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Dear Mr. Gregoire

Introduction:

The following report deals with certain aspects of the matter styled **State of Louisiana v The Louisiana Land and Exploration Company, et al.** In particular, this report deals with oil and gas operations conducted by Union Exploration Partners, LTD, Union Producing Company and Union Oil Company of California on the Vermilion Parish School Board property in the East White Lake Field. For purposes of this report the various Union entities will be referred to as Unocal. It also contains comments on the general industry practices and the regulations affecting oil and gas production operations in the State of Louisiana over the time period in question. I have also reviewed the Plaintiff's expert reports to include: Charles Norman's, dated March 28, 2010 and January 15 2015. The following initial comments are based on the information and data reviewed to date, and my education, training and experience.

Information and Data:

The information and data that has been provided to date is listed on Attachment "A", which is attached to and made a part of this report.

Narrative:**East White Lake Field**

The East White Lake (EWL) Field is located in the western part of Vermilion Parish, Louisiana. The field is located +/- 40 miles south, southwest of Lafayette, Louisiana. White Lake is located +/- 1 mile west of the field, which is +/- 13 miles inland from the Gulf of Mexico (GOM). Louisiana State Highway 82 passes +/- 1 mile east of the EWL Field. The old intra-coastal waterway (Schooner Bayou) passes through the northern edge of the field, running in a northeast / southwest direction. Access to the EWL field is by boat through the old intra-coastal waterway.

The EWL Field is an old oil and gas field that has an aerial extent that covers several sections of marsh land, predominately in Township 15 South (T15S) and Range 1 East (R1E). To date +/- 145 wells have been permitted in the field since oil and gas operations began in the late 1930s. The information available to date indicates that the EWL Field was developed early on in a centralized manner. Various operators have operated in the EWL Field over its productive life.

The initial well permitted in the EWL Field from the Louisiana Department of Natural Resources (La-DNR) records was the Vermilion Parish School Board #1 well (VPSB #1) serial number (SN) 22847. VPSB #1 was permitted by the Louisiana Land & Exploration Company (LL&E) in August of 1939. The well was to be located in Section (Sec) 16, T15S, R1E. However it appears the well's permit was allowed to expire without the well being drilled. LL&E also permitted a second well in August 1939, the Louisiana Furs, Inc. (LFI) # 2 well, which was to be located in Sec 15, T15S, R1E. The LFI # 2 well apparently was not drilled either as it is listed as having its permit expire.

The initial well drilled in the area designated the EWL Field was the Heirs of Walter White #1 well (Well W1), SN 23537. The well was located in Sec 17, T15S,

R1E. Well W1 was permitted in mid December 1939 by Unocal and was spudded in March 1940. It was drilled to a total depth (TD) of 11,098 feet by mid July 1940. Well W1 was completed and tested as a Miocene producer through perforations from 10,536 feet to 10,542 feet by September 13, 1940. It was the discovery well for the field. The well initially tested a limited amount of water, +/- 6 BWPD out of +/- 233 BFPD. The lower part of the productive interval was squeezed off in early 1941 and the well tested water free. Well W1 was plugged and abandoned (P&A'd) by Unocal in June of 1975.

The latest well drilled in the EWL field was the (VPSB A 54 (Well A54), SN 245488, drilled in December 2012. The well was drilled by Peak Operating Company (POC) in Sec 16, T15S, R1E to a TD of 9,460 feet. Well A54 is listed as an active producer from the Y-1 Sand through perforations from 9,226 feet to 9,244 feet.

The East White Lake Field is a large, anticlinal structure formed on the upthrown side of a very large, regional down to the coast fault. Reflection and refraction surveys run in the area identified the structure prior to drilling. This anticline is elliptical in shape and is dissected by several parallel southeast dipping faults. Production is from Lower Miocene and Upper Oligocene sands ranging in depth from 5,300'-12,000'. East White Lake Field has produced a cumulative of 53 million barrels of oil and 95 billion cubic feet of gas.

As is common with many oil and gas fields, formation water was produced in association with the oil and gas produced at the EWL Field during a portion of the life of the field. Various production process, handling and storage facilities were constructed in the EWL Field to process the hydrocarbons for sale and to separate the produced water for disposal. The information reviewed refers to various SWD wells utilized during the life of the EWL Field.

Development of the EWL Field included some usage of earthen pits. It appears it also included the discharge of some amounts of produced water into surface water bodies during a part of the history of the field. The information available to date indicates that SWD wells were utilized in the EWL Field early on. The use of earthen pits was an accepted, common and routine part of oil and gas field operations in South Louisiana for a substantial period of the time that the EWL Field has existed. Discharge of produced water into surface water bodies was also an accepted, common and routine part of oil and gas field operations in coastal Louisiana for a substantial period of the time that the EWL Field has existed. Earthen pits and surface discharge operations were open and observable to the various state inspectors with site responsibility, as well as others who would be onsite. Both were allowed by the applicable governmental agencies, which had oversight responsibility for oil and gas operations, for a significant portion of the time that oil and gas operations have been conducted in the field.

Unocal Operations on the VPSB Property:

The Vermilion Parish School Board (VPSB) property in EWL Field consist of all of the acreage in Sec 16, T 15S, R1E, which was noted to be comprised of +/- 1180 acres. The subject oil and gas exploration and production operations were conducted on the VPSB property under the rights granted by Oil and Gas Mineral (OG&M) lease number 57081, which was held 50% by Wilson Brothers and 50% by Unocal. Wilson Brothers Drilling Company is listed in the information provided as a wholly owned subsidiary of LL&E. The VPSB lease was granted to LL&E in April 1935. The VPSB lease was noted to cover +/- 927 acres. It appears that the VPSB lease was subdivided into "Area A" and "Area B". Area A covered +/- 640 acres and carried a 1/8 royalty. Area B covered 287 acres immediately south of Area A and carried a 1/8 royalty and a 1/32 over-riding royalty interest (ORRI). No damage provision was noted in the VPSB lease but the lease did grant the rights to test,

prospect, drill, produce, treat and take care of oil and gas. It also gave the right to construct certain items to include tanks but did not specify the type of tanks, either earthen, wood or steel.

An agreement was executed between LL&E and Unocal dated March 27, 1940 that named Unocal as the operator for the joint account for the EWL Field. The VPSB property was part of the leasehold affected by that agreement. Unocal operated on the VPSB property from 1940 until mid 1995, when Resources Acquisition Corporation (RAC) acquired the interest and became the operator of record. In January 2003 the operator of record was changed to POC. It appears that the OG&M rights have been maintained in force and effect on the property through the years by production and unit operations.

Information and data from the La DNR indicate that over the 70 years of productive life in the EWL Field 91 wells were permitted on the VPSB property. Of the wells permitted on the VPSB property: 6 permits were allowed to lapse; 6 wells were dry holes, 6 wells are active producers; 2 wells are active SWD wells; 2 wells are shut in with future utility (SIFU); 56 wells produced and have been P&A'd; and 5 wells have been converted from dual wells to single wells. Initially there were 19 wells completed as dual producers. This would yield a total of 67 wellbores on the VPSB property accounting for dual completions and expired permits over the producing life of the property. The 56 productive wells that have been P&A'd include the 5 P&As which converted a dual producer back to a single producer and 51 P&A'd wellbores. Currently the available information indicates there are 18 wellbores on the VPSB property. These 18 wellbores house 6 active wells, 3 active SWD injectors and 11 wells SIFU. The remaining numbers indicate that there are 2 dual wells among the remaining wellbores. POC is listed as the current operator of record by the LA DNR.

Unocal permitted +/- 77 of the wells located on the VPSB property during its tenure as operator. Of the 77 wells, 17 were duals and 3 permits were allowed to expire, yielding 57 wellbores installed by Unocal. Unocal drilled and P&A'd the 5 dry holes and P&A'd 35 of the producing wells on the VPSB property during its tenure as operator. RAC permitted 5 wells after it took over operations on the VPSB lease. These were the wells numbered 44, 45, 46, 47 and 47D. RAC had 1 permit expire and P&A'd 9 of the producing wells on the VPSB property. POC permitted 5 wells after they took over operations. These were the wells numbered 49, 49D, 50, 51 and 52. POC P&A'd 12 of the producing wells on the VPSB property to date.

The initial well drilled on the VPSB property was the VPSB B-1 well (Well B1), SN 24764. Well W1 was permitted in mid September 1940 by Unocal. It was drilled to a TD of 12,116 feet. Well B1 was completed and tested through perforations from 9,863 feet to 9,880 feet by February 1941. It was the discovery well for the VPSB property. The well's IP was 274 BOPD and 420 MCFPD, with no BS&W. Well B1 was P&A'd by RAC in December 1999.

The last well drilled by Unocal on the VPSB property was the VPSB A-41 well (Well A41), SN 209103, drilled in the fall of 1988. The well was drilled to a TD of 7,200 feet. Well A41 was completed through perforations from 6,340 feet to 6,377 feet in the R sand. The well's IP was 280 BOPD and 219 MCPPD, with 0% BS&W. POC deepened the well in 2010 to a TD of 11,895 feet but made a shallow completion in the S-4 sand through perforations from 7,435 feet to 7,441 feet. The well's IP was 157 BOPD and 390 MCFPD, with 0% BS&W. Well A41 is listed as an active producer and is being currently operated by POC.

The information available indicates that Unocal's oil and gas operations were centralized. Centralized operations were often employed in marsh operations in South Louisiana. By centralizing operations fewer facilities were required resulting

in less disruption to the surrounding areas. There were 2 Unocal tank batteries (TB) on the VPSB property. TB-A was located in Area A and TB-B was located in Area B. The Unocal production facilities included production process equipment, production test equipment, production storage equipment and a SWD system.

SWD

The available information indicates a centralized SWD system was developed by Unocal for its oil and gas operations in the EWL Field. The information reviewed to date indicates that Unocal utilized all of the various options allowed under the applicable regulations during its tenure as operator. It appears that initially the produced water was released to surface waterways followed by the installation of a SWD injection disposal system.

Available information and data indicates that between the start of production in February 1941 and the installation of the first SWD well in early 1948 any produced water associated with Unocal oil and gas operations was retained, treated and likely discharged into the surface waterways available to the field. Retention and treatment of the produced water for disposal would have been accomplished through the use of some type of temporary containment system: pit; steel/fiberglass tank; barge; etc. The volume of water produced in association with the oil and gas operations varied based on productive zone, well configuration and production operations. Estimates of the cumulative water production from the VPSB property over this time interval, based on available well test and production data, yields a produced water volume of +/- 470,300 Bbls.

The available information and data also indicates that the first SWD well in the EWL field was installed in early 1948. It was located near the western boundary of Sec 15, T15S, R1E. This well was indicated to be part of a closed SWD system that Unocal employed at that time. Unocal followed this first well with 6 subsequent SWD wells. The subsequent wells were all located in Sec16, T15S, R1E.

Subsequent operators added 2 additional SWD wells on the VPSB property. The information available to date indicates that the Unocal SWD wells were designed to be capable of handling the volume of water Unocal produced on the VPSB and La Furs properties during the time periods they were in full service. The vast majority of water produced by Unocal's oil and gas operations was injected into subsurface salt water aquifers through its SWD well system.

SWD Wells

As noted above, Unocal's plans included the use of a closed SWD system utilizing injection wells starting in early 1948. At that time the field was producing approximately +/- 375 barrels of water per day. Subsequent reports indicate that the initial SWD well was capable of taking a significant volume of water per day at low injection pressures.

The information available to date indicates that Unocal converted a former producing well, the Louisiana Furs No. 4-A (LF #4A), SN 24642, to be the initial SWD well. The well was located near the western boundary of Sec 15, T15S, R1E. The LF #4A was spudded September 27, 1940 and was drilled to 9,028 feet. It was then sidetracked to a total depth of 8,903 feet in January 1941. The well had 18-5/8" conductor casing set at 207 feet and cemented to the surface with 400 sacks of cement. Surface casing (11-3/4") was set at 2,857 feet and also cemented to surface with 1,100 sacks of cement. Production casing (7-5/8") was set and cemented at 8,890 feet. The well was perforated from 7,342 feet to 7,355 feet. The well's initial production (IP) was 154 BOPD, 221 MCF/day, with 0.2% BS&W. The well was unsuccessfully sidetracked in early 1943 and subsequently plugged in June 1943. The 7-5/8" casing was cut at 3,060 feet and pulled. A 150 sack cement plug was set from 2,810 feet to 3,060 feet.

On February 6, 1948 the Louisiana Department of Conservation (La DOC) granted Unocal approval to convert the LF #4A to a SWD well. The 11-3/4" casing

was perforated from 1,557 feet to 1,570 feet for injection in February 1948 and 1,570 feet to 1,580 feet in 1953. Injection was through a 2 3/8" tubing string set at +/- 1,500' without a packer. In April 1969, Unocal applied to the La DOC to recomplete the well to a deeper sand for injection. As part of that work, Unocal ran 7" casing to 1,700 feet and cemented it to the surface with 660 sacks of cement. The well was then drilled out and perforated in the 11-3/4" casing from 1,895 feet to 1,965 feet. A 2-3/8" tubing string was run to 1,729 feet with a packer set at 1,700 feet. The LF SWD #4A was shut-in on April 30, 1974 and P&A'd by Unocal in April 1987. From time to time during its 26 year operational life the well would sand/plug up and require clean out. Also, from time to time replacement of bad tubing joints was required to maintain an intact injection string.

In May 1965 Unocal received approval to convert the VPSB A-12 (Well A12), SN 30046, to a SWD well. The well was a producing well that was spudded January 31, 1945. Well A12 was initially perforated at 6,735 feet to 6,737 feet and tested at 115 BOPD, 428 MCF/day with no water. Conductor casing (16") was set at 198 feet and cemented to the surface with 250 sacks of cement. Surface casing (10-3/4") was set at 1,243 feet and cemented with 750 sacks of cement. Production casing (5-1/2") was set at 6,797 feet and cemented with 500 sacks of cement. On May 19, 1965 a cast iron bridge plug (CIBP) was set at 1,890 feet and 3-1/2 feet of cement was set on top. The well was perforated from 1,830 feet to 1,880 feet for injection. A 2-7/8" injection tubing string was run to 1,849 feet without a packer.

In June and July 1974 the 5-1/2" casing was cut at 1,475 feet and pulled due to holes being found in the 5-1/2" casing. A new string of 5-1/2" casing was run to 1,475 feet and cemented with 300 sacks of cement. The 5-1/2" casing was perforated at 1,430 feet to 1,458 feet for water injection. Injection tubing (2-3/8") was run to 1,288 feet without a packer. In 1981 Unocal found that holes had developed in the 5-1/2" and 10-3/4" casings, with injected fluid reaching the surface. This situation

was repaired by replacing the top 465' of 5-1/2" casing and cementing the new section of 5-1/2"X10-3/4" annulus back to the surface. No water was injected in the well between the time the problem was noted and the repairs were made. Well A12 was shut-in July 1983 and the well was P&A'd by Unocal in July 1986. From time to time during its 18 year operational life the well would sand/plug up and require clean out. Also, from time to time replacement of bad tubing joints was required to maintain an intact injection string. At times the injection zone would also plug off and be treated with acid.

In February 1973 Unocal received approval from the LA DOC to convert the VPSB A-16 (Well A16), SN 40010 to a SWD well. Well A16 was spudded January 18, 1950 and completed through perforations 5,970 feet to 6,000 feet with an IP rate of 102 BOPD, 598 MCF/day, with 0.1% BS&W. Conductor casing (16") was set at 140 feet and cemented to surface with 100 sacks cement. Surface casing (10-3/4") was set at 972 feet and cemented with 525 sacks of cement. Production casing (7") was set at 6,316 feet and cemented with 400 sacks.

In February 1973 a cement retainer was set at 2,014 feet and the 7" casing was blocked squeezed at 2,040 feet to 2,042 feet and 1,870 feet to 1,872 feet with 250 sacks and 150 sacks respectively. The well was then perforated from 1,980 feet to 2,014 feet for water injection. It was completed utilizing 2-3/8" tubing without a packer. In October of 1980 injected fluid was found to be escaping from the well and reaching the surface. A failure of the 7" and 10-3/4" casing was confirmed and Well A16 was P&A'd by Unocal in October 1980. The information reviewed indicates that no water was injected in the well once the problem was noted. Also, from time to time during its 7 year operational life the well would sand/plug up and require clean out. Further, replacement of bad tubing joints was required to maintain an intact injection string.

In April 1974 Unocal received approval from the La DOC to convert the VPSB A-30 (Well A30), SN 89035, to a SWD well. Well A30 was spudded March 11, 1962 and completed through perforations 5,383 feet to 5,390 feet with an IP rate of 151 BOPD, 1192 MCF/day, with 0% BS&W. Conductor casing (16") was run to 120 feet. Surface casing (10-3/4") was set at 656 feet and cemented with 400 sacks of cement. Production casing (5-1/2") was set at 5,519 feet and cemented with 500 sacks of cement.

During April 1974 a 250 sack cement squeeze was placed at 2,660 feet to 2,662 feet, a 250 sack cement squeeze was placed at 2,550 feet to 2,552 feet and a 400 sack cement squeeze was placed at 1,041 feet to 1,043 feet. Later operations noted a 5' split in the casing at the site of the upper squeeze perforations. The 5-1/2" casing was then perforated at 2,580 feet to 2,620 feet for water injection. Injection tubing (2-3/8") was run open ended (without a packer) to 2,598 feet. The initial injection test was reported as 10,000 barrels per day at 250 psi injection pressure. In October 1980 a 12 sack cement plug was set from 2,400 feet to 2,300 feet to isolate the original injection perforations. The well was then perforated from 1,880 feet to 1,920 feet for water injection. Tubing was run to 2,594 feet without a packer. The last reported injection volumes for Well A30 well were in 1981. Well A30 was P&A'd by Unocal in August 1981. At times the injection zone would also plug off and be treated with acid.

In April 1981 Unocal received approval from the La DNR to drill SWD well VPSB SWD A-37 (Well A37), SN 970723. The well was spudded April 4, 1981 and drilled to a total depth of 2,040 feet. Conductor pipe (16") was driven to 118 feet. A 10-3/4" casing string was run to 1,888 feet and cemented with 660 sacks of cement. The 10-3/4" casing was then perforated and squeezed with 200 sacks cement from 1,850 feet to 1,852 feet. The well was then drilled to 2,040 feet and under-reamed to a 16" diameter. A 7" screen was run from 1,793 feet to 2,039 feet and a 7" liner was

run from surface and stung into a packer at 1,773 feet. A 2-7/8" backwash string was run to 1,729 feet. Water injection began on April 12, 1981.

In July 1990 a recommendation was made to repair communications between the 7" and 10-3/4" casings in Well A37. On August 9, 1990 the 7" liner was cut at 1,715 feet and pulled and the well was temporarily abandoned (TA'd). On March 13, 1991 Unocal submitted a work permit to change the disposal zone to perforations at 1,470 feet to 1,500 feet. The Injection and Mining Division of the Office of Conservation required Unocal to supply data for a migration potential (Mig Pot) test. Unocal submitted the required information as well as perforating the proposed injection zone in an offset idle well (VPSB A-27D). The fluid level in the proposed injection zone was found at 198 feet. The well received a successful Mig Pot test and Injection and Mining approved the recompletion on March 25, 1991. In April 1991 the zone at 1,898 feet to 2,033 feet was cemented. A string of 7" casing was run to 1,518 feet and cemented with 340 sacks cement. A CIBP was set at 1,505 feet and the well was perforated and gravel packed from 1,470 feet to 1,500 feet. A 3-1/2" injection string was run to 1,352 feet and was set on a packer. The last reported water injection was during 1992. There was no water injection reported for 1993 and 1994. On September 9, 1994 Well A37 failed a mechanical integrity pressure test (MIPT). Unocal P&A'd the well in October 1994. From time to time during its 11 year operational life the well would sand/plug up and require clean out.

In May 1981 Unocal received approval from the La DNR to drill SWD well VPSB SWD A-38 (Well A38), SN 970681. The well was drilled to 1,867 feet in August 1982 and P&A'd by Unocal on September 2, 1982. State well files do not report the reason for not finishing the well and the well was never used for water injection. The well was P&A'd as per its La DOC permit requirements.

In July 1983 Unocal received approval from the La DNR to drill SWD well VPSB SWD A-39 (Well A39), SN 971154. Conductor pipe (16") was driven to 169 feet. A 10-3/4" casing string was run to 2,152 feet and cemented with 1115 sacks of cement. The 10-3/4" casing was perforated from 1,980 feet to 2,010 feet and gravel packed. A 7" fiberglass injection string was run on a packer set at 1,827 feet. In February 1984 the 7" fiberglass injection string was pulled and rerun on a new packer to 1,812 feet.

On September 18, 1987 Unocal submitted a work permit to change the injection zone to 1,520 feet to 1,580 feet due to injection zone plugging. UIC required Unocal to supply data for a Mig Pot test. The Mig Pot test showed that migration would not occur and approval to do the work was granted on November 18, 1987. During November 1987 the 7" fiberglass tubing was pulled, a CIBP was set at 1,800 feet and 10 feet of cement was placed on the CIBP. The 10-3/4" casing was perforated and gravel packed from 1,520 feet to 1,580 feet. A string of 7" internally coated casing was run as an injection string to 1,387 feet on a packer. In 1990 SWD A39 received approval for higher injection pressure.

During January 1994 the 7" injection string was pulled and Unocal found bad 10-3/4" casing from 1,295 feet to 1,220 feet. A string of 7" casing was run and cemented at 1,369 feet with 320 sacks cement. A 4-1/2" injection string was run on a packer set at 1,329 feet. In June 1994 an AFE was prepared to wash out fill and run a radioactive tracer survey (RTS). In November 1994 pressure was discovered on the 10-3/4" casing string with slight communications to the surface being noted in early December 1994. Well A39 was shut in on December 5, 1994 and no water was injected after that time. Unocal P&A'd the well in February 1995.

On March 31, 1994 Unocal received approval from the La DNR to convert the VPSB A-34 (Well A34), SN 162006 to a SWD well. Well A34 was spudded November 30, 1978 and was drilled to a total depth of 12,300 feet. Conductor pipe

(16") was driven to 119 feet and 10-3/4" surface casing was run to 2,206 feet and cemented with 750 sacks of cement. A 7" intermediate casing string was run to 11,464 feet and cemented with 1500 sacks of cement. A 5" liner was run from 11,373 feet to 12,279 feet and cemented with 100 sacks of cement. The well was initially completed in the Siph Davisi Sand through perforations from 11,681 feet to 11,702 feet and tested at a rate of 60 BOPD, 3782 MCF/day with no water.

In April 1994 Unocal set a plug in the 3-1/2" tubing at 10,986 feet. The 3-1/2" tubing was cut and pulled at 3,640 feet. The 7" casing was cement squeezed through perforations from 3,564 feet to 3,566 feet and 3,090 feet to 3,092 feet with 150 sacks of cement for each set of perforations. The well was perforated from 3,190 feet to 3,230 feet for water injection. A 4-1/2" tubing string was run to 2,988 feet on a packer. A RTS was run on December 21, 1994 for the purpose of increasing the maximum authorized surface injection pressure (MASIP). The survey showed that injected water was not moving upward to the shallower zones. Unocal sold its interest to RAC and operations were turned over to RAC effective April 1, 1995. The well's current status is as an active injector and it is currently operated by POC.

Two other wells were converted to SWD wells on the VPSB property after Unocal's tenure as an operator in EWL Field ended. The VPSB A-6, SN 28381 was converted in June 1995 and the VPSB A-35, SN 166402, was converted in January 2001.

Common SWD Well Issues

The most common problems noted for the SWD wells was the poor consolidation of the available sands used as injection sands in the area and the corrosive nature of the produced water from CO₂ corrosion. Unocal worked on both these problems throughout its time as operator in the field using multiple attempted solutions to remedy these issues and maintain an efficient SWD system.

The sand control solutions utilized by Unocal included well washing operations, sand control operations such as gravel packing and zone changes. The corrosion control program included monthly inspections, monitoring by corrosion control coupons, replacing tubulars with internally and externally coated tubulars and with chrome or fiberglass tubulars. Unocal also employed several corrosion control companies including Gulf Coast Chemical, Exxon Chemical, NL Treating Chemicals and Tretolite Control. Furthermore, Unocal conducted pressure testing of vessels, flowlines and gas lift lines.

SWD Reporting

Two different types of SWD volume reporting was noted in the materials reviewed. One was the data recorded in the field based on daily monitoring of the SWD wells by field personnel. It appears this form was maintained on site at the field office. The other was a form issued to the state from the Lafayette division office. The volumes reported to the state by a clerk at the division office appeared to use calculated SWD water volumes derived from the periodic well test data. Using the well test data that was taken several months apart would mean that the SWD volumes would be calculated on an average bases and not a daily reported number; which would explain the discrepancies noted between the 2 forms. SWO 29B requires that a reasonable estimate of injected water volumes be reported to the state. Using data based on well test data should satisfy such a requirement.

Pits

The La DNR information reviewed to date indicates that there are no active pits located on the VPSB property. It was also noted that several closed loop systems were also used on the VPSB property. The La DNR records further indicate that 2 pits are listed as having been located on the VPSB and Furs property at the time the pit registration requirement was implemented. The January 20, 1986 amendment to SWO 29B required operators to register any

existing pits that they had which were covered by the amendment. Pits that were closed prior to the January 20, 1986 amendment either by active closure or acceptable natural attenuation were not required to be registered.

The pit that existed on the VPSB property as of January 20, 1986 was assigned Pit ID #57P235. This pit was listed on the Production Pit Notification (PPN) form dated July 1986 as having been an emergency pit for the VPSB A TB. Pit ID #57P235 was shown to be 150' X 50' X 7', with a natural clay liner. The Production Pit Inspection Report (PPIR) for pit #57P235, dated May 18, 1989, indicates the pit was closed in January 1989, prior to the date of the inspection and was in compliance.

The pit located immediately adjacent to the VPSB property which was on the Furs property was assigned Pit ID #57P236. This pit was listed on the PPN form dated July 1986 as having been an emergency pit near the VUA - La Furs-VPSB #1 well. Pit ID #57P236 was shown to be 140' X 75' X 4.5', with a natural clay liner. The PPIR for pit ID #57P236, dated May 18, 1989, indicates the pit was closed in January 1989, prior to the date of the inspection, and was in compliance.

LFIR

A review of the Lease Facility Inspection Reports (LFIRs) provided to date for the VPSB property was performed. All of the LFIRs reviewed showed the various well sites on the VPSB property to be in compliance, with the exception of the POC VPSB SWD A-6/A-6D well. On June 10, 2008 the La DNR inspector found debris at the well site, such debris being cribbing and flowline left after the well was P&A'd. A compliance order (CO), CO-08-0430, was issued to POC to remove the debris by October 1 2008. POC complied and the well was re-inspected on October 8, 2008 by the La DNR inspector and was found to be in compliance.

Compliance Orders/Notices

The information available indicates that 2 COs were issued for the VPSB property. One CO was issued to Unocal involving its oil and gas operations on the VPSB property. It appears that the issue was resolved in a satisfactory manner. The CO was listed as CO E I&E 08-0422 which involved debris being left at the VPSB SWD A-39 well after Unocal P&A'd that well. The CO was issued in June 2008. As per agreement between POC and Unocal, POC complied with the CO and removed all debris by May 7, 2009. The site was re-inspected on July 29, 2009 by the La DNR inspector and was found to be in compliance.

The second CO on the VPSB property was CO E-I&E-08-0430 that was discussed in the LFIR section above.

Compliance Notices (CNs) are typically issued by the La DNR or La DEQ to advise or instruct an operator on required issues such as the maximum amount of surface injection pressure allowed for a SWD well. Such types of CNs were noted among the available information.

State Inspections

The information and data reviewed indicates that state inspectors from the various agencies were routinely in and round the property. Multiple hand signed documents by state agents were noted along with many typed signature state agent signed documents.

Spills

Various spill reports and inspection reports were noted on the VPSB property. Some of these occurred during Unocal's tenure as an operator on the VPSB. However, it appears that the most significant spills occurred after Unocal's tenure as operator on the VPSB property.

The first incident report noted involving Unocal involved a report of possible reserve pit and flowline leakage into the marsh in Sec 16 and Sec 17, T15S, R1E. The matter was reported as a possible violation and given Possible Violation (PV) # V87067. This report was prepared by the LA DNR Coastal Management Division (CMD). The time frame noted was May and early June of 1987. It appears the matter was referred to the La DEQ's Office of Water Resources – Water Pollution Control Division for handling. The La DEQ inspected the site on June 5, 1987 and noted no problems observed at the time of inspection.

The La DEQ re-inspected the site on July 7, 1987. The La DEQ inspection report (IR) for that date addressed the 3 Impact Areas listed in the La DNR report. The pit listed in the La DNR report as Impact Area #2 was noted in the La DEQ IR as actually being a small flare pit that was not in use and was to be closed. The La DNR report's Impact Area #1 was noted to have been caused by a small oil leak from Well A9's flowline. The LA DEQ IR indicates that very little evidence of the spill was visible at the time of the La DEQ inspection. The La DNR report's Impact Area #3 was noted to have been caused by a small oil leak from Well LF #11's flowline. The LA DEQ IR indicated that a small area around the leak had some oil stained vegetation and a slight sheen was still visible at the time of the La DEQ inspection. The La DEQ IR indicated that no further action was recommended.

A La DEQ IR for the Unocal operations in the EWL Field was noted for March 18, 1991. The La DEQ inspection report (IR) for that date indicated no problems were found.

A La DEQ spill report, log number 1-91-1045, dated December 9, 1991 was noted for the Unocal operations in the EWL Field. The spill report indicates that a 2" flowline had a small leak that led to +/- 3-4 barrels of oil being spilled. The affected area was noted as 100 feet X 100 feet. The well was shut in. The

recommendation appeared to be to burn off the oil. No field data reviewed indicated that the reported spill was on the VPSB property.

A La DEQ spill report, log number 1-92-0451, dated June 15, 1992 was noted for the Unocal operations in the EWL Field. The spill report indicates that a flowline had a small leak that led to +/- 2-3 barrels of oil being spilled. The well was shut in and the leak repaired. The oil was burned off. No field data reviewed indicated that the reported spill was on the VPSB property.

A La DEQ spill report, log number 1-93-0513, dated July 2, 1993 was noted for the Unocal operations in the EWL Field. The spill report indicates that a flowline had a pinhole leak that led to +/- 4 barrels of oil being spilled. Well B-6 was shut in and the leak repaired. The oil was cleaned up.

A National Response Center (NRC) spill report, Incident Report Number 253599, dated August 4, 1994 was noted for the Unocal operations in the EWL Field. The spill report indicates that a 2" flowline had a small leak that led to +/- 3/4 barrel of oil being spilled. The leak was secured. No field data reviewed indicated that the reported spill was on the VPSB property.

As noted above various significant spills were noted during both RAC's and POC's tenure as operators on the VPSB property.

Flow Line Removal

Information provided indicates that POC removed old out-of-service flowlines that crossed waterways. These flowlines were removed as far out into the marsh as they could be pulled from the waterway. No attempt was made to enter the marsh with equipment to remove old abandoned flowlines so as to limit the impact on the marsh. In my experience, in such remote areas flowlines are generally left in place unless they are causing a direct problem or their removal is required under the agreements in place. However, if such removal is requested by the landowner every

attempt should be made to comply with such request if possible and practicable. Certainly if removal of the abandoned flowlines is going to cause more damage to the environment than leaving them in place, the flowlines should be left in place.

Canals

A system of canals was use to explore and develop the EWL Field. Canal systems were routinely used to develop oil and gas fields in such marsh areas. In many instances canals remained in place after the fact unless there was a requirement in the agreements that governed such canals that the canals be blocked or closed after the fact. In some instances the canals were left in place as required by, or at the behest of, the landowner. Certainly the EWL canals should be handled as provided for in the agreements between the VPSB and Unocal.

It appears Unocal utilized canals early on as a means for transporting equipment and gaining access to the area. As the field progressed additional canals and dredged well locations were needed to develop the field given the local conditions. The use of land based locations in areas away from canal locations, and the roads to support such locations, would have been expensive and impractical in my opinion. Using fill dirt from the area would require the dredging of a borrow canal along the roadway and a borrow pit at location area, which still would have created canals, borrow ditches and borrow pits in the field. A network of built up roads, built up site locations, borrow ditches or canals and pits would have been more intrusive to the marsh that just the canals.

Current Operations

POC continues to actively operate the EWL Field. Since 2010, POC has drilled 7 wells in the EWL Field. Five of those wells have been on the VPSB lease. La DNR data shows that there are currently 6 producing wells, 2 active SWD wells and 2 wells that are shut-in with future utility on the VPSB property. In addition POC maintains a central facility, campsite and multiple flowlines on the VPSB

property. Any canals deemed necessary to further current and future operations would need to be left open.

Given the fact that POC currently operates a field SWD system, and the fact that a field SWD system has been in place since 1948, indicates the practicality of using such an onsite system in the event that a ground water related cleanup was deemed necessary.

General Louisiana Oil and Gas Industry's Practices and Regulations

The oil and gas industry in Louisiana has been under State regulation since the early 20th century. Certain aspects of oil and gas operations have also been under Federal regulation for many years. Over the years knowledge in the oil and gas industry about the proper handling of drilling and production materials and by-products has changed. Likewise, the technology available to deal with those materials and the ability to detect materials at increasing miniscule amounts has changed. Generally state and federal regulations have reflected the changes in knowledge and technology. The regulations that govern the oil and gas industry in Louisiana have been revised on numerous occasions since regulation of the oil industry began in the early 20th Century.

LA CC

Louisiana initially formed the Louisiana Commission for the Conservation of Natural Resources (La CCNR) in 1908 by Act 144 of the State Legislature. The La CCNR was formed in concert with a national call by President Theodore Roosevelt to conserve, and not waste nor needlessly consume, the nation's natural resources. It appears the initial role of the La CCNR was largely to report on the status of the state's various natural resources and to make recommendations to the Governor for the management and conservation of the State's natural resources. By 1910 the name had been shortened to the Louisiana Conservation Commission (LA CC).

Louisiana recognized very early the need to control wells. Prior to the formation of the La CC, Louisiana passed Act 71 in 1906 that was directed against those who set wells on fire or let wells go wild. It also required gas wells be P&A'd. This was followed by Act 190 in 1910 that required oil and gas be properly confined in pipes and proper receptacles within 2 days after a well has been brought in.

Likewise, early on Louisiana recognized the need to control the handling of waste oil and water produced in association with oil and gas production into the fresh waters of the state and to protect the fresh waters of the state. Water is often found underground in connection with oil and gas deposits. As the oil and gas is produced the water associated with the oil and gas reservoir can also be produced. Typically during the early stages of production the oil and gas are produced water free. As the production life of a field continues it is common for the amount of water being produced to increase. However, the volume of water produced from a field can, and does, vary greatly and will change as different productive zones, or wells, go into or out of production. The water produced with oil and gas production is typically saline (but could be fresh) and can contain trace elements other than just salts.

In 1910 Louisiana passed Act 183 to protect the rice planters and owners of canals used for irrigation purposes against pollution from salt water, oil and other substances and to protect the fish. It prohibited releasing oil, salt water or other noxious or poisonous gas into irrigation water sources between March 1 and September 1 of each year. It allowed for the release of oil field waters into said sources between September 1 and March 1.

Containment or storage in earthen pits or earthen tanks was used to impound produced waters in certain areas of the state. Earthen tankage was often used given the volumes and rates being produced and the availability of such tankage. Some produced water pits were referred to at times as evaporation pits.

However, in my experience, the term was a term of art as at certain times substantial evaporation may occur. However, at times of high rain fall any evaporation would be offset by rain volume and dilution. Recognizing the effect of rain fall and surface water volumes to facilitate dilution, Louisiana allowed producers to discharge the produced waters out of the impoundment areas at certain times.

In 1912 Louisiana passed Act 127 which established the La CC as a Department of the State, with control over the natural resources of the State. The La CC was given the authority to make regulations to protect the state's natural resources. Some of the regulations established through Act 127 were requirements for drilling permits, maps of well locations and the usage of surface casing and cement. It also included a requirement that abandoned wells be plugged. The Commissioner of Conservation headed up the La CC.

LA DOC

In 1916 Louisiana passed Act 66 which created the Louisiana Department of Conservation (La DOC), which replaced the La CC. The La DOC's continued purpose was to address the conservation of minerals and other natural resources of the state. Act 127 continued to give the La DOC the authority to make regulations to protect state resources.

The La DOC began requiring the use of slush pits during drilling operations by +/- 1918 through Rule 17. The La DNR still allows the use of drilling reserve pits as approved by the state.

Over time the idea of impounding and discharging produced water at certain times of the year for certain areas of the state was replaced with the discharging being done based on Louisiana state regulatory agency approval only, for all areas of the state. However, no formal permitting process that generated an issued permit, as is in effect currently, has been noted to date concerning impounding and

release. Louisiana passed Act 133 in 1924 that essentially mirrored Act 183 of 1910 except that it was not limited to rice growing areas of the state but simply dealt with the natural streams of the state and allowed for the release of impounded water as scheduled by the La DOC instead of fixing a set time table for impounding and releasing.

The oil and gas industry began investigating the underground injection of produced waters utilizing salt water disposal (SWD) wells in certain areas of the country in the mid to late 1920s and 1930s. The La DOC raised the possibility of injecting produced water into salt dome cap rock or into depleted producing formations as early as 1927 but continued to use the impound and release method as the approved produced water disposal method. During that time frame some in the industry believed that salt water injection wells may not be as good a solution as impounding and releasing the produced waters during periods of high rainfall due to the potential to contaminate fresh water sands penetrated by the SWD wellbores or the potential to damage productive zones.

The initial SWD well in Louisiana came on line in +/- 1933 and over time SWD wells became the primary method for disposal of produced waters. However, as with any new technology neither the industry nor the regulators changed completely from one method to the other quickly. Earthen containment pits continued to be used as temporary holding areas for produced water until it could be disposed of through a salt water injection well or released as approved by the State in certain areas. The La DOC published a "Recommended Specification and Design for Earthen Oil-Water Separating Pits" in December 1940 to be used to construct earthen pits for the purpose of removing oil from produced water before the produced water was either discharged to streams or to a SWD well. Again over time earthen pits/tanks without approved liners (either natural or synthetic) were phased out as produced water storage areas, with steel storage tanks replacing

them. The change over time for the various methods of handling produced water and other waste varied depending on several factors to include geographic area, soil types and conductivities, water sources and conditions, environmental conditions and the potential for contamination and/or risk of harm. The State of Louisiana continued to allow the storage of produced water in earthen pits/tanks for many years based on certain criteria, in various areas and under certain conditions.

La DOC SWOs

The La DOC promulgated the first general Statewide Order (SWO), Rule A-1 in the summer of 1939 concerning the drilling, production and operations of oil and gas wells in the state. Rule A-1 was the forerunner of the modern SWO 29B. Rule A-1 was quickly amended in the fall 1939 and renamed Rule A-2. In 1940 Louisiana passed Act 157 which effectively created the modern La DOC and was the forerunner of Title 30, "Minerals, Oil and Gas" which was adopted in 1950. Several SWOs were promulgated under Act 157 during the 1940s to cover oil and gas operations in the state. These SWOs included SWO 29, which was promulgated in July 1941. SWO 29 was revised and renamed SWO 29A in May 1942. SWO 29A was revised and renamed SWO 29B in August 1943. SWO 29B has been revised on multiple occasions but the designation 29B has remained. The current version of SWO 29B is one of the primary SWOs covering drilling, production and operations of oil and gas wells in the state.

Starting in the mid-1930s the publicized Acts concerning the La DOC included a section on water pollution, Section VI. Once SWO 29 was adopted in 1940 salt water was dealt with in Section XIII. When SWO 29A replaced SWO 29 salt water production and disposal was covered in Section XV. When SWO 29B replaced SWO 29A salt water production and disposal was kept under Section XV. During this time, DM1R forms were created to report the testing of wells; which

includes the reporting of base sediment and water (BS&W). It was the first official reporting of saltwater production in the state.

As noted above, Louisiana adopted Title 30 “Minerals, Oil and Gas” as part of the La Revised Statute of 1950. SWO 29B was continued after the adoption of Title 30. Multiple amendments to SWO 29B have occurred since the adoption of Title 30. Several of the amendments to SWO 29B have dealt with the handling of produced water, oil field waste, pits and other environmental issues. The first such amendment to Section XV of SWO 29B was in May 1961, which was an amendment that dealt with the approval process for disposing salt water in SWD wells. The Louisiana Geological Survey (LGS) became involved in the permitting of SWD wells. LGS had the responsibility of determining if the SWD well’s surface casing was set deep enough to protect fresh water zones; among other responsibilities.

The next amendment to Section XV was in November 1967, which renamed Section XV from “Production and Disposal of Salt Water” to “Pollution Control”. The 1967 amendment also addressed the discharge of produced water. Produced water discharge was no longer allowed into the state’s usable fresh water bodies but it did allow for discharge into tidally affected waters, brackish waters or any other waters unsuitable for human consumption or agricultural purposes. Also at this time, the state began requiring reporting of water injection volumes. Injected volumes were reported to the La DOC annually on a LGS card. The Louisiana Stream Control Commission also began monitoring injection volumes and required reporting on their form SWDR1. These forms were in place until the UIC division of La DNR was formed in 1982 and the UIC 10 Form became the form for the reporting of injected volumes.

In the 1970s several Federal regulations came into play that affected environmental issues. These included the formation of the US EPA; the Clean Air Act; the Clean Water Act and the Safe Drinking Water Act among others. Non-

hazardous oilfield waste (NOW) was, and is, exempted from federal hazardous materials regulations. NOW waste are exploration and production (E&P) waste and includes several types of drilling and production waste to include drilling, completion and workover fluids and produced waters. NOW waste are managed by Louisiana under SWO 29B.

A complete SWO 29B was published in 1974 that incorporated all of the amendments up to that time.

La DNR

In 1976 the Louisiana Department of Natural Resources (La DNR) was created; replacing the La DOC. The Office of Conservation (OOC) was one of the divisions under the La DNR. Act 449 of 1979 created the Office of Environmental Affairs (OEA) which was placed in the La DNR. The Louisiana stream Control Commission (La SCC) and various other entities were incorporated into the OEA. In 1983 Louisiana passed legislation that created the Louisiana Department of Environmental Quality (La DEQ). The La DEQ formally began operation in February 1984.

In the 1980s several significant amendments to Section XV of SWO 29B were made. In July 1980 Section XV was amended to add Paragraph 13 which provided coverage for offsite disposal of drilling and completion fluids and produced waters. Act 804 was also added in August 1980 which specified the requirements for commercial disposal facilities. Section XV of SWO 29B was amended again in January 1982 implementing underground injection control (UIC) of SWD wells, enhanced recovery wells and liquid hydrocarbon storage wells. Paragraph 13 of Section XV was amended in 1983 and again in 1984. In 1985 Section XV was amended concerning injection during secondary recovery projects. The amendment to Section XV of SWO 29B on January 20, 1986 greatly restricted the use of earthen pits and covered non-hazardous oil field waste (NOW). The January 20, 1986

Amendment to Section XV of Statewide Order 29B covers the closure standards for “all existing” produced water pits, natural gas plant pits, compressor station pits and washout pits being used if they did not comply with the liner requirements of the order or were not exempted under specific provisions of the order. The January 20, 1986 Amendment to Section XV of Statewide Order 29B also covers the closure standards for “all existing” pits not being used or not exempted.

Section XV of SWO 29B was changed to the Louisiana Administrative Code (LAC) format as LAC Title 43: Part XIX, Section 129. Further refinement of SWO 29B continued to occur through the 1990s and into the 21st Century. In October 1990 Section 129 was amended concerning certain aspects of NOW testing, passive pit closure and pit closure for coastal areas of the state. Section 129 was amended again in 1991 concerning the onsite storage, treatment and disposal of NOW generated during drilling and production of oil and gas wells.

Reorganization of LAC 43:XIX.129 into Chapters 3, 4 and 5 under SWO 29B occurred effective December 20, 2000. The reorganized SWO 29B consisted of: Chapter 1. General Provisions, Section 129. (Reserved); Chapter 3. Pollution Control – Onsite Storage, Treatment and Disposal of NOW Generated from the Drilling and Production of Oil and Gas Wells (Oilfield Pit Regulations); Chapter 4 Pollution Control – (Class II Injection/Disposal Well Regulations); and Chapter 5 Off-site Storage, Treatment and /or Disposal of NOW Generated from Drilling and Production of Oil and Gas Wells – (Commercial Facility Regulations).

In November 2001 LAC 43:XIX.433 (Chapter 4) was changed to cover a new topic the disposal of E&P wastes by Slurry Fracture Injection. Also in November 2001 and again in June 2003, LAC 43:XIX.501 (Chapter 5) was amended. In December 2003, LAC 43:XIX was edited and compiled effective that date. In February 2004 LAC 43:XIX.303 which deals with produced waters was amended. LAC 43:XIX was last amended in November 2005 and compiled in December 2005.

Louisiana remains active in the oversight and regulation of the oil and gas industry within its borders.

La SCC

In 1940 Louisiana created the Louisiana Stream Control Commission (La SCC). The La SCC was created to protect the usable surface fresh water resources of the state, with jurisdiction over all applicable entities utilizing those waters. Commission members were initially comprised of the Commissioner of Conservation, the President of the State Board of Health and the Attorney General of the State. Rules governing the disposal of oil field waste were adopted by the La SCC in April 1941 and were revised in April 1943. There were 8 rules promulgated and adopted by the La SCC dealing with the disposal of oilfield waste, some of which included the handling of produced water. In these rules the La SCC indicated its preference for subsurface injection of produced water but continued the surface discharge of produced water based on certain criteria. Rule 8 specifically stated: "Wherever possible, disposition of oil field brine shall be accomplished by discharge through disposal wells to underground horizons below the fresh water level, such wells to be so drilled, cased, cemented, equipped, and operated that no fresh water horizon shall be polluted; provided that this rule shall not apply in fields or areas where it is determined by the Stream Control Commission that disposition of the brine is or may be accomplished by discharge into water bodies normally or seasonably sufficiently saline to preclude any actual or potential pollution hazard due to such discharge". Again, no formal permitting process that generated an issued permit during that time period, as is in effect currently, has been noted to date.

The La SCC issued an order in 1942 that went into effect in January 1944 which prohibited the release of impounded produced water in rice growing areas after January 15th until a time approved by the La SCC, estimated to be after

October 1, each year. However, the La SCC still allowed for the surface discharge of produced waters as approved by the La SCC and the order only affected the rice growing areas. The order was known as the Rice Order.

The La SCC re-adopted its rules governing disposal of waste oil, oil field brine and all other materials resulting from the drilling for, production of, or transportation of oil, gas or sulfur in January 1953 under Title 56, Louisiana Revised Statutes of 1950. The rules concerning the disposal of produced water appeared to be unchanged from the original rules adopted and revised by the La SCC in the 1940's. The La SCC oil field rules adopted in January 1953 are currently found under LAC Title 33, Part IX, Subpart 1, Chapter 17. In July 1968 the La SCC adopted additional rules which allowed produced salt water to be discharged into normally saline waters, tidally affected waters, brackish waters or other waters unsuitable for human consumption or agricultural purposes. The 1968 La SCC oil field rules also acknowledged the rules and regulations of the La DOC and the other existing rules of the La SCC concerning oil and gas operations. Furthermore the 1968 rules tracks the wording found in the 1967 revision to La DOC SWO 29 B concerning the discharge of produced water. The 1968 La SCC oil field rules are currently found under LAC Title 33, Part IX, Subpart 1, Chapter 19.

The La SCC was effectively incorporated into the La DNR's OEA and later into the La DNR's Water Quality Division; which currently has oversight for water quality in the state.

The State of Louisiana continued to allow the discharge of produced waters at the surface for many years, based on certain criteria, in various areas and under certain conditions based on prior approval by the state.

General Historical Industry SWD Review

The issue of handling produced water from a historical standpoint was a topic of significant discussion within the oil and gas industry. Industry personnel of good

conscience were concerned with the protection of the environment and the proper handling of produced water early on. As noted above in the previous section, Louisiana was active from a regulatory standpoint protecting its sources of freshwater almost from the inception of the oil and gas industry in Louisiana. Discussions were also occurring in other areas of the country early in the life of the oil and gas industry, with the recognition that conditions and criteria were different depending on area and would affect the manner in which produced water was handled.

The oil industry initially used earthen pits for the capture and storage of oil in the early life of the industry. Beginning in the early 1900s operators designed and built pits to minimize or eliminate losses and sought out areas with clay soils where available. As the oil and gas industry grew in the United States during the early 1900s, more water was produced from oil and gas wells and pits were inevitably used to store, process and treat produce water prior to releasing it for surface or subsurface disposal. The quantity of produced oil and associated water grew significantly during the 1920s through the 1950s in many areas of the US. These areas often had different conditions available for handling produced water and the protection of fresh water. The practice of impounding water and releasing it into streams and rivers was widely practiced and accepted by industry and regulatory authorities. Over time, operators became aware that the construction of pits should include sufficient clay to control the seepage of pits while water was impounded.

Several papers dealing with the issue of handling produced waters and pits are routinely presented for discussion in matters of this type. These papers, when viewed in full, are generally consistent with my experience and the above regulatory discussion. Many of the articles presented deal primarily with other sections of the United States which has different conditions and criteria from those found in

Louisiana related to the handling and disposal of produced water. Some of the articles presented do discuss Louisiana, with most discussing produced water in the context of what was being done generally on a state by state basis from a regulatory standpoint. However, none of the early articles discussed the operational history for produced waters in Louisiana in detail or discussed, compared and contrasted the various methods for handling produced water being employed in Louisiana over time. Papers concerning the operational use of earthen pits in Louisiana typically post-date Louisiana's regulatory restrictions on the use of such pits. These articles generally tie in with the timeline that evolved for dealing with the handling of produced water in the various areas of the country.

Selected parts of various articles are often cited in these matters for discussion. By way of example a paper given by VL Martin in 1932 in Pampa, Texas concerning disposal of production waste is often cited. The quotes used normally concern the use of earthen pits as evaporation pits. However, the use of earthen evaporation pits was not a method that was routinely used as a disposal end point in Louisiana. Earthen pits were routinely used in Louisiana for many years as an impounding and treating step to process the produced water and remove any oil before the produced water went on to a disposal end point that could include either surface or subsurface disposal. This was a produced water treating process that Mr. Martin approved of in the 1932 paper. In the 1932 paper Mr. Martin expresses concerns dealing with SWD injection wells and expressed approval on impounding and releasing produced water in the appropriate environment. Anyone reading the Martin paper would not come away with an understanding that SWD by subsurface injection was the industry preferred method at that time, even for the mid-continent area of the USA.

Mr. Martin classified waste into four groups: 1) Waste oil; 2) saline waters; 3) drilling mud; and 4) gases and vapors. As part of the discussion Mr. Martin

comments on the issue of increasing water production from maturing fields and the various disposal techniques available. The methods of water disposal in general practice in the Mid-Continent area of the US at that time were: 1) Unrestricted flow to natural drainage; 2) impounding in earthen storage for either dumping during flood stage or evaporation and seepage; 3) conducting to polluted waters; and 4) return to subsurface formations. Mr. Martin stated “probably the safest of these methods, where the volume is not too great and the rainfall sufficiently frequent is that of impounding and dumping at the proper time, however, great care must be exercised.” Mr. Martin realized the impracticality of evaporation and storing produced water in evaporation pits as a disposal endpoint. Mr. Martin stated that “The only successful disposal systems are those which conduct oil free waste water to coastal waters, polluted streams, or streams of sufficient volume that resulting mixture will have a harmless concentration.” When discussing subsurface reinjection Mr. Martin stated “There have been numerous attempts to return waste water to subsurface formations, but, almost without exception, these have been proven impractical except for a short period of time. It can probably be stated as a general rule that, unless such water can be returned by gravity, it will not be successful.” Mr. Martin considered subsurface reinjection impractical due to the possibility of migration and contamination of fresh water zones at that time. He concluded that “No successful method, of general application, has been devised for the disposal of salt water.

Prior to the Martin papers in 1930 and 1932, work on produced water was being done by others to include the US government. In 1929 Schmidt and Devine discussed the water disposal situation in their report for the U.S. Bureau of Mines titled “The Disposal of Oil Field Brines”. The authors surveyed 31 oil properties, all in Osage County Oklahoma, (none in Louisiana) and commented on water handling techniques including pits, surface disposal and subsurface injection. The paper discusses an experiment in which a sample of a type of clay from an Oklahoma pit

was used to test the relative effects on hydraulic conductivity (seepage) of different water compositions. The results of the experiment indicated that certain salts slightly increased the seepage through the clay as opposed to distilled water. Magnesium, potassium and calcium cations caused a higher seepage rate than sodium. It was noted that when the vessel containing distilled water was drained and refilled with oil field brine that the seepage was only slightly greater than with the distilled water. The authors also discussed the effects of salt water on livestock, fish, plants and surface water. The paper concludes that it was feasible to divert produced water to selected streams.

A 1938 Bureau of Mines Report by Schmidt and Wilhelm titled “Disposal of Petroleum Wastes on Oil-Producing Properties” discussed the use of pits and water discharge and their effects on biology and soil. The authors state “...oil-field brines frequently can be disposed of most economically by allowing them to accumulate in ponds or settling basins, from which they are permitted to escape during periods of heavy rainfall into streams flowing at flood stage.”

Other examples of cites from papers include certain 1940s era American Petroleum Institute (API) documents on salt water disposal which again appears to be for the mid-continent area and also indicates that while SWD injection is generally preferable it is not applicable for all fields. A review of the fields cited in those API documents shows that the focus was for areas other than Louisiana as no Louisiana fields or production operations were listed as being reviewed. As stated in other sections of this report, the change over time for the various methods of handling produced water and other waste varied depending on several factors to include geographic area, soil types and conductivities, water sources and conditions, environmental conditions and the potential for contamination and/or risk of harm.

The 1940 API “Drilling and Production Practice” publication recognized four methods of salt water disposal. The four methods were: 1) Storage in open pits; 2)

periodic release into streams at flood stage; 3. evaporation and; 4. underground injection

In December 1940 the Louisiana Department of Conservation (La DOC) published “Recommended Specifications and Design for Earthen Oil-water Separating Pits”.

In April 1943 the Louisiana Stream Control Commission (La SCC) published their “Rules Governing Disposal of Oil Field Wastes”. The general provisions allowed for the use of pits combined with either proper surface or subsurface disposal. These rules were re-issued in 1953. As discussed above amendments to the La SCC rules were added in 1968. Both the La SCC 1953 rules and the 1968 amendments can be found in the current La DEQ regulations.

An API “Drilling and Production Practice” dated 1966 again recognizes discharge as a possible means of disposal.

During the 1960s various articles appeared in certain industry periodicals that discussed produced water handling issues. The articles reviewed dealt with the issue either from a regulatory perspective or as viewed by state regulators such as certain Texas Railroad commissioners from the mid-continent area of Texas.

The API Recommended Practice (RP) 51 titled “API Recommended Onshore Production Operating Practices” issued in 1974 and reissued in 1982 recognized the use of pits and made recommendations for the proper utilization of pits associated with production practices.

An assessment by the La DNR titled “Surface Impoundments Assessment Final Report for Louisiana” was presented to the U. S. Environmental Protection Agency in May 1980. The survey examines water quality in aquifers below surface impoundments. The report results show that the aquifers water quality below most surface impoundments was found to be excellent. Coastal swamps and marshes

where the ground water is locally saline due to natural causes were noted to be an exception.

In October 1982, the API sponsored an independent study to provide data on the effects of oil and gas field waste management and disposal activities. The study concluded that any contamination was localized and unlikely to constitute a significant environmental or health hazard.

As noted above, on January 20, 1986 Louisiana adopted requirements for the construction, use and closure of certain types of pits. Prior to that date reasonable operators conducted operations in Louisiana that properly utilized earthen pits as an internal stage of their SWD systems.

Report Comments

Charles Norman's Litigation Reports

Mr. Norman indicates that his report addresses engineering and operational issues in the EWL Field. Mr. Norman opines about the engineering and operational aspects of the oil and gas operations conducted by various operators who operated on the subject property, along with lease issues and clean up requirements. Mr. Norman does not distinguish the accepted and required operational, engineering and regulatory oil and gas practices of prior times with the more stringent practices and requirements of today. This erroneously implies that operations conducted in earlier times were not kept in compliance with industry standards and regulatory requirements.

Early on in his reports Mr. Norman states that very high volumes of produced saltwater were discharged overboard on the VPSB property. He later attempts to quantify the volume. Mr. Norman sites volumes for 2 different time periods. First, he cites a volume of 78.5 million barrels. This volume appears to be based on his assertion that produced water discharge continued from initial production in the early 1940s until 1973 when he contends the first SWD well was

installed by Unocal. The volume stated by Mr. Norman is half of the entire volume of water he contends was produced on the VPSB property over its entire productive life. Mr. Norman later contends that another 5 million barrels were discharged between 1973 and 1989 when he contends the surface pits were closed. This alleged discharge appears to be the result of SWD system capacity. It appears he gives no discharge volumes post 1989.

These volumes are not supported by the information available to date. As discussed previously in the report the first Unocal SWD well was installed in 1948. It appeared to be generally capable of handling the produced water volumes estimated from the available data for that time. In mid-1965 a second Unocal SWD was placed in service, as was a third well in 1973. Other Unocal SWD wells followed as needed. From time to time the SWD wells did experience problems as discussed above. There were times over the life of the field post 1948 that injection was supplemented by either release and/or curtailment of production but the work performed to date indicates that Unocal's predominant SWD method for the EWL Field was injection.

Mr. Norman states that 159 million barrels of produced water has been handled at the EWL facilities. The support data or calculations for these numbers were not provided. Actual water production data has not been noted for a significant portion of the productive life under discussion. Any estimated discharged water volumes put forward by Mr. Norman could and very likely would vary significantly from actual produced water volumes. Produced water rates can and do vary significantly over the life of a field, particularly when the time frame is as long as the one cited. This variation can be the result of operational, mechanical, reservoir or production zone changes that can and do occur over the life of a field. In any event, as stated above the available information and data indicates that Unocal's predominant method of SWD was to inject the produced water into

subsurface saltwater strata that contained the same type native salt water as produced with the oil and gas.

Mr. Norman is critical of the use of earthen pits and the practice of discharging produced water to surface water bodies. The use of earthen pits to impound/retain water and the practice of discharging water to surface water bodies in coastal areas such as the EWL Field was an accepted and approved method of operation for a significant part of the time period Mr. Norman is addressing. The information and data available indicates that Unocal in fact injected its produced water into state approved SWD wells for the vast majority of the time they operated in the EWL Field. While pits were part of the water processing mechanism employed by Unocal in the EWL Field it appears that after the start of SWD injection in 1948 they were predominantly used on an emergency basis.

Beginning in 1948, Unocal used a combination of SWD wells, pit/tank storage (for processing), discharge, and the shutting in of high water rate wells as part of its efforts to handle the produced water at the EWL Field. All of these procedures would have been known and accepted methods for the handling of produced water at the time they were done. During this review, there was no prohibition by any state agency found to water storage in pits and discharge either into SWD wells or surface water bodies capable of handling such releases at the EWL Field for the time periods they were done. Earthen pits and surface discharge operations were open and observable to the various state inspectors with site responsibility, as well as others who would be onsite. The Louisiana Office of Conservation (La OOC) as well as the Louisiana Department of Wildlife and Fisheries (La WF) were in the EWL field at various times and would have been aware of any problems associated with water storage and discharge. The La WF personnel and La OOC personnel were responsible for reporting problems to their respective agencies and the Louisiana Stream Control Commission (La SCC). A review of La SCC documents

available indicates that the La SCC was aware of Unocal's handling of produced water in the EWL Field as early as May 1943. Nothing reviewed indicates that the La SCC or the La DOC had any problems or issues with Unocal as a result of the water discharge in the EWL Field.

Mr. Norman further states that the oil and gas industry early on was well aware that earthen pits would leak produced brine and waste waters and that water injection wells and pit liners were common practice and must be used. This is simply not the case. While there was a realization that a potential could exist for pits to seep, given all the factors to consider and the understanding at the time of the potential impact, using earthen pits was an accepted and viable solution.

He further states that the design and operation of the pits utilized earthen bottoms that were not designed and tested for leakage as required by good engineering practice. However, he does not cite the reference he is quoting or the timing of that reference. At the time of the construction of the subject pits there was no requirement for such design or testing. The state requirements for earthen pits and water discharges have changed over the time frame Unocal operated on the VPSB property. State pit regulation came in to play in 1986 and developed from that date forward. Curtailment of coastal water discharges were allowed until the mid-1990s. The information available indicates that Unocal's operations on the VPSB was in compliance with state requirements during its tenure as operator on the VPSB property.

The pits associated with the VPSB A tank battery and the La Furs tank battery were closed by Unocal in 1988 as per the January 20, 1986 amendment to SWO 29B. Samples show that the closed pits passed the 29-B standards. The pit associated with the VPSB B tank battery was closed in 1985 when the tank battery was decommissioned, dismantled and removed. Therefore, neither the VPSB B tank

battery nor the pit associated with the VPSB B tank battery existed at the time the January 20, 1986 amendment to SWO 29 B can into effect.

Mr. Norman opines that the Unocal SWD wells were not adequately designed and were not operated in accordance with safe operating practices. I disagree. The configuration of the SWD wells was discussed previously in this report. All of the SWD wells were reviewed and approved by the La DOC and/or the Louisiana Geological Survey (LGS). Operational issues were noted that were predominantly due to the types of fluids being handle and the geo-mechanical conditions of the zones. When issues arose with the SWD wells it appears those issues were dealt with in an appropriate fashion.

Mr. Norman references wording found in certain AFEs in his supplemental report. AFE wording is often strongly phrased in an attempt to motivate the recipient to provide authorization for the work being requested. While AFE language certainly should be considered, the issue it is discussing should be fully developed by reviewing any and all available materials on the topic. One example presented by Mr. Norman is a 1965 AFE associated with adding an addition SWD well which contains a statement that Unocal was in regulatory violation for dumping salt water into the canal at the EWL Field. The obvious aim is to get approval for the new SWD well. Nothing has been noted in the information reviewed that indicates any issues were noted at the time with the discharge or that any regulatory body had any issue with the discharge. There was no prohibition found on discharging produced water into the waters around EWL for the time frame involved, provided such release complied with existing regulations and did not result in oil and noxious gas exceedances or cause harm to the local environment.

Mr. Norman states that numerous AFEs show “problems with SWD wells that resulted in the use of production pits and overboard discharge.” The AFEs

cited reflect a history of an active SWD system in a large field which was used and underwent repairs and maintenance due to the types of fluids being handled and mechanical stability of the formations. These types of systems are mechanical by nature and do have mechanical failures related to issues of usage and wear and tear over the life of the system. It appears that Unocal utilized the components that were available to it under the existing regulatory scheme of the time in the EWL Field; such as water injection and utilizing pits coupled with discharge as part of its SWD system as necessary.

Reference is made by Mr. Norman to documents that indicate produced water was being filtered into the marsh or leaked into the marsh from pits. To date the only document noted on this issue was a 1943 La SCC document that did not use the term leakage but does indicate the state's knowledge about the manner of water release from the pit area in 1943. This time period was prior to the installation of the first SWD well. Again, as long as the method of discharge was consistent with the regulations of the day then no violations would have occurred. Furthermore, if no impact was noted either at the time or by a review of aerials of the time, or today by sampling, then no current action would be required.

Mr. Norman discusses the disposal of La Furs produced water into VPSB SWD wells. Between February 1948 and May 1965 (17 years) the La Furs A #4 was the only SWD in the field. At that time it disposed of both VPSB and La Furs produced water. In mid-1965 the VPSB A #12 was converted to a SWD well with water being disposed of on both the La Furs tract and the VPSB tract. The La Furs A #4 continued disposing produced water until mid-1976. After the abandonment of the La Furs A #4 well produced water for the field was sent to Section 16 SWD wells. Unocal's operations for the EWL Field were conducted utilizing a centralized facilities concept. Utilizing a centralized facilities concept that shared SWD operations to develop the field minimized the impact felt by all parties in the

development of the resources from the field. Utilizing a central facilities concept was routine for south Louisiana coastal operations.

The water that was being produced from the EWL Field was subsurface water that was common to the subsurface strata that underlie the field and was not specific to any one surface tract. As such returning it to the subsurface strata below the field would simply be placing it back into the environment from which it came regardless of the location of the injection point. Many of the SWD wells, to include the La Furs #4 SWD well injected water into the same subsurface zone where the water was comingled under both properties.

Mr. Norman claims there were mechanical integrity issues and provides five examples. One example utilized by Mr. Norman was a Unocal PIP dated September 16, 1991 that supplied information about pilot settings on flow lines. The usage of flow line pilots indicates the usage of a production safety system at EWL. API RP 14C covers offshore production facilities safety systems. It has been adopted by reference under the Federal regulations for many years and is mandated on Federal OCS production facilities. The state of Louisiana has not adopted compliance with API RP14C for onshore production facilities. The fact that Unocal was using an offshore production facilities safety system indicates that Unocal was operating at a level substantially above any regulatory requirements in the EWL Field.

A memo dated October 17, 1984 concerning the La Furs tank battery pit is cited by Mr. Norman as an example of failed mechanical integrity. However, this memo does not address any issue on the VPSB lease and does not conclude that the pit poses any environmental threat to either the La Furs or VPSB property. The La Furs tank battery was taken out of service 1986.

A review of the information available to date has shown relatively few instances of mechanical problems. Oil and gas operations are mechanical operations. Equipment problems, pressure communication issues, leaks and spills

can and on occasion do occur as part of normal and routine operations. Nothing unusual or out of the ordinary was noted on the area under discussion.

Mr. Norman also discusses violations of mechanical integrity in concert with permit violations. Nothing was noted in the review that indicates Unocal's operations led to any mechanical integrity permit violations. The one example Mr. Norman uses of permit violations is the lack of adequate La DEQ discharge permits. It appears that Unocal had the necessary La DEQ discharge permits required for the time.

Mr. Norman cites documents that he alleges are evidence of over 70 spills experienced by Unocal between 1970 and 1995 (25 years). Some of the documents cited by Mr. Norman are not spills or leaks and some of the documents are not on the VPSB property. A reviewed of Mr. Norman's cited documents appear to indicate that Unocal handled the leaks in a routine and customary manner. The leaks and spills that were noted appear to be relatively diverse and spread-out across the field. No one well or area was noted to have an unusually high concentration of incidences and in fact some wells and equipment never leaked. Furthermore, the majority of leaks were relatively small indicating quick detection. The leaks and spills appear consistent with aging infrastructure operations. The highest yearly counted noted was 15 items (either leaks or repairs) field wide which occurred in 1989. The number and diversity of leaks and repairs would hardly be considered an excessive amount for a field as old, large and diverse as the EWL Field.

As noted by Mr. Norman some of the spills were of oil that required notification of the agencies with oversight of such matters. The information provided indicates that Unocal complied with the reporting requirements and paid any final assessed penalties. The two fines noted were regulatory required and were set at minimal levels given Unocal's operational history in the field. It appears the incidents involved limited quantities which indicates quick detection.

Mr. Norman further opines that these leaks are evidence that many more leaks would have occurred during the earlier years but were simply undocumented. It should be noted that Unocal operated at the EWL Field, which was in a coastal environment, for 55 years. During the earlier years of the field, and as wells and facilities were added, the equipment and facilities would have been new and less likely to have mechanical issues. By 1970 operations would have been ongoing for 30 years with the infrastructure aging. The older the field and the more usage and wear and tear on the infrastructure the greater the likelihood of mechanical issues.

The documents reviewed indicate Unocal had an equipment and flow line inspection protocol. Many of the vessels and flow lines were refurbished or replaced as necessary. By way of example in March 1990 Unocal x-rayed, tested and inspected 62 vessels in the EWL Field. Furthermore, Unocal also provided training on leak detection and prevention, with mock cleanup drills. Unocal had practice drills that simulated spills that tested field personnel's responses to those mock spills. The company had an established corrosion inhibition program designed to prevent corrosion that could lead to leaks. Unocal responded to spills by shutting in wells and repairing or replacing flow lines. Periodically Unocal would have airplane flyovers for the field to look for leaks or other problems.

Further, Mr. Norman asserts that Unocal did not follow good engineering design, maintenance and operating practices. The documents reviewed appear to indicate that Unocal installed, operated and maintained its facilities within the norms of accepted engineering and operational practices of the time.

Mr. Norman also references "casing problems in specific wells". The document cited by Mr. Norman with bates number 4074021-0014356 appears to reference tubing to casing communication which would indicate a tubing issue. No problem with the casing was noted. A review of the information and documents provided did indicate that certain SWD wells had issues with holes in the casing;

with water reaching the surface in two of the SWD wells from shallow casing leaks. It appears that workover plans were initiated once the problem was detected. As discussed previously the casing issues that were noted in the materials appeared to be dealt with in a timely and appropriate manner.

Mr. Norman discusses photographs dealing with the manifold at the Unocal Tank Battery Facility in 1985. The photographs reviewed do show soil discoloration below the header system. The origin of this discoloration is unknown. It may be associated with marsh soil and be a combination of decayed vegetation and moisture or could be leakage of oil from repairs to the header system. Oil stained soil below a header complex would not be out of the question for a large header system that had been in place for many years. This would be the type of wear and tear usage that could be expected for the time frame as the header system would not be decommissioned after each event but instead the area would be clean and the stained soil removed once the header was decommissioned at the end of the facility's life. Certainly if live oil was present it should be removed leaving the stained soil behind.

Mr. Norman cites documents that he indicates shows communication between one or more producing wells, the SWD #37 well and the Unocal's camp potable water. While there is a discussion on methane being detected at the camp in the Unocal documents, there is no mention about a producing wellbore or the SWD #37 well being the source of the methane or eliminating marsh gas as being a potential source of the methane. Unocal tested the potable water in 1994 and found that in its opinion the methane was not oil and gas related due to the lack of other associated hydrocarbon gases. A review of the gas sample taken from the camp's potable water supply indicates the gas at the camp was likely swamp gas; given the lack of hydrocarbon elements heavier than methane in the sample and the elevated level of nitrogen (N₂) in the sample. Furthermore, a comparison of the camp's

potable water gas sample and field produced gas samples show a marked difference indicating they are from a different source. The documents reviewed indicate that the potable water system was repaired. No other reference to a methane being in the potable water supply was noted.

Mr. Norman indicates that land farming of pit solids occurred on the property. Land farming is one of the methods recognized by the State of Louisiana as a means for handling pit material. It appears that Unocal utilized a standard industry procedure of first injecting the slurred pit material down a well, then bringing in fill and mixing the remaining material with the fill before spreading the mixture in the process known as land farming.

Mr. Norman discusses issues with mercury in the soil on the VPSB property and cites a document that he claims shows Unocal operated the gas metering and gas sales line from the EWL Field to Transco. However the document cited only deals with one well (the VPSB #35) drilled in 1980 and 500' of a 2-1/2" pipeline. Nevertheless, Unocal would have operated several gas meters including test meters, gas lift meters and check meter(s). Transco would have operated the gas sales meter at the gas custody transfer point. Any gas meter storage or repair may have caused mercury to be present in the limited specific areas around the meter being repaired. A Phase I and II Environmental Site Assessment (ESA) performed by Envico in early 1995 shows the presence of mercury in isolated areas of the field. Mr. Norman states in his report "that the Envico reports...show the presence of Mercury [sic] in canals and soils throughout the property." The results of the Envico Phase II showed levels of mercury exceeding 29-B limits near the meter building - not throughout the field. In September 1995, Envico remediated two areas that they had identified earlier in the area known as the base camp. An area around the glycol unit was remediated for BTEX and an area around the meter station was remediated for mercury. IES found one 29-B exceedance in 2010. It

was located at the VPSB A facility. IES did not find any 29-B exceedances of mercury when they tested during 2014.

Mr. Norman discusses environmental reports done during the 1990s – the Envico report, the Titan report and the Newpark report. The Envico ESA was prepared in February 1995 – prior to Unocal selling the property to Resource Acquisition Corporation (RAC). The report states that “Only minor spills have ever occurred in the field and they have been reported and handled prudently and as per regulatory requirements.” Envico did cite “minor visible or assumed environmental risk or hazards...” but goes on to say that “[All] other environmental and operational aspects of the East White Lake Field meet specifications set forth by local, state and federal regulatory agencies with jurisdiction in this field.” The minor risks cited were 1) presence of elevated mercury around the meter house at the main dock, 2) presence of elevated BTEX around the glycol area at the main dock, 3) 29-B exceedances of oil and grease at twelve locations out of fifteen sampled and, 4) Sodium Adsorption Ratios (SAR) that exceeded 29-B limits in thirteen out of fifteen locations sampled. The ESA resulted in BTEX and mercury remediation performed by Unocal during September 1995.

Highlander Environmental Corporation (Highlander) prepared an ESA for Titan Resources in September 1997 covering multiple oil and gas properties including the EWL field. The report indicates that onsite personnel stated that Unocal had remediated the mercury and BTEX exceedances. The Highlander ESA noted minor issues but no major problems. A review of the attached photographs to the report indicates that the EWL field surface facilities have been well maintained.

Newpark Environmental Services (NES) performed an ESA in April 1999 - 5 years after Unocal sold the property. The ESA was performed based on two days of visual examination covering nine oil and gas properties. The ESA was prepared for Phoenix Oil and Gas for properties owned by Carrollton Resources. However the

EWL Carrollton property was operated by RAC. For the EWL property, NES noted that “[t]he level of visible soil staining at the field production facility is minimal...” and commented on a “recent spill event”.

Mr. Norman quotes general statements in the Newpark report that may not be attributable to the EWL field such as glycol filters and accumulations of oil materials. NES stated that in the EWL field “...used oils are collected and recycled into the production process, and filters are drained and transported to shore for proper disposal.” The NES report does not identify any problems that relate to the time Unocal operated the field.

Mr. Norman refers to materials that he indicates shows Unocal’s level of knowledge concerning soil and ground water issues. The materials reviewed indicate that these materials are contemporaneous with or postdate the time period when Louisiana was either moving toward requiring or requiring the closure of earthen pits. Certainly, as environmental knowledge and detection capabilities increased Unocal’s knowledge base increased as did other companies.

Mr. Norman also discusses various other issues to include permit violations, DEQ violations, handling of spills and chemicals, other sources of contaminations and prudent operations. These issues are discussed previously in this report. Mr. Norman briefly mentions some of the other types of chemical he believes could have been used. He gives no specific cites as to the areas under discussion. Mr. Norman opines that the operations on the subject property were performed unreasonably and inadequately in certain areas of operation and protection of the environment and that there is clear evidence that Unocal did not act in a reasonable prudent manner. I disagree. It appears that Unocal acted in a manner that was generally consistent with the then current industry practices and then current regulations.

Mr. Norman appears to suggest that the wording in the 1994 Surface and Saltwater Injection agreement between VPSB and Unocal somehow establishes

some form of prior obligation. It appears the wording cited by Mr. Norman makes it clear that the restoration should return the property as nearly as practicable to its 1994 condition, not some prior condition. The 1994 surface lease appears to recognize the fact that a prior history for the area existed and acknowledges that future usage will potentially have an effect on the property.

Observations and Conclusions

Based on a review of the information and data available to date, it appears that the oil and gas exploration and production operations performed by Unocal on the VPSB property were reasonable, routine and necessary operations for the exploration and development of the oil and gas reserves on the property and for the production, processing and sale of the oil and gas.

The information and data available to date indicates that Unocal conducted its operations in a manner that was consistent with the normal and customary way oil and gas operations were conducted for coastal, rural, marsh based operations in the region, for the time periods the operations were performed. Furthermore, it appears that Unocal conducted its oil and gas operations on the VPSB in a reasonable manner, generally in keeping with applicable industry standards and governmental regulations.

Centralized operations were employed in marsh operations in South Louisiana. By centralizing operations fewer facilities were required resulting in less disruption to the surrounding areas. The centralized oil and gas operations conducted by Unocal on the VPSB property included some usage of earthen pits and some discharge and/or the injection of produced salt water. These operations were known of and accepted by the appropriated regulatory agencies with oversight of the oil and gas industry and were within accepted industry standards for coastal Louisiana during the time periods they were used.

The vast majority of water produced by Unocal's oil and gas operations at EWL Field was injected into subsurface salt water aquifers through its SWD well system. The Unocal SWD wells under discussion appeared to be constructed in a proper fashion. They were all approved by the state and no unresolved issues were noted to have been raised by the state.

During normal drilling and production operations, leaks and other mechanical problems can and sometimes do occur. Often times such situations can allow releases of oil, gas, salt water and/or other fluids at well sites, production facilities and along flowline or pipeline right of ways. The simple fact that such incidents may or may not occur is not indicative of unreasonable or imprudent operations. Likewise the issuance of COs and CNs does not in and of itself imply that unreasonable or imprudent operations occurred. The information and data available to date does not indicate that Unocal had an unusual number of incidents or occurrences on the VPSB property. Several leak issues were noted but they appeared to be addressed by Unocal. One CO was noted for the VPSB property related to Unocal that involved left over materials at a P&A'd well, which again was addressed by Unocal.

Oil and gas operations are industrial type operations and will leave some type of indication or foot print that they were conducted. However, any areas adversely impacted above the applicable, appropriate, regulatory requirements, that create a real risk of harm, should be restored in a reasonable and practical manner by the responsible party. If there are areas on the VPSB property attributable to oil and gas operations that require special attention the party responsible for those problems should address such areas in a common sense fashion that does not create more interruption and damage to the area's environment. Any restoration should be done at the appropriate time based on the situation and the agreements and regulations in place.

The salt water produced in association with the oil and gas operations on the tracts under discussion was native fluid. As such, it came out of the ground with the oil and gas, was separated from the oil and gas and was either returned to subsurface strata that contained the same type of native fluid or discharged to surface water bodies. Any retention of the produced water would be limited to the temporary surface retention in tanks and/or pits. This type of temporary retention would be part of normal, routine and customary production operations and would be covered under normal OG&M lease agreements or other operational type agreements. It would also be necessary for the production, processing and sale of the oil and gas.

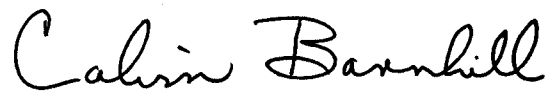
Produced water rates can and do vary significantly over the life of a field, particularly when the time frame is as long as the one cited. This variation can be the result of operational, mechanical, reservoir or production zone changes that can and do occur over the life of a field. Actual water production data has not been noted for a significant portion of the productive life under discussion. Without actual water production data the estimated discharged water volumes put forward by Mr. Norman could and very likely would vary significantly from actual produced water volumes.

These remarks and conclusions are based on the information furnished to date and my education, training, knowledge and experience in the oil and gas industry. I am a Registered Professional Petroleum Engineer with two (2) degrees in Petroleum Engineering and 30 plus hours of graduate level environmental science course work. Over the course of the past +/- 46 years, I have worked in many aspects of the oil and gas industry, including time spent designing wells, drilling and completing wells, working over and maintaining wells; producing wells; operating properties, designing and installing facilities, negotiating leases, agreements and contracts, P&A'ing wells and restoring sites.

A copy of my resume is attached as Attachment "B" and made a part of this report. If called to testify at trial, I would expect to testify as to the agreements and operations involved in this situation, the roles and responsibilities of the various personnel, the equipment involved and any applicable recommended practices, guidelines or regulations.

Please be advised this is an initial report based on the work performed to date. As additional information is received and/or reviewed I will adjust my findings if necessary. If you have any questions or if I can be of any further assistance please let me know. With kind regards, I remain

Sincerely,

A handwritten signature in black ink that reads "Calvin Barnhill". The signature is written in a cursive style with a large initial 'C'.

Calvin Barnhill, P.E.