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 02/07/1994
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.10-18.B
Area of violation: TSD - General
Date violation determined: 02/03/1994
Date achieved compliance: 09/28/1994
Violation lead agency: State
Enforcement action: INITIAL 3008(A) COMPLIANCE
Enforcement action date: 06/30/1994
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 200000
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.190-201.J
Area of violation: TSD - General
Date violation determined: 02/03/1994
Date achieved compliance: 11/03/1994
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 02/07/1994
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.10-18.B
Area of violation: TSD - General

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Date violation determined: 02/03/1994
Date achieved compliance: 09/28/1994
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 02/07/1994
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 262.50-60
Area of violation: Generators - General
Date violation determined: 02/03/1994
Date achieved compliance: 11/03/1994
Violation lead agency: State
Enforcement action: INITIAL 3008(A) COMPLIANCE
Enforcement action date: 06/30/1994
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: 200000
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 12/11/1990
Date achieved compliance: 01/11/1991
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/11/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.110-120.G
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 11/27/1989
Date achieved compliance: 12/11/1990
Violation lead agency: State
Enforcement action: REFERRAL TO ATTORNEY GENERAL
Enforcement action date: 01/25/1990
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 11/27/1989

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Date achieved compliance: 12/11/1990
Violation lead agency: State
Enforcement action: FINAL CIVIL JUDICIAL ACTION FOR COMPLIANCE AND/OR MONETARY PENALTY
Enforcement action date: 09/11/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.70-77.E
Area of violation: TSD - General
Date violation determined: 11/27/1989
Date achieved compliance: 12/11/1990
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/25/1990
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 11/27/1989
Date achieved compliance: 12/11/1990
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/25/1990
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.110-120.G
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 11/27/1989
Date achieved compliance: 12/11/1990
Violation lead agency: State
Enforcement action: FINAL CIVIL JUDICIAL ACTION FOR COMPLIANCE AND/OR MONETARY PENALTY
Enforcement action date: 09/11/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.110-120.G
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 11/27/1989
Date achieved compliance: 12/11/1990

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 01/25/1990
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 11/27/1989
Date achieved compliance: 12/11/1990
Violation lead agency: State
Enforcement action: REFERRAL TO ATTORNEY GENERAL
Enforcement action date: 01/25/1990
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.70-77.E
Area of violation: TSD - General
Date violation determined: 11/27/1989
Date achieved compliance: 12/11/1990
Violation lead agency: State
Enforcement action: REFERRAL TO ATTORNEY GENERAL
Enforcement action date: 01/25/1990
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.70-77.E
Area of violation: TSD - General
Date violation determined: 11/27/1989
Date achieved compliance: 12/11/1990
Violation lead agency: State
Enforcement action: FINAL CIVIL JUDICIAL ACTION FOR COMPLIANCE AND/OR MONETARY PENALTY
Enforcement action date: 09/11/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.110-120.G
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 11/30/1988
Date achieved compliance: 12/11/1990
Violation lead agency: State

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Enforcement action: WRITTEN INFORMAL
Enforcement action date: 02/06/1989
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.110-120.G
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 11/30/1988
Date achieved compliance: 12/11/1990
Violation lead agency: State
Enforcement action: FINAL CIVIL JUDICIAL ACTION FOR COMPLIANCE AND/OR MONETARY PENALTY
Enforcement action date: 09/11/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.110-120.G
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 11/30/1988
Date achieved compliance: 12/11/1990
Violation lead agency: State
Enforcement action: REFERRAL TO ATTORNEY GENERAL
Enforcement action date: 04/28/1989
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 11/30/1988
Date achieved compliance: 01/11/1991
Violation lead agency: State
Enforcement action: REFERRAL TO ATTORNEY GENERAL
Enforcement action date: 04/28/1989
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 11/30/1988
Date achieved compliance: 01/11/1991
Violation lead agency: State
Enforcement action: FINAL CIVIL JUDICIAL ACTION FOR COMPLIANCE AND/OR MONETARY PENALTY

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Enforcement action date: 09/11/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 11/30/1988
Date achieved compliance: 01/11/1991
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 02/06/1989
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.140-150.H
Area of violation: TSD - Financial Requirements
Date violation determined: 11/01/1988
Date achieved compliance: 03/21/1989
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 11/28/1988
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 268 ALL
Area of violation: LDR - General
Date violation determined: 03/31/1988
Date achieved compliance: 03/21/1989
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/03/1988
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 268.7
Area of violation: LDR - General
Date violation determined: 03/31/1988
Date achieved compliance: 03/21/1989
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/03/1988

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 268 ALL
Area of violation: LDR - General
Date violation determined: 03/31/1988
Date achieved compliance: 03/21/1989
Violation lead agency: State
Enforcement action: FINAL CIVIL JUDICIAL ACTION FOR COMPLIANCE AND/OR MONETARY PENALTY
Enforcement action date: 09/11/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 268.7
Area of violation: LDR - General
Date violation determined: 03/31/1988
Date achieved compliance: 03/21/1989
Violation lead agency: State
Enforcement action: FINAL CIVIL JUDICIAL ACTION FOR COMPLIANCE AND/OR MONETARY PENALTY
Enforcement action date: 09/11/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 03/29/1988
Date achieved compliance: 03/21/1989
Violation lead agency: State
Enforcement action: FINAL CIVIL JUDICIAL ACTION FOR COMPLIANCE AND/OR MONETARY PENALTY
Enforcement action date: 09/11/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.90-94.F
Area of violation: TSD IS-Ground-Water Monitoring
Date violation determined: 03/29/1988
Date achieved compliance: 03/21/1989
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/03/1988
Enf. disposition status: Not reported

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 270
Area of violation: TSD - General
Date violation determined: 03/29/1988
Date achieved compliance: 03/21/1989
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/03/1988
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.90-94.F
Area of violation: TSD IS-Ground-Water Monitoring
Date violation determined: 03/29/1988
Date achieved compliance: 03/21/1989
Violation lead agency: State
Enforcement action: FINAL CIVIL JUDICIAL ACTION FOR COMPLIANCE AND/OR MONETARY PENALTY
Enforcement action date: 09/11/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.110-120.G
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 03/29/1988
Date achieved compliance: 03/21/1989
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/03/1988
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 264.110-120.G
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 03/29/1988
Date achieved compliance: 03/21/1989
Violation lead agency: State
Enforcement action: FINAL CIVIL JUDICIAL ACTION FOR COMPLIANCE AND/OR MONETARY PENALTY
Enforcement action date: 09/11/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Evaluation Action Summary:

Evaluation date: 08/24/2007
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: TSD - Financial Requirements
Date achieved compliance: 09/07/2007
Evaluation lead agency: State

Evaluation date: 06/27/2007
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 04/20/2007
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 09/30/2005
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: EPA

Evaluation date: 06/24/2004
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 06/02/1998
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 05/14/1996
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 05/14/1996
Evaluation lead agency: State

Evaluation date: 05/14/1996
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 06/14/1996
Evaluation lead agency: State

Evaluation date: 08/30/1994
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Date achieved compliance: 11/03/1994
Evaluation lead agency: State

Evaluation date: 08/30/1994
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 11/03/1994
Evaluation lead agency: State

Evaluation date: 08/30/1994
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 09/28/1994
Evaluation lead agency: State

Evaluation date: 11/18/1993
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 09/28/1994
Evaluation lead agency: State

Evaluation date: 11/18/1993
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 11/03/1994
Evaluation lead agency: State

Evaluation date: 11/18/1993
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 11/03/1994
Evaluation lead agency: State

Evaluation date: 10/01/1992
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 09/10/1992
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 07/23/1992
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 03/23/1992
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Evaluation date: 12/18/1990
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 12/11/1990
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 01/11/1991
Evaluation lead agency: State

Evaluation date: 11/27/1989
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 12/11/1990
Evaluation lead agency: State

Evaluation date: 11/27/1989
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - Closure/Post-Closure
Date achieved compliance: 12/11/1990
Evaluation lead agency: State

Evaluation date: 11/21/1989
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 11/30/1988
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 01/11/1991
Evaluation lead agency: State

Evaluation date: 11/30/1988
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - Closure/Post-Closure
Date achieved compliance: 12/11/1990
Evaluation lead agency: State

Evaluation date: 11/01/1988
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: TSD - Financial Requirements
Date achieved compliance: 03/21/1989
Evaluation lead agency: State

Evaluation date: 06/14/1988
Evaluation: GROUNDWATER MONITORING EVALUATION
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 03/31/1988
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: LDR - General

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Date achieved compliance: 03/21/1989
Evaluation lead agency: State

Evaluation date: 03/29/1988
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD IS-Ground-Water Monitoring
Date achieved compliance: 03/21/1989
Evaluation lead agency: State

Evaluation date: 03/29/1988
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 03/21/1989
Evaluation lead agency: State

Evaluation date: 03/29/1988
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - Closure/Post-Closure
Date achieved compliance: 03/21/1989
Evaluation lead agency: State

Evaluation date: 11/02/1987
Evaluation: FINANCIAL RECORD REVIEW
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

FINDS:
Other Pertinent Environmental Activity Identified at Site

California - Hazardous Waste Tracking System - Datamart

NCDB (National Compliance Data Base) supports implementation of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Toxic Substances Control Act (TSCA). The system tracks inspections in regions and states with cooperative agreements, enforcement actions, and settlements.

TRIS (Toxics Release Inventory System) contains information from facilities on the amounts of over 300 listed toxic chemicals that these facilities release directly to air, water, land, or that are transported off-site.

The NEI (National Emissions Inventory) database contains information on stationary and mobile sources that emit criteria air pollutants and their precursors, as well as hazardous air pollutants (HAPs).

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

ICIS (Integrated Compliance Information System) is the Integrated Compliance Information System and provides a database that, when complete, will contain integrated Enforcement and Compliance information across most of EPA's programs. The vision for ICIS is to

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

replace EPA's independent databases that contain Enforcement data with a single repository for that information. Currently, ICIS contains all Federal Administrative and Judicial enforcement actions. This information is maintained in ICIS by EPA in the Regional offices and its Headquarters. A future release of ICIS will replace the Permit Compliance System (PCS) which supports the NPDES and will integrate that information with Federal actions already in the system. ICIS also has the capability to track other activities occurring in the Region that support Compliance and Enforcement programs. These include; Incident Tracking, Compliance Assistance, and Compliance Monitoring.

CORRACTS:

EPA ID:	CAD009151671
EPA Region:	09
Area Name:	ENTIRE FACILITY
Actual Date:	1/1/1983
Action:	CA100 - RFI Imposition
NAICS Code(s):	325131 Inorganic Dye and Pigment Manufacturing
Original schedule date:	Not reported
Schedule end date:	Not reported

EPA ID:	CAD009151671
EPA Region:	09
Area Name:	ENTIRE FACILITY
Actual Date:	1/1/1995
Action:	CA725YE - Current Human Exposures Under Control, Yes, Current Human Exposures Under Control has been verified
NAICS Code(s):	325131 Inorganic Dye and Pigment Manufacturing
Original schedule date:	Not reported
Schedule end date:	Not reported

EPA ID:	CAD009151671
EPA Region:	09
Area Name:	ENTIRE FACILITY
Actual Date:	1/1/1995
Action:	CA750YE - Migration of Contaminated Groundwater under Control, Yes, Migration of Contaminated Groundwater Under Control has been verified
NAICS Code(s):	325131 Inorganic Dye and Pigment Manufacturing
Original schedule date:	Not reported
Schedule end date:	Not reported

EPA ID:	CAD009151671
EPA Region:	09
Area Name:	ENTIRE FACILITY
Actual Date:	1/8/2008
Action:	CA200 - RFI Approved
NAICS Code(s):	325131 Inorganic Dye and Pigment Manufacturing
Original schedule date:	Not reported
Schedule end date:	Not reported

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 1/10/1983
Action: CA150 - RFI Workplan Approved
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 1/10/2001
Action: CA750NO - Migration of Contaminated Groundwater under Control, Unacceptable migration of contaminated groundwater is observed or expected
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 1/10/2001
Action: CA725YE - Current Human Exposures Under Control, Yes, Current Human Exposures Under Control has been verified
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 1/28/1985
Action: CA600SR - Stabilization Measures Implemented, Primary measure is source removal and/or treatment
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 2/10/1995
Action: CA225NR - Stabilization Measures Evaluation, This facility is, not amenable to stabilization activity at the, present time for reasons other than (1) it appears to be technically, infeasible or inappropriate (NF) or (2) there is a lack of technical, information (IN). Reasons for this conclusion may be the status of, closure at the facility, the degree of risk, timing considerations, the status of corrective action work at the facility, or other, administrative considerations
NAICS Code(s): 325131

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 2/20/1984
Action: CA200 - RFI Approved
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 5/4/2005
Action: CA750YE - Migration of Contaminated Groundwater under Control, Yes, Migration of Contaminated Groundwater Under Control has been verified
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: FLOURIDE & IRON CHLORIDE SYST.
Actual Date: 6/30/1994
Action: CA600GW - Stabilization Measures Implemented, Groundwater extraction and treatment
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 6/30/1994
Action: CA600GW - Stabilization Measures Implemented, Groundwater extraction and treatment
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 7/9/2004
Action: CA150 - RFI Workplan Approved
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 7/26/2004
Action: CA150 - RFI Workplan Approved
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 8/23/2007
Action: CA150 - RFI Workplan Approved
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 9/25/1985
Action: CA650 - Stabilization Construction Completed
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 10/8/1997
Action: CA750NO - Migration of Contaminated Groundwater under Control, Unacceptable migration of contaminated groundwater is observed or expected
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09
Area Name: ENTIRE FACILITY
Actual Date: 10/8/1997
Action: CA225YE - Stabilization Measures Evaluation, This facility ,is amenable to stabilization activity based on the, status of corrective action work at the facility, technical factors, the degree of risk, timing considerations and administrative considerations
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: CAD009151671
EPA Region: 09

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Area Name: ENTIRE FACILITY
Actual Date: 11/23/1988
Action: CA075HI - CA Prioritization, Facility or area was assigned a high corrective action priority
NAICS Code(s): 325131
Inorganic Dye and Pigment Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

CERC-NFRAP:
Site ID: 0901175
Federal Facility: Not a Federal Facility
NPL Status: Not on the NPL
Non NPL Status: NFRAP

CERCLIS-NFRAP Site Contact Name(s):
Contact Name: Matt Mitguard
Contact Tel: (415) 972-3096
Contact Title: Site Assessment Manager (SAM)

Contact Name: Nuria Muniz
Contact Tel: (415) 972-3811
Contact Title: Site Assessment Manager (SAM)

CERCLIS-NFRAP Site Alias Name(s):
Alias Name: DUPONT ANTIOCH WORKS
Alias Address: Not reported
CA
Site Description: Not reported

CERCLIS-NFRAP Assessment History:
Action: DISCOVERY
Date Started: Not reported
Date Completed: 11/01/1979
Priority Level: Not reported

Action: PRELIMINARY ASSESSMENT
Date Started: Not reported
Date Completed: 03/01/1985
Priority Level: High

Action: SITE INSPECTION
Date Started: Not reported
Date Completed: 03/01/1985
Priority Level: High

Action: PRELIMINARY ASSESSMENT
Date Started: Not reported
Date Completed: 11/23/1988
Priority Level: Deferred to RCRA (Subtitle C)

Action: ARCHIVE SITE
Date Started: Not reported
Date Completed: 09/13/1990
Priority Level: Not reported

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Action: PRELIMINARY ASSESSMENT
Date Started: Not reported
Date Completed: 09/13/1990
Priority Level: NFRAP (No Futher Remedial Action Planned

HIST UST:
Region: STATE
Facility ID: 00000008471
Facility Type: Other
Other Type: CHEMICAL MFG.
Total Tanks: 0028
Contact Name: D.T. ARGYRIOU
Telephone: 4157796371
Owner Name: E.I. DU PONT DE NEMOURS&CO.INC
Owner Address: P.O. BOX 310
Owner City,St,Zip: ANTIOCH, CA 94509

Tank Num: 001
Container Num: 101
Year Installed: 1969
Tank Capacity: 00751000
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 4 inches
Leak Detection: None

Tank Num: 002
Container Num: 102
Year Installed: 1971
Tank Capacity: 02478000
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 4 inches
Leak Detection: None

Tank Num: 003
Container Num: 103
Year Installed: 1972
Tank Capacity: 02260000
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 4 inches
Leak Detection: None

Tank Num: 004
Container Num: 104
Year Installed: 1956
Tank Capacity: 01870000
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 120 inches
Leak Detection: None

Tank Num: 005
Container Num: 105
Year Installed: 1956
Tank Capacity: 01870000

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 120 inches
Leak Detection: None

Tank Num: 006
Container Num: 106
Year Installed: 1956
Tank Capacity: 00001500
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 6 inches
Leak Detection: None

Tank Num: 007
Container Num: 107
Year Installed: 1972
Tank Capacity: 00003800
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 8 inches
Leak Detection: None

Tank Num: 008
Container Num: 111
Year Installed: 1974
Tank Capacity: 00001400
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 6 inches
Leak Detection: None

Tank Num: 009
Container Num: 112
Year Installed: 1956
Tank Capacity: 00006227
Tank Used for: Not reported
Type of Fuel: Not reported
Tank Construction: 10 inches
Leak Detection: None

Tank Num: 010
Container Num: 113
Year Installed: 1967
Tank Capacity: 00019400
Tank Used for: Not reported
Type of Fuel: Not reported
Tank Construction: 10 inches
Leak Detection: None

Tank Num: 011
Container Num: 114
Year Installed: 1965
Tank Capacity: 00048800
Tank Used for: Not reported
Type of Fuel: Not reported
Tank Construction: 12 inches

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Leak Detection: None

Tank Num: 012
Container Num: 115
Year Installed: 1956
Tank Capacity: 00004320
Tank Used for: Not reported
Type of Fuel: Not reported
Tank Construction: 8 inches
Leak Detection: None

Tank Num: 013
Container Num: 201
Year Installed: 1961
Tank Capacity: 00002400
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 2 inches
Leak Detection: None

Tank Num: 014
Container Num: 202
Year Installed: 1979
Tank Capacity: 00000540
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 0.5 inches
Leak Detection: None

Tank Num: 015
Container Num: 301
Year Installed: 1962
Tank Capacity: 01000000
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: Not reported
Leak Detection: None

Tank Num: 016
Container Num: 302
Year Installed: 1965
Tank Capacity: 01000000
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: Not reported
Leak Detection: None

Tank Num: 017
Container Num: 303
Year Installed: 1982
Tank Capacity: 00042500
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 8 inches
Leak Detection: None

Tank Num: 018

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Container Num: 304
Year Installed: 1971
Tank Capacity: 00035400
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 8 inches
Leak Detection: None

Tank Num: 019
Container Num: 305
Year Installed: 1962
Tank Capacity: 00004300
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 10 inches
Leak Detection: None

Tank Num: 020
Container Num: 306
Year Installed: 1984
Tank Capacity: 00001300
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 3/8 inches
Leak Detection: None

Tank Num: 021
Container Num: 307
Year Installed: 1962
Tank Capacity: 00006000
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 10 inches
Leak Detection: None

Tank Num: 022
Container Num: 308
Year Installed: 1963
Tank Capacity: 00006988
Tank Used for: PRODUCT
Type of Fuel: Not reported
Tank Construction: 0.25 inches
Leak Detection: Not reported

Tank Num: 023
Container Num: 401
Year Installed: 1956
Tank Capacity: 00000420
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 6 inches
Leak Detection: None

Tank Num: 024
Container Num: 402
Year Installed: 1956
Tank Capacity: 00025000

E. I. DUPONT DE NEMOURS & CO (Continued) **1000111309**

Tank Used for: PRODUCT
Type of Fuel: Not reported
Tank Construction: 5/16 inches
Leak Detection: None

Tank Num: 025
Container Num: 403
Year Installed: 1962
Tank Capacity: 00001000
Tank Used for: PRODUCT
Type of Fuel: DIESEL
Tank Construction: 0.25 inches
Leak Detection: Stock Inventor

Tank Num: 026
Container Num: 404
Year Installed: 1979
Tank Capacity: 00000515
Tank Used for: PRODUCT
Type of Fuel: UNLEADED
Tank Construction: 12 gauge
Leak Detection: Stock Inventor

Tank Num: 027
Container Num: 405
Year Installed: 1975
Tank Capacity: 00005000
Tank Used for: PRODUCT
Type of Fuel: REGULAR
Tank Construction: 0.25 inches
Leak Detection: Stock Inventor

Tank Num: 028
Container Num: 406
Year Installed: 1962
Tank Capacity: 00001001
Tank Used for: WASTE
Type of Fuel: Not reported
Tank Construction: 6 inches
Leak Detection: None

G27 **DUPONT CHEMICAL CO., ANTIOCH WORKS (E.I. DUPONT)** **SLIC** **S106717942**
East **6000 BRIDGEHEAD ROAD** **N/A**
1/4-1/2 **OAKLEY, CA**
0.416 mi.
2198 ft. **Site 2 of 6 in cluster G**

Relative:
Higher

Actual:
20 ft.

SLIC:
Region: STATE
Facility Status: Open - Remediation
Status Date: 2004-12-17 00:00:00
Global Id: SL0601340233
Lead Agency: Not reported
Lead Agency Case Number: Not reported
Latitude: 38.012221
Longitude: -121.750783
Case Type: Cleanup Program Site
Case Worker: Not reported

DUPONT CHEMICAL CO., ANTIOCH WORKS (E.I. DUPONT) (Continued) **S106717942**

Local Agency: Not reported
RB Case Number: Not reported
File Location: Not reported
Potential Media Affected: Other Groundwater (uses other than drinking water), Surface water
Potential Contaminants of Concern: * Chlorinated Solvents - PCE, * Chlorinated Solvents - TCE, * Other Spill, * Semi-Volatile Organic Compounds, * Volatile Organic Compounds (VOC)
Site History: Not reported

G28
East
1/4-1/2
0.416 mi.
2198 ft.

E.I. DUPONT DE NEMOURS & CO.
6000 BRIDGEHEAD RD
ANTIOCH, CA 94509

Site 3 of 6 in cluster G

LUST **S101580703**
Cortese **N/A**
CA FID UST
SWEEPS UST

Relative:
Higher

Actual:
20 ft.

LUST:
Region: STATE
Global Id: T0601300745
Latitude: 38.0121453
Longitude: -121.7508293
Case Type: LUST Cleanup Site
Status: Open - Remediation
Status Date: 2001-05-01 00:00:00
Lead Agency: CENTRAL VALLEY RWQCB (REGION 5S)
Case Worker: Not reported
Local Agency: CONTRA COSTA COUNTY
RB Case Number: Not reported
LOC Case Number: Not reported
File Location: Regional Board
Potential Media Affect: Aquifer used for drinking water supply
Potential Contaminats of Concern: Gasoline
Site History: Not reported

LUST REG 5:
Region: 5
Status: Remedial action (cleanup) Underway
Case Number: 070004
Case Type: Drinking Water Aquifer affected
Substance: UNLEAD GASOLINE
Staff Initials: MWC
Lead Agency: Regional
Program: LUST
MTBE Code: N/A

Cortese:
Region: CORTESE
Facility Addr2: 6000 BRIDGEHEAD RD

CA FID UST:
Facility ID: 07000002
Regulated By: UTNKA
Regulated ID: CAD009151
Cortese Code: Not reported
SIC Code: Not reported
Facility Phone: 4157571210
Mail To: Not reported
Mailing Address: 6000 BRIDGEHEAD RD

E.I. DUPONT DE NEMOURS & CO. (Continued) **S101580703**

Mailing Address 2: Not reported
Mailing City,St,Zip: ANTIOCH 94509
Contact: Not reported
Contact Phone: Not reported
DUNs Number: Not reported
NPDES Number: Not reported
EPA ID: Not reported
Comments: Not reported
Status: Active

SWEEPS UST:
Status: Not reported
Comp Number: 8471
Number: Not reported
Board Of Equalization: Not reported
Ref Date: Not reported
Act Date: Not reported
Created Date: Not reported
Tank Status: Not reported
Owner Tank Id: Not reported
Swrcb Tank Id: 07-000-008471-000002
Actv Date: Not reported
Capacity: 6988
Tank Use: CHEMICAL
Stg: PRODUCT
Content: UNKNOWN
Number Of Tanks: 5

Status: Not reported
Comp Number: 8471
Number: Not reported
Board Of Equalization: Not reported
Ref Date: Not reported
Act Date: Not reported
Created Date: Not reported
Tank Status: Not reported
Owner Tank Id: Not reported
Swrcb Tank Id: 07-000-008471-000003
Actv Date: Not reported
Capacity: 25000
Tank Use: CHEMICAL
Stg: PRODUCT
Content: UNKNOWN
Number Of Tanks: Not reported

Status: Not reported
Comp Number: 8471
Number: Not reported
Board Of Equalization: Not reported
Ref Date: Not reported
Act Date: Not reported
Created Date: Not reported
Tank Status: Not reported
Owner Tank Id: Not reported
Swrcb Tank Id: 07-000-008471-000004
Actv Date: Not reported
Capacity: 1000

E.I. DUPONT DE NEMOURS & CO. (Continued) **S101580703**

Tank Use:	M.V. FUEL
Stg:	PRODUCT
Content:	DIESEL
Number Of Tanks:	Not reported

Status:	Not reported
Comp Number:	8471
Number:	Not reported
Board Of Equalization:	Not reported
Ref Date:	Not reported
Act Date:	Not reported
Created Date:	Not reported
Tank Status:	Not reported
Owner Tank Id:	Not reported
Swrcb Tank Id:	07-000-008471-000005
Actv Date:	Not reported
Capacity:	515
Tank Use:	M.V. FUEL
Stg:	PRODUCT
Content:	REG UNLEADED
Number Of Tanks:	Not reported

Status:	Not reported
Comp Number:	8471
Number:	Not reported
Board Of Equalization:	Not reported
Ref Date:	Not reported
Act Date:	Not reported
Created Date:	Not reported
Tank Status:	Not reported
Owner Tank Id:	Not reported
Swrcb Tank Id:	07-000-008471-000006
Actv Date:	Not reported
Capacity:	5000
Tank Use:	M.V. FUEL
Stg:	PRODUCT
Content:	REG UNLEADED
Number Of Tanks:	Not reported

G29 **DUPONT DE NEMOURS & CO INC** **ENVIROSTOR** **S101479932**
East **6000 BRIDGEHEAD ROAD** **N/A**
1/4-1/2 **ANTIOCH, CA 94509**
0.416 mi.
2198 ft. **Site 4 of 6 in cluster G**

Relative:
Higher

Actual:
20 ft.

ENVIROSTOR:

Site Type:	Historical
Site Type Detailed:	* Historical
Acres:	Not reported
NPL:	NO
Regulatory Agencies:	DTSC
Lead Agency:	NONE SPECIFIED
Program Manager:	Not reported
Supervisor:	Referred - Not Assigned
Division Branch:	Berkeley
Facility ID:	07280084
Site Code:	Not reported
Assembly:	15

DUPONT DE NEMOURS & CO INC (Continued) **S101479932**

Senate:	07
Special Program:	Not reported
Status:	Refer: RCRA
Status Date:	2002-04-19 00:00:00
Restricted Use:	NO
Funding:	Not reported
Latitude:	38.0077777777778
Longitude:	-121.750555555556
Alias Name:	110000482718
Alias Type:	EPA (FRS #)
Alias Name:	CAD009151671
Alias Type:	EPA Identification Number
Alias Name:	DUPONT ANTIOCH WORKS
Alias Type:	Alternate Name
Alias Name:	DUPONT OAKLEY
Alias Type:	Alternate Name
Alias Name:	E I DUPONT DE NEMOUR
Alias Type:	Alternate Name
Alias Name:	SHELL OIL
Alias Type:	Alternate Name
Alias Name:	07280084
Alias Type:	Envirostor ID Number
APN:	NONE SPECIFIED
APN Description:	Not reported
Comments:	Not reported

Completed Info:

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Discovery
Completed Date:	1979-04-01 00:00:00
Confirmed:	NONE SPECIFIED
Confirmed Description:	Not reported
Future Area Name:	Not reported
Future Sub Area Name:	Not reported
Future Document Type:	Not reported
Future Due Date:	Not reported
Media Affected:	10009, 10061, 10077, 10179, 10193, 10199, 20013, 20023
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported

Management:

Management Required:	NONE SPECIFIED
Management Required Desc:	Not reported
Potential:	NONE SPECIFIED
Potenital Description:	Not reported
Schedule Area Name:	Not reported
Schedule Sub Area Name:	Not reported
Schedule Document Type:	Not reported
Schedule Due Date:	Not reported

DUPONT DE NEMOURS & CO INC (Continued) **S101479932**

Schedule Revised Date: Not reported
PastUse: NONE SPECIFIED

G30 East 1/4-1/2 0.416 mi. 2198 ft.

DUPONT CHEMICAL CO., ANTIOCH WORKS UP TO 2000 ARC **HAZNET** **S104573837**
6000 BRIDGEHEAD RD **SLIC** **N/A**
OAKLEY, CA **CONTRA COSTA CO. SITE LIST**
EMI
Site 5 of 6 in cluster G **CA WDS**

Relative: Higher

Actual: 20 ft.

HAZNET:

Gepaid:	CAD009151671
Contact:	E I DUPONT DE NEMOURS & CO INC
Telephone:	3027741000
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	6000 BRIDGEHEAD RD
Mailing City,St,Zip:	OAKLEY, CA 945612940
Gen County:	7
TSD EPA ID:	CAD009452657
TSD County:	San Mateo
Waste Category:	Other organic solids
Disposal Method:	Disposal, Land Fill
Tons:	.4250
Facility County:	7

Gepaid:	CAD009151671
Contact:	E I DUPONT DE NEMOURS & CO INC
Telephone:	3027741000
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	6000 BRIDGEHEAD RD
Mailing City,St,Zip:	OAKLEY, CA 945612940
Gen County:	7
TSD EPA ID:	CAD009452657
TSD County:	San Mateo
Waste Category:	Liquids with halogenated organic compounds > 1000 mg/l
Disposal Method:	Recycler
Tons:	8.3058
Facility County:	7

Gepaid:	CAD009151671
Contact:	E I DUPONT DE NEMOURS & CO INC
Telephone:	3027741000
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	6000 BRIDGEHEAD RD
Mailing City,St,Zip:	OAKLEY, CA 945612940
Gen County:	7
TSD EPA ID:	CAD009452657
TSD County:	San Mateo
Waste Category:	Laboratory waste chemicals
Disposal Method:	Treatment, Incineration
Tons:	.1500
Facility County:	7

Gepaid:	CAD009151671
Contact:	E I DUPONT DE NEMOURS & CO INC
Telephone:	3027741000

DUPONT CHEMICAL CO., ANTIOCH WORKS UP TO 2000 ARC (Continued) **S104573837**

Facility Addr2: Not reported
Mailing Name: Not reported
Mailing Address: 6000 BRIDGEHEAD RD
Mailing City,St,Zip: OAKLEY, CA 945612940
Gen County: 7
TSD EPA ID: CAT000646117
TSD County: Kings
Waste Category: Other organic solids
Disposal Method: Disposal, Other
Tons: .9000
Facility County: 7

Gepaid: CAD009151671
Contact: E I DUPONT DE NEMOURS & CO INC
Telephone: 3027741000
Facility Addr2: Not reported
Mailing Name: Not reported
Mailing Address: 6000 BRIDGEHEAD RD
Mailing City,St,Zip: OAKLEY, CA 945612940
Gen County: 7
TSD EPA ID: CAT000646117
TSD County: Kings
Waste Category: Waste oil and mixed oil
Disposal Method: Not reported
Tons: .1000
Facility County: 7

Click this hyperlink while viewing on your computer to access
198 additional CA_HAZNET: record(s) in the EDR Site Report.

SLIC:
Region: 5
Facility Status: RI, REM
Unit: Facility is a Spill or site
Pollutant: PCE,TCE, DCE, other VOCs, Pb, As, benzene, freon 113
Lead Agency: DTSC
Date Filed: / /
Report Date: / /
Date Added: Not reported
Date Closed: Not reported

Region: 5
Facility Status: Remediation Underway
Unit: Facility is a Spill or site
Pollutant: Metals, VOCs
Lead Agency: DTSC/DLL
Date Filed: / /
Report Date: / /
Date Added: 10/25/2004
Date Closed: Not reported

CONTRA COSTA CO. SITE LIST:
Region: CONTRA COSTA
Facility ID: 708471
Tier: Not reported
Program Status: HWG

DUPONT CHEMICAL CO., ANTIOCH WORKS UP TO 2000 ARC (Continued) **S104573837**

Generator Fee Item: No
Inactive Date: Not reported

EMI:

Year:	1999
County Code:	7
Air Basin:	SF
Facility ID:	21
Air District Name:	BA
SIC Code:	2869
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	3
Reactive Organic Gases Tons/Yr:	2
Carbon Monoxide Emissions Tons/Yr:	0
NOX - Oxides of Nitrogen Tons/Yr:	0
SOX - Oxides of Sulphur Tons/Yr:	0
Particulate Matter Tons/Yr:	0
Part. Matter 10 Micrometers & Smllr Tons/Yr:	0

Year:	2000
County Code:	7
Air Basin:	SF
Facility ID:	21
Air District Name:	BA
SIC Code:	2869
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	3
Reactive Organic Gases Tons/Yr:	2
Carbon Monoxide Emissions Tons/Yr:	0
NOX - Oxides of Nitrogen Tons/Yr:	0
SOX - Oxides of Sulphur Tons/Yr:	0
Particulate Matter Tons/Yr:	0
Part. Matter 10 Micrometers & Smllr Tons/Yr:	0

Year:	2001
County Code:	7
Air Basin:	SF
Facility ID:	21
Air District Name:	BA
SIC Code:	3559
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	5
Reactive Organic Gases Tons/Yr:	4
Carbon Monoxide Emissions Tons/Yr:	0
NOX - Oxides of Nitrogen Tons/Yr:	0
SOX - Oxides of Sulphur Tons/Yr:	0
Particulate Matter Tons/Yr:	0
Part. Matter 10 Micrometers & Smllr Tons/Yr:	0

CA WDS:

DUPONT CHEMICAL CO., ANTIOCH WORKS UP TO 2000 ARC (Continued) **S104573837**

Facility ID:	5S 07I016773
Facility Type:	Industrial - Facility that treats and/or disposes of liquid or semisolid wastes from any servicing, producing, manufacturing or processing operation of whatever nature, including mining, gravel washing, geothermal operations, air conditioning, ship building and repairing, oil production, storage and disposal operations, water pumping.
Facility Status:	Active - Any facility with a continuous or seasonal discharge that is under Waste Discharge Requirements.
NPDES Number:	CAS000001 The 1st 2 characters designate the state. The remaining 7 are assigned by the Regional Board
Subregion:	0
Facility Telephone:	9257575836
Facility Contact:	BOBBY C DEAVER
Agency Name:	E I DUPONT DE NEMOURS & CO
Agency Address:	6000 Bridgehead Rd
Agency City,St,Zip:	Oakley 945612940
Agency Contact:	BOBBY C DEAVER
Agency Telephone:	9257575836
Agency Type:	Private
SIC Code:	0
SIC Code 2:	Not reported
Primary Waste:	Not reported
Primary Waste Type:	Not reported
Secondary Waste:	Not reported
Secondary Waste Type:	Not reported
Design Flow:	0
Baseline Flow:	0
Reclamation:	Not reported
POTW:	Not reported
Treat To Water:	Minor Threat to Water Quality. A violation of a regional board order should cause a relatively minor impairment of beneficial uses compared to a major or minor threat. Not: All nurds without a TTWQ will be considered a minor threat to water quality unless coded at a higher Level. A Zero (0) may be used to code those NURDS that are found to represent no threat to water quality.
Complexity:	Category C - Facilities having no waste treatment systems, such as cooling water dischargers or thosewho must comply through best management practices, facilities with passive waste treatment and disposal systems, such as septic systems with subsurface disposal, or dischargers having waste storage systems with land disposal such as dairy waste ponds.

G31 **E.I. DUPONI DE NEMOURS & CO.** **CHMIRS** **S101310468**
East **6000 BRIDGEHEAD RD** **WMUDS/SWAT** **N/A**
1/4-1/2 **ANTIOCH, CA 94509** **EMI**
0.416 mi. **SWEEPS UST**
2198 ft. **Site 6 of 6 in cluster G**

Relative:
Higher

Actual:
20 ft.

CHMIRS:

OES Incident Number:	009953
OES notification:	Not reported
OES Date:	9/9/1995
OES Time:	09:59:23 PM
Incident Date:	Not reported
Date Completed:	**Not reported**
Property Use:	Not reported
Agency Id Number:	Not reported

E.I. DUPONI DE NEMOURS & CO. (Continued) **S101310468**

Agency Incident Number:	Not reported
Time Notified:	Not reported
Time Completed:	Not reported
Surrounding Area:	Not reported
Estimated Temperature:	Not reported
Property Management:	Not reported
Special Studies 1:	Not reported
Special Studies 2:	Not reported
Special Studies 3:	Not reported
Special Studies 4:	Not reported
Special Studies 5:	Not reported
Special Studies 6:	Not reported
More Than Two Substances Involved?:	Not reported
Resp Agncy Personel # Of Decontaminated:	Not reported
Responding Agency Personel # Of Injuries:	Not reported
Responding Agency Personel # Of Fatalities:	Not reported
Others Number Of Decontaminated:	Not reported
Others Number Of Injuries:	Not reported
Others Number Of Fatalities:	Not reported
Vehicle Make/year:	Not reported
Vehicle License Number:	Not reported
Vehicle State:	Not reported
Vehicle Id Number:	Not reported
CA/DOT/PUC/ICC Number:	Not reported
Company Name:	Not reported
Reporting Officer Name/ID:	Not reported
Report Date:	Not reported
Comments:	Not reported
Facility Telephone:	Not reported
Waterway Involved:	YES
Waterway:	Not reported
Spill Site:	Not reported
Cleanup By:	dupont
Containment:	Not reported
What Happened:	Not reported
Type:	CHEMICAL
Measure:	Not reported
Other:	Not reported
Date/Time:	Not reported
Year:	1995
Agency:	private cit.
Incident Date:	9/9/95 1500
Admin Agency:	Not reported
Amount:	400 lbs.
Contained:	NO
Site Type:	OTHER
E Date:	Not reported
Substance:	sodium hydroxide solution
Quantity Released:	Not reported
BBLS:	Not reported
Cups:	Not reported
CUFT:	Not reported
Gallons:	Not reported
Grams:	Not reported
Pounds:	Not reported
Liters:	Not reported
Ounces:	Not reported

E.I. DUPONI DE NEMOURS & CO. (Continued) **S101310468**

Pints: Not reported
Quarts: Not reported
Sheen: Not reported
Tons: Not reported
Unknown: Not reported
Description: electricity shutoff caused water valve to open causing an overflow.
Evacuations: NO
Number of Injuries: NO
Number of Fatalities: NO
Description: Not reported

WMUDS/SWAT:
Edit Date: Not reported
Complexity: Category A - Any major NPDES facility, any non-NPDES facility (particularly those with toxic wastes) that would be a major if discharge was made to surface or ground waters, or any Class I disposal site. Includes any small-volume complex facility (particularly those with toxicwastes) with numerous discharge points, leak detection systems or ground water monitoring wells.
Primary Waste: Process Waste (Waste produced as part of the industrial/manufacturing process)
Primary Waste Type: Designated/Influent or Solid Wastes that pose a significant threat to water quality because of their high concentrations (E.G., BOD, Hardness, TRF, Chloride). 'Manageable' hazardous wastes (E.G., inorganic salts and heavy metals) are included in this category.
Secondary Waste: Domestic Sewage
Secondary Waste Type: Designated/Influent or Solid Wastes that pose a significant threat to water quality because of their high concentrations (E.G., BOD, Hardness, TRF, Chloride). 'Manageable' hazardous wastes (E.G., inorganic salts and heavy metals) are included in this category.
Base Meridian: Not reported
NPID: CA0004936
Tonnage: 0
Regional Board ID: Not reported
Municipal Solid Waste: False
Superorder: False
Open To Public: False
Waste List: False
Agency Type: Private
Agency Name: E.I. DU PONT DE NEMOURS & CO.
Agency Department: Not reported
Agency Address: 6000 BRIDGEHEAD RD
Agency City,St,Zip: ANTIOCH CA 94509
Agency Contact: ROBERT DOREMUS, JR.
Agency Telephone: 9257796265
Land Owner Name: Not reported
Land Owner Address: Not reported
Land Owner City,St,Zip: Not reported
Land Owner Contact: Not reported
Land Owner Phone: Not reported
Region: 5S
Facility Type: Industrial - Facility that treats and/or disposes of liquid or semisolid wastes from any servicing, producing, manufacturing or processing operation of whatever nature, including mining, gravel washing, geothermal operations, air conditioning, ship building and repairing, oil production, storage and disposal operations, water pumping.

E.I. DUPONI DE NEMOURS & CO. (Continued) **S101310468**

Facility Description:	Not reported
Facility Telephone:	Not reported
SWAT Facility Name:	Not reported
Primary SIC:	2816
Secondary SIC:	Not reported
Comments:	Not reported
Last Facility Editors:	Not reported
Waste Discharge System:	True
Solid Waste Assessment Test Program:	False
Toxic Pits Cleanup Act Program:	False
Resource Conservation Recovery Act:	True
Department of Defence:	False
Solid Waste Assessment Test Program:	Not reported
Threat to Water Quality:	Moderate Threat to Water Quality. A violation could have a major adverse impact on receiving biota, can cause aesthetic impairment to a significant human population, or render unusable a potential domestic or municipal water supply. Awsthetic impairment would include nuisance from a waste treatment facility.
Sub Chapter 15:	True
Regional Board Project Officer:	RJ
Number of WMUDS at Facility:	1
Section Range:	Not reported
RCRA Facility:	Yes
Waste Discharge Requirements:	Active - Any facility with a continuous or seasonal discharge that is under Waste Discharge Requirements.
Self-Monitoring Rept. Frequency:	Monthly Submittal
Waste Discharge System ID:	5B072038001
Solid Waste Information ID:	Not reported

EMI:

Year:	1990
County Code:	7
Air Basin:	SF
Facility ID:	21
Air District Name:	BA
SIC Code:	2816
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	43
Reactive Organic Gases Tons/Yr:	36
Carbon Monoxide Emissions Tons/Yr:	9151
NOX - Oxides of Nitrogen Tons/Yr:	54
SOX - Oxides of Sulphur Tons/Yr:	0
Particulate Matter Tons/Yr:	25
Part. Matter 10 Micrometers & Smllr Tons/Yr:	21

Year:	1993
County Code:	7
Air Basin:	SF
Facility ID:	21
Air District Name:	BA
SIC Code:	2816
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	33

E.I. DUPONI DE NEMOURS & CO. (Continued) **S101310468**

Reactive Organic Gases Tons/Yr:	29
Carbon Monoxide Emissions Tons/Yr:	9548
NOX - Oxides of Nitrogen Tons/Yr:	55
SOX - Oxides of Sulphur Tons/Yr:	0
Particulate Matter Tons/Yr:	26
Part. Matter 10 Micrometers & Smllr Tons/Yr:	23

Year:	1995
County Code:	7
Air Basin:	SF
Facility ID:	21
Air District Name:	BA
SIC Code:	2816
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	21
Reactive Organic Gases Tons/Yr:	17
Carbon Monoxide Emissions Tons/Yr:	9165
NOX - Oxides of Nitrogen Tons/Yr:	55
SOX - Oxides of Sulphur Tons/Yr:	0
Particulate Matter Tons/Yr:	16
Part. Matter 10 Micrometers & Smllr Tons/Yr:	14

Year:	1996
County Code:	7
Air Basin:	SF
Facility ID:	21
Air District Name:	BA
SIC Code:	2816
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	48
Reactive Organic Gases Tons/Yr:	40
Carbon Monoxide Emissions Tons/Yr:	9168
NOX - Oxides of Nitrogen Tons/Yr:	71
SOX - Oxides of Sulphur Tons/Yr:	1
Particulate Matter Tons/Yr:	8
Part. Matter 10 Micrometers & Smllr Tons/Yr:	8

Year:	1997
County Code:	7
Air Basin:	SF
Facility ID:	21
Air District Name:	BA
SIC Code:	2816
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	23
Reactive Organic Gases Tons/Yr:	19
Carbon Monoxide Emissions Tons/Yr:	6974
NOX - Oxides of Nitrogen Tons/Yr:	43
SOX - Oxides of Sulphur Tons/Yr:	0
Particulate Matter Tons/Yr:	6
Part. Matter 10 Micrometers & Smllr Tons/Yr:	6

E.I. DUPONI DE NEMOURS & CO. (Continued) **S101310468**

Year:	1998
County Code:	7
Air Basin:	SF
Facility ID:	21
Air District Name:	BA
SIC Code:	2869
Air District Name:	BAY AREA AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	3
Reactive Organic Gases Tons/Yr:	3
Carbon Monoxide Emissions Tons/Yr:	0
NOX - Oxides of Nitrogen Tons/Yr:	0
SOX - Oxides of Sulphur Tons/Yr:	0
Particulate Matter Tons/Yr:	0
Part. Matter 10 Micrometers & Smllr Tons/Yr:	0

SWEEPS UST:

Status:	A
Comp Number:	8471
Number:	1
Board Of Equalization:	44-002213
Ref Date:	02-11-92
Act Date:	02-11-92
Created Date:	07-22-88
Tank Status:	A
Owner Tank Id:	203
Swrcb Tank Id:	07-000-008471-000001
Actv Date:	02-11-92
Capacity:	200
Tank Use:	CHEMICAL
Stg:	P
Content:	CL2 F2 CH4
Number Of Tanks:	2

Status:	A
Comp Number:	8471
Number:	1
Board Of Equalization:	44-002213
Ref Date:	02-11-92
Act Date:	02-11-92
Created Date:	07-22-88
Tank Status:	A
Owner Tank Id:	407
Swrcb Tank Id:	07-000-008471-000007
Actv Date:	02-11-92
Capacity:	2500
Tank Use:	M.V. FUEL
Stg:	P
Content:	REG UNLEADED
Number Of Tanks:	Not reported

32 ENE 1/4-1/2 0.472 mi. 2493 ft. | **NEW BRIDGE MARINA**
6325 BRIDGEHEAD RD
ANTIOCH, CA 94509 | **HAZNET**
LUST
Cortese | **S103979159**
N/A

Relative: Higher

Actual: 14 ft.

HAZNET:

Gepaid:	CAC001371960
Contact:	NEW BRIDGE MARINA
Telephone:	6503285776
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	6325 BRIDGEHEAD RD
Mailing City,St,Zip:	ANTIOCH, CA 945090000
Gen County:	7
TSD EPA ID:	CAD099452708
TSD County:	Los Angeles
Waste Category:	Unspecified oil-containing waste
Disposal Method:	Recycler
Tons:	1.0842
Facility County:	7

Gepaid:	CAC001371960
Contact:	NEW BRIDGE MARINA
Telephone:	6503285776
Facility Addr2:	Not reported
Mailing Name:	Not reported
Mailing Address:	6325 BRIDGEHEAD RD
Mailing City,St,Zip:	ANTIOCH, CA 945090000
Gen County:	7
TSD EPA ID:	CAD099452708
TSD County:	Los Angeles
Waste Category:	Unspecified oil-containing waste
Disposal Method:	Recycler
Tons:	0.6255
Facility County:	7

LUST:

Region:	STATE
Global Id:	T0601300810
Latitude:	38.0168421
Longitude:	-121.7509044
Case Type:	LUST Cleanup Site
Status:	Open - Remediation
Status Date:	2003-08-29 00:00:00
Lead Agency:	CENTRAL VALLEY RWQCB (REGION 5S)
Case Worker:	Not reported
Local Agency:	CONTRA COSTA COUNTY
RB Case Number:	Not reported
LOC Case Number:	Not reported
File Location:	Not reported
Potential Media Affect:	Aquifer used for drinking water supply
Potential Contaminats of Concern:	Gasoline
Site History:	Not reported

LUST REG 5:

Region:	5
Status:	Remediation Plan

NEW BRIDGE MARINA (Continued) **S103979159**

Case Number: 070093
Case Type: Drinking Water Aquifer affected
Substance: GASOLINE
Staff Initials: PMV
Lead Agency: Regional
Program: LUST
MTBE Code: 7

Cortese:
Region: CORTESE
Facility Addr2: 6325 BRIDGEHEAD RD

---

33 ESE 1/4-1/2 0.472 mi. 2494 ft.

PG&E ANTIOCH NATURAL GAS TERMINAL
5900 BRIDGEHEAD ROAD
OAKLEY, CA

SLIC **S108937543**
N/A

Relative: Higher

Actual: 22 ft.

SLIC:
Region: STATE
Facility Status: Open - Site Assessment
Status Date: 2007-11-01 00:00:00
Global Id: SL0601394831
Lead Agency: CENTRAL VALLEY RWQCB (REGION 5S)
Lead Agency Case Number: Not reported
Latitude: 38.009059
Longitude: -121.750794
Case Type: Cleanup Program Site
Case Worker: Not reported
Local Agency: Not reported
RB Case Number: Not reported
File Location: Not reported
Potential Media Affected: Under Investigation
Potential Contaminants of Concern: Not reported
Site History: Not reported

---

34 SSW 1/2-1 0.522 mi. 2758 ft.

PECKHAM PROPERTY
3215 18TH ST E
ANTIOCH, CA

LUST **S104403147**
Cortese **N/A**
CONTRA COSTA CO. SITE LIST

Relative: Higher

Actual: 43 ft.

LUST:
Region: STATE
Global Id: T0601300779
Latitude: 38.0050095
Longitude: -121.7576864
Case Type: LUST Cleanup Site
Status: Completed - Case Closed
Status Date: 1997-01-27 00:00:00
Lead Agency: CONTRA COSTA COUNTY
Case Worker: Not reported
Local Agency: CONTRA COSTA COUNTY
RB Case Number: Not reported
LOC Case Number: Not reported
File Location: Not reported

PECKHAM PROPERTY (Continued) **S104403147**

Potential Media Affect: Soil
Potential Contaminats of Concern: Gasoline
Site History: Not reported

LUST REG 5:
Region: 5
Status: Case Closed
Case Number: 070057
Case Type: Soil only
Substance: GASOLINE
Staff Initials: PMV
Lead Agency: Local
Program: LUST
MTBE Code: N/A

Cortese:
Region: CORTESE
Facility Addr2: 3215 18TH ST E

CONTRA COSTA CO. SITE LIST:
Region: CONTRA COSTA
Facility ID: 770782
Tier: Not reported
Program Status: UST
Generator Fee Item: No
Inactive Date: 9/12/1990

35
ENE
1/2-1
0.597 mi.
3151 ft.

LAURITZEN YACHT HARBOR LLC **LUST** **S105003969**
115 LAURITZEN LANE **CA WDS** **N/A**
OAKLEY, CA 94561

Relative:
Lower

Actual:
5 ft.

LUST:
Region: STATE
Global Id: T0601391419
Latitude: 38.019304
Longitude: -121.749146
Case Type: LUST Cleanup Site
Status: Completed - Case Closed
Status Date: 1965-01-01 00:00:00
Lead Agency: CENTRAL VALLEY RWQCB (REGION 5S)
Case Worker: Not reported
Local Agency: CONTRA COSTA COUNTY
RB Case Number: Not reported
LOC Case Number: Not reported
File Location: Not reported
Potential Media Affect: Aquifer used for drinking water supply
Potential Contaminats of Concern: Gasoline
Site History: Not reported

LUST REG 5:
Region: 5
Status: No Action
Case Number: 070096
Case Type: Drinking Water Aquifer affected

LAURITZEN YACHT HARBOR LLC (Continued) **S105003969**

Substance: GASOLINE
Staff Initials: PMV
Lead Agency: Regional
Program: LUST
MTBE Code: 6

CA WDS:

Facility ID:	5S 07I000585
Facility Type:	Other - Does not fall into the category of Municipal/Domestic, Industrial, Agricultural or Solid Waste (Class I, II or III)
Facility Status:	Active - Any facility with a continuous or seasonal discharge that is under Waste Discharge Requirements.
NPDES Number:	CAS000001 The 1st 2 characters designate the state. The remaining 7 are assigned by the Regional Board
Subregion:	0
Facility Telephone:	9257571916
Facility Contact:	CHRIS LAURITZEN
Agency Name:	LAURITZEN YACHT HARBOR LLC
Agency Address:	115 LAURITZEN LN
Agency City,St,Zip:	OAKLEY 94561
Agency Contact:	CHRIS LAURITZEN
Agency Telephone:	9257571916
Agency Type:	Private
SIC Code:	4493
SIC Code 2:	Not reported
Primary Waste:	Stormwater Runoff
Primary Waste Type:	Inert/Influent or Solid Wastes that do not contain soluble pollutants or organic wastes and have little adverse impact on water quality. Such wastes could cause turbidity and siltation. Uncontaminated soils, rubble and concrete are examples of this category.
Secondary Waste:	Not reported
Secondary Waste Type:	Not reported
Design Flow:	0
Baseline Flow:	0
Reclamation:	No reclamation requirements associated with this facility.
POTW:	The facility is not a POTW.
Treat To Water:	Minor Threat to Water Quality. A violation of a regional board order should cause a relatively minor impairment of beneficial uses compared to a major or minor threat. Not: All nurds without a TTWQ will be considered a minor threat to water quality unless coded at a higher Level. A Zero (0) may be used to code those NURDS that are found to represent no threat to water quality.
Complexity:	Category C - Facilities having no waste treatment systems, such as cooling water dischargers or thosewho must comply through best management practices, facilities with passive waste treatment and disposal systems, such as septic systems with subsurface disposal, or dischargers having waste storage systems with land disposal such as dairy waste ponds.

H36 West 1/2-1 0.634 mi. 3346 ft. | **EAST MILL**
2603 WILBUR AVENUE
ANTIOCH, CA 94509

VCP **S106152509**
ENVIROSTOR **N/A**

Site 1 of 2 in cluster H

Relative: Higher

Actual: 29 ft.

VCP:

Facility ID:	07260003
Site Type:	Voluntary Cleanup
Site Type Detail:	Voluntary Cleanup
Acres:	80.11
National Priorities List:	NO
Cleanup Oversight Agencies:	SMBRP, RWQCB 5S - Central Valley
Lead Agency:	SMBRP
Lead Agency Description:	DTSC - Sit
Project Manager:	JANET NAITO
Supervisor:	Barbara Cook
Division Branch:	Berkeley
Site Code:	201536
Assembly:	11
Senate:	07
Special Programs Code:	Designation of Single Agency
Status:	Active
Status Date:	2004-01-27 00:00:00
Restricted Use:	NO
Funding:	Responsible Party
Lat/Long:	38.0110825147944 / -121.754830895351
Alias Name:	110033618725
Alias Type:	EPA (FRS #)
Alias Name:	051-031-005-5
Alias Type:	APN
Alias Name:	EAST MILL
Alias Type:	Alternate Name
Alias Name:	07260003
Alias Type:	Envirostor ID Number
Alias Name:	201536
Alias Type:	Project Code (Site Code)
APN:	051-031-005-5
APN Description:	Not reported
Comments:	Approve Public Participation Plan for the nine sites addressed under the Agreement.Fact Sheet providing a status update for the 9 sites covered under the VCA.Voluntary Environmental Oversight Agreement Docket No. HSA-A 03/04-084 signed with Gaylord Container Corporation, d/b/a Inland Paperboard and Packaging, Antioch Mill.Held site conference pursuant to H&SC Section 25398.2.Approve Remedial Action Plan (RAP) to address the black liquor pond area. The draft RAP recommended removal and offsite disposal of black liquor pond materials. The draft RAP underwent a public comment period which ran from September 1, 2004 througThe Negative Declaration underwent a public comment period from September 22, 2004 through October 22, 2004. In addition, a public meeting was held on Thursday, September 23, 2004.Fact Sheet providing an update on work taking place at the 9 Gaylord sites being addressed under the VCA.Due to minor changes in the project to address potential cultural resource and transportation issues, the public comment period for the RAP has been extended to October 22, 2004 and the public comment period for the Negative Declaration will begin oFact Sheet announces a public comment period on plans to remove the former black liquor pond as an interim action.

EAST MILL (Continued) **S106152509**

Black liquor pond material would be excavated and disposed offsite at an appropriately permitted landfill. Public comment period to rDTSC coordinated with the Water Board to approve this injection workplan. Injection test will be initiated on 6/2/2008.Proposal accepted with modifications.Remedial Design for removal of the black liquor pond approved.Approved forcused RIFS for black liquor pond area. The black liquor pond, an area roughly 125 by 450 feet, with a maximum depth of 21 feet below ground surface, is located on the southeast corner of the Site. From the early 1950s until approximatelDTSC approved implementation report for the interim action taken to remove the 125 by 450 foot black liquor pond at this Site. Chemicals of concern in the black liquor pond fill material were lead, nickel and dioxin/furans. In total, 1,747 truckGroundwater monitoring will be conducted in April 2006 and September 2006 for metals, TPH, VOCs, PAHs and dioxin/furans. One additional upgradient well will be installed.All existing wells will be sampled in April and September 2006.DTSC approved plan to collect additional soil vapor and groundwater samples.DTSC approved additional groundwater sampling to better define the extent of volatile organic compounds contamination in groundwater.Workplan approved with modifications for additional groundwater monitoring and soil sampling.Workplan is approved with modifications.Reviewed plans to ensure that the additional investigation activities proposed were consistent with previous discussions with the consultant. It was consistent, therefore no comments provided and work was conducted.Report documents February and May 2007 groundwater sampling events.4Q 2008 Groundwater Monitoring Report approved.Workplan accepted with modifications. Boring logs and results of the step and longer term extraction testing will be submitted to facilitate review of the proposed injection testing.Plan was approved with modifications. An additional multi-port groundwater monitoring well was required.n September 22, 2004 and end on October 22, 2004.y 1970, the pond was used intermittently to store black liquor, a byproduct of the mill operation. It was later backfilled with soil and wood chips. Soil samples show higher than usual amounts of some metals and dioxins/furans in the black liquorun from 9/1/2004 to 10/1/2004.loads or 45,840 tons (34,955 cy) of BLP fill material were removed from the site between November 19, 2004 and January 31, 2005. Backfilling and regrading were completed in May 2005.h October 22, 2004.pond. The contaminants are generally limited to the black liquor pond area boundaries.

Completed Info:

Completed Area Name:	Black Liquor Pond
Completed Sub Area Name:	Not reported
Completed Document Type:	CEQA - Initial Study/ Neg. Declaration
Completed Date:	2004-11-01 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Site Conferences for SB 923 Sites
Completed Date:	2004-01-29 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Voluntary Clean-up Agreement
Completed Date:	2003-12-30 00:00:00

EAST MILL (Continued) **S106152509**

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: AB 2061 - Designation
Completed Date: 2003-12-15 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Amendment - Order/Agreement
Completed Date: 2008-08-14 00:00:00

Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Action Plan
Completed Date: 2004-11-01 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Preliminary Endangerment Assessment Report
Completed Date: 2005-06-09 00:00:00

Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Design
Completed Date: 2004-11-12 00:00:00

Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Investigation / Feasibility Study
Completed Date: 2004-08-30 00:00:00

Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Action Completion Report
Completed Date: 2005-11-22 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Groundwater Monitoring Plan
Completed Date: 2006-03-28 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Groundwater Monitoring Plan
Completed Date: 2006-03-28 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Investigation Workplan
Completed Date: 2006-06-08 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Investigation Workplan
Completed Date: 2006-08-24 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported

EAST MILL (Continued) **S106152509**

Completed Document Type: Groundwater Monitoring Plan
Completed Date: 2007-05-23 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Investigation Workplan
Completed Date: 2005-05-11 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Investigation Workplan
Completed Date: 2007-08-01 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Groundwater Monitoring Report
Completed Date: 2007-10-02 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Groundwater Monitoring Report
Completed Date: 2008-04-23 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Other Workplan
Completed Date: 2008-05-13 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Investigation Workplan
Completed Date: 2006-12-07 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Correspondence - Received
Completed Date: 2008-04-23 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Other Workplan
Completed Date: 2008-05-28 00:00:00

Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported
Completed Document Type: Fact Sheets
Completed Date: 2004-08-30 00:00:00

Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported
Completed Document Type: Public Notice
Completed Date: 2004-09-20 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Fact Sheets
Completed Date: 2005-08-04 00:00:00

EAST MILL (Continued) **S106152509**

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Fact Sheets
Completed Date:	2006-07-20 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Public Participation Plan / Community Relations Plan
Completed Date:	2004-10-25 00:00:00
Confirmed:	30009,,
Confirmed Description:	Dioxin (as
Confirmed Description:	Not reported
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Operations and Maintenance Plan
Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Fact Sheets
Future Due Date:	2008
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Remedial Action Completion Report
Future Due Date:	2008
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Removal Action Completion Report
Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Removal Action Workplan
Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Deed Restriction / Land Use Covenant
Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Certification
Future Due Date:	2010
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Removal Action Workplan
Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Fact Sheets
Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	CEQA - Notice of Exemption
Future Due Date:	2008
Media Affected:	30009, 30009, 30024, 3002502
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported

EAST MILL (Continued) **S106152509**

Media Affected Desc: Not reported

Management:
Management Required: NONE SPECIFIED
Management Required Desc: Not reported
Potential: OTH, SOIL, OTH, SOIL
Potenital Description: Not reported
Potenital Description: Not reported
Potenital Description: Not reported
Potenital Description: Not reported
Schedule Area Name: Not reported
Schedule Sub Area Name: Not reported
Schedule Document Type: Not reported
Schedule Due Date: Not reported
Schedule Revised Date: Not reported
PastUse: MANUFACTURING - PAPER, MANUFACTURING - PAPER

ENVIROSTOR:
Site Type: Voluntary Cleanup
Site Type Detailed: Voluntary Cleanup
Acres: 80.11
NPL: NO
Regulatory Agencies: SMBRP, RWQCB 5S - Central Valley
Lead Agency: SMBRP
Program Manager: JANET NAITO
Supervisor: Barbara Cook
Division Branch: Berkeley
Facility ID: 07260003
Site Code: 201536
Assembly: 11
Senate: 07
Special Program: Designation of Single Agency
Status: Active
Status Date: 2004-01-27 00:00:00
Restricted Use: NO
Funding: Responsible Party
Latitude: 38.0110825147944
Longitude: -121.754830895351
Alias Name: 110033618725
Alias Type: EPA (FRS #)
Alias Name: 051-031-005-5
Alias Type: APN
Alias Name: EAST MILL
Alias Type: Alternate Name
Alias Name: 07260003
Alias Type: Envirostor ID Number
Alias Name: 201536
Alias Type: Project Code (Site Code)

APN: 051-031-005-5
APN Description: Not reported
Comments: Approve Public Participation Plan for the nine sites addressed under the Agreement.Fact Sheet providing a status update for the 9 sites covered under the VCA.Voluntary Environmental Oversight Agreement Docket No. HSA-A 03/04-084 signed with Gaylord Container Corporation, d/b/a Inland Paperboard and Packaging, Antioch Mill.Held site conference pursuant to H&SC Section 25398.2.Approve Remedial Action

EAST MILL (Continued) **S106152509**

Plan (RAP) to address the black liquor pond area. The draft RAP recommended removal and offsite disposal of black liquor pond materials. The draft RAP underwent a public comment period which ran from September 1, 2004 througThe Negative Declaration underwent a public comment period from September 22, 2004 through October 22, 2004. In addition, a public meeting was held on Thursday, September 23, 2004.Fact Sheet providing an update on work taking place at the 9 Gaylord sites being addressed under the VCA.Due to minor changes in the project to address potential cultural resource and transportation issues, the public comment period for the RAP has been extended to October 22, 2004 and the public comment period for the Negative Declaration will begin oFact Sheet announces a public comment period on plans to remove the former black liquor pond as an interim action. Black liquor pond material would be excavated and disposed offsite at an appropriately permitted landfill. Public comment period to rDTSC coordinated with the Water Board to approve this injection workplan. Injection test will be initiated on 6/2/2008.Proposal accepted with modifications.Remedial Design for removal of the black liquor pond approved.Approved forcused RIFS for black liquor pond area. The black liquor pond, an area roughly 125 by 450 feet, with a maximum depth of 21 feet below ground surface, is located on the southeast corner of the Site. From the early 1950s until approximatelDTSC approved implementation report for the interim action taken to remove the 125 by 450 foot black liquor pond at this Site. Chemicals of concern in the black liquor pond fill material were lead, nickel and dioxin/furans. In total, 1,747 truckGroundwater monitoring will be conducted in April 2006 and September 2006 for metals, TPH, VOCs, PAHs and dioxin/furans. One additional upgradient well will be installed.All existing wells will be sampled in April and September 2006.DTSC approved plan to collect additional soil vapor and groundwater samples.DTSC approved additional groundwater sampling to better define the extent of volatile organic compounds contamination in groundwater.Workplan approved with modifications for additional groundwater monitoring and soil sampling.Workplan is approved with modifications.Reviewed plans to ensure that the additional investigation activities proposed were consistent with previous discussions with the consultant. It was consistent, therefore no comments provided and work was conducted.Report documents February and May 2007 groundwater sampling events.4Q 2008 Groundwater Monitoring Report approved.Workplan accepted with modifications. Boring logs and results of the step and longer term extraction testing will be submitted to facilitate review of the proposed injection testing.Plan was approved with modifications. An additional multi-port groundwater monitoring well was required.n September 22, 2004 and end on October 22, 2004.y 1970, the pond was used intermittently to store black liquor, a byproduct of the mill operation. It was later backfilled with soil and wood chips. Soil samples show higher than usual amounts of some metals and dioxins/furans in the black liquorun from 9/1/2004 to 10/1/2004.loads or 45,840 tons (34,955 cy) of BLP fill material were removed from the site between November 19, 2004 and January 31, 2005. Backfilling and regrading were completed in May 2005.h October 22, 2004.pond. The contaminants are generally limited to the black liquor pond area boundaries.

Completed Info:
Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported

EAST MILL (Continued) **S106152509**

Completed Document Type: CEQA - Initial Study/ Neg. Declaration
Completed Date: 2004-11-01 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Site Conferences for SB 923 Sites
Completed Date: 2004-01-29 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Voluntary Clean-up Agreement
Completed Date: 2003-12-30 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: AB 2061 - Designation
Completed Date: 2003-12-15 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Amendment - Order/Agreement
Completed Date: 2008-08-14 00:00:00

Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Action Plan
Completed Date: 2004-11-01 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Preliminary Endangerment Assessment Report
Completed Date: 2005-06-09 00:00:00

Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Design
Completed Date: 2004-11-12 00:00:00

Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Investigation / Feasibility Study
Completed Date: 2004-08-30 00:00:00

Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Action Completion Report
Completed Date: 2005-11-22 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Groundwater Monitoring Plan
Completed Date: 2006-03-28 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Groundwater Monitoring Plan
Completed Date: 2006-03-28 00:00:00

EAST MILL (Continued) **S106152509**

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Investigation Workplan
Completed Date: 2006-06-08 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Investigation Workplan
Completed Date: 2006-08-24 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Groundwater Monitoring Plan
Completed Date: 2007-05-23 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Investigation Workplan
Completed Date: 2005-05-11 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Investigation Workplan
Completed Date: 2007-08-01 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Groundwater Monitoring Report
Completed Date: 2007-10-02 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Groundwater Monitoring Report
Completed Date: 2008-04-23 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Other Workplan
Completed Date: 2008-05-13 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Remedial Investigation Workplan
Completed Date: 2006-12-07 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Correspondence - Received
Completed Date: 2008-04-23 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Other Workplan
Completed Date: 2008-05-28 00:00:00

Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported

EAST MILL (Continued) **S106152509**

Completed Document Type: Fact Sheets
Completed Date: 2004-08-30 00:00:00

Completed Area Name: Black Liquor Pond
Completed Sub Area Name: Not reported
Completed Document Type: Public Notice
Completed Date: 2004-09-20 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Fact Sheets
Completed Date: 2005-08-04 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Fact Sheets
Completed Date: 2006-07-20 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Public Participation Plan / Community Relations Plan
Completed Date: 2004-10-25 00:00:00

Confirmed: 30009,,
Confirmed Description: Dioxin (as
Confirmed Description: Not reported
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Operations and Maintenance Plan
Future Due Date: 2009
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Fact Sheets
Future Due Date: 2008
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Remedial Action Completion Report
Future Due Date: 2008
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Removal Action Completion Report
Future Due Date: 2009
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Removal Action Workplan
Future Due Date: 2009
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Deed Restriction / Land Use Covenant
Future Due Date: 2009
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Certification
Future Due Date: 2010
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Removal Action Workplan

EAST MILL (Continued) **S106152509**

Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Fact Sheets
Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	CEQA - Notice of Exemption
Future Due Date:	2008
Media Affected:	30009, 30009, 30024, 3002502
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported

Management:

Management Required:	NONE SPECIFIED
Management Required Desc:	Not reported
Potential:	OTH, SOIL, OTH, SOIL
Potenital Description:	Not reported
Potenital Description:	Not reported
Potenital Description:	Not reported
Potenital Description:	Not reported
Schedule Area Name:	Not reported
Schedule Sub Area Name:	Not reported
Schedule Document Type:	Not reported
Schedule Due Date:	Not reported
Schedule Revised Date:	Not reported
PastUse:	MANUFACTURING - PAPER, MANUFACTURING - PAPER

H37 **INDUSTRIAL LOT WITH RAILROAD SIDING** **VCP** **S106568193**
West **2600 WILBUR AVENUE** **ENVIROSTOR** **N/A**
1/2-1 **ANTIOCH, CA 94509**
0.637 mi.
3361 ft. **Site 2 of 2 in cluster H**

Relative:
Higher

Actual:
29 ft.

VCP:

Facility ID:	07990014
Site Type:	Voluntary Cleanup
Site Type Detail:	Voluntary Cleanup
Acres:	10.28
National Priorities List:	NO
Cleanup Oversight Agencies:	SMBRP, RWQCB 5S - Central Valley, CONTRA COSTA COUNTY
Lead Agency:	SMBRP
Lead Agency Description:	DTSC - Sit
Project Manager:	JANET NAITO
Supervisor:	Barbara Cook
Division Branch:	Berkeley
Site Code:	201534
Assembly:	11
Senate:	07
Special Programs Code:	Designation of Single Agency
Status:	Certified
Status Date:	2006-03-06 00:00:00
Restricted Use:	NO
Funding:	Responsible Party
Lat/Long:	38.0110825147944 / -121.754830895351
Alias Name:	110033615130

INDUSTRIAL LOT WITH RAILROAD SIDING (Continued) **S106568193**

Alias Type:	EPA (FRS #)
Alias Name:	INDUSTRIAL LOT WITH
Alias Type:	Alternate Name
Alias Name:	051-032-009-6
Alias Type:	APN
Alias Name:	07990014
Alias Type:	Envirostor ID Number
Alias Name:	INDUSTRIAL LOT #2
Alias Type:	Alternate Name
Alias Name:	201534
Alias Type:	Project Code (Site Code)
APN:	051-032-009-6
APN Description:	Not reported
Comments:	Public Participation Plan approved for the nine Gaylord Mill and Non-Mill Properties.PEA completed and no further action is required. In accordance with Site Designation requirements, the site is certified.DTSC designated lead administering agency.Voluntary Environmental Oversight Agreement Docket No. HSA-A 03/04-084 signed with Gaylord Container Corporation, d/b/a Inland Paperboard and Packaging, Antioch Mill.

Completed Info:

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Certification
Completed Date:	2006-03-06 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Site Conferences for SB 923 Sites
Completed Date:	2004-01-29 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Voluntary Clean-up Agreement
Completed Date:	2003-12-30 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	AB 2061 - Designation
Completed Date:	2003-12-15 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Preliminary Endangerment Assessment Report
Completed Date:	2006-03-06 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Public Participation Plan / Community Relations Plan
Completed Date:	2004-10-25 00:00:00
Confirmed:	30024,3002502
Confirmed Description:	TPH-diesel
Confirmed Description:	TPH-MOTOR
Future Area Name:	Not reported
Future Sub Area Name:	Not reported

INDUSTRIAL LOT WITH RAILROAD SIDING (Continued) **S106568193**

Future Document Type: Not reported
Future Due Date: Not reported
Media Affected: 30024, 3002502
Media Affected Desc: Not reported
Media Affected Desc: Not reported

Management:
Management Required: NONE SPECIFIED
Management Required Desc: Not reported
Potential: SOIL
Potenital Description: Not reported
Schedule Area Name: Not reported
Schedule Sub Area Name: Not reported
Schedule Document Type: Not reported
Schedule Due Date: Not reported
Schedule Revised Date: Not reported
PastUse: MANUFACTURING - PAPER

ENVIROSTOR:
Site Type: Voluntary Cleanup
Site Type Detailed: Voluntary Cleanup
Acres: 10.28
NPL: NO
Regulatory Agencies: SMBRP, RWQCB 5S - Central Valley, CONTRA COSTA COUNTY
Lead Agency: SMBRP
Program Manager: JANET NAITO
Supervisor: Barbara Cook
Division Branch: Berkeley
Facility ID: 07990014
Site Code: 201534
Assembly: 11
Senate: 07
Special Program: Designation of Single Agency
Status: Certified
Status Date: 2006-03-06 00:00:00
Restricted Use: NO
Funding: Responsible Party
Latitude: 38.0110825147944
Longitude: -121.754830895351
Alias Name: 110033615130
Alias Type: EPA (FRS #)
Alias Name: INDUSTRIAL LOT WITH
Alias Type: Alternate Name
Alias Name: 051-032-009-6
Alias Type: APN
Alias Name: 07990014
Alias Type: Envirostor ID Number
Alias Name: INDUSTRIAL LOT #2
Alias Type: Alternate Name
Alias Name: 201534
Alias Type: Project Code (Site Code)

APN: 051-032-009-6
APN Description: Not reported
Comments: Public Participation Plan approved for the nine Gaylord Mill and Non-Mill Properties.PEA completed and no further action is required. In accordance with Site Designation requirements, the site is

INDUSTRIAL LOT WITH RAILROAD SIDING (Continued) **S106568193**

certified.DTSC designated lead administering agency.Voluntary Environmental Oversight Agreement Docket No. HSA-A 03/04-084 signed with Gaylord Container Corporation, d/b/a Inland Paperboard and Packaging, Antioch Mill.

Completed Info:

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Certification
Completed Date:	2006-03-06 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Site Conferences for SB 923 Sites
Completed Date:	2004-01-29 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Voluntary Clean-up Agreement
Completed Date:	2003-12-30 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	AB 2061 - Designation
Completed Date:	2003-12-15 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Preliminary Endangerment Assessment Report
Completed Date:	2006-03-06 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Public Participation Plan / Community Relations Plan
Completed Date:	2004-10-25 00:00:00
Confirmed:	30024,3002502
Confirmed Description:	TPH-diesel
Confirmed Description:	TPH-MOTOR
Future Area Name:	Not reported
Future Sub Area Name:	Not reported
Future Document Type:	Not reported
Future Due Date:	Not reported
Media Affected:	30024, 3002502
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported

Management:

Management Required:	NONE SPECIFIED
Management Required Desc:	Not reported
Potential:	SOIL
Potenital Description:	Not reported
Schedule Area Name:	Not reported
Schedule Sub Area Name:	Not reported
Schedule Document Type:	Not reported
Schedule Due Date:	Not reported
Schedule Revised Date:	Not reported
PastUse:	MANUFACTURING - PAPER

38 West 1/2-1 0.914 mi. 4825 ft. | **WEST MILL**
2301 WILBUR AVENUE
ANTIOCH, CA 94509 | **VCP**
ENVIROSTOR | **S106152508**
N/A

Relative: Higher

Actual: 32 ft.

VCP:

Facility ID:	07260002
Site Type:	Voluntary Cleanup
Site Type Detail:	Voluntary Cleanup
Acres:	27.7
National Priorities List:	NO
Cleanup Oversight Agencies:	SMBRP, RWQCB 5S - Central Valley, CONTRA COSTA COUNTY
Lead Agency:	SMBRP
Lead Agency Description:	DTSC - Sit
Project Manager:	JANET NAITO
Supervisor:	Barbara Cook
Division Branch:	Berkeley
Site Code:	201535
Assembly:	11
Senate:	07
Special Programs Code:	Designation of Single Agency
Status:	Active
Status Date:	2004-01-27 00:00:00
Restricted Use:	NO
Funding:	Responsible Party
Lat/Long:	38.0110825147944 / -121.754830895351
Alias Name:	110033619966
Alias Type:	EPA (FRS #)
Alias Name:	051-020-006-6
Alias Type:	APN
Alias Name:	WEST MILL
Alias Type:	Alternate Name
Alias Name:	07260002
Alias Type:	Envirostor ID Number
Alias Name:	201535
Alias Type:	Project Code (Site Code)
APN:	051-020-006-6
APN Description:	Not reported
Comments:	Voluntary Environmental Oversight Agreement Docket No. HSA-A 03/04-084 signed with Gaylord Container Corporation, d/b/a Inland Paperboard and Packaging, Antioch Mill.Held site conference pursuant to H&SC Section 25398.2.Workplan approved with modifications and clarifications provided by the consultant.Public Participation Plan approved for nine Gaylord Mill and Non-Mill properties in Antioch.Reviewed plans to ensure that the additional investigation activities proposed were consistent with previous discussions with the consultant. It was consistent, therefore no comments provided and work was conducted mid-August 2007.PEA Workplan approved with modifications

Completed Info:

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Site Conferences for SB 923 Sites
Completed Date:	2004-01-29 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported

WEST MILL (Continued) **S106152508**

Completed Document Type: Voluntary Clean-up Agreement
Completed Date: 2003-12-30 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: AB 2061 - Designation
Completed Date: 2003-12-15 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Amendment - Order/Agreement
Completed Date: 2008-08-14 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Preliminary Endangerment Assessment Workplan
Completed Date: 2006-03-16 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Other Workplan
Completed Date: 2006-03-13 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Other Workplan
Completed Date: 2006-04-19 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Public Participation Plan / Community Relations Plan
Completed Date: 2004-10-25 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Site Investigation/Characterization Workplan
Completed Date: 2007-08-01 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Correspondence - Received
Completed Date: 2008-07-14 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Other Workplan
Completed Date: 2008-07-02 00:00:00

Confirmed: 30024,3002502
Confirmed Description: TPH-diesel
Confirmed Description: TPH-MOTOR
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Removal Action Completion Report
Future Due Date: 2009
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported

WEST MILL (Continued) **S106152508**

Future Document Type:	Removal Action Workplan
Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Preliminary Endangerment Assessment Report
Future Due Date:	2008
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Fact Sheets
Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Public Notice
Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Deed Restriction / Land Use Covenant
Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	Certification
Future Due Date:	2009
Future Area Name:	PROJECT WIDE
Future Sub Area Name:	Not reported
Future Document Type:	CEQA - Notice of Exemption
Future Due Date:	2007
Media Affected:	30024, 3002502
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported

Management:

Management Required:	NONE SPECIFIED
Management Required Desc:	Not reported
Potential:	SOIL
Potenital Description:	Not reported
Schedule Area Name:	Not reported
Schedule Sub Area Name:	Not reported
Schedule Document Type:	Not reported
Schedule Due Date:	Not reported
Schedule Revised Date:	Not reported
PastUse:	MANUFACTURING - PAPER

ENVIROSTOR:

Site Type:	Voluntary Cleanup
Site Type Detailed:	Voluntary Cleanup
Acres:	27.7
NPL:	NO
Regulatory Agencies:	SMBRP, RWQCB 5S - Central Valley, CONTRA COSTA COUNTY
Lead Agency:	SMBRP
Program Manager:	JANET NAITO
Supervisor:	Barbara Cook
Division Branch:	Berkeley
Facility ID:	07260002
Site Code:	201535
Assembly:	11
Senate:	07
Special Program:	Designation of Single Agency

WEST MILL (Continued) **S106152508**

Status: Active
Status Date: 2004-01-27 00:00:00
Restricted Use: NO
Funding: Responsible Party
Latitude: 38.0110825147944
Longitude: -121.754830895351
Alias Name: 110033619966
Alias Type: EPA (FRS #)
Alias Name: 051-020-006-6
Alias Type: APN
Alias Name: WEST MILL
Alias Type: Alternate Name
Alias Name: 07260002
Alias Type: Envirostor ID Number
Alias Name: 201535
Alias Type: Project Code (Site Code)

APN: 051-020-006-6
APN Description: Not reported
Comments: Voluntary Environmental Oversight Agreement Docket No. HSA-A 03/04-084 signed with Gaylord Container Corporation, d/b/a Inland Paperboard and Packaging, Antioch Mill.Held site conference pursuant to H&SC Section 25398.2.Workplan approved with modifications and clarifications provided by the consultant.Public Participation Plan approved for nine Gaylord Mill and Non-Mill properties in Antioch.Reviewed plans to ensure that the additional investigation activities proposed were consistent with previous discussions with the consultant. It was consistent, therefore no comments provided and work was conducted mid-August 2007.PEA Workplan approved with modifications

Completed Info:
Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Site Conferences for SB 923 Sites
Completed Date: 2004-01-29 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Voluntary Clean-up Agreement
Completed Date: 2003-12-30 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: AB 2061 - Designation
Completed Date: 2003-12-15 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Amendment - Order/Agreement
Completed Date: 2008-08-14 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Preliminary Endangerment Assessment Workplan
Completed Date: 2006-03-16 00:00:00

Completed Area Name: PROJECT WIDE

WEST MILL (Continued) **S106152508**

Completed Sub Area Name: Not reported
Completed Document Type: Other Workplan
Completed Date: 2006-03-13 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Other Workplan
Completed Date: 2006-04-19 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Public Participation Plan / Community Relations Plan
Completed Date: 2004-10-25 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Site Investigation/Characterization Workplan
Completed Date: 2007-08-01 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Correspondence - Received
Completed Date: 2008-07-14 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Other Workplan
Completed Date: 2008-07-02 00:00:00

Confirmed: 30024,3002502
Confirmed Description: TPH-diesel
Confirmed Description: TPH-MOTOR
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Removal Action Completion Report
Future Due Date: 2009
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Removal Action Workplan
Future Due Date: 2009
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Preliminary Endangerment Assessment Report
Future Due Date: 2008
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Fact Sheets
Future Due Date: 2009
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Public Notice
Future Due Date: 2009
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: Deed Restriction / Land Use Covenant
Future Due Date: 2009
Future Area Name: PROJECT WIDE

WEST MILL (Continued) **S106152508**

Future Sub Area Name: Not reported
Future Document Type: Certification
Future Due Date: 2009
Future Area Name: PROJECT WIDE
Future Sub Area Name: Not reported
Future Document Type: CEQA - Notice of Exemption
Future Due Date: 2007
Media Affected: 30024, 3002502
Media Affected Desc: Not reported
Media Affected Desc: Not reported

Management:
Management Required: NONE SPECIFIED
Management Required Desc: Not reported
Potential: SOIL
Potenital Description: Not reported
Schedule Area Name: Not reported
Schedule Sub Area Name: Not reported
Schedule Document Type: Not reported
Schedule Due Date: Not reported
Schedule Revised Date: Not reported
PastUse: MANUFACTURING - PAPER

39
South
> 1
1.008 mi.
5321 ft.

OAKLEY ROAD METERING SITE **ENVIROSTOR** **S101479973**
OAKLEY RD. / PHILLIPS LN. **N/A**
ANTIOCH, CA 94509

Relative:
Higher

Actual:
79 ft.

ENVIROSTOR:
Site Type: Evaluation
Site Type Detailed: Evaluation
Acres: 0.7
NPL: NO
Regulatory Agencies: NONE SPECIFIED
Lead Agency: NONE SPECIFIED
Program Manager: Not reported
Supervisor: Referred - Not Assigned
Division Branch: Berkeley
Facility ID: 07490002
Site Code: Not reported
Assembly: 11
Senate: 07
Special Program: Not reported
Status: Refer: RWQCB
Status Date: 2002-08-28 00:00:00
Restricted Use: NO
Funding: Not reported
Latitude: 37.9975
Longitude: -121.759722222222
Alias Name: 07490002
Alias Type: Envirostor ID Number
Alias Name: STANDARD PACIFIC GAS
Alias Type: Alternate Name

APN: NONE SPECIFIED
APN Description: Not reported
Comments: Completed Site Screening. Investigation conducted in August 1991

OAKLEY ROAD METERING SITE (Continued) **S101479973**

showed that soil and groundwater are contaminated with hydrocarbons, BTEX and PCBs.

Completed Info:

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Site Screening
Completed Date:	1992-01-31 00:00:00
Confirmed:	NONE SPECIFIED
Confirmed Description:	Not reported
Future Area Name:	Not reported
Future Sub Area Name:	Not reported
Future Document Type:	Not reported
Future Due Date:	Not reported
Media Affected:	10009, 30018
Media Affected Desc:	Not reported
Media Affected Desc:	Not reported

Management:

Management Required:	NONE SPECIFIED
Management Required Desc:	Not reported
Potential:	NONE SPECIFIED
Potenital Description:	Not reported
Schedule Area Name:	Not reported
Schedule Sub Area Name:	Not reported
Schedule Document Type:	Not reported
Schedule Due Date:	Not reported
Schedule Revised Date:	Not reported
PastUse:	NONE SPECIFIED

---

40 WSW > 1 1.101 mi. 5813 ft. | **ALMOND ORCHARD 2101 E. 18TH STREET ANTIOCH, CA 94509** | **VCP ENVIROSTOR** | **S106152505 N/A**

Relative: Higher

Actual: 49 ft.

VCP:

Facility ID:	07010011
Site Type:	Voluntary Cleanup
Site Type Detail:	Voluntary Cleanup
Acres:	8.78
National Priorities List:	NO
Cleanup Oversight Agencies:	SMBRP
Lead Agency:	SMBRP
Lead Agency Description:	DTSC - Sit
Project Manager:	JANET NAITO
Supervisor:	Barbara Cook
Division Branch:	Berkeley
Site Code:	201530
Assembly:	11
Senate:	07
Special Programs Code:	Designation of Single Agency
Status:	Certified
Status Date:	2005-06-13 00:00:00
Restricted Use:	NO
Funding:	Responsible Party
Lat/Long:	38.0059911381088 / -121.77679920421
Alias Name:	110033614131

ALMOND ORCHARD (Continued) **S106152505**

Alias Type:	EPA (FRS #)
Alias Name:	051-100-023-4
Alias Type:	APN
Alias Name:	ALMOND ORCHARD
Alias Type:	Alternate Name
Alias Name:	051-100-022-6
Alias Type:	APN
Alias Name:	07010011
Alias Type:	Envirostor ID Number
Alias Name:	201530
Alias Type:	Project Code (Site Code)
APN:	051-100-023-4, 051-100-022-6
APN Description:	Not reported
APN Description:	Not reported
Comments:	Voluntary Environmental Oversight Agreement Docket No. HSA-A 03/04-084 signed with Gaylord Container Corporation, d/b/a Inland Paperboard and Packaging, Antioch Mill.Held site conference pursuant to H&SC Section 25398.2.Site certified under the Site Designation process.Based upon the results of the PEA, no further action is required for the northern and southern Almond Orchard.Soil samples were collected in January and August 2004 which found that all metals, dioxins/furans, PAHs, pesticides and herbicides were either not detected or were detected at concentrations below residential screening goals. The risk evaluation deNOE filedDTSC reviewed Phase I Environmental Assessment as part of its review of the PEA Workplan.termined that risks from chemicals in soil did not exceed the de minimis risk level under a single-family residential use scenario. Therefore, DTSC determined that no further action was required.

Completed Info:

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Site Conferences for SB 923 Sites
Completed Date:	2004-01-29 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Voluntary Clean-up Agreement
Completed Date:	2003-12-30 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	AB 2061 - Designation
Completed Date:	2003-12-15 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Certification
Completed Date:	2005-06-13 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	CEQA - Notice of Exemption
Completed Date:	2005-06-08 00:00:00
Completed Area Name:	PROJECT WIDE

ALMOND ORCHARD (Continued) **S106152505**

Completed Sub Area Name: Not reported
Completed Document Type: Preliminary Endangerment Assessment Report
Completed Date: 2005-06-13 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Phase 1
Completed Date: 2002-09-01 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Fact Sheets
Completed Date: 2005-04-18 00:00:00

Confirmed: 31000
Confirmed Description: No Contami
Future Area Name: Not reported
Future Sub Area Name: Not reported
Future Document Type: Not reported
Future Due Date: Not reported
Media Affected: NONE SPECIFIED,31000
Media Affected Desc: Not reported
Media Affected Desc: Not reported

Management:
Management Required: NONE SPECIFIED
Management Required Desc: Not reported
Potential: SOIL
Potenital Description: Not reported
Schedule Area Name: Not reported
Schedule Sub Area Name: Not reported
Schedule Document Type: Not reported
Schedule Due Date: Not reported
Schedule Revised Date: Not reported
PastUse: AGRICULTURAL - ORCHARD

ENVIROSTOR:
Site Type: Voluntary Cleanup
Site Type Detailed: Voluntary Cleanup
Acres: 8.78
NPL: NO
Regulatory Agencies: SMBRP
Lead Agency: SMBRP
Program Manager: JANET NAITO
Supervisor: Barbara Cook
Division Branch: Berkeley
Facility ID: 07010011
Site Code: 201530
Assembly: 11
Senate: 07
Special Program: Designation of Single Agency
Status: Certified
Status Date: 2005-06-13 00:00:00
Restricted Use: NO
Funding: Responsible Party
Latitude: 38.0059911381088
Longitude: -121.77679920421

ALMOND ORCHARD (Continued) **S106152505**

Alias Name:	110033614131
Alias Type:	EPA (FRS #)
Alias Name:	051-100-023-4
Alias Type:	APN
Alias Name:	ALMOND ORCHARD
Alias Type:	Alternate Name
Alias Name:	051-100-022-6
Alias Type:	APN
Alias Name:	07010011
Alias Type:	Envirostor ID Number
Alias Name:	201530
Alias Type:	Project Code (Site Code)
APN:	051-100-023-4, 051-100-022-6
APN Description:	Not reported
APN Description:	Not reported
Comments:	Voluntary Environmental Oversight Agreement Docket No. HSA-A 03/04-084 signed with Gaylord Container Corporation, d/b/a Inland Paperboard and Packaging, Antioch Mill.Held site conference pursuant to H&SC Section 25398.2.Site certified under the Site Designation process.Based upon the results of the PEA, no further action is required for the northern and southern Almond Orchard.Soil samples were collected in January and August 2004 which found that all metals, dioxins/furans, PAHs, pesticides and herbicides were either not detected or were detected at concentrations below residential screening goals. The risk evaluation deNOE filedDTSC reviewed Phase I Environmental Assessment as part of its review of the PEA Workplan.termined that risks from chemicals in soil did not exceed the de minimis risk level under a single-family residential use scenario. Therefore, DTSC determined that no further action was required.

Completed Info:

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Site Conferences for SB 923 Sites
Completed Date:	2004-01-29 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Voluntary Clean-up Agreement
Completed Date:	2003-12-30 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	AB 2061 - Designation
Completed Date:	2003-12-15 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Certification
Completed Date:	2005-06-13 00:00:00
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	CEQA - Notice of Exemption
Completed Date:	2005-06-08 00:00:00

ALMOND ORCHARD (Continued) **S106152505**

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Preliminary Endangerment Assessment Report
Completed Date: 2005-06-13 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Phase 1
Completed Date: 2002-09-01 00:00:00

Completed Area Name: PROJECT WIDE
Completed Sub Area Name: Not reported
Completed Document Type: Fact Sheets
Completed Date: 2005-04-18 00:00:00

Confirmed: 31000
Confirmed Description: No Contami
Future Area Name: Not reported
Future Sub Area Name: Not reported
Future Document Type: Not reported
Future Due Date: Not reported
Media Affected: NONE SPECIFIED,31000
Media Affected Desc: Not reported
Media Affected Desc: Not reported

Management:
Management Required: NONE SPECIFIED
Management Required Desc: Not reported
Potential: SOIL
Potenital Description: Not reported
Schedule Area Name: Not reported
Schedule Sub Area Name: Not reported
Schedule Document Type: Not reported
Schedule Due Date: Not reported
Schedule Revised Date: Not reported
PastUse: AGRICULTURAL - ORCHARD

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
ANTIOCH	S106931820	SAN JOAQUIN YACHT HARBOR	RT 1 BOX 566	94509	SWEEPS UST
ANTIOCH	S102259942	BRIDGEHEAD TRUCK STOP	RT 1, BOX 495	94509	CONTRA COSTA CO. SITE LIST
ANTIOCH	S106932144	SHERMAN ISL. DEHYDRATOR-ODORAN	HIGHWAY 160	94509	SWEEPS UST
ANTIOCH	S103678955	CHEVRON 93801	HWY 4/NEROLY RD	94509	HAZNET
ANTIOCH	1003878987	ABANDONED DRUM/ANTIOCH	ANTIOCH	94509	CERC-NFRAP
ANTIOCH	U001596213	BRIDGEHEAD TRUCK STOP	RT-1 BOX 495	94509	HIST UST, SWEEPS UST
ANTIOCH	S106666501	CHEVRON SS# 96946	BRIDGEHEAD RD / HWY 4	94509	CONTRA COSTA CO. SITE LIST
ANTIOCH	S107531950		2616 CARPENTERIA DRIVE	94509	CDL
ANTIOCH	S107529468		1651 DRIVE IN AVE/BRIDGEHEAD S	94509	CDL
ANTIOCH	S103679048	PG&E ANTIOCH MAINT STATION	INTERSECT NEROLY RD / HWY 4	94509	HAZNET
ANTIOCH	S107736205	DALLAS RANCH MIDDLE SCHOOL	LONE TREE WAY/1401 MOUNT HAMIL	94509	SCH, ENVIROSTOR
ANTIOCH	S107527376		1137 MISSION DRIVE (MOTORHOME	94509	CDL
ANTIOCH	1000252416	CALIFORNIA ORGANICS	445 A OLD HWY 4	94509	FINDS, RCRA-NonGen
ANTIOCH	1003878417	ANTIOCH DSPL SITE	PASO CORTO & SOMERSVILLE RDS	94509	CERC-NFRAP
ANTIOCH	S108751940	OLD SCHOOL AUTO WORKS	2665 PITTSBURG-ANTIOCH HWY UNI	94509	HAZNET
ANTIOCH	S107531083		2208 SYCAMORE DRIVE APT #27	94509	CDL
ANTIOCH	1000355266	FIBREBOARD CORPORATION	WILBUR AVENUE	94509	HIST UST
ANTIOCH	S102259989	LINCOLN PROPERTIES	4650 WILBUR AVE	94509	CONTRA COSTA CO. SITE LIST
ANTIOCH	S106152511	INDUSTRIAL LOT WITH TANK	WILBUR AVENUE	94509	VCP, ENVIROSTOR
ANTIOCH	S106837035	PACIFIC GAS AND ELECTRIC CO, A	WILBUR AVENUE	94509	EMI
ANTIOCH	S106928741	LLOYD'S HOLIDAY HARBOR	WILBUR AVE	94509	SWEEPS UST
ANTIOCH	S108657197	REBELLO RACING	511 WILBUR AVE A-5	94509	CONTRA COSTA CO. SITE LIST
CONTRA COSTA COUNTY	S105631151		CAMINO DIABLO RD. WEST OF VASC		CHMIRS, EMI
RURAL	U001596245	SHERMAN ISL. DEHYDRATOR-ODORAN	HIGHWAY 160	94509	HIST UST
SANTA MARIA	S104159552	PACIFIC GAS & ELECTRIC COMPANY	2445 S SKYWAY DRIVE	94509	CONTRA COSTA CO. SITE LIST, ENVIROSTOR

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 09/29/2008
Date Data Arrived at EDR: 10/10/2008
Date Made Active in Reports: 11/19/2008
Number of Days to Update: 40

Source: EPA
Telephone: N/A
Last EDR Contact: 09/29/2008
Next Scheduled EDR Contact: 01/26/2009
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 09/29/2008
Date Data Arrived at EDR: 10/10/2008
Date Made Active in Reports: 11/19/2008
Number of Days to Update: 40

Source: EPA
Telephone: N/A
Last EDR Contact: 09/29/2008
Next Scheduled EDR Contact: 01/26/2009
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: No Update Planned

Federal Delisted NPL site list

DELISTED NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 09/29/2008	Source: EPA
Date Data Arrived at EDR: 10/10/2008	Telephone: N/A
Date Made Active in Reports: 11/19/2008	Last EDR Contact: 09/29/2008
Number of Days to Update: 40	Next Scheduled EDR Contact: 01/26/2009
	Data Release Frequency: Quarterly

Federal CERCLIS list

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 10/07/2008	Source: EPA
Date Data Arrived at EDR: 10/16/2008	Telephone: 703-412-9810
Date Made Active in Reports: 12/08/2008	Last EDR Contact: 10/16/2008
Number of Days to Update: 53	Next Scheduled EDR Contact: 01/12/2009
	Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 12/03/2007	Source: EPA
Date Data Arrived at EDR: 12/06/2007	Telephone: 703-412-9810
Date Made Active in Reports: 02/20/2008	Last EDR Contact: 01/12/2009
Number of Days to Update: 76	Next Scheduled EDR Contact: 03/16/2009
	Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 09/11/2008	Source: EPA
Date Data Arrived at EDR: 09/19/2008	Telephone: 800-424-9346
Date Made Active in Reports: 10/16/2008	Last EDR Contact: 12/01/2008
Number of Days to Update: 27	Next Scheduled EDR Contact: 03/02/2009
	Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Transporters, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 09/10/2008
Date Data Arrived at EDR: 09/23/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 23

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 11/18/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 09/10/2008
Date Data Arrived at EDR: 09/23/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 23

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 11/18/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 09/10/2008
Date Data Arrived at EDR: 09/23/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 23

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 11/18/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 09/10/2008
Date Data Arrived at EDR: 09/23/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 23

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 11/18/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Varies

Federal institutional controls / engineering controls registries

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 10/06/2008
Date Data Arrived at EDR: 10/17/2008
Date Made Active in Reports: 12/08/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 10/06/2008
Date Data Arrived at EDR: 10/17/2008
Date Made Active in Reports: 12/08/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 01/23/2008
Date Made Active in Reports: 03/17/2008
Number of Days to Update: 54

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 10/21/2008
Next Scheduled EDR Contact: 01/19/2009
Data Release Frequency: Annually

State- and tribal - equivalent NPL

RESPONSE: State Response Sites

Identifies confirmed release sites where DTSC is involved in remediation, either in a lead or oversight capacity. These confirmed release sites are generally high-priority and high potential risk.

Date of Government Version: 08/25/2008
Date Data Arrived at EDR: 08/27/2008
Date Made Active in Reports: 09/03/2008
Number of Days to Update: 7

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/26/2008
Next Scheduled EDR Contact: 02/23/2009
Data Release Frequency: Quarterly

State- and tribal - equivalent CERCLIS

ENVIROSTOR: EnviroStor Database

The Department of Toxic Substances Control's (DTSC's) Site Mitigation and Brownfields Reuse Program's (SMBRP's) EnviroStor database identifes sites that have known contamination or sites for which there may be reasons to investigate further. The database includes the following site types: Federal Superfund sites (National Priorities List (NPL)); State Response, including Military Facilities and State Superfund; Voluntary Cleanup; and School sites. EnviroStor provides similar information to the information that was available in CalSites, and provides additional site information, including, but not limited to, identification of formerly-contaminated properties that have been released for reuse, properties where environmental deed restrictions have been recorded to prevent inappropriate land uses, and risk characterization information that is used to assess potential impacts to public health and the environment at contaminated sites.

Date of Government Version: 08/25/2008
Date Data Arrived at EDR: 08/27/2008
Date Made Active in Reports: 09/03/2008
Number of Days to Update: 7

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/26/2008
Next Scheduled EDR Contact: 02/23/2009
Data Release Frequency: Quarterly

State and tribal landfill and/or solid waste disposal site lists

SWF/LF (SWIS): Solid Waste Information System

Active, Closed and Inactive Landfills. SWF/LF records typically contain an inve ntory of solid waste disposal facilities or landfills. These may be active or i nactive facilities or open dumps that failed to meet RCRA Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 09/08/2008
Date Data Arrived at EDR: 09/09/2008
Date Made Active in Reports: 09/18/2008
Number of Days to Update: 9

Source: Integrated Waste Management Board
Telephone: 916-341-6320
Last EDR Contact: 12/09/2008
Next Scheduled EDR Contact: 03/09/2009
Data Release Frequency: Quarterly

State and tribal leaking storage tank lists

LUST REG 8: Leaking Underground Storage Tanks
California Regional Water Quality Control Board Santa Ana Region (8). For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 02/14/2005
Date Data Arrived at EDR: 02/15/2005
Date Made Active in Reports: 03/28/2005
Number of Days to Update: 41

Source: California Regional Water Quality Control Board Santa Ana Region (8)
Telephone: 909-782-4496
Last EDR Contact: 11/04/2008
Next Scheduled EDR Contact: 02/02/2009
Data Release Frequency: Varies

LUST REG 9: Leaking Underground Storage Tank Report
Orange, Riverside, San Diego counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 03/01/2001
Date Data Arrived at EDR: 04/23/2001
Date Made Active in Reports: 05/21/2001
Number of Days to Update: 28

Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 858-637-5595
Last EDR Contact: 01/12/2009
Next Scheduled EDR Contact: 04/13/2009
Data Release Frequency: No Update Planned

LUST REG 7: Leaking Underground Storage Tank Case Listing
Leaking Underground Storage Tank locations. Imperial, Riverside, San Diego, Santa Barbara counties.

Date of Government Version: 02/26/2004
Date Data Arrived at EDR: 02/26/2004
Date Made Active in Reports: 03/24/2004
Number of Days to Update: 27

Source: California Regional Water Quality Control Board Colorado River Basin Region (7)
Telephone: 760-776-8943
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: No Update Planned

LUST REG 6V: Leaking Underground Storage Tank Case Listing
Leaking Underground Storage Tank locations. Inyo, Kern, Los Angeles, Mono, San Bernardino counties.

Date of Government Version: 06/07/2005
Date Data Arrived at EDR: 06/07/2005
Date Made Active in Reports: 06/29/2005
Number of Days to Update: 22

Source: California Regional Water Quality Control Board Victorville Branch Office (6)
Telephone: 760-241-7365
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: No Update Planned

LUST REG 6L: Leaking Underground Storage Tank Case Listing
For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 09/09/2003
Date Data Arrived at EDR: 09/10/2003
Date Made Active in Reports: 10/07/2003
Number of Days to Update: 27

Source: California Regional Water Quality Control Board Lahontan Region (6)
Telephone: 530-542-5572
Last EDR Contact: 12/01/2008
Next Scheduled EDR Contact: 03/02/2009
Data Release Frequency: No Update Planned

LUST: Geotracker's Leaking Underground Fuel Tank Report
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state. For more information on a particular leaking underground storage tank sites, please contact the appropriate regulatory agency.

Date of Government Version: 11/04/2008
Date Data Arrived at EDR: 11/04/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 22

Source: State Water Resources Control Board
Telephone: see region list
Last EDR Contact: 01/08/2009
Next Scheduled EDR Contact: 04/06/2009
Data Release Frequency: Quarterly

LUST REG 1: Active Toxic Site Investigation
Del Norte, Humboldt, Lake, Mendocino, Modoc, Siskiyou, Sonoma, Trinity counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 02/01/2001
Date Data Arrived at EDR: 02/28/2001
Date Made Active in Reports: 03/29/2001
Number of Days to Update: 29

Source: California Regional Water Quality Control Board North Coast (1)
Telephone: 707-570-3769
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: No Update Planned

LUST REG 2: Fuel Leak List
Leaking Underground Storage Tank locations. Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma counties.

Date of Government Version: 09/30/2004
Date Data Arrived at EDR: 10/20/2004
Date Made Active in Reports: 11/19/2004
Number of Days to Update: 30

Source: California Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-622-2433
Last EDR Contact: 01/05/2009
Next Scheduled EDR Contact: 04/06/2009
Data Release Frequency: Quarterly

LUST REG 3: Leaking Underground Storage Tank Database
Leaking Underground Storage Tank locations. Monterey, San Benito, San Luis Obispo, Santa Barbara, Santa Cruz counties.

Date of Government Version: 05/19/2003
Date Data Arrived at EDR: 05/19/2003
Date Made Active in Reports: 06/02/2003
Number of Days to Update: 14

Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-542-4786
Last EDR Contact: 11/10/2008
Next Scheduled EDR Contact: 02/02/2009
Data Release Frequency: No Update Planned

LUST REG 4: Underground Storage Tank Leak List
Los Angeles, Ventura counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 09/07/2004
Date Data Arrived at EDR: 09/07/2004
Date Made Active in Reports: 10/12/2004
Number of Days to Update: 35

Source: California Regional Water Quality Control Board Los Angeles Region (4)
Telephone: 213-576-6710
Last EDR Contact: 12/23/2008
Next Scheduled EDR Contact: 03/23/2009
Data Release Frequency: No Update Planned

LUST REG 5: Leaking Underground Storage Tank Database
Leaking Underground Storage Tank locations. Alameda, Alpine, Amador, Butte, Colusa, Contra Costa, Calveras, El Dorado, Fresno, Glenn, Kern, Kings, Lake, Lassen, Madera, Mariposa, Merced, Modoc, Napa, Nevada, Placer, Plumas, Sacramento, San Joaquin, Shasta, Solano, Stanislaus, Sutter, Tehama, Tulare, Tuolumne, Yolo, Yuba counties.

Date of Government Version: 07/01/2008
Date Data Arrived at EDR: 07/22/2008
Date Made Active in Reports: 07/31/2008
Number of Days to Update: 9

Source: California Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-464-4834
Last EDR Contact: 07/22/2008
Next Scheduled EDR Contact: 10/20/2008
Data Release Frequency: Quarterly

SLIC: Statewide SLIC Cases
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 11/04/2008
Date Data Arrived at EDR: 11/04/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 22

Source: State Water Resources Control Board
Telephone: 866-480-1028
Last EDR Contact: 01/08/2009
Next Scheduled EDR Contact: 04/06/2009
Data Release Frequency: Varies

SLIC REG 1: Active Toxic Site Investigations
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 04/03/2003
Date Data Arrived at EDR: 04/07/2003
Date Made Active in Reports: 04/25/2003
Number of Days to Update: 18

Source: California Regional Water Quality Control Board, North Coast Region (1)
Telephone: 707-576-2220
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 11/17/2008
Data Release Frequency: No Update Planned

SLIC REG 2: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 09/30/2004
Date Data Arrived at EDR: 10/20/2004
Date Made Active in Reports: 11/19/2004
Number of Days to Update: 30

Source: Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-286-0457
Last EDR Contact: 01/05/2009
Next Scheduled EDR Contact: 04/06/2009
Data Release Frequency: Quarterly

SLIC REG 3: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 05/18/2006
Date Data Arrived at EDR: 05/18/2006
Date Made Active in Reports: 06/15/2006
Number of Days to Update: 28

Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-549-3147
Last EDR Contact: 11/10/2008
Next Scheduled EDR Contact: 02/09/2009
Data Release Frequency: Semi-Annually

SLIC REG 4: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 11/17/2004
Date Data Arrived at EDR: 11/18/2004
Date Made Active in Reports: 01/04/2005
Number of Days to Update: 47

Source: Region Water Quality Control Board Los Angeles Region (4)
Telephone: 213-576-6600
Last EDR Contact: 10/20/2008
Next Scheduled EDR Contact: 01/19/2009
Data Release Frequency: Varies

SLIC REG 5: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 04/01/2005
Date Data Arrived at EDR: 04/05/2005
Date Made Active in Reports: 04/21/2005
Number of Days to Update: 16

Source: Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-464-3291
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Semi-Annually

SLIC REG 6V: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 05/24/2005
Date Data Arrived at EDR: 05/25/2005
Date Made Active in Reports: 06/16/2005
Number of Days to Update: 22

Source: Regional Water Quality Control Board, Victorville Branch
Telephone: 619-241-6583
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Semi-Annually

SLIC REG 6L: SLIC Sites
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 09/07/2004
Date Data Arrived at EDR: 09/07/2004
Date Made Active in Reports: 10/12/2004
Number of Days to Update: 35

Source: California Regional Water Quality Control Board, Lahontan Region
Telephone: 530-542-5574
Last EDR Contact: 12/01/2008
Next Scheduled EDR Contact: 03/02/2009
Data Release Frequency: No Update Planned

SLIC REG 7: SLIC List
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 11/24/2004
Date Data Arrived at EDR: 11/29/2004
Date Made Active in Reports: 01/04/2005
Number of Days to Update: 36

Source: California Regional Quality Control Board, Colorado River Basin Region
Telephone: 760-346-7491
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: No Update Planned

SLIC REG 8: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 04/03/2008
Date Data Arrived at EDR: 04/03/2008
Date Made Active in Reports: 04/14/2008
Number of Days to Update: 11

Source: California Region Water Quality Control Board Santa Ana Region (8)
Telephone: 951-782-3298
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Semi-Annually

SLIC REG 9: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 09/10/2007
Date Data Arrived at EDR: 09/11/2007
Date Made Active in Reports: 09/28/2007
Number of Days to Update: 17

Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 858-467-2980
Last EDR Contact: 11/24/2008
Next Scheduled EDR Contact: 02/23/2009
Data Release Frequency: Annually

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 10/10/2008
Date Data Arrived at EDR: 10/10/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 6

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Quarterly

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 11/18/2008
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 12/23/2008
Number of Days to Update: 34

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Quarterly

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 03/12/2008
Date Data Arrived at EDR: 03/14/2008
Date Made Active in Reports: 03/20/2008
Number of Days to Update: 6

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 06/06/2008
Date Data Arrived at EDR: 10/09/2008
Date Made Active in Reports: 11/19/2008
Number of Days to Update: 41

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Semi-Annually

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 11/25/2008
Date Data Arrived at EDR: 11/26/2008
Date Made Active in Reports: 12/23/2008
Number of Days to Update: 27

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 04/01/2008
Date Data Arrived at EDR: 12/03/2008
Date Made Active in Reports: 12/23/2008
Number of Days to Update: 20

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 11/19/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 12/02/2008
Date Data Arrived at EDR: 12/04/2008
Date Made Active in Reports: 12/23/2008
Number of Days to Update: 19

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Quarterly

State and tribal registered storage tank lists

UST: Active UST Facilities
Active UST facilities gathered from the local regulatory agencies

Date of Government Version: 11/04/2008
Date Data Arrived at EDR: 11/04/2008
Date Made Active in Reports: 12/05/2008
Number of Days to Update: 31

Source: SWRCB
Telephone: 916-480-1028
Last EDR Contact: 01/08/2009
Next Scheduled EDR Contact: 04/06/2009
Data Release Frequency: Semi-Annually

AST: Aboveground Petroleum Storage Tank Facilities
Registered Aboveground Storage Tanks.

Date of Government Version: 11/01/2007
Date Data Arrived at EDR: 11/27/2007
Date Made Active in Reports: 02/14/2008
Number of Days to Update: 79

Source: State Water Resources Control Board
Telephone: 916-341-5712
Last EDR Contact: 10/27/2008
Next Scheduled EDR Contact: 01/26/2009
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

INDIAN UST R1: Underground Storage Tanks on Indian Land
A listing of underground storage tank locations on Indian Land.

Date of Government Version: 03/12/2008
Date Data Arrived at EDR: 03/14/2008
Date Made Active in Reports: 03/20/2008
Number of Days to Update: 6

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land
No description is available for this data

Date of Government Version: 06/06/2008
Date Data Arrived at EDR: 10/09/2008
Date Made Active in Reports: 11/19/2008
Number of Days to Update: 41

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land
No description is available for this data

Date of Government Version: 09/08/2008
Date Data Arrived at EDR: 09/19/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 27

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land
No description is available for this data

Date of Government Version: 11/25/2008
Date Data Arrived at EDR: 11/26/2008
Date Made Active in Reports: 12/23/2008
Number of Days to Update: 27

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Semi-Annually

INDIAN UST R7: Underground Storage Tanks on Indian Land
No description is available for this data

Date of Government Version: 06/01/2007
Date Data Arrived at EDR: 06/14/2007
Date Made Active in Reports: 07/05/2007
Number of Days to Update: 21

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 11/19/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land
No description is available for this data

Date of Government Version: 12/01/2008
Date Data Arrived at EDR: 12/04/2008
Date Made Active in Reports: 12/23/2008
Number of Days to Update: 19

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Quarterly

INDIAN UST R10: Underground Storage Tanks on Indian Land
No description is available for this data

Date of Government Version: 11/18/2008
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 12/23/2008
Number of Days to Update: 34

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land
No description is available for this data

Date of Government Version: 09/05/2008
Date Data Arrived at EDR: 09/19/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 27

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Quarterly

State and tribal voluntary cleanup sites

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 10/20/2008
Next Scheduled EDR Contact: 01/19/2009
Data Release Frequency: Varies

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 04/02/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 10/20/2008
Next Scheduled EDR Contact: 01/19/2009
Data Release Frequency: Varies

VCP: Voluntary Cleanup Program Properties
Contains low threat level properties with either confirmed or unconfirmed releases and the project proponents have request that DTSC oversee investigation and/or cleanup activities and have agreed to provide coverage for DTSC's costs.

Date of Government Version: 08/25/2008
Date Data Arrived at EDR: 08/27/2008
Date Made Active in Reports: 09/03/2008
Number of Days to Update: 7

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/26/2008
Next Scheduled EDR Contact: 02/23/2009
Data Release Frequency: Quarterly

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Included in the listing are brownfields properties addresses by Cooperative Agreement Recipients and brownfields properties addressed by Targeted Brownfields Assessments. Targeted Brownfields Assessments-EPA's Targeted Brownfields Assessments (TBA) program is designed to help states, tribes, and municipalities--especially those without EPA Brownfields Assessment Demonstration Pilots--minimize the uncertainties of contamination often associated with brownfields. Under the TBA program, EPA provides funding and/or technical assistance for environmental assessments at brownfields sites throughout the country. Targeted Brownfields Assessments supplement and work with other efforts under EPA's Brownfields Initiative to promote cleanup and redevelopment of brownfields. Cooperative Agreement Recipients-States, political subdivisions, territories, and Indian tribes become Brownfields Cleanup Revolving Loan Fund (BCRLF) cooperative agreement recipients when they enter into BCRLF cooperative agreements with the U.S. EPA. EPA selects BCRLF cooperative agreement recipients based on a proposal and application process. BCRLF cooperative agreement recipients must use EPA funds provided through BCRLF cooperative agreement for specified brownfields-related cleanup activities.

Date of Government Version: 10/01/2008
Date Data Arrived at EDR: 11/14/2008
Date Made Active in Reports: 12/23/2008
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 10/16/2008
Next Scheduled EDR Contact: 01/12/2009
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 03/25/2008
Date Data Arrived at EDR: 04/17/2008
Date Made Active in Reports: 05/15/2008
Number of Days to Update: 28

Source: EPA, Region 9
Telephone: 415-972-3336
Last EDR Contact: 12/22/2008
Next Scheduled EDR Contact: 03/23/2009
Data Release Frequency: Varies

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

WMUDS/SWAT: Waste Management Unit Database

Waste Management Unit Database System. WMUDS is used by the State Water Resources Control Board staff and the Regional Water Quality Control Boards for program tracking and inventory of waste management units. WMUDS is composed of the following databases: Facility Information, Scheduled Inspections Information, Waste Management Unit Information, SWAT Program Information, SWAT Report Summary Information, SWAT Report Summary Data, Chapter 15 (formerly Subchapter 15) Information, Chapter 15 Monitoring Parameters, TPCA Program Information, RCRA Program Information, Closure Information, and Interested Parties Information.

Date of Government Version: 04/01/2000
Date Data Arrived at EDR: 04/10/2000
Date Made Active in Reports: 05/10/2000
Number of Days to Update: 30

Source: State Water Resources Control Board
Telephone: 916-227-4448
Last EDR Contact: 12/01/2008
Next Scheduled EDR Contact: 03/02/2009
Data Release Frequency: Quarterly

SWRCY: Recycler Database

A listing of recycling facilities in California.

Date of Government Version: 10/06/2008
Date Data Arrived at EDR: 10/08/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 49

Source: Department of Conservation
Telephone: 916-323-3836
Last EDR Contact: 01/08/2009
Next Scheduled EDR Contact: 04/06/2009
Data Release Frequency: Quarterly

HAULERS: Registered Waste Tire Haulers Listing
A listing of registered waste tire haulers.

Date of Government Version: 09/22/2008
Date Data Arrived at EDR: 09/22/2008
Date Made Active in Reports: 09/29/2008
Number of Days to Update: 7

Source: Integrated Waste Management Board
Telephone: 916-341-6422
Last EDR Contact: 12/22/2008
Next Scheduled EDR Contact: 03/09/2009
Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 11/24/2008
Next Scheduled EDR Contact: 02/23/2009
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

CDL: Clandestine Drug Labs
A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 07/01/2008
Date Data Arrived at EDR: 10/31/2008
Date Made Active in Reports: 12/23/2008
Number of Days to Update: 53

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 10/31/2008
Next Scheduled EDR Contact: 03/23/2009
Data Release Frequency: Quarterly

HIST CAL-SITES: Calsites Database
The Calsites database contains potential or confirmed hazardous substance release properties. In 1996, California EPA reevaluated and significantly reduced the number of sites in the Calsites database. No longer updated by the state agency. It has been replaced by ENVIROSTOR.

Date of Government Version: 08/08/2005
Date Data Arrived at EDR: 08/03/2006
Date Made Active in Reports: 08/24/2006
Number of Days to Update: 21

Source: Department of Toxic Substance Control
Telephone: 916-323-3400
Last EDR Contact: 11/24/2008
Next Scheduled EDR Contact: 02/23/2009
Data Release Frequency: No Update Planned

SCH: School Property Evaluation Program
This category contains proposed and existing school sites that are being evaluated by DTSC for possible hazardous materials contamination. In some cases, these properties may be listed in the CalSites category depending on the level of threat to public health and safety or the environment they pose.

Date of Government Version: 08/25/2008
Date Data Arrived at EDR: 08/27/2008
Date Made Active in Reports: 09/03/2008
Number of Days to Update: 7

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/26/2008
Next Scheduled EDR Contact: 02/23/2009
Data Release Frequency: Quarterly

TOXIC PITS: Toxic Pits Cleanup Act Sites
Toxic PITS Cleanup Act Sites. TOXIC PITS identifies sites suspected of containing hazardous substances where cleanup has not yet been completed.

Date of Government Version: 07/01/1995
Date Data Arrived at EDR: 08/30/1995
Date Made Active in Reports: 09/26/1995
Number of Days to Update: 27

Source: State Water Resources Control Board
Telephone: 916-227-4364
Last EDR Contact: 11/04/2008
Next Scheduled EDR Contact: 01/26/2009
Data Release Frequency: No Update Planned

CDL: Clandestine Drug Labs

A listing of drug lab locations. Listing of a location in this database does not indicate that any illegal drug lab materials were or were not present there, and does not constitute a determination that the location either requires or does not require additional cleanup work.

Date of Government Version: 09/30/2008
Date Data Arrived at EDR: 10/06/2008
Date Made Active in Reports: 10/13/2008
Number of Days to Update: 7

Source: Department of Toxic Substances Control
Telephone: 916-255-6504
Last EDR Contact: 09/29/2008
Next Scheduled EDR Contact: 01/19/2009
Data Release Frequency: Varies

Local Lists of Registered Storage Tanks

CA FID UST: Facility Inventory Database

The Facility Inventory Database (FID) contains a historical listing of active and inactive underground storage tank locations from the State Water Resource Control Board. Refer to local/county source for current data.

Date of Government Version: 10/31/1994
Date Data Arrived at EDR: 09/05/1995
Date Made Active in Reports: 09/29/1995
Number of Days to Update: 24

Source: California Environmental Protection Agency
Telephone: 916-341-5851
Last EDR Contact: 12/28/1998
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

UST MENDOCINO: Mendocino County UST Database

A listing of underground storage tank locations in Mendocino County.

Date of Government Version: 10/06/2008
Date Data Arrived at EDR: 10/06/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 10

Source: Department of Public Health
Telephone: 707-463-4466
Last EDR Contact: 12/22/2008
Next Scheduled EDR Contact: 03/23/2009
Data Release Frequency: Varies

HIST UST: Hazardous Substance Storage Container Database

The Hazardous Substance Storage Container Database is a historical listing of UST sites. Refer to local/county source for current data.

Date of Government Version: 10/15/1990
Date Data Arrived at EDR: 01/25/1991
Date Made Active in Reports: 02/12/1991
Number of Days to Update: 18

Source: State Water Resources Control Board
Telephone: 916-341-5851
Last EDR Contact: 07/26/2001
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

SWEEPS UST: SWEEPS UST Listing

Statewide Environmental Evaluation and Planning System. This underground storage tank listing was updated and maintained by a company contacted by the SWRCB in the early 1990's. The listing is no longer updated or maintained. The local agency is the contact for more information on a site on the SWEEPS list.

Date of Government Version: 06/01/1994
Date Data Arrived at EDR: 07/07/2005
Date Made Active in Reports: 08/11/2005
Number of Days to Update: 35

Source: State Water Resources Control Board
Telephone: N/A
Last EDR Contact: 06/03/2005
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 08/19/2008
Date Data Arrived at EDR: 08/29/2008
Date Made Active in Reports: 09/09/2008
Number of Days to Update: 11

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Varies

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 12/09/2005
Date Data Arrived at EDR: 12/11/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 31

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 12/08/2008
Next Scheduled EDR Contact: 03/09/2009
Data Release Frequency: Varies

LIENS: Environmental Liens Listing

A listing of property locations with environmental liens for California where DTSC is a lien holder.

Date of Government Version: 11/06/2008
Date Data Arrived at EDR: 11/07/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 19

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/03/2008
Next Scheduled EDR Contact: 02/02/2009
Data Release Frequency: Varies

DEED: Deed Restriction Listing

Site Mitigation and Brownfields Reuse Program Facility Sites with Deed Restrictions & Hazardous Waste Management Program Facility Sites with Deed / Land Use Restriction. The DTSC Site Mitigation and Brownfields Reuse Program (SMBRP) list includes sites cleaned up under the program's oversight and generally does not include current or former hazardous waste facilities that required a hazardous waste facility permit. The list represents deed restrictions that are active. Some sites have multiple deed restrictions. The DTSC Hazardous Waste Management Program (HWMP) has developed a list of current or former hazardous waste facilities that have a recorded land use restriction at the local county recorder's office. The land use restrictions on this list were required by the DTSC HWMP as a result of the presence of hazardous substances that remain on site after the facility (or part of the facility) has been closed or cleaned up. The types of land use restriction include deed notice, deed restriction, or a land use restriction that binds current and future owners.

Date of Government Version: 09/30/2008
Date Data Arrived at EDR: 09/30/2008
Date Made Active in Reports: 10/13/2008
Number of Days to Update: 13

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 12/30/2009
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 09/30/2008
Date Data Arrived at EDR: 10/16/2008
Date Made Active in Reports: 11/19/2008
Number of Days to Update: 34

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 01/13/2009
Next Scheduled EDR Contact: 04/13/2009
Data Release Frequency: Annually

CHMIRS: California Hazardous Material Incident Report System

California Hazardous Material Incident Reporting System. CHMIRS contains information on reported hazardous material incidents (accidental releases or spills).

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 05/09/2008
Date Made Active in Reports: 06/20/2008
Number of Days to Update: 42

Source: Office of Emergency Services
Telephone: 916-845-8400
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Varies

LDS: Land Disposal Sites Listing

The Land Disposal program regulates of waste discharge to land for treatment, storage and disposal in waste management units.

Date of Government Version: 11/04/2008
Date Data Arrived at EDR: 11/07/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 19

Source: State Water Qualilty Control Board
Telephone: 866-480-1028
Last EDR Contact: 01/08/2009
Next Scheduled EDR Contact: 04/06/2009
Data Release Frequency: Quarterly

MCS: Military Cleanup Sites Listing

The State Water Resources Control Board and nine Regional Water Quality Control Boards partner with the Department of Defense (DoD) through the Defense and State Memorandum of Agreement (DSMOA) to oversee the investigation and remediation of water quality issues at military facilities.

Date of Government Version: 11/04/2008
Date Data Arrived at EDR: 11/07/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 19

Source: State Water Resources Control Board
Telephone: 866-480-1028
Last EDR Contact: 01/08/2009
Next Scheduled EDR Contact: 04/06/2009
Data Release Frequency: Quarterly

Other Ascertainable Records

RCRA-NonGen: RCRA - Non Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 09/10/2008
Date Data Arrived at EDR: 09/23/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 23

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 11/18/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Varies

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 05/14/2008
Date Data Arrived at EDR: 05/28/2008
Date Made Active in Reports: 08/08/2008
Number of Days to Update: 72

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 11/26/2008
Next Scheduled EDR Contact: 02/23/2009
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 703-692-8801
Last EDR Contact: 11/07/2008
Next Scheduled EDR Contact: 02/02/2009
Data Release Frequency: Semi-Annually

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 09/05/2008
Date Made Active in Reports: 09/23/2008
Number of Days to Update: 18

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 09/15/2008
Date Data Arrived at EDR: 10/22/2008
Date Made Active in Reports: 12/23/2008
Number of Days to Update: 62

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 01/19/2009
Data Release Frequency: Varies

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 10/21/2008
Date Data Arrived at EDR: 10/29/2008
Date Made Active in Reports: 12/23/2008
Number of Days to Update: 55

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 07/13/2007
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/16/2009
Data Release Frequency: Varies

MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/07/2008
Date Data Arrived at EDR: 09/23/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 23

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 12/23/2008
Next Scheduled EDR Contact: 03/23/2009
Data Release Frequency: Semi-Annually

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 02/29/2008
Date Made Active in Reports: 04/18/2008
Number of Days to Update: 49

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 09/19/2008
Next Scheduled EDR Contact: 12/15/2008
Data Release Frequency: Annually

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2002
Date Data Arrived at EDR: 04/14/2006
Date Made Active in Reports: 05/30/2006
Number of Days to Update: 46

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 01/12/2009
Next Scheduled EDR Contact: 04/13/2009
Data Release Frequency: Every 4 Years

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 10/08/2008
Date Data Arrived at EDR: 10/17/2008
Date Made Active in Reports: 12/08/2008
Number of Days to Update: 52

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 12/15/2008
Next Scheduled EDR Contact: 03/16/2009
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 10/08/2008
Date Data Arrived at EDR: 10/17/2008
Date Made Active in Reports: 12/08/2008
Number of Days to Update: 52

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 12/15/2008
Next Scheduled EDR Contact: 03/16/2009
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 03/14/2008
Date Made Active in Reports: 04/18/2008
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 12/04/2008
Next Scheduled EDR Contact: 01/12/2009
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 07/31/2008
Date Data Arrived at EDR: 08/13/2008
Date Made Active in Reports: 09/09/2008
Number of Days to Update: 27

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 01/12/2009
Next Scheduled EDR Contact: 04/13/2009
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 12/04/2007
Date Data Arrived at EDR: 02/07/2008
Date Made Active in Reports: 03/17/2008
Number of Days to Update: 39

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 09/18/2008
Next Scheduled EDR Contact: 11/03/2008
Data Release Frequency: Annually

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 10/03/2008
Date Data Arrived at EDR: 10/15/2008
Date Made Active in Reports: 11/19/2008
Number of Days to Update: 35

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Quarterly

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 10/28/2008
Date Data Arrived at EDR: 10/29/2008
Date Made Active in Reports: 12/08/2008
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 10/29/2008
Next Scheduled EDR Contact: 01/26/2009
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 10/30/2008
Date Data Arrived at EDR: 10/31/2008
Date Made Active in Reports: 12/23/2008
Number of Days to Update: 53

Source: EPA
Telephone: (415) 947-8000
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Quarterly

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 03/06/2007
Date Made Active in Reports: 04/13/2007
Number of Days to Update: 38

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 12/09/2008
Next Scheduled EDR Contact: 03/09/2009
Data Release Frequency: Biennially

CA BOND EXP. PLAN: Bond Expenditure Plan

Department of Health Services developed a site-specific expenditure plan as the basis for an appropriation of Hazardous Substance Cleanup Bond Act funds. It is not updated.

Date of Government Version: 01/01/1989
Date Data Arrived at EDR: 07/27/1994
Date Made Active in Reports: 08/02/1994
Number of Days to Update: 6

Source: Department of Health Services
Telephone: 916-255-2118
Last EDR Contact: 05/31/1994
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

CA WDS: Waste Discharge System

Sites which have been issued waste discharge requirements.

Date of Government Version: 06/19/2007
Date Data Arrived at EDR: 06/20/2007
Date Made Active in Reports: 06/29/2007
Number of Days to Update: 9

Source: State Water Resources Control Board
Telephone: 916-341-5227
Last EDR Contact: 12/15/2008
Next Scheduled EDR Contact: 03/16/2009
Data Release Frequency: Quarterly

CORTESE: "Cortese" Hazardous Waste & Substances Sites List

The sites for the list are designated by the State Water Resource Control Board (LUST), the Integrated Waste Board (SWF/LS), and the Department of Toxic Substances Control (Cal-Sites). This listing is no longer updated by the state agency.

Date of Government Version: 04/01/2001
Date Data Arrived at EDR: 05/29/2001
Date Made Active in Reports: 07/26/2001
Number of Days to Update: 58

Source: CAL EPA/Office of Emergency Information
Telephone: 916-323-3400
Last EDR Contact: 10/20/2008
Next Scheduled EDR Contact: 01/19/2009
Data Release Frequency: No Update Planned

NOTIFY 65: Proposition 65 Records

Proposition 65 Notification Records. NOTIFY 65 contains facility notifications about any release which could impact drinking water and thereby expose the public to a potential health risk.

Date of Government Version: 10/21/1993
Date Data Arrived at EDR: 11/01/1993
Date Made Active in Reports: 11/19/1993
Number of Days to Update: 18

Source: State Water Resources Control Board
Telephone: 916-445-3846
Last EDR Contact: 01/12/2009
Next Scheduled EDR Contact: 04/13/2009
Data Release Frequency: No Update Planned

DRYCLEANERS: Cleaner Facilities

A list of drycleaner related facilities that have EPA ID numbers. These are facilities with certain SIC codes: power laundries, family and commercial; garment pressing and cleaner's agents; linen supply; coin-operated laundries and cleaning; drycleaning plants, except rugs; carpet and upholster cleaning; industrial launderers; laundry and garment services.

Date of Government Version: 09/23/2008
Date Data Arrived at EDR: 09/24/2008
Date Made Active in Reports: 09/29/2008
Number of Days to Update: 5

Source: Department of Toxic Substance Control
Telephone: 916-327-4498
Last EDR Contact: 01/12/2009
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Annually

WIP: Well Investigation Program Case List

Well Investigation Program case in the San Gabriel and San Fernando Valley area.

Date of Government Version: 10/31/2008
Date Data Arrived at EDR: 11/03/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 23

Source: Los Angeles Water Quality Control Board
Telephone: 213-576-6726
Last EDR Contact: 11/03/2008
Next Scheduled EDR Contact: 01/19/2009
Data Release Frequency: Varies

HAZNET: Facility and Manifest Data

Facility and Manifest Data. The data is extracted from the copies of hazardous waste manifests received each year by the DTSC. The annual volume of manifests is typically 700,000 - 1,000,000 annually, representing approximately 350,000 - 500,000 shipments. Data are from the manifests submitted without correction, and therefore many contain some invalid values for data elements such as generator ID, TSD ID, waste category, and disposal method.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 10/04/2007
Date Made Active in Reports: 11/07/2007
Number of Days to Update: 34

Source: California Environmental Protection Agency
Telephone: 916-255-1136
Last EDR Contact: 11/07/2008
Next Scheduled EDR Contact: 02/02/2008
Data Release Frequency: Annually

EMI: Emissions Inventory Data

Toxics and criteria pollutant emissions data collected by the ARB and local air pollution agencies.

Date of Government Version: 12/31/2006
Date Data Arrived at EDR: 10/16/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 41

Source: California Air Resources Board
Telephone: 916-322-2990
Last EDR Contact: 10/16/2008
Next Scheduled EDR Contact: 01/12/2009
Data Release Frequency: Varies

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 11/07/2008
Next Scheduled EDR Contact: 02/02/2009
Data Release Frequency: Semi-Annually

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing
The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 09/08/2008
Date Data Arrived at EDR: 09/10/2008
Date Made Active in Reports: 09/23/2008
Number of Days to Update: 13

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 12/08/2008
Next Scheduled EDR Contact: 02/09/2009
Data Release Frequency: Varies

PWS: Public Water System Data
This Safe Drinking Water Information System (SDWIS) file contains public water systems name and address, population served and the primary source of water

Date of Government Version: 02/24/2000
Date Data Arrived at EDR: 04/27/2005
Date Made Active in Reports: N/A
Number of Days to Update: 0

Source: EPA
Telephone: N/A
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: N/A

FEDLAND: Federal and Indian Lands
Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 11/07/2008
Next Scheduled EDR Contact: 02/02/2009
Data Release Frequency: N/A

PRP: Potentially Responsible Parties
A listing of verified Potentially Responsible Parties

Date of Government Version: 07/09/2008
Date Data Arrived at EDR: 09/30/2008
Date Made Active in Reports: 10/07/2008
Number of Days to Update: 7

Source: EPA
Telephone: 202-564-6064
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Quarterly

EDR PROPRIETARY RECORDS

EDR Proprietary Records

Manufactured Gas Plants: EDR Proprietary Manufactured Gas Plants
The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

COUNTY RECORDS

ALAMEDA COUNTY:

Contaminated Sites

A listing of contaminated sites overseen by the Toxic Release Program (oil and groundwater contamination from chemical releases and spills) and the Leaking Underground Storage Tank Program (soil and ground water contamination from leaking petroleum USTs).

Date of Government Version: 10/28/2008
Date Data Arrived at EDR: 10/30/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 27

Source: Alameda County Environmental Health Services
Telephone: 510-567-6700
Last EDR Contact: 10/20/2008
Next Scheduled EDR Contact: 01/19/2009
Data Release Frequency: Semi-Annually

Underground Tanks

Underground storage tank sites located in Alameda county.

Date of Government Version: 10/28/2008
Date Data Arrived at EDR: 10/30/2008
Date Made Active in Reports: 12/05/2008
Number of Days to Update: 36

Source: Alameda County Environmental Health Services
Telephone: 510-567-6700
Last EDR Contact: 10/20/2008
Next Scheduled EDR Contact: 01/19/2009
Data Release Frequency: Semi-Annually

CONTRA COSTA COUNTY:

Site List

List includes sites from the underground tank, hazardous waste generator and business plan/2185 programs.

Date of Government Version: 09/03/2008
Date Data Arrived at EDR: 09/04/2008
Date Made Active in Reports: 09/18/2008
Number of Days to Update: 14

Source: Contra Costa Health Services Department
Telephone: 925-646-2286
Last EDR Contact: 11/24/2008
Next Scheduled EDR Contact: 02/23/2009
Data Release Frequency: Semi-Annually

FRESNO COUNTY:

CUPA Resources List

Certified Unified Program Agency. CUPA's are responsible for implementing a unified hazardous materials and hazardous waste management regulatory program. The agency provides oversight of businesses that deal with hazardous materials, operate underground storage tanks or aboveground storage tanks.

Date of Government Version: 09/30/2008
Date Data Arrived at EDR: 10/20/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 37

Source: Dept. of Community Health
Telephone: 559-445-3271
Last EDR Contact: 11/03/2008
Next Scheduled EDR Contact: 02/02/2009
Data Release Frequency: Semi-Annually

KERN COUNTY:

Underground Storage Tank Sites & Tank Listing
Kern County Sites and Tanks Listing.

Date of Government Version: 09/15/2008
Date Data Arrived at EDR: 09/16/2008
Date Made Active in Reports: 10/01/2008
Number of Days to Update: 15

Source: Kern County Environment Health Services Department
Telephone: 661-862-8700
Last EDR Contact: 12/15/2008
Next Scheduled EDR Contact: 03/02/2009
Data Release Frequency: Quarterly

LOS ANGELES COUNTY:

San Gabriel Valley Areas of Concern
San Gabriel Valley areas where VOC contamination is at or above the MCL as designated by region 9 EPA office.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 07/07/1999
Date Made Active in Reports: N/A
Number of Days to Update: 0

Source: EPA Region 9
Telephone: 415-972-3178
Last EDR Contact: 01/12/2009
Next Scheduled EDR Contact: 04/13/2009
Data Release Frequency: No Update Planned

HMS: Street Number List
Industrial Waste and Underground Storage Tank Sites.

Date of Government Version: 07/31/2008
Date Data Arrived at EDR: 10/17/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 40

Source: Department of Public Works
Telephone: 626-458-3517
Last EDR Contact: 11/10/2008
Next Scheduled EDR Contact: 02/02/2009
Data Release Frequency: Semi-Annually

List of Solid Waste Facilities
Solid Waste Facilities in Los Angeles County.

Date of Government Version: 08/12/2008
Date Data Arrived at EDR: 08/22/2008
Date Made Active in Reports: 09/03/2008
Number of Days to Update: 12

Source: La County Department of Public Works
Telephone: 818-458-5185
Last EDR Contact: 11/13/2008
Next Scheduled EDR Contact: 02/09/2009
Data Release Frequency: Varies

City of Los Angeles Landfills
Landfills owned and maintained by the City of Los Angeles.

Date of Government Version: 03/01/2008
Date Data Arrived at EDR: 03/20/2008
Date Made Active in Reports: 04/14/2008
Number of Days to Update: 25

Source: Engineering & Construction Division
Telephone: 213-473-7869
Last EDR Contact: 12/08/2008
Next Scheduled EDR Contact: 03/09/2009
Data Release Frequency: Varies

Site Mitigation List
Industrial sites that have had some sort of spill or complaint.

Date of Government Version: 02/14/2008
Date Data Arrived at EDR: 04/10/2008
Date Made Active in Reports: 05/06/2008
Number of Days to Update: 26

Source: Community Health Services
Telephone: 323-890-7806
Last EDR Contact: 11/10/2008
Next Scheduled EDR Contact: 02/02/2009
Data Release Frequency: Annually

City of El Segundo Underground Storage Tank
Underground storage tank sites located in El Segundo city.

Date of Government Version: 09/19/2008
Date Data Arrived at EDR: 10/06/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 10

Source: City of El Segundo Fire Department
Telephone: 310-524-2236
Last EDR Contact: 11/10/2008
Next Scheduled EDR Contact: 02/02/2009
Data Release Frequency: Semi-Annually

City of Long Beach Underground Storage Tank
Underground storage tank sites located in the city of Long Beach.

Date of Government Version: 03/28/2003
Date Data Arrived at EDR: 10/23/2003
Date Made Active in Reports: 11/26/2003
Number of Days to Update: 34

Source: City of Long Beach Fire Department
Telephone: 562-570-2563
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Annually

City of Torrance Underground Storage Tank
Underground storage tank sites located in the city of Torrance.

Date of Government Version: 08/26/2008
Date Data Arrived at EDR: 09/11/2008
Date Made Active in Reports: 10/01/2008
Number of Days to Update: 20

Source: City of Torrance Fire Department
Telephone: 310-618-2973
Last EDR Contact: 12/11/2008
Next Scheduled EDR Contact: 02/02/2009
Data Release Frequency: Semi-Annually

MARIN COUNTY:

Underground Storage Tank Sites
Currently permitted USTs in Marin County.

Date of Government Version: 08/04/2008
Date Data Arrived at EDR: 08/29/2008
Date Made Active in Reports: 09/15/2008
Number of Days to Update: 17

Source: Public Works Department Waste Management
Telephone: 415-499-6647
Last EDR Contact: 10/27/2008
Next Scheduled EDR Contact: 01/26/2009
Data Release Frequency: Semi-Annually

NAPA COUNTY:

Sites With Reported Contamination
A listing of leaking underground storage tank sites located in Napa county.

Date of Government Version: 07/09/2008
Date Data Arrived at EDR: 07/09/2008
Date Made Active in Reports: 07/31/2008
Number of Days to Update: 22

Source: Napa County Department of Environmental Management
Telephone: 707-253-4269
Last EDR Contact: 12/22/2008
Next Scheduled EDR Contact: 03/23/2009
Data Release Frequency: Semi-Annually

Closed and Operating Underground Storage Tank Sites
Underground storage tank sites located in Napa county.

Date of Government Version: 01/15/2008
Date Data Arrived at EDR: 01/16/2008
Date Made Active in Reports: 02/08/2008
Number of Days to Update: 23

Source: Napa County Department of Environmental Management
Telephone: 707-253-4269
Last EDR Contact: 12/22/2008
Next Scheduled EDR Contact: 03/23/2009
Data Release Frequency: Annually

ORANGE COUNTY:

List of Industrial Site Cleanups
Petroleum and non-petroleum spills.

Date of Government Version: 09/02/2008
Date Data Arrived at EDR: 09/16/2008
Date Made Active in Reports: 09/29/2008
Number of Days to Update: 13

Source: Health Care Agency
Telephone: 714-834-3446
Last EDR Contact: 12/02/2008
Next Scheduled EDR Contact: 03/02/2009
Data Release Frequency: Annually

List of Underground Storage Tank Cleanups
Orange County Underground Storage Tank Cleanups (LUST).

Date of Government Version: 09/02/2008
Date Data Arrived at EDR: 09/17/2008
Date Made Active in Reports: 09/29/2008
Number of Days to Update: 12

Source: Health Care Agency
Telephone: 714-834-3446
Last EDR Contact: 12/02/2008
Next Scheduled EDR Contact: 03/02/2009
Data Release Frequency: Quarterly

List of Underground Storage Tank Facilities
Orange County Underground Storage Tank Facilities (UST).

Date of Government Version: 09/02/2008
Date Data Arrived at EDR: 09/25/2008
Date Made Active in Reports: 10/01/2008
Number of Days to Update: 6

Source: Health Care Agency
Telephone: 714-834-3446
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: 03/02/2009
Data Release Frequency: Quarterly

PLACER COUNTY:

Master List of Facilities
List includes aboveground tanks, underground tanks and cleanup sites.

Date of Government Version: 07/23/2007
Date Data Arrived at EDR: 07/23/2007
Date Made Active in Reports: 08/09/2007
Number of Days to Update: 17

Source: Placer County Health and Human Services
Telephone: 530-889-7312
Last EDR Contact: 01/12/2009
Next Scheduled EDR Contact: 03/16/2009
Data Release Frequency: Semi-Annually

RIVERSIDE COUNTY:

Listing of Underground Tank Cleanup Sites
Riverside County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 11/06/2008
Date Data Arrived at EDR: 11/17/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 9

Source: Department of Public Health
Telephone: 951-358-5055
Last EDR Contact: 01/12/2009
Next Scheduled EDR Contact: 04/13/2009
Data Release Frequency: Quarterly

Underground Storage Tank Tank List
Underground storage tank sites located in Riverside county.

Date of Government Version: 11/12/2008
Date Data Arrived at EDR: 11/25/2008
Date Made Active in Reports: 12/05/2008
Number of Days to Update: 10

Source: Health Services Agency
Telephone: 951-358-5055
Last EDR Contact: 01/12/2009
Next Scheduled EDR Contact: 04/13/2009
Data Release Frequency: Quarterly

SACRAMENTO COUNTY:

Contaminated Sites

List of sites where unauthorized releases of potentially hazardous materials have occurred.

Date of Government Version: 08/08/2008
Date Data Arrived at EDR: 08/08/2008
Date Made Active in Reports: 09/03/2008
Number of Days to Update: 26

Source: Sacramento County Environmental Management
Telephone: 916-875-8406
Last EDR Contact: 10/29/2008
Next Scheduled EDR Contact: 01/26/2009
Data Release Frequency: Quarterly

ML - Regulatory Compliance Master List

Any business that has hazardous materials on site - hazardous material storage sites, underground storage tanks, waste generators.

Date of Government Version: 09/08/2008
Date Data Arrived at EDR: 10/29/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 28

Source: Sacramento County Environmental Management
Telephone: 916-875-8406
Last EDR Contact: 10/29/2008
Next Scheduled EDR Contact: 01/26/2009
Data Release Frequency: Quarterly

SAN BERNARDINO COUNTY:

Hazardous Material Permits

This listing includes underground storage tanks, medical waste handlers/generators, hazardous materials handlers, hazardous waste generators, and waste oil generators/handlers.

Date of Government Version: 10/01/2008
Date Data Arrived at EDR: 10/06/2008
Date Made Active in Reports: 10/13/2008
Number of Days to Update: 7

Source: San Bernardino County Fire Department Hazardous Materials Division
Telephone: 909-387-3041
Last EDR Contact: 12/01/2008
Next Scheduled EDR Contact: 03/02/2009
Data Release Frequency: Quarterly

SAN DIEGO COUNTY:

Hazardous Materials Management Division Database

The database includes: HE58 - This report contains the business name, site address, business phone number, establishment 'H' permit number, type of permit, and the business status. HE17 - In addition to providing the same information provided in the HE58 listing, HE17 provides inspection dates, violations received by the establishment, hazardous waste generated, the quantity, method of storage, treatment/disposal of waste and the hauler, and information on underground storage tanks. Unauthorized Release List - Includes a summary of environmental contamination cases in San Diego County (underground tank cases, non-tank cases, groundwater contamination, and soil contamination are included.)

Date of Government Version: 07/16/2008
Date Data Arrived at EDR: 10/29/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 28

Source: Hazardous Materials Management Division
Telephone: 619-338-2268
Last EDR Contact: 12/31/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Quarterly

Solid Waste Facilities

San Diego County Solid Waste Facilities.

Date of Government Version: 08/01/2007
Date Data Arrived at EDR: 02/05/2008
Date Made Active in Reports: 02/14/2008
Number of Days to Update: 9

Source: Department of Health Services
Telephone: 619-338-2209
Last EDR Contact: 12/02/2008
Next Scheduled EDR Contact: 11/17/2008
Data Release Frequency: Varies

Environmental Case Listing

The listing contains all underground tank release cases and projects pertaining to properties contaminated with hazardous substances that are actively under review by the Site Assessment and Mitigation Program.

Date of Government Version: 08/07/2008
Date Data Arrived at EDR: 10/31/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 26

Source: San Diego County Department of Environmental Health
Telephone: 619-338-2371
Last EDR Contact: 12/30/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Varies

SAN FRANCISCO COUNTY:

Local Oversite Facilities

A listing of leaking underground storage tank sites located in San Francisco county.

Date of Government Version: 09/19/2008
Date Data Arrived at EDR: 09/19/2008
Date Made Active in Reports: 09/29/2008
Number of Days to Update: 10

Source: Department Of Public Health San Francisco County
Telephone: 415-252-3920
Last EDR Contact: 12/01/2008
Next Scheduled EDR Contact: 03/02/2009
Data Release Frequency: Quarterly

Underground Storage Tank Information

Underground storage tank sites located in San Francisco county.

Date of Government Version: 09/19/2008
Date Data Arrived at EDR: 09/19/2008
Date Made Active in Reports: 10/01/2008
Number of Days to Update: 12

Source: Department of Public Health
Telephone: 415-252-3920
Last EDR Contact: 12/01/2008
Next Scheduled EDR Contact: 03/02/2009
Data Release Frequency: Quarterly

SAN JOAQUIN COUNTY:

San Joaquin Co. UST

A listing of underground storage tank locations in San Joaquin county.

Date of Government Version: 08/26/2008
Date Data Arrived at EDR: 08/27/2008
Date Made Active in Reports: 09/15/2008
Number of Days to Update: 19

Source: Environmental Health Department
Telephone: N/A
Last EDR Contact: 01/12/2009
Next Scheduled EDR Contact: 04/13/2009
Data Release Frequency: Semi-Annually

SAN MATEO COUNTY:

Business Inventory

List includes Hazardous Materials Business Plan, hazardous waste generators, and underground storage tanks.

Date of Government Version: 11/19/2008
Date Data Arrived at EDR: 11/19/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 7

Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921
Last EDR Contact: 01/05/2009
Next Scheduled EDR Contact: 04/06/2009
Data Release Frequency: Annually

Fuel Leak List

A listing of leaking underground storage tank sites located in San Mateo county.

Date of Government Version: 10/06/2008
Date Data Arrived at EDR: 10/07/2008
Date Made Active in Reports: 10/13/2008
Number of Days to Update: 6

Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921
Last EDR Contact: 01/05/2009
Next Scheduled EDR Contact: 04/06/2009
Data Release Frequency: Semi-Annually

SANTA CLARA COUNTY:

HIST LUST - Fuel Leak Site Activity Report

A listing of open and closed leaking underground storage tanks. This listing is no longer updated by the county. Leaking underground storage tanks are now handled by the Department of Environmental Health.

Date of Government Version: 03/29/2005
Date Data Arrived at EDR: 03/30/2005
Date Made Active in Reports: 04/21/2005
Number of Days to Update: 22

Source: Santa Clara Valley Water District
Telephone: 408-265-2600
Last EDR Contact: 12/22/2008
Next Scheduled EDR Contact: 03/23/2009
Data Release Frequency: No Update Planned

LOP Listing

A listing of leaking underground storage tanks located in Santa Clara county.

Date of Government Version: 09/24/2008
Date Data Arrived at EDR: 09/25/2008
Date Made Active in Reports: 09/29/2008
Number of Days to Update: 4

Source: Department of Environmental Health
Telephone: 408-918-3417
Last EDR Contact: 12/22/2008
Next Scheduled EDR Contact: 03/23/2009
Data Release Frequency: Varies

Hazardous Material Facilities

Hazardous material facilities, including underground storage tank sites.

Date of Government Version: 09/02/2008
Date Data Arrived at EDR: 09/04/2008
Date Made Active in Reports: 09/18/2008
Number of Days to Update: 14

Source: City of San Jose Fire Department
Telephone: 408-277-4659
Last EDR Contact: 12/01/2008
Next Scheduled EDR Contact: 03/02/2009
Data Release Frequency: Annually

SOLANO COUNTY:

Leaking Underground Storage Tanks

A listing of leaking underground storage tank sites located in Solano county.

Date of Government Version: 09/22/2008
Date Data Arrived at EDR: 10/06/2008
Date Made Active in Reports: 10/13/2008
Number of Days to Update: 7

Source: Solano County Department of Environmental Management
Telephone: 707-784-6770
Last EDR Contact: 01/05/2009
Next Scheduled EDR Contact: 03/23/2009
Data Release Frequency: Quarterly

Underground Storage Tanks

Underground storage tank sites located in Solano county.

Date of Government Version: 09/22/2008
Date Data Arrived at EDR: 10/17/2008
Date Made Active in Reports: 12/05/2008
Number of Days to Update: 49

Source: Solano County Department of Environmental Management
Telephone: 707-784-6770
Last EDR Contact: 12/22/2008
Next Scheduled EDR Contact: 03/23/2009
Data Release Frequency: Quarterly

SONOMA COUNTY:

Leaking Underground Storage Tank Sites

A listing of leaking underground storage tank sites located in Sonoma county.

Date of Government Version: 10/20/2008
Date Data Arrived at EDR: 10/20/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 37

Source: Department of Health Services
Telephone: 707-565-6565
Last EDR Contact: 10/20/2008
Next Scheduled EDR Contact: 01/19/2009
Data Release Frequency: Quarterly

SUTTER COUNTY:

Underground Storage Tanks
Underground storage tank sites located in Sutter county.

Date of Government Version: 05/04/2007
Date Data Arrived at EDR: 05/04/2007
Date Made Active in Reports: 05/24/2007
Number of Days to Update: 20

Source: Sutter County Department of Agriculture
Telephone: 530-822-7500
Last EDR Contact: 12/29/2008
Next Scheduled EDR Contact: 03/30/2009
Data Release Frequency: Semi-Annually

VENTURA COUNTY:

Business Plan, Hazardous Waste Producers, and Operating Underground Tanks
The BWT list indicates by site address whether the Environmental Health Division has Business Plan (B), Waste Producer (W), and/or Underground Tank (T) information.

Date of Government Version: 08/27/2008
Date Data Arrived at EDR: 10/14/2008
Date Made Active in Reports: 11/26/2008
Number of Days to Update: 43

Source: Ventura County Environmental Health Division
Telephone: 805-654-2813
Last EDR Contact: 12/10/2008
Next Scheduled EDR Contact: 03/09/2009
Data Release Frequency: Quarterly

Inventory of Illegal Abandoned and Inactive Sites
Ventura County Inventory of Closed, Illegal Abandoned, and Inactive Sites.

Date of Government Version: 08/01/2008
Date Data Arrived at EDR: 09/04/2008
Date Made Active in Reports: 09/18/2008
Number of Days to Update: 14

Source: Environmental Health Division
Telephone: 805-654-2813
Last EDR Contact: 11/17/2008
Next Scheduled EDR Contact: 02/16/2009
Data Release Frequency: Annually

Listing of Underground Tank Cleanup Sites
Ventura County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 05/29/2008
Date Data Arrived at EDR: 06/24/2008
Date Made Active in Reports: 07/31/2008
Number of Days to Update: 37

Source: Environmental Health Division
Telephone: 805-654-2813
Last EDR Contact: 12/09/2008
Next Scheduled EDR Contact: 03/09/2009
Data Release Frequency: Quarterly

Underground Tank Closed Sites List
Ventura County Operating Underground Storage Tank Sites (UST)/Underground Tank Closed Sites List.

Date of Government Version: 10/01/2008
Date Data Arrived at EDR: 10/08/2008
Date Made Active in Reports: 10/16/2008
Number of Days to Update: 8

Source: Environmental Health Division
Telephone: 805-654-2813
Last EDR Contact: 01/08/2009
Next Scheduled EDR Contact: 04/06/2009
Data Release Frequency: Quarterly

YOLO COUNTY:

Underground Storage Tank Comprehensive Facility Report
Underground storage tank sites located in Yolo county.

Date of Government Version: 08/11/2008
Date Data Arrived at EDR: 08/29/2008
Date Made Active in Reports: 09/15/2008
Number of Days to Update: 17

Source: Yolo County Department of Health
Telephone: 530-666-8646
Last EDR Contact: 01/12/2009
Next Scheduled EDR Contact: 04/13/2009
Data Release Frequency: Annually

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data
Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 06/15/2007
Date Made Active in Reports: 08/20/2007
Number of Days to Update: 66

Source: Department of Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 12/11/2008
Next Scheduled EDR Contact: 03/09/2009
Data Release Frequency: Annually

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 09/30/2007
Date Data Arrived at EDR: 12/04/2007
Date Made Active in Reports: 12/31/2007
Number of Days to Update: 27

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 11/07/2008
Next Scheduled EDR Contact: 02/02/2009
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 10/21/2008
Date Data Arrived at EDR: 11/26/2008
Date Made Active in Reports: 12/11/2008
Number of Days to Update: 15

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 11/26/2008
Next Scheduled EDR Contact: 02/23/2009
Data Release Frequency: Annually

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 09/11/2008
Date Made Active in Reports: 10/02/2008
Number of Days to Update: 21

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 12/08/2008
Next Scheduled EDR Contact: 03/09/2009
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 10/07/2008
Date Data Arrived at EDR: 10/10/2008
Date Made Active in Reports: 10/28/2008
Number of Days to Update: 18

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 12/15/2008
Next Scheduled EDR Contact: 03/16/2009
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2007
Date Data Arrived at EDR: 08/22/2008
Date Made Active in Reports: 09/08/2008
Number of Days to Update: 17

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 01/05/2009
Next Scheduled EDR Contact: 04/06/2009
Data Release Frequency: Annually

Oil/Gas Pipelines: This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines.

Electric Power Transmission Line Data
Source: PennWell Corporation
Telephone: (800) 823-6277
This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Licensed Facilities
Source: Department of Social Services
Telephone: 916-657-4041

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

STREET AND ADDRESS INFORMATION

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GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

MARSH LANDING
WILBUR AVENUE
ANTIOCH, CA 94509

TARGET PROPERTY COORDINATES

Latitude (North):	38.01230 - 38˚ 0' 44.3''
Longitude (West):	121.7584 - 121˚ 45' 30.2''
Universal Tranverse Mercator:	Zone 10
UTM X (Meters):	608995.8
UTM Y (Meters):	4207701.5
Elevation:	13 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	38121-A7 ANTIOCH NORTH, CA
Most Recent Revision:	1978
East Map:	38121-A6 JERSEY ISLAND, CA
Most Recent Revision:	1978
Southeast Map:	37121-H6 BRENTWOOD, CA
Most Recent Revision:	1978
South Map:	37121-H7 ANTIOCH SOUTH, CA
Most Recent Revision:	1980

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

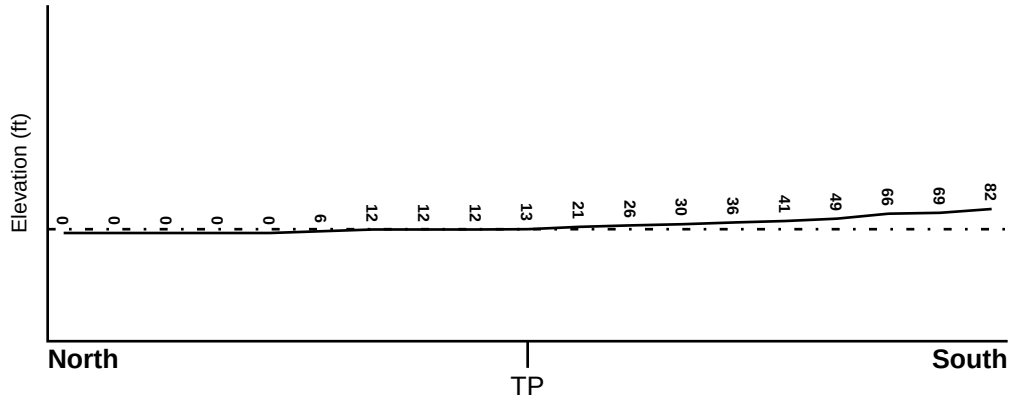
TOPOGRAPHIC INFORMATION

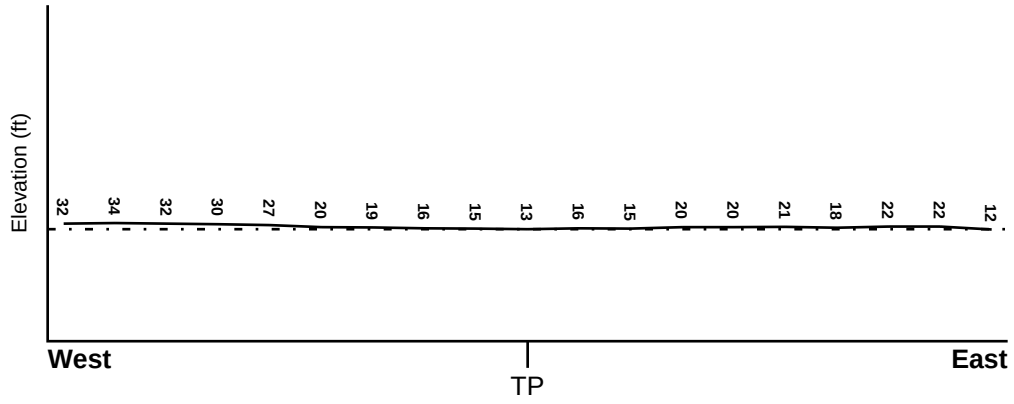
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

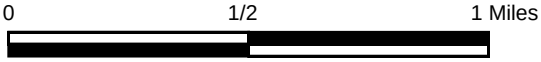
General Topographic Gradient: General NNW

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 13 ft.



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
CONTRA COSTA, CA	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: 0600250145B

Additional Panels in search area:
0602620690C
0602620670C
0600250175B
0600260002D
0600260003C
0600250355B
0600250335B

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
ANTIOCH NORTH	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius: 1.25 miles
Status: Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

* ©1996 Site−specific hydrogeological data gathered by CERCLIS Alerts, Inc., Bainbridge Island, WA. All rights reserved. All of the information and opinions presented are those of the cited EPA report(s), which were completed under a Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) investigation.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

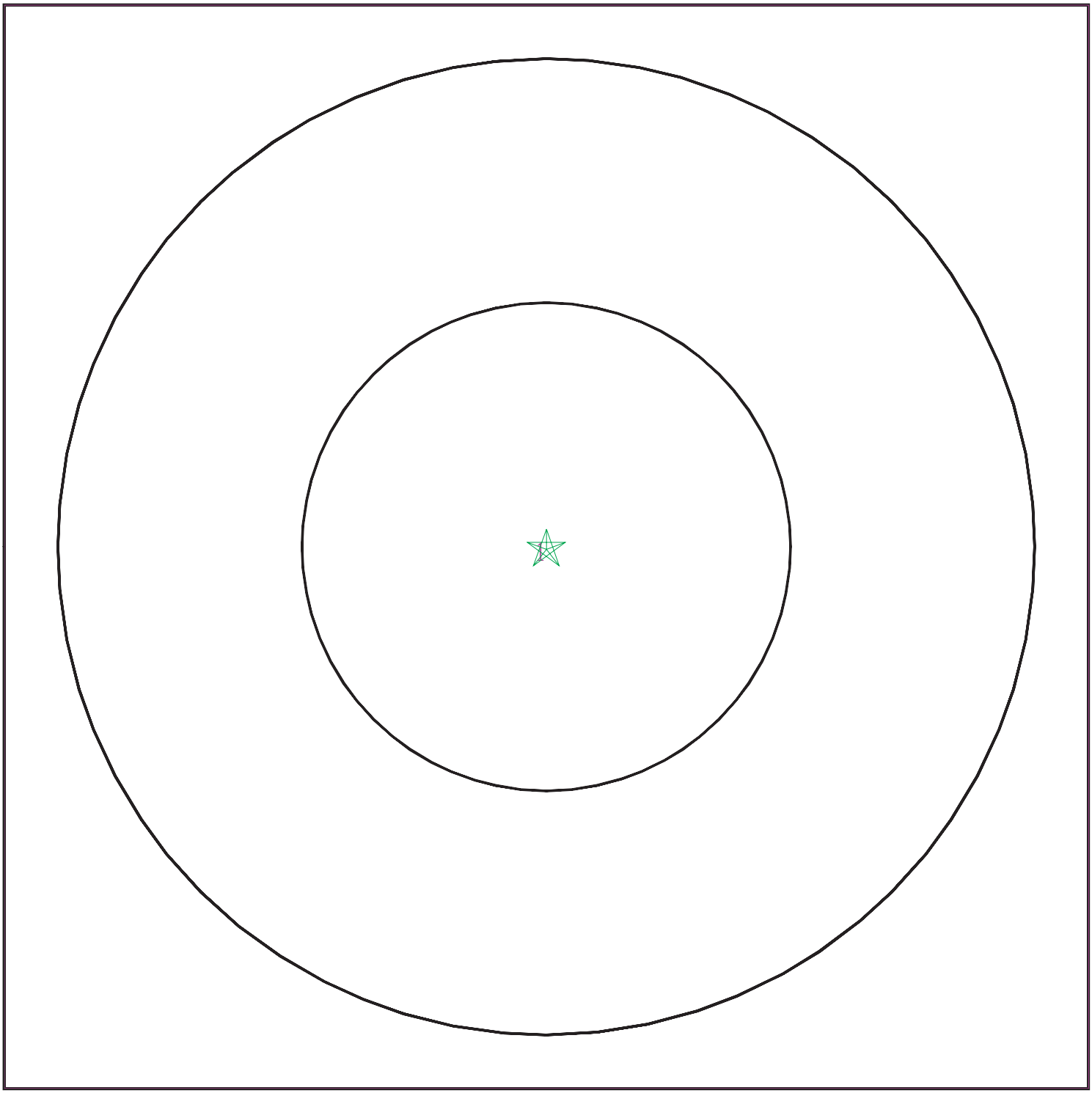
Era:	Cenozoic
System:	Quaternary
Series:	Quaternary
Code:	Q *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratifed Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 2398575.2s



Target Property
SSURGO Soil
Water

0 1/16 1/8 1/4 Miles

N

SITE NAME:	Marsh Landing	CLIENT:	URS Corporation
ADDRESS:	Wilbur Avenue Antioch CA 94509	CONTACT:	Kirk Martin
		INQUIRY #:	2398575.2s
LAT/LONG:	38.0123 / 121.7584	DATE:	January 14, 2009 12:52 pm

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GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: DELHI

Soil Surface Texture: sand

Hydrologic Group: Class A - High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	5 inches	sand	Granular materials (35 pct. or less passing No. 200), Fine Sand.	COARSE-GRAINED SOILS, Sands, Clean Sands, Well-graded sand. COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 141 Min: 42	Max: 7.8 Min: 6.6
2	5 inches	59 inches	sand	Granular materials (35 pct. or less passing No. 200), Fine Sand.	COARSE-GRAINED SOILS, Sands, Clean Sands, Well-graded sand. COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 141 Min: 42	Max: 7.8 Min: 6.6

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
3	USGS3227864	1/2 - 1 Mile SSW
A5	USGS3227921	1/2 - 1 Mile West
A6	USGS3227920	1/2 - 1 Mile West
7	USGS3227913	1/2 - 1 Mile West
8	USGS3227868	1/2 - 1 Mile SW
10	USGS3227874	1/2 - 1 Mile ESE
11	USGS3227860	1/2 - 1 Mile SW
12	USGS3227867	1/2 - 1 Mile ESE

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

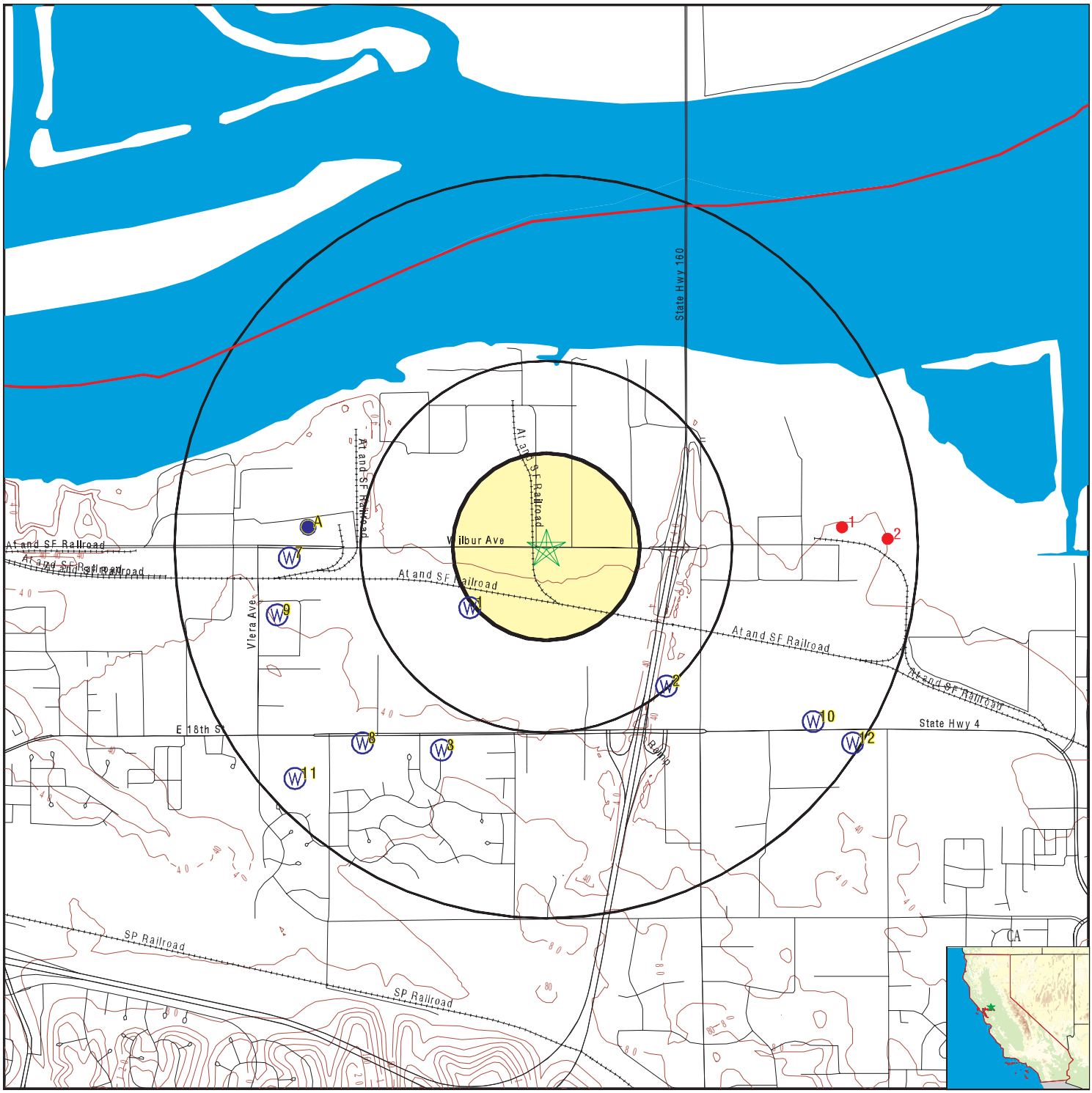
MAP ID	WELL ID	LOCATION FROM TP
1	1682	1/4 - 1/2 Mile SW
2	1683	1/4 - 1/2 Mile SE
A4	1679	1/2 - 1 Mile West
9	1680	1/2 - 1 Mile WSW

OTHER STATE DATABASE INFORMATION

STATE OIL/GAS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	CAOG50000186055	1/2 - 1 Mile East
2	CAOG50000186054	1/2 - 1 Mile East

PHYSICAL SETTING SOURCE MAP - 2398575.2s



0 1/4 1/2 1 Miles

- County Boundary
- Major Roads
- Contour Lines
- Earthquake Fault Lines
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons
- Groundwater Flow Direction
- GI Indeterminate Groundwater Flow at Location
- GV Groundwater Flow Varies at Location
- HD Closest Hydrogeological Data
- Oil, gas or related wells

N

SITE NAME:	Marsh Landing	CLIENT:	URS Corporation
ADDRESS:	Wilbur Avenue Antioch CA 94509	CONTACT:	Kirk Martin
		INQUIRY #:	2398575.2s
LAT/LONG:	38.0123 / 121.7584	DATE:	January 14, 2009 12:52 pm

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Map ID Direction Distance Elevation	Database	EDR ID Number
1 **SW** **1/4 - 1/2 Mile** **Higher**	**CA WELLS**	**1682**

Water System Information:

Prime Station Code:	02N/02E-21C01 M	User ID:	07C
FRDS Number:	0707554001	County:	Contra Costa
District Number:	37	Station Type:	WELL/AMBNT/MUN/INTAKE
Water Type:	Well/Groundwater	Well Status:	Active Raw
Source Lat/Long:	380036.0 1214540.0	Precision:	1,000 Feet (10 Seconds)
Source Name:	WELL 01		
System Number:	0707554		
System Name:	RIVERVIEW MOTEL		
Organization That Operates System:			
	Not Reported		
Pop Served:	Unknown, Small System	Connections:	Unknown, Small System
Area Served:	Not Reported		
Sample Collected:	06/08/2004 00:00:00	Findings:	9.5 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	03/11/2004 00:00:00	Findings:	8.6 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	12/11/2003 00:00:00	Findings:	11 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	09/15/2003 00:00:00	Findings:	11 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	06/19/2003 00:00:00	Findings:	9.8 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	03/18/2003 00:00:00	Findings:	9.2 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	12/12/2002 00:00:00	Findings:	9 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	09/12/2002 00:00:00	Findings:	9 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	06/13/2002 00:00:00	Findings:	9.4 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	03/13/2002 00:00:00	Findings:	8.7 MG/L
Chemical:	NITRATE (AS NO3)		

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2 **SE** **1/4 - 1/2 Mile** **Higher**	**CA WELLS**	**1683**

Water System Information:

Prime Station Code:	02N/02E-21H01 M	User ID:	07C
FRDS Number:	0707548001	County:	Contra Costa
District Number:	37	Station Type:	WELL/AMBNT/MUN/INTAKE
Water Type:	Well/Groundwater	Well Status:	Active Raw
Source Lat/Long:	380025.0 1214505.0	Precision:	1,000 Feet (10 Seconds)
Source Name:	WELL 01		

System Number: 0707548
System Name: LODGE WATER SYSTEM
Organization That Operates System:
Not Reported
Pop Served: Unknown, Small System Connections: Unknown, Small System
Area Served: Not Reported

3
SSW **FED USGS** **USGS3227864**
1/2 - 1 Mile
Higher

Agency cd:	USGS	Site no:	380016121454501
Site name:	002N002E21L001M		
Latitude:	380016		
Longitude:	1214545	Dec lat:	38.00436596
Dec lon:	-121.76356558	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	06
State:	06	County:	013
Country:	US	Land net:	NENWSES21 T02N R02E M
Location map:	ANTIOCH NORTH	Map scale:	24000
Altitude:	50.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	10		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Upper ChowchillaUpper Fresno. California. Area = 938 sq.mi.		
Topographic:	Hillside (slope)		
Site type:	Ground-water other than Spring	Date construction:	19620101
Date inventoried:	Not Reported	Mean greenwich time offset:	PST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	ALLUVIUM (QUATERNARY)		
Well depth:	140	Hole depth:	140
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	1972-09-20
Water quality data end date:	1982-09-24	Water quality data count:	26
Ground water data begin date:	1962-01-01	Ground water data end date:	1980-04-10
Ground water data count:	2		

Ground-water levels, Number of Measurements: 4

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1980-04-10	22.8		1980-04-10	22.8	
1962-01-01	50.00		1962-01-01	50.00	

A4
West **CA WELLS** **1679**
1/2 - 1 Mile
Higher

Water System Information:

Prime Station Code:	02N/02E-20A01 M	User ID:	07C
FRDS Number:	0707522001	County:	Contra Costa
District Number:	37	Station Type:	WELL/AMBNT/MUN/INTAKE
Water Type:	Well/Groundwater	Well Status:	Active Raw
Source Lat/Long:	380046.0 1214608.0	Precision:	1,000 Feet (10 Seconds)
Source Name:	WELL 03		
System Number:	0707522		
System Name:	LOUISIANA PACIFIC		
Organization That Operates System:	Not Reported		
Pop Served:	Unknown, Small System	Connections:	Unknown, Small System
Area Served:	Not Reported		

A5
West
1/2 - 1 Mile
Higher

FED USGS **USGS3227921**

Agency cd:	USGS	Site no:	380048121460902
Site name:	002N002E17R003M		
Latitude:	380048		
Longitude:	1214609	Dec lat:	38.01325455
Dec lon:	-121.77023255	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	06
State:	06	County:	013
Country:	US	Land net:	SESE S17 T02N R02E M
Location map:	ANTIOCH NORTH	Map scale:	24000
Altitude:	30.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	10		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Upper ChowchillaUpper Fresno. California. Area = 938 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19720301
Date inventoried:	Not Reported	Mean greenwich time offset:	PST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	Not Reported		
Well depth:	102	Hole depth:	102
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	0000-00-00
Water quality data end date:	0000-00-00	Water quality data count:	0
Ground water data begin date:	1978-04-20	Ground water data end date:	1982-09-24
Ground water data count:	8		

Ground-water levels, Number of Measurements: 8

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1982-09-24	24.38		1982-04-28	23.48	
1981-09-17	25.12		1981-04-20	24.71	

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1980-09-26	24.47				
Note: Foreign substance was present on the surface of the water.					
1980-04-10	21.8		1979-09-24	25.30	
1978-04-20	23.73				

A6
West
1/2 - 1 Mile
Higher

FED USGS **USGS3227920**

Agency cd:	USGS	Site no:	380048121460901
Site name:	002N002E17R002M		
Latitude:	380048		
Longitude:	1214609	Dec lat:	38.01325455
Dec lon:	-121.77023255	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	06
State:	06	County:	013
Country:	US	Land net:	SESE S17 T02N R02E M
Location map:	ANTIOCH NORTH	Map scale:	24000
Altitude:	30.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	10		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Upper ChowchillaUpper Fresno. California. Area = 938 sq.mi.		
Topographic:	Not Reported		
Site type:	Ground-water other than Spring	Date construction:	Not Reported
Date inventoried:	Not Reported	Mean greenwich time offset:	PST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	ALLUVIUM (QUATERNARY)		
Well depth:	67.0	Hole depth:	67.0
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	1972-09-20
Water quality data end date:	1979-04-17	Water quality data count:	17
Ground water data begin date:	1972-07-20	Ground water data end date:	1982-09-24
Ground water data count:	28		

Ground-water levels, Number of Measurements: 28

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1982-09-24	24.86		1982-04-28	23.98	
1981-09-17	26.72		1981-04-20	26.47	
1980-09-26	25.35		1980-04-10	24.4	
1979-09-24	26.15		1979-04-17	25.46	
1978-09-25	26.36				
Note: A nearby site that taps the same aquifer was being pumped.					
1978-04-20	24.60				
1977-09-13	28.14				
Note: A nearby site that taps the same aquifer was being pumped.					

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1977-04-26	29.17				
Note: A nearby site that taps the same aquifer was being pumped.					
1976-09-16	28.63				
Note: A nearby site that taps the same aquifer was being pumped.					
1976-04-14	26.29				
Note: A nearby site that taps the same aquifer was being pumped.					
1975-09-17	27.87				
Note: A nearby site that taps the same aquifer was being pumped.					
1975-04-08	26.33				
Note: A nearby site that taps the same aquifer was being pumped.					
1974-09-24	27.03				
Note: A nearby site that taps the same aquifer was being pumped.					
1974-03-12	24.97				
Note: A nearby site that taps the same aquifer was being pumped.					
1973-10-04	28.64				
Note: A nearby site that taps the same aquifer was being pumped.					
1973-05-24	24.89				
1973-03-22	25.23				
Note: A nearby site that taps the same aquifer was being pumped.					
1973-02-20	25.83				
1973-01-24	26.00				
Note: A nearby site that taps the same aquifer was being pumped.					
1972-12-20	26.89				
Note: A nearby site that taps the same aquifer was being pumped.					
1972-11-15	28.91				
Note: A nearby site that taps the same aquifer was being pumped.					
1972-09-20	28.62				
Note: A nearby site that taps the same aquifer was being pumped.					
1972-08-23	26.49		1972-07-20	25.95	

7
West
1/2 - 1 Mile
Higher

FED USGS **USGS3227913**

Agency cd:	USGS	Site no:	380043121461201
Site name:	002N002E20A001M		
Latitude:	380043		
Longitude:	1214612	Dec lat:	38.0118657
Dec lon:	-121.77106589	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	06
State:	06	County:	013
Country:	US	Land net:	NENE S20 T02N R02E G
Location map:	ANTIOCH NORTH	Map scale:	24000
Altitude:	30.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	10		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Upper ChowchillaUpper Fresno. California. Area = 938 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19480101
Date inventoried:	Not Reported	Mean greenwich time offset:	PST

Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	ALLUVIUM (QUATERNARY)		
Well depth:	78.0	Hole depth:	78.0
Source of depth data:	Not Reported		
Project number:	479435800		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	1957-02-04
Water quality data end date:	1982-09-24	Water quality data count:	44
Ground water data begin date:	1948-01-01	Ground water data end date:	1948-01-01
Ground water data count:	1		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1948-01-01	31.00	

8
SW
1/2 - 1 Mile
Higher

FED USGS **USGS3227868**

Agency cd:	USGS	Site no:	380017121455901
Site name:	002N002E21K001M		
Latitude:	380017		
Longitude:	1214559	Dec lat:	38.00464372
Dec lon:	-121.76745459	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	06
State:	06	County:	013
Country:	US	Land net:	NWNWSES21 T02N R02E M
Location map:	ANTIOCH NORTH	Map scale:	24000
Altitude:	44.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	10		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	San Joaquin Delta. California. Area = 938 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19520501
Date inventoried:	Not Reported	Mean greenwich time offset:	PST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	ALLUVIUM (QUATERNARY)		
Well depth:	120	Hole depth:	120
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	1972-06-22
Water quality data end date:	1982-09-24	Water quality data count:	26
Ground water data begin date:	0000-00-00	Ground water data end date:	0000-00-00
Ground water data count:	0		

Ground-water levels, Number of Measurements: 0

Map ID Direction Distance Elevation	Database	EDR ID Number
9 **WSW** **1/2 - 1 Mile** **Higher**	**CA WELLS**	**1680**

Water System Information:

Prime Station Code:	02N/02E-20A02 M	User ID:	07C
FRDS Number:	0707506001	County:	Contra Costa
District Number:	37	Station Type:	WELL/AMBNT/MUN/INTAKE
Water Type:	Well/Groundwater	Well Status:	Active Raw
Source Lat/Long:	380035.0 1214614.0	Precision:	1,000 Feet (10 Seconds)
Source Name:	WELL 01		
System Number:	0707506		
System Name:	SANTA FE APARTMENTS		
Organization That Operates System:			
	Not Reported		
Pop Served:	Unknown, Small System	Connections:	Unknown, Small System
Area Served:	Not Reported		
Sample Collected:	12/19/2007 00:00:00	Findings:	33 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	01/31/2007 00:00:00	Findings:	29 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	12/20/2006 00:00:00	Findings:	51 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	12/27/2005 00:00:00	Findings:	42 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	12/16/2004 00:00:00	Findings:	32 MG/L
Chemical:	NITRATE (AS NO3)		
Sample Collected:	12/18/2003 00:00:00	Findings:	48 MG/L
Chemical:	NITRATE (AS NO3)		

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10 **ESE** **1/2 - 1 Mile** **Higher**	**FED USGS**	**USGS3227874**

Agency cd:	USGS	Site no:	380020121443901
Site name:	002N002E22F001M		
Latitude:	380020		
Longitude:	1214439	Dec lat:	38.00547706
Dec lon:	-121.74523183	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	06
State:	06	County:	013
Country:	US	Land net:	SWSENWS22 T02N R02E M
Location map:	JERSEY ISLAND	Map scale:	24000
Altitude:	27.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	10		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Upper ChowchillaUpper Fresno. California. Area = 938 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19540101
Date inventoried:	Not Reported	Mean greenwich time offset:	PST

Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	ALLUVIUM (QUATERNARY)		
Well depth:	66.0	Hole depth:	66.0
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	1973-01-25
Water quality data end date:	1982-09-24	Water quality data count:	22
Ground water data begin date:	1973-01-25	Ground water data end date:	1982-09-24
Ground water data count:	22		

Ground-water levels, Number of Measurements: 22

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1982-09-24	13.38		1982-04-28	12.50	
1981-09-17	14.98		1981-04-21	14.50	
1980-09-24	13.80		1980-04-10	13.02	
1979-09-24	14.93		1979-04-17	14.00	
1978-09-25	14.62		1978-04-17	13.66	
1977-09-13	16.57		1977-04-26	16.08	
1976-09-15	15.90		1976-04-12	15.80	
1975-09-16	15.38		1975-04-07	14.68	
1974-09-24	14.82		1974-03-11	14.05	
1973-10-04	13.89		1973-03-21	12.24	
1973-02-20	13.02		1973-01-25	14.03	

11
SW
1/2 - 1 Mile
Higher

FED USGS **USGS3227860**

Agency cd:	USGS	Site no:	380012121461101
Site name:	002N002E20J001M		
Latitude:	380012		
Longitude:	1214611	Dec lat:	38.00325487
Dec lon:	-121.770788	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	06
State:	06	County:	013
Country:	US	Land net:	NESE S20 T02N R02E M
Location map:	ANTIOCH NORTH	Map scale:	24000
Altitude:	45.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	10		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Upper ChowchillaUpper Fresno. California. Area = 938 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	18700101
Date inventoried:	Not Reported	Mean greenwich time offset:	PST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	ALLUVIUM (QUATERNARY)		
Well depth:	95.0	Hole depth:	95.0
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00

Peak flow data count:	0	Water quality data begin date:	1972-06-22
Water quality data end date:	1982-09-23	Water quality data count:	29
Ground water data begin date:	0000-00-00	Ground water data end date:	0000-00-00
Ground water data count:	0		

Ground-water levels, Number of Measurements: 0

12
ESE
1/2 - 1 Mile
Higher

FED USGS **USGS3227867**

Agency cd:	USGS	Site no:	380017121443201
Site name:	002N002E22L001M		
Latitude:	380017		
Longitude:	1214432	Dec lat:	38.00464376
Dec lon:	-121.74328736	Coor meth:	M
Coor accr:	S	Latlong datum:	NAD27
Dec latlong datum:	NAD83	District:	06
State:	06	County:	013
Country:	US	Land net:	NENESWS22 T02N R02E M
Location map:	JERSEY ISLAND	Map scale:	24000
Altitude:	32.00		
Altitude method:	Interpolated from topographic map		
Altitude accuracy:	10		
Altitude datum:	National Geodetic Vertical Datum of 1929		
Hydrologic:	Upper ChowchillaUpper Fresno. California. Area = 938 sq.mi.		
Topographic:	Flat surface		
Site type:	Ground-water other than Spring	Date construction:	19620601
Date inventoried:	Not Reported	Mean greenwich time offset:	PST
Local standard time flag:	Y		
Type of ground water site:	Single well, other than collector or Ranney type		
Aquifer Type:	Not Reported		
Aquifer:	ALLUVIUM (QUATERNARY)		
Well depth:	63.0	Hole depth:	63.0
Source of depth data:	Not Reported		
Project number:	Not Reported		
Real time data flag:	0	Daily flow data begin date:	0000-00-00
Daily flow data end date:	0000-00-00	Daily flow data count:	0
Peak flow data begin date:	0000-00-00	Peak flow data end date:	0000-00-00
Peak flow data count:	0	Water quality data begin date:	1972-06-22
Water quality data end date:	1981-04-21	Water quality data count:	25
Ground water data begin date:	1962-06-01	Ground water data end date:	1982-09-24
Ground water data count:	9		

Ground-water levels, Number of Measurements: 18

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1982-09-24	23.18		1982-09-24	23.18	
1982-04-28	22.29		1982-04-28	22.29	
1981-09-17	24.85		1981-09-17	24.85	
1981-04-21	24.32		1981-04-21	24.32	
1980-09-26	23.52		1980-09-26	23.52	
1980-09-24	26.20				
Note: The site was being pumped.					
1980-09-24	26.20				
Note: The site was being pumped.					
1980-04-10	22.8		1980-04-10	22.8	

Ground-water levels, continued.

Date	Feet below Surface	Feet to Sealevel
1979-10-25	23.7	
1962-06-01	20.00	

Date	Feet below Surface	Feet to Sealevel
1979-10-25	23.7	
1962-06-01	20.00	

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance	Database	EDR ID Number

1
East
1/2 - 1 Mile

OIL_GAS **CAOG50000186055**

Apinumber:	01300608	Operator:	E. I. du PONT de NEMOURS & Co. INC.
Lease:	WWD	Well no:	1
Field:	Not Reported	Cagasoil m2 area:	Not Reported
Map:	606	Status cod:	016
Source:	Not Reported		
Latitude:	38.013141		
Longitude:	-121.742751		
Td:	0		
Sec:	15		
Twn:	2N	Rge:	2E
Bm:	MD		
X coord:	0		
Y coord:	0		
Zone:	Not Reported	Spuddate:	06/27/2007 00:00:00
Abanddate:	09/28/2007 00:00:00	Comments:	Not Reported
District:	6	Site id:	CAOG50000186055

2
East
1/2 - 1 Mile

OIL_GAS **CAOG50000186054**

Apinumber:	01320057	Operator:	Great Yellowstone Corp.
Lease:	Du Pont	Well no:	2
Field:	Not Reported	Cagasoil m2 area:	Not Reported
Map:	608	Status cod:	007
Source:	Not Reported		
Latitude:	38.01269		
Longitude:	-121.7405		
Td:	0		
Sec:	15		
Twn:	2N	Rge:	2E
Bm:	MD		
X coord:	0		
Y coord:	0		
Zone:	Not Reported	Spuddate:	06/27/2007 00:00:00
Abanddate:	09/28/2007 00:00:00	Comments:	Not Reported
District:	6	Site id:	CAOG50000186054

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: CA Radon

Radon Test Results

Zip	Total Sites	> 4 Pci/L	Pct. > 4 Pci/L
94509	5	0	0.00

Federal EPA Radon Zone for CONTRA COSTA County: 2

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 94509

Number of sites tested: 2

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.500 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Scanned Digital USGS 7.5' Topographic Map (DRG)
Source: United States Geologic Survey
A digital raster graphic (DRG) is a scanned image of a U.S. Geological Survey topographic map. The map images are made by scanning published paper maps on high-resolution scanners. The raster image is georeferenced and fit to the Universal Transverse Mercator (UTM) projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Water Well Database
Source: Department of Water Resources
Telephone: 916-651-9648

California Drinking Water Quality Database
Source: Department of Health Services
Telephone: 916-324-2319
The database includes all drinking water compliance and special studies monitoring for the state of California since 1984. It consists of over 3,200,000 individual analyses along with well and water system information.

OTHER STATE DATABASE INFORMATION

California Oil and Gas Well Locations
Source: Department of Conservation
Telephone: 916-323-1779

RADON

State Database: CA Radon
Source: Department of Health Services
Telephone: 916-324-2208
Radon Database for California

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

California Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary fault lines, prepared in 1975 by the United State Geological Survey. Additional information (also from 1975) regarding activity at specific fault lines comes from California's Preliminary Fault Activity Map prepared by the California Division of Mines and Geology.

STREET AND ADDRESS INFORMATION

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Marsh Landing
Wilbur Avenue
Antioch, CA 94509

Inquiry Number: 2398575.5
January 14, 2009

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EDR® Environmental Data Resources Inc

440 Wheelers Farms Road
Milford, CT 06461
800.352.0050
www.edrnet.com

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Date EDR Searched Historical Sources:

Aerial Photography January 14, 2009

Target Property:

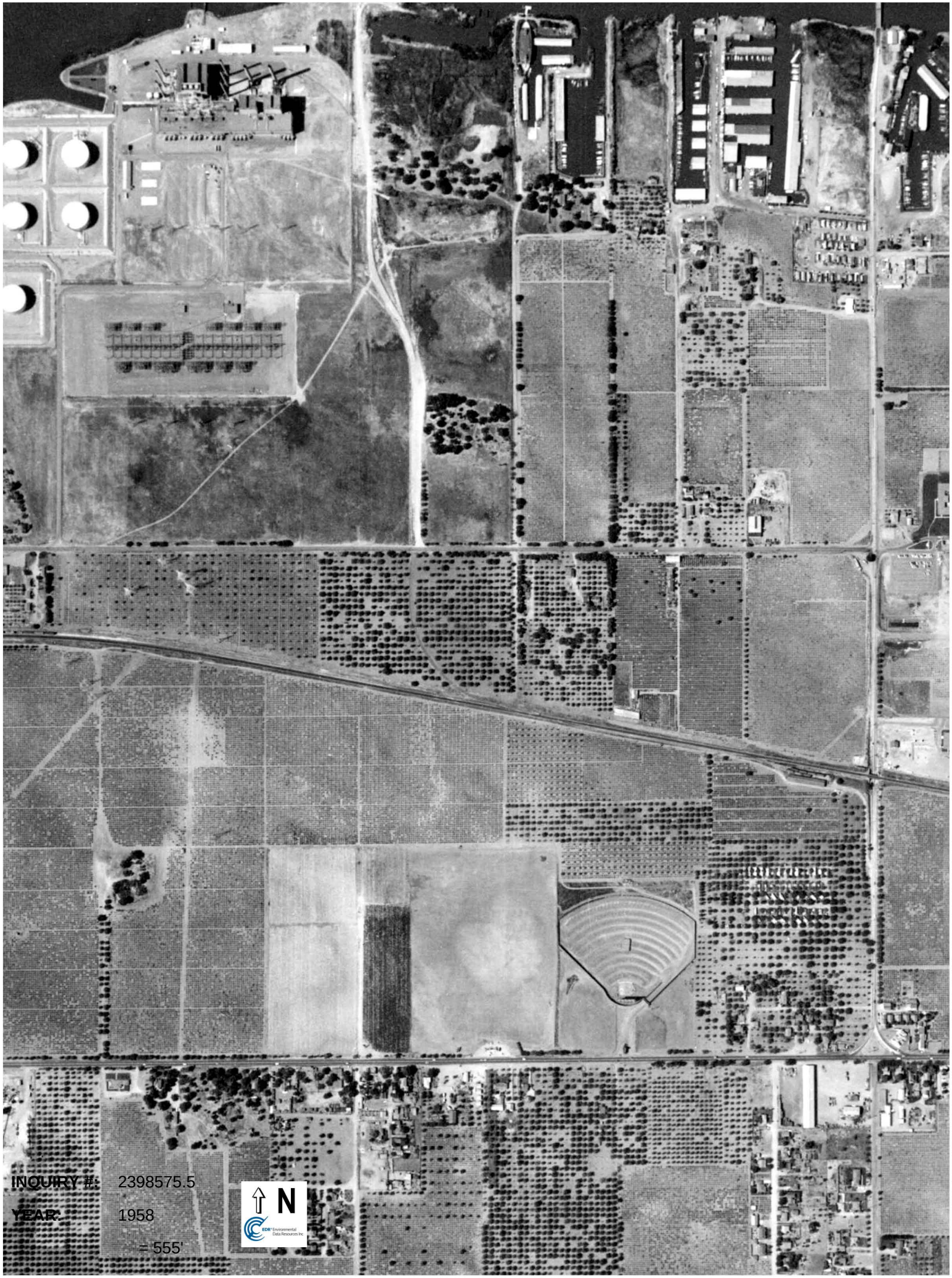
Wilbur Avenue

Antioch, CA 94509

Year	***Scale***	***Details***	***Source***
1939	Aerial Photograph. Scale: 1"=555'	Flight Year: 1939	Fairchild
1952	Aerial Photograph. Scale: 1"=555'	Flight Year: 1952	Pacific Air
1958	Aerial Photograph. Scale: 1"=555'	Flight Year: 1958	Cartwright
1965	Aerial Photograph. Scale: 1"=333'	Flight Year: 1965	Cartwright
1971	Aerial Photograph. Scale: 1"=333'	Flight Year: 1971	Cartwright
1984	Aerial Photograph. Scale: 1"=690'	Flight Year: 1984	USGS
1993	Aerial Photograph. Scale: 1"=666'	Flight Year: 1993	USGS
1998	Aerial Photograph. Scale: 1"=666'	Flight Year: 1998	USGS
2005	Aerial Photograph. Scale: 1"=484'	Flight Year: 2005	EDR

INQUIRY #: 2398575.5
YEAR: 1939
= 555'
N

INQUIRY #: 2398575.5
YEAR: 1952
= 555'
N


INQUIRY #: 2398575.5
YEAR: 1958
= 555'
N

INQUIRY #: 2398575.5

YEAR: 1965

= 333'

INQUIRY #: 2398575.5

YEAR: 1971

= 333'

INQUIRY #: 2398575.5
YEAR: 1984
= 690'
N

INQUIRY #: 2398575.5
YEAR: 1993
1=666'
N
EDR Environmental Data Resources Inc

INQUIRY #: 2398575.5
YEAR: 1998
= 666
N

INQUIRY #: 2398575.5
YEAR: 2005
= 484'
N

Marsh Landing
Wilbur Avenue
Antioch, CA 94509

Inquiry Number: 2398575.4
January 14, 2009

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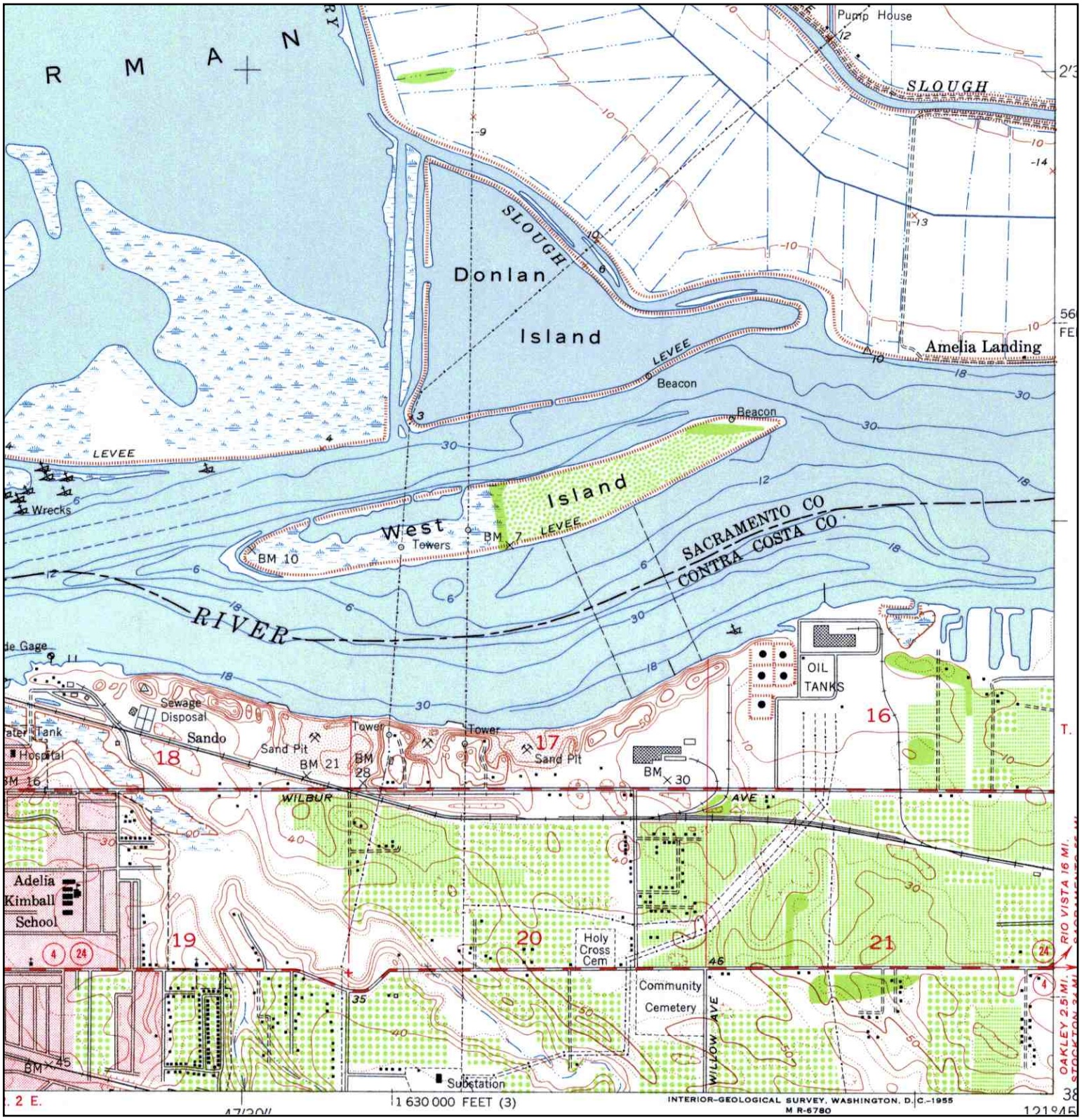
Historical Topographic Map

N	TARGET QUAD NAME: ANTIOCH MAP YEAR: 1908 SERIES: 15 SCALE: 1:62500	SITE NAME: Marsh Landing ADDRESS: Wilbur Avenue Antioch, CA 94509 LAT/LONG: 38.0123 / 121.758	CLIENT: URS Corporation CONTACT: Kirk Martin INQUIRY#: 2398575.4 RESEARCH DATE: 01/14/2009

Historical Topographic Map

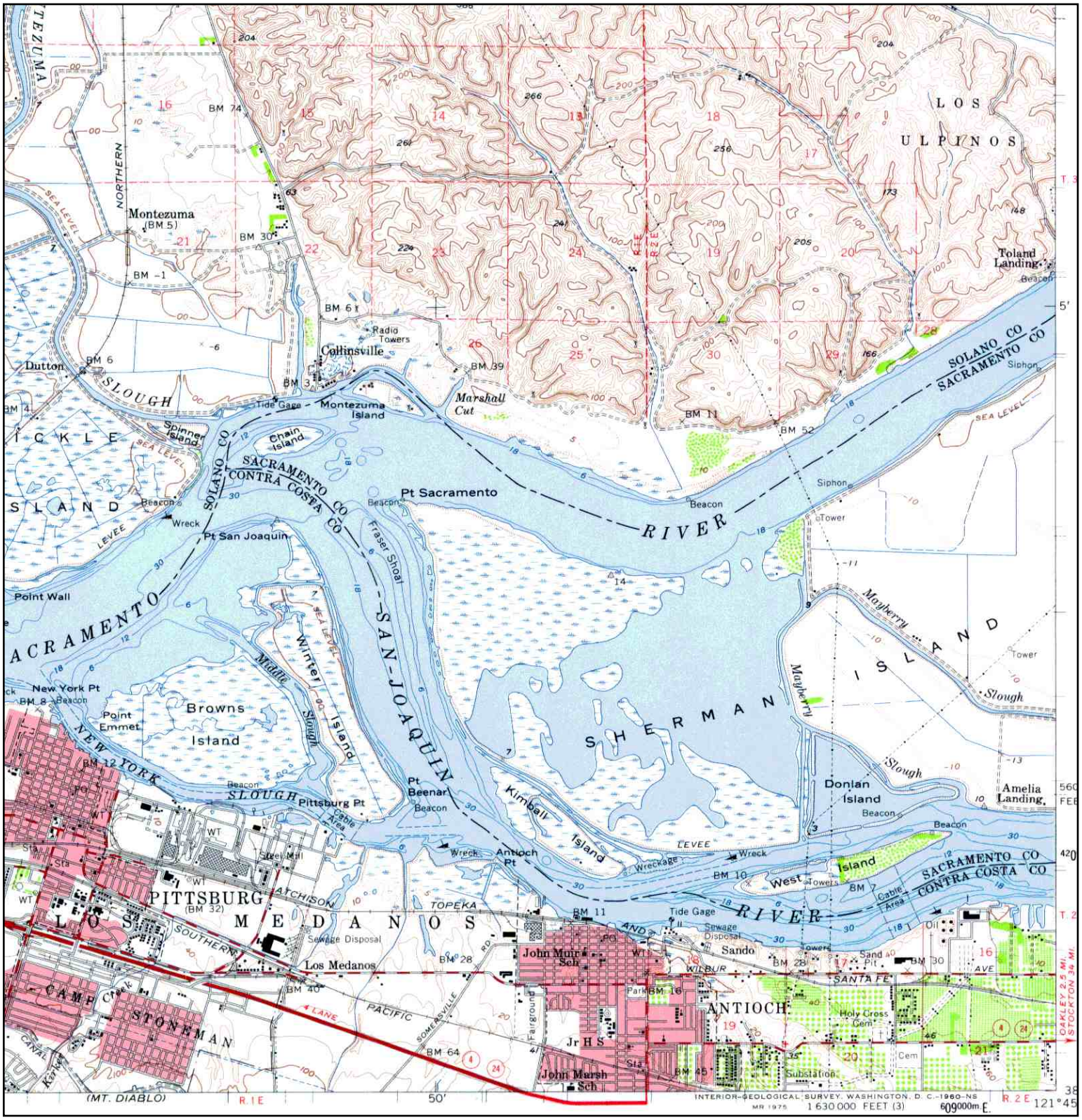
N	TARGET QUAD NAME: COLLINSVILLE MAP YEAR: 1918 SERIES: 7.5 SCALE: 1:31680	SITE NAME: Marsh Landing ADDRESS: Wilbur Avenue Antioch, CA 94509 LAT/LONG: 38.0123 / 121.758	CLIENT: URS Corporation CONTACT: Kirk Martin INQUIRY#: 2398575.4 RESEARCH DATE: 01/14/2009

Historical Topographic Map



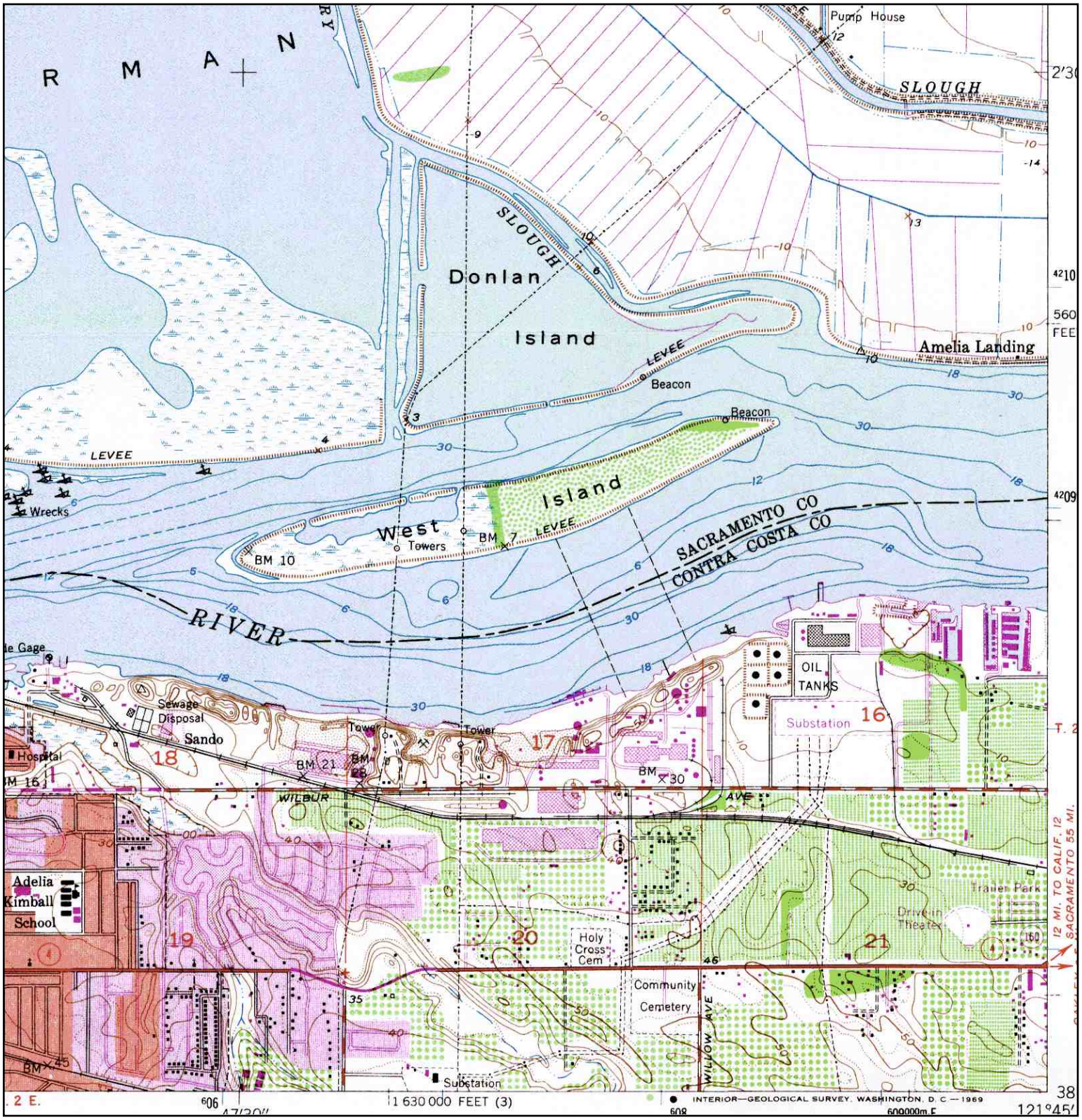
N	TARGET QUAD NAME: ANTIOCH NORTH MAP YEAR: 1953 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Marsh Landing ADDRESS: Wilbur Avenue Antioch, CA 94509 LAT/LONG: 38.0123 / 121.758	CLIENT: URS Corporation CONTACT: Kirk Martin INQUIRY#: 2398575.4 RESEARCH DATE: 01/14/2009

Historical Topographic Map



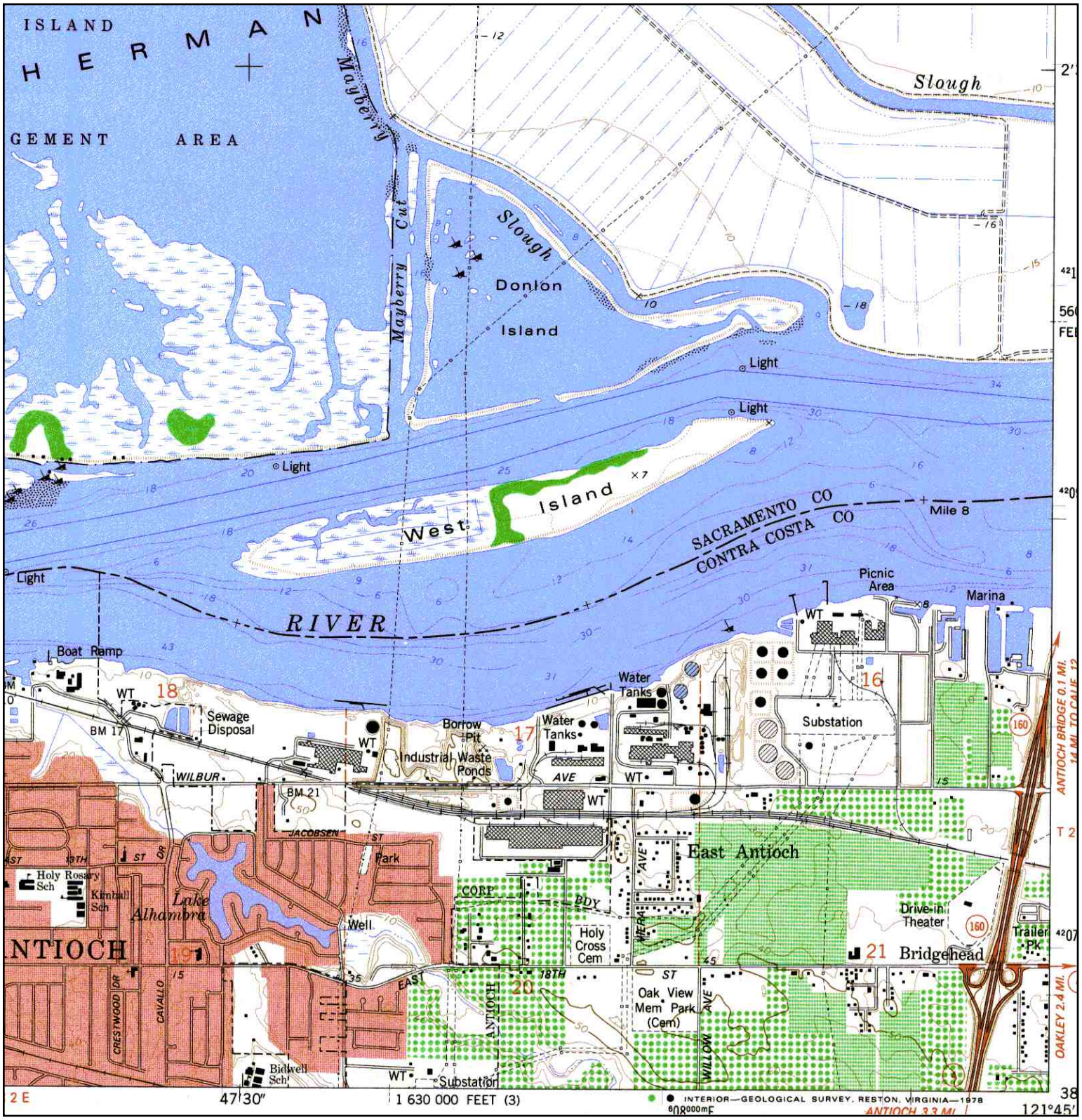
N	TARGET QUAD NAME: PITTSBURG MAP YEAR: 1953 SERIES: 15 SCALE: 1:62500	SITE NAME: Marsh Landing ADDRESS: Wilbur Avenue Antioch, CA 94509 LAT/LONG: 38.0123 / 121.758	CLIENT: URS Corporation CONTACT: Kirk Martin INQUIRY#: 2398575.4 RESEARCH DATE: 01/14/2009

Historical Topographic Map



N	TARGET QUAD NAME: ANTIOCH NORTH MAP YEAR: 1968 PHOTOREVISED FROM:1953 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Marsh Landing ADDRESS: Wilbur Avenue Antioch, CA 94509 LAT/LONG: 38.0123 / 121.758	CLIENT: URS Corporation CONTACT: Kirk Martin INQUIRY#: 2398575.4 RESEARCH DATE: 01/14/2009

Historical Topographic Map



N	TARGET QUAD NAME: ANTIOCH NORTH MAP YEAR: 1978 SERIES: 7.5 SCALE: 1:24000	SITE NAME: Marsh Landing ADDRESS: Wilbur Avenue Antioch, CA 94509 LAT/LONG: 38.0123 / 121.758	CLIENT: URS Corporation CONTACT: Kirk Martin INQUIRY#: 2398575.4 RESEARCH DATE: 01/14/2009

Marsh Landing
Wilbur Avenue
Antioch, CA 94509

Inquiry Number: 2398575.3
January 14, 2009

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1/14/09

Site Name:
Marsh Landing
Wilbur Avenue
Antioch, CA 94509

Client Name:
URS Corporation
221 Main Street
San Francisco, CA 94105

EDR Inquiry # 2398575.3

Contact: Kirk Martin

EDR® Environmental Data Resources Inc

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Certified Sanborn Results:

Site Name:	Marsh Landing
Address:	Wilbur Avenue
City, State, Zip:	Antioch, CA 94509
Cross Street:	
P.O. #	NA
Project:	Mirant Marsh La
Certification #	C7F9-4DB8-A632

Sanborn® Library search results
Certification # C7F9-4DB8-A632

UNMAPPED PROPERTY

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- ✔ Library of Congress
- ✔ University Publications of America
- ✔ EDR Private Collection

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Appendix D

Historical Documentation

PHASE I ENVIRONMENTAL SITE ASSESSMENT

CONTRA COSTA POWER PLANT
AND
MARSH LANDING GENERATING STATION
3201 WILBUR AVENUE
ANTIOCH, CALIFORNIA

Prepared for

MIRANT CALIFORNIA, LLC
ANTIOCH, CA

Prepared by

URS CORPORATION
221 MAIN STREET, SUITE 600
SAN FRANCISCO, CALIFORNIA 94105
(415) 896-5858 FAX (415) 882-9261

URS PROJECT NO. 28067344

May 2008

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CERTIFICATION OF RESULTS

This report has been prepared for the exclusive use of Mirant California, LLC (Mirant), its affiliates, lenders, and insurers. URS Corporation (URS) acknowledges that Mirant, its affiliates, lenders, and insurers, may rely on this report in connection with financing, insuring and acquiring the Site. Photocopying of this document, in part or in whole, by parties other than those designated by Mirant, or use of this document for purposes other than it is intended, is prohibited. Anyone relying upon this report is subject to the same limitations and conditions as the Client and this report. In addition, this report is time dependent, and use or reliance upon said report after 180 days from the date of the report is limited to the circumstances described in ASTM 1527 Standard Practice for Environmental Site Assessments.

Respectfully submitted this 23 day of May 2008.

URS Corporation

Erik Skov P.G. C.H.G.
Senior Geologist

Katherine Brady, REA
Senior Environmental Scientist

1.0 EXECUTIVE SUMMARY

URS conducted a Site Reconnaissance and document review as part of a Phase I Environmental Site Assessment (ESA) for a proposed new power plant to be located within the property boundary of an existing power plant (Contra Costa Power Plant (CCPP)) located at 3201 Wilbur Avenue in unincorporated Contra Costa County, California, adjacent to the City of Antioch. For purposes of this document, the term "Site" refers to the existing power plant (the CCPP), and the term "Subject Site" refers to that part of the existing power plant proposed for development of a new power plant. The new power plant will occupy approximately 27 acres and be the Marsh Landing Generating Station (MLGS). While Site Reconnaissance and document review was performed for the entire CCPP Site recommendations and conclusions are focused on the Subject Site (MLGS). It is anticipated that a parcel subdivision will be pursued and the MLGS Subject Site will become a new property in the future.

URS has performed a Phase I ESA of the Site in conformance with the scope and limitations of American Society for Testing and Materials (ASTM) Practice E 1527. The Phase I ESA was accomplished by, and limited to, review of existing Phase I ESA and Phase II site investigation documents, a site reconnaissance, limited review of hydrological literature, review of Site history, a review of federal, state, and local agency lists, and contact with governmental agencies.

Any exceptions to, or deletions from, this practice are described in Sections 2.2 and 2.3 of this report. The assessment was conducted by URS in response to authorization by Mirant California, LLC. The report was prepared by the following:

Erik Skov: Senior Geologist
Phone: (415) 243-3845
Fax: (415) 882-9261

Katherine Brady: Senior Environmental Scientist
Phone: (415) 243-3815
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Mr. Skov has over 19 years of experience conducting Phase I ESA and Phase II site investigation and remedial activities. He has prepared many Phase I ESAs throughout the state of California. A copy of Mr. Skov's résumé is presented in Appendix A of this report.

Ms. Brady has over 7 years of experience conducting Phase I ESA and Phase II site investigation and remedial activities. She has prepared Phase I ESAs throughout the state of California. A copy of Ms. Brady's résumé is presented in Appendix A of this report.

The focus of the Phase I ESA was to identify Recognized Environmental Conditions (RECs) that may exist at the Site. This includes areas where chemicals were processed, stored, and handled in association with Site operations. The format and content of this Phase I ESA is in accordance with the ASTM Standard Practice for Environmental Site Assessments: Phase I Site Assessment Process E-1527, which

defines RECs as "the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property." A brief summary of URS' findings regarding potential environmental concerns at the Site is presented below.

The Site is located on Wilbur Avenue within unincorporated Contra Costa County, California, adjacent to the City of Antioch. The Site carries the address 3201 Wilbur Avenue and has been assigned County Assessor's Parcel Number (APN) 051-031-014. The Subject Site is situated on the southern side of the San Joaquin River, and is bound by the Contra Costa Power Plant (Site) and the PG&E Switchyard to the east; portions of the existing Contra Costa Power Plant site to the south; vacant, former industrial development property to the west; and existing Contra Costa Power Plant facilities to the north. The Site vicinity consists of a mixture of industrial, light industrial, commercial, and residential uses.

The Site is situated on approximately 114 acres improved with, but not limited to, power generating units, a Tank Farm that includes five 120,000 barrels (bbl) bulk aboveground storage tanks (ASTs), three 500,000 bbl bulk ASTs, pipelines, an operating and non operational water treatment system, an oily water collection system work sheds, storage buildings, non-hazardous waste storage areas, hazardous waste storage areas, a sandblasting building, parking areas, septic systems, and fire pump house.

Based on the results of the Phase I ESA and communication with on-site management, the following RECs and Areas of Concern (AOC) were identified at the Site:

- The Fuel Tank Farm, which includes ASTs 1 through 8, is located on the west and south end of the Subject Site. The tanks have not been used for approximately 10 years. The power plant has been using natural gas for power generation. Approximately 2.2 million gallons of Number 6 fuel oil remain in the tanks, according to site personnel (Welch, 2008). The structural integrity of the tanks and the concrete pad beneath them is unknown. The areas around the tanks are unpaved. Staining was observed at the fuel oil processing units adjacent to each of the ASTs. According to CDM's Phase I ESA report, Tank 7 was formerly used to store black liquor for the Gaylord property adjacent to the west. A pipeline from Tank 7 at the Site led to a shed on the Gaylord property boundary. The exact location of the pipeline is not known. A release of black liquor occurred near Tanks 5 and 6 from the pipeline leading from Tank 7, reportedly on the Gaylord property, in the mid 1980s. CDM reported no releases or staining around the base of Tanks 6 through 8; however, no documentation is available on the integrity of the tanks. Based on the limited information regarding integrity of the foundations beneath the ASTs, the ASTs are considered RECs.

- According to a drawing from the previous Phase I ESA prepared by CDM, a paint storage area was previously located north of the former asbestos accumulation bins and south of the work sheds and underground septic tank. Information regarding the paint storage area

was not available. Based on this information, the former paint storage shed is considered an AOC.

- A concrete pad is located just south of the access road and west of the small firehouse and hazardous waste storage shed in the Subject Site. Both the firehouse and the shed have been placed on a portion of the concrete pad. Dried paint was observed on the western portion of the concrete pad. Storm water runoff from the concrete following painting activities may have impacted soil and/or groundwater. Based on this information, the paint from the concrete pad is considered an AOC.

- Construction debris piles were formerly located at the Site. According to the Phase I ESA report prepared by CDM in 1997, total petroleum hydrocarbon (TPH) was detected at 322 parts per million (ppm) in the piles. Soil and/or groundwater may be impacted in this area. Based on this information, the former construction debris piles present a REC.

- The leach mound and former leach field at the Contra Costa Power Plant are located to the east of the Subject Site. According to CDM's Phase I ESA, laboratory wastes were discharged to the former leach field and in-use leach mound. The Phase I ESA also indicates that groundwater flow is to the north-northwest. Any hazardous substances discharged to the septic system may potentially impact the groundwater at the Site. Based on this information, the leach mound and the former leach field are considered a REC.

- Based on the information in the Fluor Daniel GTI Phase II investigation report (Fluor Daniel GTI 1988), there are several places within the Subject Site that are identified as having "Remedial Issues". Areas with "Remedial Issues" are those that have either TPH or arsenic in soil or groundwater at concentrations that exceed regulatory threshold levels. These locations are shown on Figure 3. Additionally, Fluor Daniel GTI identified areas of future environmental concerns outside those identified in the Phase II investigation that would be recognized after a "triggering event" (e.g., demolition onsite). Specifically, Fluor Daniel GTI identified a potential for impact to soil and groundwater that may exist beneath the foundations of the petroleum ASTs in Area 4. As such, as indicated in the first bullet, the foundations supporting the ASTs in the Tank Farm Area are considered RECs. Additionally, those other areas identified as having "Remedial Issues" are also considered RECs.

Surrounding Properties

The adjacent property to the west of the Subject Site, the former Gaylord Corporation, had a release of black liquor (a waste product from wood pulping that typically contains a mixture of sodium hydroxide and sodium sulfide/sulfite) in the mid-1980s, according to a Phase I ESA prepared by CDM dated October 1997. No information regarding the sampling of the soil and groundwater or information regarding the cleanup was available. CDM reported that the release was near the Fuel Tank Farm at

Tanks 5 and 6 from the pipeline leading from Tank 7. Site investigation and cleanup has been ongoing at the Gaylord property after CDM's Phase I ESA. Based on this information, the Gaylord Corporation property is considered an offsite REC.

The PG&E Switchyard is located south and east of the Subject Site. CDM documented that persons familiar with the Site knew of two oil circuit breaker (OCB) explosions in the switchyard that happened in 1976 and 1979 to 1981. Dielectric fluid potentially containing polychlorinated biphenyls (PCBs) may have impacted the surrounding soil during these incidences. Due to shallow groundwater ranging from 6 to 10 feet below ground surface, the groundwater may have been impacted. Groundwater flow is to the north-northwest. Based on this information, the release of dielectric fluid may have impacted the groundwater at the PG&E Switchyard. This area is considered a REC on adjacent property to the south of the Subject Site.

1.1 RECOMMENDATIONS

Recommendations are focused on the Subject Site:

URS recommends soil sampling be conducted beneath the AST foundations after tank demolition and at various locations around the Tank Farm at the Subject Site to assess potential releases of Number 6 fuel oil from the tanks and associated piping.

Areas identified in the Fluor Daniel GTI Phase II report as areas with "Remedial Issues" within the Subject Site should be appropriately addressed prior to site construction or grading activities.

URS recommends soil sampling be conducted at the locations of the former paint storage shed and construction debris pile to assess potential impact to soil in these areas.

Asbestos is located throughout the Site, including the Subject Site. Based on information provided to URS, asbestos is present in the insulating materials on the conveyance piping at the Fuel Tank Farm and possibly on the roofing materials on the storage buildings and work sheds at the Subject Site. URS recommends sampling and abatement of any asbestos prior to undertaking any demolition activities.

Painted surfaces at the Subject Site, which include the Fuel Tank Farm, work and storage sheds may contain lead. URS recommends testing of the paint for lead and removal of any lead-based paint (LBP) that is required under local, state, and Federal regulations prior to demolition.

An in-use septic tank was observed at the Subject Site adjacent to a circuit breaker unit south of the work sheds. URS recommends removal of the septic tank prior to redevelopment of the Site provided an alternative system to handle these wastes is installed or a hook up to the city sanitary system is made possible.

2.0 INTRODUCTION

This report summarizes the results of a Phase I Environmental Site Assessment (ESA) for a proposed new power plant located within the property boundary of an existing power plant (Contra Costa Power Plant) located at 3201 Wilbur Avenue in unincorporated Contra Costa County, California. For purposes of this document the term "Site" refers to the existing power plant and the term "Subject Site" refers to that part of the existing power plant proposed for development of a new power plant (see Figure 1 - Site Location Map). The new power plant will occupy approximately 27 acres and be the Marsh Landing Generating Station (MLGS). While Site Reconnaissance and document review was performed for the entire CCPP Site recommendations and conclusions are focused on the Subject Site or (MLGS). It is anticipated that a parcel subdivision will be pursued and the MLGS Subject Site will become a new property in the future. URS Corporation (URS) conducted the assessment in response to the authorization by Mirant California LLC.

2.1 PURPOSE AND SCOPE OF WORK

The purpose of the Phase I ESA was to identify Recognized Environmental Conditions (RECs) that may exist at the Site and the Subject Site. This includes areas where there could have been a release to the subsurface that has not been identified. The ASTM guidance document *ASTM Standards on Environmental Site Assessments for Commercial Real Estate*, Designation E 1527, defines RECs as "the presence or likely presence of any hazardous substances or petroleum products on a Property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the Property or into the ground, groundwater, or surface water of the Property." The extent of research to identify RECs is limited by the scope of services discussed below.

Our scope of services for this ESA is in general conformance with the ASTM Standard Practice for a Phase I ESA (ASTM E 1527) and included the following elements:

- Review of pertinent, readily available documents and maps regarding local geologic and hydrogeologic conditions.
- Review and interpretation of selected historical aerial photographs of the Site and vicinity for selected years back to the property's first developed use or 1940, whichever is earlier, provided by Environmental Data Resources (EDR).
- Review and interpretation of available archival topographic maps, historical land use maps (e.g., Sanborn Fire Insurance maps) and city directories (e.g., Coles and Polks and Haines Criss-Cross directories) for the Site and vicinity provided by EDR. These were reviewed for information regarding historical site land use that could have involved the manufacture, generation, use, storage and/or disposal of petroleum products or hazardous materials/wastes.

- Review of available documents regarding past and/or current property development provided by Mirant or which reside in URS' San Francisco office library.

- A reconnaissance survey of the Site, Subject Site, and surrounding areas to make visual observations of existing conditions and activities at the Site and in the property vicinity. The reconnaissance of the Site was focused on the major areas where potentially hazardous substances are stored and processed, as well as power plant operation locations.

- Interviews with the owner, property manager, or other personnel identified as being knowledgeable of past tenants and environmental practices at the Site involving petroleum products and hazardous materials/wastes.

- Review of county, state, and U.S. Environmental Protection Agency (EPA) lists of known or potential hazardous waste sites or landfills, and sites currently under investigation for environmental violations located in the vicinity of the property within the search radius specified in ASTM E 1527, including:

  - U.S. EPA National Priorities ("Federal Superfund") List (1 mile radius)
  - U.S. Environmental Protection Agency (EPA) National Priorities ("Federal Superfund") List (1-mile radius)
  - EPA Delisted NPL List (1/2-mile radius)
  - EPA Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) and CERCLIS No Further Remedial Action Planned (NFRAP) Lists (1/2-mile radius)
  - EPA Emergency Response Notification System (ERNS) List (property)
  - EPA Resource Conservation and Recovery Act (RCRA) List (property and adjoining)
  - EPA RCRA Corrective Action (CORRACTS) Treatment, Storage, and Disposal (TSD) Facilities List (1-mile radius)
  - EPA Inventory of Open Dumps (1/2-mile radius) (USEPA 1985)
  - EPA Institutional and Engineering Controls databases (property and adjoining)
  - EPA Brownfields Sites
  - EPA Listing of Tribal Underground Storage Tanks (UST) Sites
  - EPA Listing of Tribal Leaking Underground Storage Tank (LUST) Sites
  - Applicable local and state agency lists.

- Telephone inquiries to applicable municipal, county, and state regulatory agencies for information regarding building or environmental permits, environmental violations or incidents and/or status of enforcement actions at the property.

- Preparation of this report for the Site describing the research performed and presenting URS' findings, conclusions, and professional opinions regarding the potential for environmental contamination at the Site. Our report includes the following, as appropriate:

  - Geologic and Hydrogeologic Setting
  - Site Specific Reconnaissance Observations
  - Current and Historical Land Use
  - Agency List Document Review
  - Results of Limited Visual Asbestos Survey
  - Reported or Suspected Hazardous Materials
  - Site Specific Findings and Recommendations
  - References
  - Site Locations and Site Plan Maps
  - Supporting Documentation.

2.2 SPECIAL TERMS AND CONDITIONS

This assessment was performed in accordance with the ASTM Standard Practice for Environmental Site Assessments, E 1527. There were no exceptions or deletions to the ASTM Standard Practice for Environmental Site Assessments, E 1527.

2.3 LIMITATIONS AND EXCEPTIONS OF ENVIRONMENTAL SITE ASSESSMENT

URS has prepared this ESA in accordance with the contract scope of work, using reasonable efforts to attempt to identify areas of potential liability associated with RECs at the Site. URS' services in the development of this report were conducted, within the limits prescribed by the Agreement, in a manner consistent with that level of care and skill ordinarily exercised by members of the same professions currently practicing in the same locality under similar conditions and no other guaranty, warranty, or representation, either express or implied, is included or intended herein. Unless limited sampling or physical testing of materials was expressly provided for in the scope of work, the conclusions in this report were based solely on a visual review of the Site and on readily available records, interviews and other secondary sources. URS has made no independent investigation of the accuracy of these secondary sources and has assumed them to be accurate and complete. URS does not warrant the accuracy or completeness of information provided by secondary sources. URS does not warrant that contamination that may exist on the Site has been discovered, that the Site is suitable for any particular purpose or that the Site is clean or free of liability. Any cost estimates are based on general comparisons with past projects of similar scope and size, and actual cost or design-phase estimates may vary substantially from these estimates.

This report is intended to be used in its entirety. No excerpts may be taken to be representative of the findings of this assessment. Opinions and recommendations presented in this report apply to site

conditions and features, as they existed at the time of the site visit, and those reasonably foreseeable. They cannot necessarily apply to conditions and features of which URS is unaware and has not had an opportunity to evaluate.

3.0 SITE AND SUBJECT SITE DESCRIPTION

Please refer to Figure 2 - Site Plan, and Appendix B - Site Photographs, for further information regarding the Site, Subject Site, and adjoining properties.

3.1 LOCATION

The Site is located on Wilbur Avenue within unincorporated Contra Costa County, California, adjacent to the City of Antioch. The Site carries the address 3201 Wilbur Avenue. The Contra Costa County Assessor's Office indicates the Site has been assigned County Assessor's Parcel Number (APN) 051-031-014.

3.2 SITE AND VICINITY CHARACTERISTICS

Ms. Katherine Brady and Mr. Erik Skov (URS) conducted a reconnaissance of the Site and vicinity on November 29, 2007. Mr. Chuck Hicklin, Project Manager for Mirant, accompanied Ms. Brady and Mr. Skov during the Site reconnaissance.

The Site is located on Wilbur Avenue within unincorporated Contra Costa County, California, adjacent to the City of Antioch. The Site carries the address 3201 Wilbur Avenue. The Subject Site is situated on the southern side of the San Joaquin River, and is bounded by Pacific Gas and Electric (PG&E) property and the Contra Costa Power Plant to the east; portions of the existing Contra Costa Power Plant to the south; vacant, former industrial development property to the west; and existing Contra Costa Power Plant facilities to the north. The Site vicinity consists of a mixture of industrial, light industrial, commercial, and residential uses.

3.3 DESCRIPTIONS OF STRUCTURES, ROADS, OTHER IMPROVEMENTS ON THE SUBJECT SITE

The Subject Site consists of the western portion, approximately 27-aces, of the approximately 114-acre Contra Costa Power Plant (Site). The Subject Site is improved with a Tank Farm which includes five aboveground bulk storage tanks (Tanks 1 through 5) that were used to store Number 6 fuel oil, heating and pumping systems for the transfer of fuel oil to the power plant, pipelines, work sheds, storage buildings, non-hazardous waste storage area, hazardous waste storage units, parking areas, a septic system, and fire pump house.

3.3.1 Potable Water Supply

The City of Antioch supplies potable water to the Site.

3.3.2 Heating/Cooling Systems

There are small air conditioning and heating units for office spaces located throughout the Subject Site and the remainder of the power plant (Site). An air conditioning unit is present in the building marked as

Building 8 Storage and Fabrication. Other storage buildings at the Subject Site were not observed to have heating and cooling systems.

3.3.3 Stormwater and Sanitary Waste Disposal

Storm water from 70.6 acres of the CCPP site is routed through an oil/water separator on the Site and then discharged through outfall-001 to the San Joaquin River under the NPDES permit #CA0004863 (Mirant, 2007). A septic tank is present south of the work sheds at the Subject Site. The main Site is serviced by a separate septic system consisting of a leach mound and former leach field.

3.4 CURRENT USES OF THE SUBJECT SITE

There are two asphalt paved parking areas and one unpaved parking area used by power plant personnel within the Subject Site. The areas also provide parking for the employees of PG&E. Several work sheds and storage trailers located east of the bulk fuel oil tanks 2 and 4 are used as offices for power plant staff and storage for documentation, painting equipment, and asbestos removal equipment. One hazardous waste storage shed and one non-hazardous waste storage shed are situated on raised platforms on a concrete pad are located east of the work sheds.

Portions of the Subject Site have a concrete pavement and some areas are not paved. A previous Phase I ESA conducted by CDM in 1997 designates this area the Insulation and Coatings Department Office and Construction Yard. A building, designated as Building 8 Storage and Fabrication, is used for various equipment, paint supplies, and insulation storage. The previous Phase I ESA also indicates that asbestos accumulation bins and a paint storage area were located in the yard; however, no asbestos accumulation bins or a paint storage shed were observed in the yard during URS' site reconnaissance. A shed located east of the former paint storage shed is used to store large piping sections. Accumulation bins for non-hazardous waste storage are located on the west side of the shed. The Tank Farm and associated piping and equipment are no longer in use.

3.5 PAST USES OF THE SITE

Based on a review of historical information for the Site, the Site was developed as a power plant in 1952-1953. Prior to 1952, the Site was undeveloped. The Tank Farm and associated piping and equipment were in service from 1952 until approximately 10 years ago, to fuel the power plant. During this time period a pipeline connecting the Contra Costa Power Plant and Pittsburg Power Plant (the Contra Costa/Pittsburg Pipeline) brought fuel oil to the Contra Costa Power Plant. The pipeline has been out of service since converting plant operation to natural gas. The status of the pipeline is updated with the National Pipeline Mapping System (NPMS). A portion of the Subject Site was designated as the Insulation and Coatings Department Office and Construction Yard, which was used for the storage of paints and paint supplies, accumulation of asbestos waste and removal equipment, and the storage of hazardous waste. The area formerly and presently contains, as observed during the site reconnaissance, an underground septic system, one hazardous waste storage unit, transformers, load center, storage and fabrication building, work sheds, a fire pump house and parking areas. This area was used as office space for power plant personnel and as a construction yard for various construction debris.

3.6 CURRENT AND PAST USES OF ADJOINING PROPERTIES

The area surrounding the Subject Site is currently and has historically been used mainly for industrial, light industrial and commercial purposes. The Subject Site was formerly and is presently used as an office and construction yard, hazardous waste and non-hazardous waste storage, and parking areas for the power plant adjacent to the Subject Site. The Subject Site contains ASTs 1 through 5. The property to the west, which is owned by Gaylord Container Company and is now vacant, was developed for industrial use. In addition, the Subject Site is surrounded to the east by the Contra Costa Power Plant (Site) and PG&E Switchyard. Prior to 1952, the surrounding properties were not developed.

3.7 PHYSICAL SETTING

The Site is situated at an approximate elevation of 10-feet above mean sea level (msl). According to information contained in the EDR database report, a portion of the Site near the San Joaquin River is located within the 100-year flood zone. The topographic gradient is to the northeast, towards San Joaquin River.

3.7.1 Geology

The Site is located in the San Joaquin River delta within the Coast Range physiographic province. Fill material and deltaic deposits are located at the Site. Although fill material, which is approximately six feet thick and consists mainly of silty sand from nearby sources, is located throughout the Site, a majority of the fill material is located at the northeastern portion of the Site. Beneath the silty sand is approximately 125- to 140-foot-thick aquifer comprised of fine to coarse-grained sand with lenses of clay silt and peat, which can range from one to 15 feet thick. The layer beneath this aquifer is called the Montezuma Formation, which is an approximately 1,200-foot layer of clay, sand, and gravel mixture.

According to a report from PG&E entitled *Hazardous Waste Part B Permit Application for Oily Water Separator and Boiler Wastewater System at the Contra Costa Power Plant*, dated May 1986, there is no evidence of any seismic activity within 3,000 feet of the Site. However, two faults, the Vaca and Antioch, are located between 1 and 25 miles from the Site.

3.7.2 Hydrogeology

The aquifer beneath the Site is composed of fine to coarse-grained sands and thin layers of clay silt and peat. The thin layers become thicker as they approach the northeastern portion of the Site and the San Joaquin River. The thin layers are less permeable, thereby causing perched water.

The depth to groundwater ranges from 6 to 10 feet below ground surface (bgs). The depths fluctuate with tidal influences from San Francisco Bay that affect water levels in the San Joaquin River as well as from seasonal forces. The direction of groundwater flow is north northwest towards the San Joaquin River according to several groundwater level measurements from the on site groundwater monitoring wells.

There are eight groundwater monitoring wells located north of the switchyard installed by Mittlehauser Corporation for PG&E in 1987. Four monitoring wells, Well 2 through Well 5, are located south of an asphalt paved road and south of Units 6 and 7 at the Site. Well 6a is located northeast of the former air preheater fireside wash pond, and Well 5a is located on the northeast corner of the construction yard. Wells 1 and 7 are located on the northeast side of the switchyard. PG&E is no longer required to monitor these wells. No monitoring wells were observed at the Subject Site.

There are no bodies of water within the Site; however the Power Plant facility uses the San Joaquin River for intake water and water discharges. There are ten outfalls located on the north end of the Site. The outfalls are all permitted under the NPDES permit #CA0004863.

4.0 RECORDS REVIEW

URS has reviewed federal, state, and local database records for the Site and surrounding properties. These records provide information on whether hazardous substances, wastes or petroleum products have been improperly handled, stored, or disposed of on, or adjacent to, the Site.

4.1 FEDERAL AND STATE REGULATORY AGENCY RECORDS REVIEW

The federal and state records review was accomplished through a computer database search of facilities, which appear on a series of government lists. The database search for the Site and surrounding properties was performed for URS by EDR. A copy of the regulatory agency database report, dated November 2, 2007, is included in Appendix C.

Through the database review, URS can identify and locate facilities based on information submitted to government environmental agencies. In some cases, the location information is misleading or incorrect. URS conducted a walkover of an area approximately one-eighth (1/8) mile in radius around the Site to identify and to locate facilities, such as gasoline stations and dry cleaners, which are suspected to utilize significant quantities of hazardous substances, wastes or petroleum products. In this way, URS is better able to establish the risk posed to the Site by surrounding properties. For the purposes of this Phase I ESA, only facilities that have been identified as release sites within 1/8 mile of the Site are discussed in this analysis. A summary of properties identified through the review is provided in Table 4.1.

The Site was listed on several of the databases including CERC-NFRAP, CORRACTS, RCRIS-TSD, RCRIS-LQG, ERNS, FTTS and Hist FTTS, FINDS, RAATS, CA WDS AST, Contra Costa County Site List, CHIMRS, HAZNET and EMI.

No surrounding release sites with a potential to impact the Site have been identified within 1/8 mile of the Site.

Unmapped Sites

Unmapped sites are sites that have been identified within the database report but not mapped because of inadequate or erroneous Geocode information. The EDR database report identified 29 unmapped sites. Of these, three are located within the power plant property and named PG&E or Contra Costa. Twelve of the referenced sites are located in the City of Antioch; however, not enough information was provided to give the exact location. The sites that could not be located are provided in the EDR report.

4.2 LOCAL REGULATORY AGENCY REVIEW

During the performance of an ESA, federal, state, and local regulatory agencies having jurisdiction over the Site are contacted to obtain the following information: the status of relevant environmental permits; whether there have been any notices of violations or other similar correspondence from such agencies; whether any corrective action or remediation is planned, is taking place, or has been completed at the Site; whether there have been any reported violations or complaints that the Site is not in compliance with environmental laws, regulations, or standards and whether the Site is under investigation for such noncompliance; whether the Site is listed on available regulatory databases; and whether there is other

pertinent documentation on file with such regulatory agencies regarding the Site or surrounding properties of concern. Regulatory agencies contacted and a summary of the information obtained from these agencies are provided below.

Table 4.1
Summary of Federal and State Regulatory Agency Records Review

Federal or State List	Does Site Appear on List?	Surrounding Area Search Radius *	Number of Sites Within Search Radius
The CERCLIS-No Further Remedial Action Planned (NFRAP) database identifies sites that have been removed from CERCLIS after an initial investigation because no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration.	Yes	Site and adjacent properties	2
Resource Conservation and Recovery Act (RCRA) Corrective Action Plan (CORRACTS) RCRA TSD facilities ordered to implement corrective actions	Yes	1.0 mile	1
Resource Conservation and Recovery Information System - Treatment, Storage or Disposal Facilities (RCRIS-TSD)	Yes	0.5 mile	1
RCRA Registered Large and Small Quantity Generators of Hazardous Waste (LQG/SQG)	Yes	Site and adjacent properties	1
Emergency Response Notification System (ERNS)	Yes	Site only	0
Tracks administrative cases and pesticide enforcement actions and compliance with FIFRA (FTTS and HIST FTTS)	Yes	0.25 mile	0
Facility index system/facility registry system contains both facility information and pointers to other sources of information (FINDS)	Yes	0.25 mile	0
RAATS	Yes	0.25 mile	0
State Water Board database of sites suspected of containing hazardous substances where cleanup has not been completed (Toxic Pits)	No	1.25 mile	2
Sites that have been issued waste discharge requirements (CA WDS)	Yes	0.25 mile	0
Waste Management Unit Database provided by the State Water Resources Control Board (SWRCB) that tracks and inventories waste management units. (WMUDS/SWAT)	No	0.75 mile	2
Hazardous Wastes & Substances Sites List (Cortese)	No	0.75 mile	6
Leaking Storage Tanks (LUST)	No	0.75 mile	5
California Spills, Leaks, Investigation and Cleanup Cost Recovery Listing (CA SLIC)	No	0.75 mile	3
State underground storage tank sites listing (UST)	No	0.5 mile	1
Sites with registered aboveground tanks (AST)	Yes	0.5 mile	1
Contra Costa County Site List	Yes	0.5 mile	9
California Hazardous Materials Incident Report System (CHMIRS)	Yes	Site only	0
State Voluntary Investigation and Cleanup Program list (VCP)	No	0.75 mile	3
Tracks hazardous waste manifests from facilities (HAZNET)	Yes	0.25 mile	0
Emission Inventory Index (EMI)	Yes	0.25 mile	0
DTSC database identifies sites that have known contamination or sites for which there may be reasons to investigate further (Envirostor)	No	1.25 mile	6
* indicates the distance measured from the Site that was included in the database record search			

- **U.S. EPA Region 9** was contacted on November 5, 2007 regarding files for the Site. There were no files for the Site. However, there were four NPDES permit effluent violations between July 2005 and June 2007 for the main power plant. Three were resolved. The remaining one, which occurred between April and June 2007, has not yet been resolved. No formal enforcement action has been issued.

- **Cal-EPA Department of Toxic Substances Control (DTSC)** was contacted on November 5, 2007 regarding files for the Site. There are no records on file for Contra Costa Power Plant.

- **Cal-EPA Regional Water Quality Control Board-Central Valley and Bay Area Regions** were contacted on November 5, 2007 regarding a request to search public records for the Site. The boards replied to the request and indicated no records for the Site are on file with the RWQCB.

- **State Regional Water Quality Control Board Geotracker** database was searched on November 5, 2007 regarding public records for the Site. No documentation for the Site was located on Geotracker.

- **Contra Costa County Hazardous Materials Program** was contacted November 5, 2007 regarding a request to search public records for the Site. Files were available for the Site. The files included hazardous materials manifests, Hazardous Materials Business Plans, correspondence between the Power Plant and the County; underground storage tanks closures and lab results.

  - The Contra Costa Power Plant is under a permit by rule for a fixed treatment unit, which treats oily water through an oil water separator and then discharges the treated water through outfalls located at the power plant. The power plant's EPA ID number is CAT080011489. The authorization date is December 13, 1993.

  - A Certificate of Insurance for Closure/Post Closure for the Contra Costa Power Plant's Hazardous waste facility was on file. The effective date of closure/post closure was April 2, 2006.

  - Tiered Permitting Phase I Environmental Assessment Checklist signature and certification for permit by rule and conditional authorization form was signed by Gregory S. Keezer, the Plant Manager for PG&E at Contra Costa Power Plant and Craig R. Fletcher, an environmental engineer, and dated December 19, 1996.

  - An Onsite Hazardous Waste Treatment Notification Form was submitted to the DTSC for the PG&E Contra Costa Power Plant for performing the demineralization of water dated March 17, 1995.

- **Contra Costa County Fire Protection District** was contacted November 5, 2007 regarding a request to search the public records for the Site. The Fire Department indicated they do not have any records available for review.

- **Bay Area Air Quality Management District (BAAQMD)** was contacted regarding a request to search the public records for air permits for tenants at the subject Site. Asbestos was removed from the Site and the power plant Units by Performance Abatement Services, Inc., of Richmond, California from June 2000 through October 2007. The following two violations were recorded for the main power plant area:
  - A Notice of violation was issued by BAAQMD April 24, 1992 for Boiler #9.
  - A second violation for a faulty flow valve CO2 monitor at Boiler #9 East was issued July 23, 1992. The valve and boiler were corrected in October 1992.

4.3 HISTORICAL USE INFORMATION

4.3.1 Aerial Photograph Review

Aerial photographs of the Site and vicinity were reviewed, and are discussed below.

1952 A power plant facility appears to be under construction at the Site. Observed on the Site are five bulk ASTs, a switchyard, power generation units, a parking area and what appear to be small office buildings located to the east of the ASTs and north of the power generation units. The power generation units appear to have several stacks. To the south of the Site is Wilbur Avenue. Further south on the Site there appears to be undeveloped land and tree groves south of the rail line, which borders the Site. To the north are the San Joaquin River and a pier extending out into the Bay from the power generation units. To the south there appears to be farmland and some undeveloped areas. East of the Site is undeveloped land. Northeast of the Site there appears to be a marina and undeveloped land. West of the Site there appears to be an industrial facility with several large piles of sand or fill material. More tree groves appear to the southwest.

1958 The power plant at the Site appears to be completed. The Site vicinity appears unchanged.

1965 Only the Site and an area to the south are visible on this aerial photograph. There appear to be additional small buildings to the north of the power generation units. Additional power generation units appear to the east of the original units, including one stack. Another section has been added to the switchyard. Another pier appears to the west of the old pier. The parking area, which was located just south of the original power generation units, has been moved further to the south. The land to the south appears to be developed with tree groves.

1970 The Site appears to have a square pond located south of the power generation unit. It is assumed that this is the former Boiler Chemical Cleaning Wash Pond. A commercial facility appears to the southwest of the Site.

1984 Three larger bulk ASTs and one small AST appear at the Site to the south and southeast of the original ASTs. An area to the south of the switchyard appears to be under construction. The property to the west appears to have several new developments, which include several ASTs, ponds, storage areas and buildings. An AST appears to the south of the adjacent property to the west, across Wilbur Avenue. The area approximately 1/3 mile to the south and southwest appears to be developed with residences. A highway appears to the southeast and east. Commercial developments and areas that appear to be under construction are observed to the east.

1993 No significant changes are observed to the Site. No significant changes are observed to the site vicinity except for additional residences to the southeast.

1998 No significant changes are observed to the Site. No significant changes are observed to the site vicinity.

No additional information was revealed during review of the aerial photos provided by EDR.

4.3.2 Historical Sanborn Map Review

URS contracted with EDR to conduct a search of their collection of Sanborn Fire Insurance Rate Maps for coverage including the Site. Sanborn Fire Insurance Rate Maps were not available for the Site.

4.3.3 Historic City Directories

URS requested EDR search their database for historical city directories. The following information was obtained from the directory.

Year	Site	Surrounding Properties
1971 – 1996	Address Not Listed	No Addresses Listed
2001	Mirant Corporation	Sportsmen Yacht Club (3301 Wilbur Avenue) Residence (3305 Wilbur Avenue) Logan's Bait and Tackle and Gift Shop (3307 Wilbur Avenue)
2006	Mirant Corporation	Same as above

4.3.4 Historical Topographic Maps

Topographic maps for the Site and the surrounding properties provided by EDR were reviewed. A summary of the historical topographic maps is presented below for the years 1908, 1918, 1953, 1968, and 1978.

1908 The Site is undeveloped. The San Joaquin River borders the Site to the north and north-northwest. Wilbur Avenue and the Atchison, Topeka and Santa Fe Railway appear to the south. Two cemeteries appear further to the south. An unpaved/unfinished road and marshland appear to the east of the Site. The City of Antioch, located to the west and south of the Site, is developed.

1918 The Site, adjacent properties, and the site vicinity appear relatively unchanged from the 1908 topographic map. However, the name Marsh Landing does appear to the east of the Site near the end of the unpaved/unfinished road.

1953 The Site is now developed with five ASTs bordered by large berms, a large structure northeast of the ASTs, several paved roads, several power lines which enter the site from the south, and rail line spurs that enter the Site from the south from the Atchison, Topeka and Santa Fe rail line. The area to the west of the Site appears to be developed with three structures. Further west there are a tower and a sand pit. Several small structures appear to the east of the Site. There are several small structures that appear to be residences to the southwest of the Site. Tree groves appear to the east, southeast, and southwest.

1968 New structures appear around the original structure at the Site. Several new structures appear on the adjacent property to the west. Two marinas appear to the east of the Site. Two piers appear at the northern Site boundary near the original structure. A drive in theater appears to the southeast adjacent to a trailer park and surrounded by tree groves.

1978 A water tank appears on the Site to the northwest and a new large structure appears to the east of the original structure. Three larger bulk ASTs appear to the south of the original five ASTs, and a smaller AST appears to the east of the bulk ASTs. A picnic area has been designated to the northeast of the new structure at the Site. Additional ASTs and water tanks appear to the west of the Site on the adjacent property. Additional rail lines and rail spurs also appear to the west of the Site. There appears to be five industrial ponds to the west. Two large structures appear to the south of the rail lines southwest of the Site. East Antioch has been developed and appears to be a residential area. Route 160 has been developed and runs between the drive in theater and the trailer park. The Site vicinity has developed into a mixture of industrial, commercial and residential areas. Many of the tree groves that appeared in the previous topographic maps have diminished in size.

4.3.5 History of Site Use

A review of aerial photographs, historical topographic maps, previous environmental investigations and interviews with individuals knowledgeable with the Site indicate the Site has been used as a power plant from 1952 to the present time.

5.0 INFORMATION FROM SUBJECT SITE RECONNAISSANCE AND INTERVIEWS

5.1 INTERVIEWS

Ms. Katherine Brady and Mr. Erik Skov (URS) conducted a reconnaissance of the Site, Subject Site and vicinity on November 29, 2007. As indicated previously, Mr. Chuck Hicklin, of Mirant, accompanied Ms. Brady and Mr. Skov during the site reconnaissance. Mr. Hicklin has been working for Mirant for approximately eight years. Weather conditions at the time of the reconnaissance were partly cloudy skies, with no weather-induced limitations to URS' site reconnaissance.

5.2 HAZARDOUS SUBSTANCES AND WASTES IN CONNECTION WITH IDENTIFIED USES

Hazardous substances in the form of diesel fuel, Number 6 fuel oil, lead paints, latex and enamel paints and asbestos are present at the Subject Site. Number 6 fuel oil is contained in the ASTs at the Tank Farm. Asbestos may be present in the buildings and is documented to be present in insulation for above ground piping from the Tank Farm. Lead paints may be present in the storage buildings and painted surfaces located in the construction yard at the Site. Latex and enamel paints as well as paint waste are located in the storage buildings.

5.3 HAZARDOUS SUBSTANCE CONTAINERS AND UNIDENTIFIED SUBSTANCE CONTAINERS

As indicated above, URS observed containers containing hazardous substances, which included enamel paint, latex paint and waste latex paint in storage areas at the Subject Site. However, no unidentified containers of potentially hazardous materials were observed. Also Hazardous Materials and Hazardous Waste enclosures were observed at Subject Site. However, no staining or indication of a release was observed. As indicated previously, staining was observed at the fuel oil processing units adjacent to each of the ASTs by CDM during their Phase I ESA. Additionally some dried paint was observed on the concrete pad near the location of the fire pump house.

5.4 STORAGE TANKS

5.4.1 Underground Storage Tanks

URS observed evidence of one operating underground septic tank during reconnaissance of the Subject Site. Four manholes to the septic tank are located adjacent to the concrete pad mounted #8 load center located on the east side of the work sheds. The area above the tank is unpaved.

5.4.2 Aboveground Storage Tanks

ASTs 1 through 5 are present along the western side of the Subject Site. The ASTs are constructed of steel situated on a concrete foundation and have individual concrete lined secondary containment berms. The area around the tank between the concrete pad and the berm is not paved. According to the Hazardous Materials Business Plan dated February 2007 for the Site, the bulk storage ASTs 1 through 8

currently contain a combined amount of approximately 7,229,500 gallons of Number 6 fuel oil; however, according to site personnel the ASTs currently contain approximately 2.2 million gallons (Welch, 2008). The ASTs have been out of use for approximately 10 years. The Phase I ESA conducted by CDM states that only ASTs 2 and 6 contain substantial amounts of fuel oil. The remaining ASTs have less than 1.5 feet of fuel oil. Fuel oil has been removed from the ASTs since the Phase I ESA was conducted by CDM in 1997. The remaining amount of fuel oil will be removed prior to proposed demolition of the ASTs and associated piping.

During the site reconnaissance, no visible staining was observed around the base of the ASTs located at the Subject Site. As indicated previously, staining was observed at the fuel oil processing units adjacent to each of the ASTs by CDM during their Phase I ESA. Any surface drainage within the secondary containment for each of the ASTs flows to a catch basin, which is directed to an oil water separator system at the northwest corner of the power plant. Once the water is treated it is discharged via outfall .001 in the northwest corner of the facility. The integrity of the concrete foundation beneath each of the ASTs was not inspected and the area between the ASTs and the berms is not paved.

5.5 POLYCHLORINATED BIPHENYLS (PCBs)

According to CDM's Phase I ESA, no electrical equipment with a concentration of PCBs greater than 50 parts per million is present at the Site based upon PG&E's annual documentation.

Main bank transformers are located south of the retired power plant units 1 through 5. According to CDM's Phase I ESA report dated October 1997, underground transfer lines were used for removing dielectric fluid from the main bank transformers. Plant personnel could not verify that the lines have been tested. Although available test results indicate low concentrations of PCBs in the dielectric fluid for the main bank transformers, the fluids were not tested prior to 1975. The integrity of the underground lines is not known, however, it is possible that the soil and groundwater may be impacted with PCBs.

5.6 INDICATION OF SOLID WASTE DISPOSAL

Office packing, and food waste are collected and disposed of off site.

5.6.1 Process Materials and Wastes

Based on observations made during the Site reconnaissance, there are no process wastes generated at the Subject Site. Two non-hazardous waste dumpsters are located south of the storage shed.

5.6.2 Site Waste Containment or Deposits

URS observed no evidence of dumping or burying of solid or hazardous wastes on the Subject Site.

5.7 OTHER ENVIRONMENTAL CONSTRAINTS

5.7.1 Drains and Sumps

Stormwater drains were observed at the base of the berms surrounding the ASTs in the Tank Farm area and in the construction yard at the Subject Site. No staining, odors, or sheen were observed around any of the drains.

5.7.2 Evidence of Cesspools

URS observed no evidence of cesspools. One septic tank was observed at the Subject Site just south of the work sheds. Sanitary waste is pumped from the tank after accumulation.

5.7.3 Stressed Vegetation and Stained Soils

URS observed no evidence of discolored soil, stressed vegetation or other indications of contamination on or adjacent to the Subject Site at the time of Site reconnaissance.

5.7.4 Wells

URS observed no evidence of the presence of wells during reconnaissance of the Subject Site. Several groundwater monitoring wells are reportedly present on the Site to the east of the Subject Site, in the area of the former leach mound and leach field.

5.7.5 Oil and Gas Wells

No oil or gas wells were observed in the vicinity of the Subject Site during the reconnaissance of the Subject Site and surrounding area.

5.7.6 Potential Wetlands Issues

According to the information provided by EDR, obtained from the United States Fish and Wildlife Service, National Wetland Inventory Map, there are no wetlands present at the Subject Site.

5.7.7 Flood Zone

According to the information provided by EDR, the Subject Site is not located within a mapped flood zone. Other portions of the Site are located within the 100-year flood zone.

5.8 ASBESTOS-CONTAINING MATERIALS (ACM)

According to Mr. Hicklin, ACM is located throughout the Site and Subject Site on piping and buildings. Within the Subject Site asbestos pipe wrapping is present on the fuel oil distribution lines. Personnel at the Site are aware of the ACM and handle it according to safe work practices. If ACM is encountered during equipment repair or maintenance, the ACM is removed from the Site. During the reconnaissance of the Subject Site, no friable or damaged ACM was observed. The ACM is proposed for removal during the proposed demolition of the Subject Site buildings and ASTs and associated conveyance piping.

The Phase I ESA conducted by CDM in 1997 for the power plant indicated that asbestos accumulation bins were in the construction yard. These bins were not observed during URS' Site reconnaissance conducted on November 29, 2007. Instead, non-hazardous construction debris including insulation materials was observed in two bins near the former paint storage area.

5.9 RADON

URS reviewed the Area Radon Information for Contra Costa County, California provided by EDR. According to the information presented in the EDR report, the EPA Radon Zone for this Zip Code in the County of Contra Costa is 2: indoor air average >= 2 picoCuries per liter (pCi/L) and <=4 pCi/L of air.

5.10 LEAD-BASED PAINT (LBP)

The painted surfaces on buildings and equipment at the Subject Site may contain LBP. The LBP, if required, will be abated during the proposed demolition of the Subject Site buildings and ASTs.

6.0 PREVIOUS REPORTS

URS reviewed reports prepared by PG&E and reports prepared for PG&E by CDM and Fluor Daniel GTI. These reports are on file with Mirant and the Contra Costa County Hazardous Materials Program. A summary of the findings from review of these reports is provided below.

6.1.1 1997 Phase I ESA Prepared by Camp Dresser and McKee (CDM)

A Phase I ESA, dated October 1997, was prepared by CDM at the request of PG&E for the entire property of the Contra Costa Power Plant, as configured in 1997. The findings and conclusions of the CDM Phase I ESA are summarized below.

A majority of the site is underlain with approximately six feet of artificial fill from nearby sources or on the power plant property (Mittelhauser 1987). Soil sample analytical results regarding the artificial fill were not available.

Oily sludge was observed in the oil water collection sump at the southwest corner of the switchyard near the fuel tank farm. The integrity of the sump is not known and, therefore, the sump may potentially impact the surrounding soil and/or groundwater.

CDM documented that persons familiar with the site knew of two OCB explosions in the switchyard that happened in 1976 and 1979 to 1981. Dielectric fluid potentially containing PCBs may have impacted the surrounding soil during these incidences.

Natural gas condensate flooded the gas regulation station approximately 25 years ago. Information was not available from PG&E regarding the incident. Hydrocarbon stained concrete was observed during the site reconnaissance. Based upon the release, the soil in the area may be impacted by natural gas condensate.

Soil staining was observed in the various hazardous materials storage areas throughout the power plant. The hazardous materials may impact the surrounding soil.

Site personnel indicated that the former paint department was located in the unpaved area near the Quonset hut on the northeast portion of the power plant. Paint brushes were cleaned routinely in this area. Based on this information the soil may be impacted.

Paint pots were washed in the unpaved area near the traveling screens for Units 6 and 7. Soil and/or groundwater may be impacted in this area.

The integrity of the power plant's drainage system is not known. The drainage from the cleaning of various mechanical parts was discharged into the system. Therefore, soil and or groundwater may be impacted from this activity.

Staining was observed around the cardboard compactor. Soil may be impacted in this area.

The main bank transformers located at the Units leaked dielectric fluid into the rock blotter. The dielectric fluid may have formerly contained PCBs. Former concrete basins collected storm water runoff from the rock blotters. The exact location of these basins and underground piping from the rock blotters was not identified and the integrity is unknown. Site personnel could not verify that the integrity of the underground piping has been tested. Therefore, soil and/or groundwater may be impacted in this area.

According to PG&E Hazardous Waste Storage Ponds Closure Plan prepared by Mittelhauser October 10, 1985, an analysis of boiler fireside and air preheater wastes indicate the presence of total chromium, copper fluoride and lead. PG&E removed the solid wastes and placed it as fill material along the northern portion of the property. The solid waste may contain waste oil. Therefore, soil and/or groundwater may be impacted in this area.

Wash water from boiler components was discharged into an oil/water separator or collecting pit. Integrity of the piping, which discharges the wash water into the separator and pit, is not known. Therefore, soil and/or groundwater may be impacted.

No information was available regarding the closures of the north and south lagoons for demineralizer wastes and oil/water treatment system. Therefore, soil and/or groundwater may be impacted in these areas.

Soil sampling for laboratory wastes was proposed in and around the leach mound located south of Units 4 and 5. No soil sampling was conducted and no information was available from PG&E or regulatory agencies. Therefore, soil and/or groundwater may be impacted in this area.

The leach mound replaced the leach field, which was formerly located adjacent to the leach mound prior to 1984. Laboratory wastes were also received here. No soil sampling was conducted and no information regarding the field was available. Therefore, soil and/or groundwater may be impacted in this area.

Hazardous substances may be contained in construction debris near the marine terminal on unpaved areas. The construction debris included sandblasting material, asphalt, concrete, soil and wood. Therefore, soil and/or groundwater may be impacted.

Soil piles from construction activities that were placed between the switchyard and construction yard were analyzed for total petroleum hydrocarbons as diesel fuel, motor oil and PCBs. PCBs were not detected. TPH as diesel fuel was detected at 132 ppm and motor oil was detected at 190 ppm. Soil and/or groundwater may be impacted in this area.

Oily sludge was observed within the oil/water collection sumps located at Units 1 through 5. Staining was also observed around the sumps. The integrity of the sumps is unknown and, therefore, soil and/or groundwater may be impacted in these areas.

6.1.2 1998 Phase II Environmental Site assessment, Pacific Gas and Electric Company, Contra Costa Power Plant

As part of the divestiture of the Contra Costa Power Plant, PG&E proposed to indemnify the plant buyer for all soil or groundwater contamination existing at the plant at the time of the sale under the terms set fort in PG&E's application to the California Public Utility Commission (CPUC). As indicated previously, CDM prepared a Phase I ESA for the CCPP in 1997. Based on these results and other information, Fluor Daniel GTI designed and implemented a Phase II site investigation of the power plant as it was configured in 1998.

The purpose and objectives of the investigation and reporting were to:

- Conduct subsurface testing to investigate issues identified in CDM's Phase I ESA and establish a baseline definition of chemical distribution.
- Present, summarize, and evaluate data collected during the subsurface investigation to determine the nature and extent of any impact on soil and groundwater.
- Conduct and present the results of a baseline health risk assessment (BHRA).
- Establish cleanup levels for chemicals which, based on the BHRA and regulatory requirements, are likely to require remediation.
- Develop an approach to any required remediation and estimate the costs.

For the Phase II Fluor Daniel GTI established a biased grid for soil and groundwater sampling to provide the necessary data to achieve the stated objectives. A soil and groundwater was prepared and the Site was divided into six different investigation areas as follows:

- Area 1: Process Treatment Area and Waste Surface Impoundments.
- Area 2: Operation Warehousing and Construction Yard.
- Area 3: Power Plant Units 1 through 7.
- Area 4: Tank Farm and Impounding Basins.
- Area 5: Paint Yard, Leach Mound and Former Impoundments.
- Area 6: Raw Water Clarifier Sludge, San Storage, and Employee Recreation Pacific Service Employee Association [PSEA]) areas.

Subsurface sampling and testing was conducted between September and December 1997 and included the following:

- Drilling 343 soil borings, including hand auger borings.
- Collection and analysis of 878 soil samples and 2 soil pile composite samples.
- Installation of 69 temporary groundwater monitoring wells.
- Installation of 7 permanent groundwater monitoring wells.
- Collection and analysis of 29 groundwater samples from the 7 newly installed wells, 11 existing permanent monitoring wells, and 4 existing sump wells.

Surrounding Properties

The Gaylord Corporation occupied the property adjacent to the power plant to the west. Tank 7 at the site was formerly used to store black liquor, a by-product of pulp production consisting of wood material in a sodium sulfide and hydroxide solution. An unreported amount of black liquor was released near the Fuel Tank Farm at the Site near Tanks 5 and 6 in the mid-1980s from the pipeline leading from Tank 7 to the Gaylord Property. Therefore, soil and/or groundwater may be impacted in this area and affect the site on the Fuel Tank Farm.

Results of Soil Sampling and Analysis

A summary of the results from the Phase II site investigation is presented below.

- Volatile Organic Compounds (VOCs) – Methylene chloride was detected at very low concentrations that were interpreted to be laboratory contamination. Four other VOCs were detected at low concentrations. Methylene chloride was however, the VOC detected at the highest concentration (0.04 milligrams per kilogram [mg/kg]).
- Concentrations of Total Petroleum Hydrocarbons (TPH) greater than 300 mg/kg were detected in several areas across the Site. The highest concentration detected was 1,300 mg/kg.
- Concentrations of Polynuclear Aromatic Hydrocarbons (PAHs) were detected in several areas and were believed to be associated with the detections of TPH in the same location. The highest concentration of total PAHs detected was 56.72 mg/kg.
- Concentrations of metals above the calculated background were found in all of the areas analyzed for metals. Of particular note was the concentration of several metals in subsurface soil samples in the Raw Water Clarifier Sludge Storage Area.
- Polychlorinated Biphenyl (PCBs) were detected in two areas of the site. Aroclor 1260 was the highest PCB concentration (0.036 mg/kg) detected.
- Asbestos was not detected in any of the samples analyzed.

Results of Groundwater Sampling and Analysis

- VOCs were detected in groundwater at low concentrations in two areas. The highest VOC detection was naphthalene at a concentration of 190 micrograms per liter (μg/L).

- The highest concentration of TPH detected in groundwater was 14 milligrams per liter (mg/L). TPH in groundwater was typically detected in the vicinity of the Area 2 leach mound, the foot of the marine dock, and at other scattered locations.

- PAHs were detected in three areas. The highest individual PAH concentration detected was naphthalene at 56 μg/L.

- A total of 11 metals at varying concentrations were detected in groundwater from different areas across the Site.

- No PCBs were detected in any of the groundwater samples analyzed.

Health Risk Assessment

Based on the results of the soil and groundwater sampling, Fluor Daniel GTI completed a Baseline Health Risk Assessment (BHRA) to determine if concentrations of chemicals detected in soil and groundwater presented an unacceptable risk to human health and the environment. Health risks were calculated for three receptor populations that included the following:

- Current and future on-site workers
- Current and future construction worker
- Current groundskeeper in the PSEA recreation area.

Based on the results of the BHRA, no unacceptable risks to the three human receptor populations were identified. Additionally, based on fate and transport modeling, no chemicals that would cause an unacceptable risk to ecological receptors at the San Joaquin River via groundwater flow were identified.

The data from the Phase II soil and groundwater investigation was used for comparison with cleanup levels that were determined in the review of regulatory requirements. The following three issues were identified as ones where a regulatory agency would likely require remediation.

- Remedial Issue I addresses the remediation of arsenic in groundwater at locations where concentrations exceed the Maximum Contaminant Level (MCL).

- Remedial Issue II addresses remediation of TPH in soil where concentrations exceed 300 mg/kg.

- Remedial Issue III addresses remediation of TPH in groundwater where concentrations exceed 100 μg/L.

The Subject Site that is proposed for the new power plant development is comprised of portions of Areas 4 and 5 discussed in the Fluor Daniel GTI Phase II. Based on the information in the Fluor Daniel GTI Phase II investigation report, there are several places within Areas 4 and 5 that are identified as being Remedial Issues. These locations are shown on Figure 3. Additionally, Fluor Daniel GTI also identified areas of future environmental concerns outside those identified in the Phase II investigation that would be recognized after a "triggering event" (e.g. demolition onsite). Specifically, Fluor Daniel GTI identified a potential for impact to soil and groundwater that may exist beneath the petroleum ASTs in Area 4.

7.0 SUMMARY AND CONCLUSIONS

URS has performed a Phase I ESA in conformance with the scope and limitations of ASTM Practice 1527 of the Site located at 3201 Wilbur Avenue, in unincorporated Contra Costa County, California, adjacent to the City of Antioch. Any exceptions to, or deletions from, this practice are described in Section 2.3 of this report.

This assessment has revealed the presence of several RECs at the Subject Site.

The Fuel Tank Farm, which includes ATSs 1 through 5, is located on the west and south end of the Site. The tanks have not been used for approximately 10 years. The power plant has been using natural gas to generate power. Approximately 2.2 million gallons of Number 6 fuel oil remain in the tanks, according to site personnel (Welch, 2008). The structural integrity of the tanks and the concrete pad beneath them is unknown. The areas around the tanks are unpaved. Staining was observed at the fuel oil processing units adjacent to each of the tanks. According to CDM's Phase I ESA report, Tank 7 was formerly used to store black liquor for the Gaylord property adjacent to the west. A pipeline from Tank 7 at the Site led to a shed on the Gaylord property boundary. The exact location of the pipeline is not known. A release of black liquor occurred near Tanks 5 and 6 in the mid-1980s from the pipeline leading from Tank 7 to the Gaylord property. CDM reported no releases or staining around the base of Tanks 6 through 8; however, no documentation is available on the integrity of the foundation pads beneath the tanks. Based on the limited information regarding tank foundation integrity, the Fuel Tank Farm presents a REC.

According to a drawing from the previous Phase I ESA prepared by CDM, a paint storage area was formerly located north of the former asbestos accumulation bins and south of the work sheds and underground septic tank at the Subject Site. Information regarding the paint storage area was not available. Based on this information, the former paint storage shed presents a REC.

A concrete pad is located just south of the access road and west of the small firehouse and hazardous waste storage shed. Both the house and the shed have been placed on the concrete pad. Dried paint was observed on the western portion of the concrete pad. Stormwater runoff from the concrete following paint activities may impact the soil and/or groundwater. Based on this information, the paint from the concrete pad presents a REC.

Construction debris piles were formerly located at the Subject Site. According to the Phase I ESA report prepared by CDM in 1997, TPH was detected at 332 ppm in the piles. Soil and/or groundwater may be impacted in this area. Based on this information, the former construction debris piles present a REC.

Based on the information in the Fluor Daniel GTI Phase II investigation report, there are several places within the Subject Site that are identified as having "Remedial Issues". These locations are shown on Figure 3. Additionally, Fluor Daniel GTI also identified areas of future environmental concerns outside those identified in the Phase II investigation that would be recognized after a "triggering event" (e.g., demolition onsite). Specifically, Fluor Daniel GTI identified a potential for impact to soil and groundwater that may exist beneath the petroleum AST foundations in Area 4. Based on this information,

the areas listed as having "Remedial Issues" and the subsurface of the AST foundations represent a REC at the Subject Site.

Offsite Sources of Potential Impact

The adjacent property to the west, the former Gaylord Corporation, had a release of black liquor in the mid-1980s, according to a Phase I ESA prepared by CDM dated October 1997. No information regarding the sampling of the soil and groundwater or information regarding the cleanup was available. CDM reported that the release was near the Fuel Tank Farm at Tanks 5 and 6. Based on this information, the Gaylord Corporation property presents an offsite REC.

The leach mound and former leach field at the Contra Costa Power Plant are located to the east of the Subject Site. According to CDM's Phase I ESA, laboratory wastes were discharged to the former leach field and in-use leach mound. The Phase I ESA also indicates that groundwater flow is to the north-northwest. Any hazardous substances impacting the groundwater may impact the groundwater at the Site. Soil and groundwater sampling were not conducted in these areas. Based on the groundwater flow direction, the leach field and leach mound present offsite RECs.

The PG&E Switchyard is located south of the Subject Site. CDM documented that persons familiar with the Site knew of two OCB explosions in the switchyard that happened in 1976 and 1979 to 1981. Dielectric fluid potentially containing PCBs may have impacted the surrounding soil during these incidences. Due to shallow groundwater ranging from 6 to 10 feet bgs, the groundwater may have been impacted. Groundwater flow is to the north-northwest. The dielectric fluid potentially containing PCBs may impact the groundwater at the Subject Site. Based on this information, the PG&E Switchyard is considered an offsite REC.

7.1 RECOMMENDATIONS

URS recommends soil sampling be conducted beneath the AST foundations after tank demolition at various locations around the Tank Farm at the Subject Site to assess potential releases of Number 6 fuel oil from the tanks and associated piping.

Areas identified in the Fluor Daniel GTI Phase II report as areas having "Remedial Issues" should be appropriately addressed prior to site construction or grading activities.

URS recommends soil sampling be conducted at the locations of the former paint storage shed and construction debris pile to assess potential impact to soil in these areas.

Asbestos is located throughout the Subject Site. Based on information provided to URS, asbestos is present in the insulating materials on the conveyance piping at the Fuel Tank Farm, and possibly on the roofing materials on the storage buildings and work sheds at the Subject Site. URS recommends sampling and abatement of any asbestos prior to undertaking any demolition activities.

Painted surfaces at the Subject Site, which include the Fuel Tank Farm, and work and storage sheds, may contain lead. URS recommends testing of the paint for lead and removal of any LBP that is required under local, state, and Federal regulations prior to demolition.

An in-use septic tank was observed at the Subject Site adjacent to a circuit breaker unit south of the work sheds. URS recommends removal of the septic tank prior to redevelopment of the Subject Site provided an alternative system to handle these wastes is installed or a hook up to the city sanitary system is made possible.

8.0 REFERENCES

American Society for Testing and Materials (ASTM) 2000, "Standard Practice for Environmental Site Assessments": Phase I Environmental Site Assessment Process," ASTM Designation E1527.

Camp Dresser and McKee, (CDM) 1997. Phase I Environmental Site Assessment, Contra Costa Power Plant, Antioch, California. October 1997.

Environmental Data Resources Inc., (EDR) 2007. The EDR Radius Map with GeoCheck, Inquiry Number 2069156.2s. November 2, 2007.

Environmental Data Resources Inc., (EDR) 2007. The EDR Radius Map with GeoCheck, Inquiry Number 2069156.2s. November 2, 2007.

Fluor Daniel GTI, (Fluor Daniel GTI) 1998. Phase II Environmental Site Assessment, Pacific Gas and Electric Company, Contra Costa Power Plant, Antioch, California.

Mirant, 2007. Storm Water Management Plan, Contra Costa Power Plant. November 30.

PG&E, 2007. Hazardous Materials Business Plan, Contra Costa Switchyard, Antioch, California. March 2007

Welch, Doug, 2008. Personal communication. February 29.

Source:
USGS Topographic Maps, 7.5 Minute Series:
Antioch North, California, 1978
Antioch South, California, 1980
Jersey Island, California, 1978
Brentwood, California, 1978

0 2000 4000
Scale in Feet
1:24,000

N

* The PG&E Switchyard and PG&E Gateway Project are not part of the Mirant Property.

PROJECT LOCATION MAP

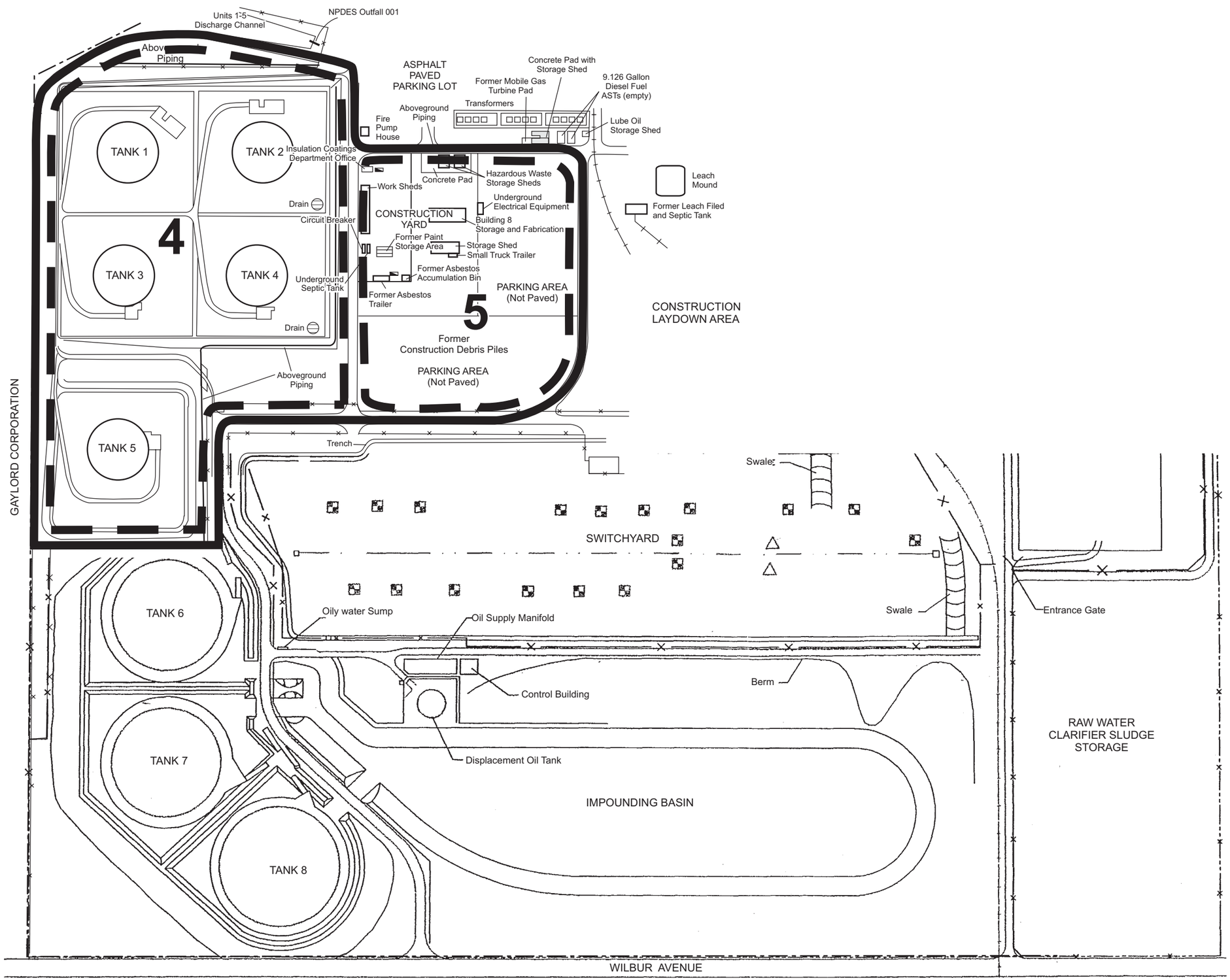
Marsh Landing Generating Station
Mirant Marsh Landing, LLC
Contra Costa County, California

May 2008
28067344

URS

FIGURE 1

5/23/08 vsa ..T:\Mirant Contra Costa\Graphics\Phase I Investigation\Fig 1_Phase 1proj loc map.cdr



LEGEND

- Building Footprint
- Property Line
- Fence Line
- Railroad Track
- Hazardous Waste Accumulation Area and Emergency Equipment
- Oil Circuit Breaker
- Transformer
- Subject Site Boundary
- Investigation Boundary Area From Fluor Daniel GTI Phase II

Note: Investigation Boundary Areas are for the Subject Site only. Original Boundary Areas extend further onto site.

N

0 350

Approximate Scale in feet

Source: Camp Dresser & McKee, 1998.

SUBJECT SITE PLAN

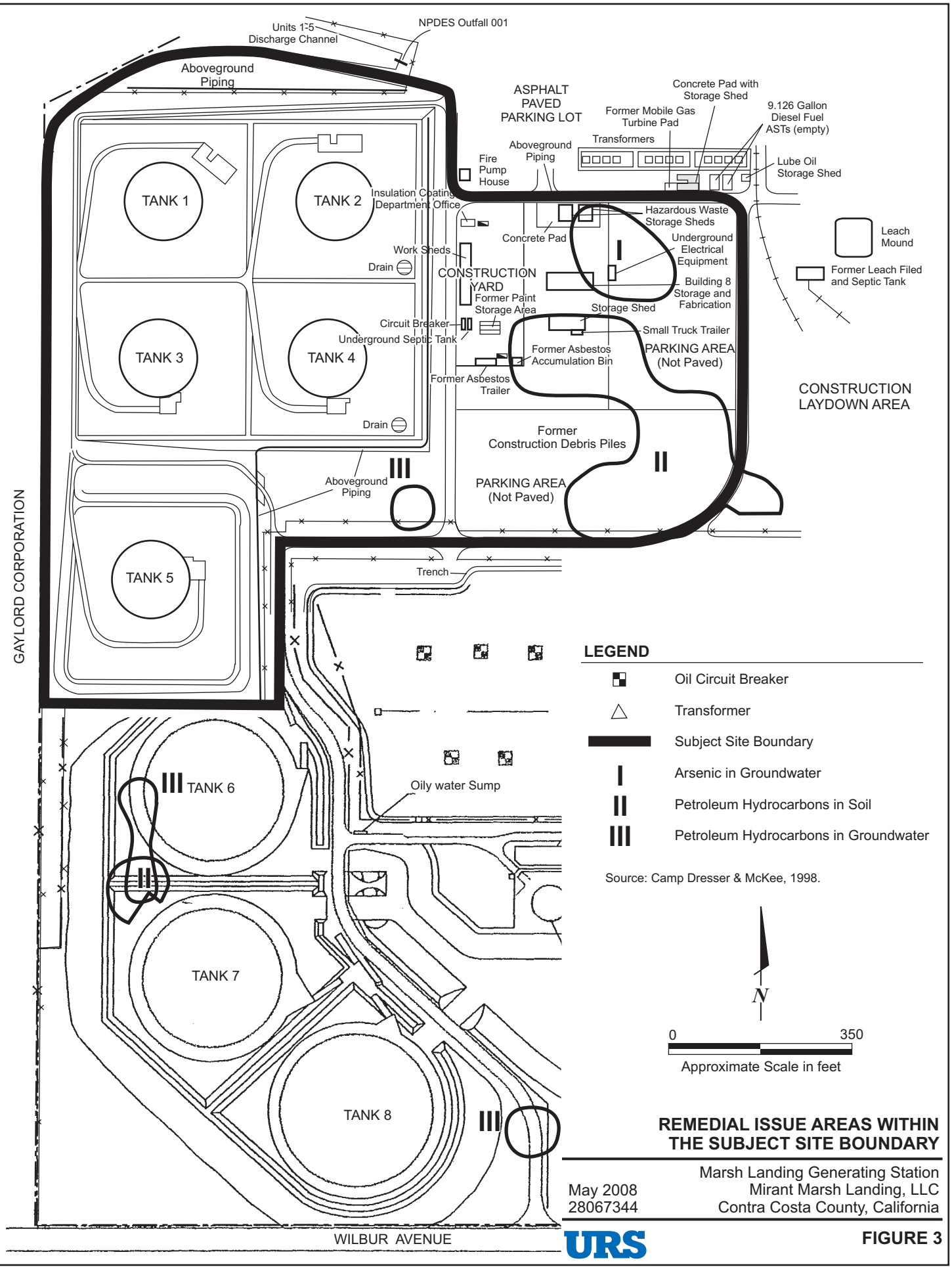
May 2008
28067344

Marsh Landing Generating Station
Mirant Marsh Landing, LLC
Contra Costa County, California

URS

FIGURE 2

5/12/08 vsa/hk ..T:\Mirant Contra Costa\Graphics\Phase I Investigation\F2_planlayout_may08.cdr



REMEDIAL ISSUE AREAS WITHIN THE SUBJECT SITE BOUNDARY

May 2008
28067344

Marsh Landing Generating Station
Mirant Marsh Landing, LLC
Contra Costa County, California

URS

FIGURE 3

5/5/08 vsa/hk ..T:\Mirant Contra Costa\Graphics\Phase I Investigation\F3_remedial_may08.cdr

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA
1516 NINTH STREET, SACRAMENTO, CA 95814
1-800-822-6228 – WWW.ENERGY.CA.GOV

APPLICATION FOR CERTIFICATION FOR THE *MARSH LANDING GENERATING STATION*	***DOCKET NO. 08-AFC-3*** **PROOF OF SERVICE** **(REVISED 12/15/2008)**

INSTRUCTIONS: All parties shall 1) send an original signed document plus 12 copies OR 2) mail one original signed copy AND e-mail the document to the web address below, AND 3) all parties shall also send a printed OR electronic copy of the documents that shall include a proof of service declaration to each of the individuals on the proof of service:

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 08-AFC-03
1516 Ninth Street, MS-15
Sacramento, CA 95814-5512
docket@energy.state.ca.us

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DECLARATION OF SERVICE

I, Catherine Short, declare that on February 12, 2009, I deposited copies of the attached *Responses to the December 18th, 2008 Data Response and Issues Resolution Workshop* in the United States mail at San Francisco, California with first-class postage thereon fully prepaid and addressed to those identified on the Proof of Service list above.

OR

Transmission via electronic mail was consistent with the requirements of California Code of Regulations, title 20, sections 1209, 1209.5, and 1210. All electronic copies were sent to all those identified on the Proof of Service list above.

C Short

* indicates change