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**COMMERCIAL SCALE DEMONSTRATION—ENHANCED
OIL RECOVERY BY MICELLAR-POLYMER FLOOD**

MASTER

Date Published—February 1980

Work Performed for DOE
Under Contract No. DE-AC19-78ET-13077

Marathon Oil Company
Findlay, Ohio

U. S. DEPARTMENT OF ENERGY

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**Annual Report
for the Period
October 1978—September 1979**

**Marathon Oil Company
Findlay, Ohio 45840**

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INTRODUCTION

A contract was executed between the United States Energy Research and Development Administration (now Department of Energy) and Marathon Oil Company, Findlay, Ohio, on September 30, 1976, for the purpose of a commercial scale test of enhanced oil recovery by the Maraflood™ oil recovery process.

This commercial scale test, known as the M-1 Project, is located in Crawford County, Illinois. It encompasses 407 acres of Robinson Sand reservoir and covers portions of several waterflood projects that were approaching economic limit. The project includes 248 acres developed on a 2.5-acre five-spot pattern and 159 acres developed on a 5.0-acre five-spot pattern.

Development work commenced in late 1974 and has previously been reported.^{1,2} Micellar Solution (Slug) injection was initiated on February 10, 1977, and is now completed. After 10% of a pore volume of slug was injected, injection of Dow 700 Pusher™ polymer was initiated.

In the 2.5-acre pattern the oil cut has increased from 4.8% in February, 1979, to 8.6% in September, 1979. As expected, the 5.0-acre pattern oil cut has shown no response to date.

SUMMARY

This Third Annual Report covers the interim from October 1, 1978, through September 30, 1979. During this interim, slug injection was completed and injection of polymer spike began. The report is organized under four Work Breakdown Structures (WBS) which are summarized below.

WBS No. 2100 - Fluid Injection

- 1) Slug injection was completed November 20, 1978, after 10% of a pore volume was injected.
- 2) Polymer injection began immediately after slug injection. The first phase of polymer injection consists of 1,156 ppm polymer in water.
- 3) Injection of 1,156 ppm polymer into the 2.5-acre pattern was completed May 20, 1979, after injecting 11% of a pore volume. Injection of 1,156 ppm polymer into the 5.0-acre pattern is expected to be completed in mid-December, 1979. Injection of 800 ppm polymer concentration follows immediately after 1,156 ppm injection is complete.

Pusher™ - Trademark of Dow Chemical Company

Maraflood™ - Trademark of Marathon Oil Company

SUMMARY (Continued)

WBS No. 2100 - Fluid Injection (Continued)

- 4) A pilot field polymerization unit was installed adjacent to the M-1 Project during November, 1978, for economic and operational evaluation. On July 29, 1979, testing was completed and the polymerization unit was shut down. The results and conclusions based on the testing are reported.
- 5) From January to the middle of March, 1979, several M-1 injection wells showed evidence of formation pressure parting. To successfully correct this situation, the wellhead pressures and injection flow rates were decreased on these wells.

WBS No. 2200 - Fluid Production

The construction of the M-1 Project treating facility main stream is complete. Separate parallel flow streams for the 2.5-acre and 5.0-acre produced fluids were designed into the facility. The separate flow streams facilitate the collection of production data for accurate monitoring of the two patterns.

WBS No. 2300 - Performance Monitoring

- 1) Analysis of the data from pressure tests in six injection wells has indicated that no wellbore damage has occurred during polymer injection. Data from pressure tests in six producing wells shows little change in mobility.
- 2) Subsequent to injection of tritiated water into ten injection wells, produced fluids from all oil wells have been analyzed monthly for the presence of tritiated water. Hopefully, this program will yield a better understanding of directional permeability, fracture orientation, and fluid conformance.
- 3) Samples of produced water have been collected monthly and analyzed for sulfonate (a slug component) content. In September, 1979, 79 wells indicated sulfonate levels higher than the field average. This high number of wells indicates that the oil bank is approaching the M-1 Project oil wells.
- 4) Two observation wells have been drilled and completed with fiberglass casing through the Robinson Sand. They have been logged monthly to determine changes in reservoir water saturation. During the reporting period, observation well GI-7 showed a decrease in resistivity. This is probably due to the approach of the saline micellar solution. Since June, 1979, GI-8 has shown increased resistivities, indicating the approach of the oil bank.

SUMMARY (Continued)

WBS No. 2300 - Performance Monitoring (Continued)

- 5) A steady increase in oil cut over the past six months in the 2.5-acre pattern from 4.8 to 8.6% is consistent with a production increase projected to occur as a result of the injection of Maraflood Process Fluids.

WBS No. 2400 - Economic Monitoring

An analysis and forecast based on historic and future economic parameter estimates is reported.

¹Commercial Scale Demonstration - Enhanced Oil Recovery by Micellar-Polymer Flooding, M-1 Project - Facilities Report (BERC/TPR-77/2), DOE Technical Information Center (Bartlesville, Oklahoma, 4/77).

²Commercial Scale Demonstration - Enhanced Oil Recovery by Micellar-Polymer Flooding, M-1 Project - Design Report (BERC/TPR-77/1), DOE Technical Information Center (Bartlesville, Oklahoma, 4/77).

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077-36

Fluid Summary Data Sheet
September, 1979

	<u>2.5-Acre Spacing</u>	<u>5.0-Acre Spacing</u>	<u>Total Project</u>
Oil Production			
B/D	395	111	506
B/M	11,838	3,342	15,180
Cumulative, Bbls.	159,054	76,277	235,331
% PV	1.50	1.27	1.42
Oil Cut - %			
This Month	8.6	5.2	7.5
Last Month	8.6	5.4	7.6
Cumulative	5.8	4.5	5.3
Total Fluid Production			
B/D	4,615	2,143	6,758
B/M	138,454	64,278	202,732
Cumulative, Bbls.	2,730,062	1,690,936	4,420,998
% PV	25.7	28.2	26.6
Fluid Injection			
B/D	4,820	1,417	6,237
B/M	144,587	42,510	187,097
Cumulative, Bbls.	2,889,080	1,126,151	4,015,231
% PV	27.2	18.8	24.2
Injection/Production Ratio*			
This Month	.97	.95	.96
Last Month	.96	.99	.97
Cumulative	.99	.92	.97

*From Five-Spot Report

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077-36

Fluid Summary Data Sheet (Cont'd.)
September, 1979

	<u>2.5-Acre Spacing</u>	<u>5.0-Acre Spacing</u>	<u>Total Project</u>
Reservoir Pore Volume	10,627,513	5,996,535	16,624,048
Plant Pressure, psig	627	625	627
Polymer Viscosity, cp	30	51.1	34.8
Polymer Screen Factor	23.8	27.9	24.7

Wells

Producers	91	41	132
Injectors			
Micellar Fluid	85	29	114
Water	6	6	12
Water Disposal	1	1	2
Inactive	6	3	9

Fluid Injection Schedule

		<u>Polymer, ppm</u>	
	<u>Slug</u>	<u>1156</u>	<u>800</u>
2.5-Acre			
Starting Date	2/10/77	11/21/78	5/20/79
% PV Actual	10.0	11.0	6.2
% PV Ultimate	10.0	11.0	19.0
Cumulative, Bbls.	1,063,446	1,169,677	655,957
5.0-Acre			
Starting Date	2/10/77	11/21/78	
% PV Actual	10.0	8.8	
% PV Ultimate	10.0	11.0	
Cumulative, Bbls.	599,679	526,472	

SLUG INJECTION COMPLETION

Introduction

The design of the M-1 Project required the injection of ten percent (10%) of a pore volume of crude oil sulfonate slug (COSS). Immediately following slug injection completion, 1,156 polymer solution is injected at a target rate of 2.5 BPD/PNF.

Discussion

Injection of slug was completed November 20, 1978, after 10% of a pore volume was injected into both patterns. This amounted to 1,063,446 barrels and 599,679 barrels cumulative slug injection into the 2.5 and 5.0-acre spacing, respectively.

During slug injection, recommended rates were calculated so that each well would receive 10% PV when the total project had received 10% PV.

Analysis of the individual injection wells after slug injection indicated that the mean value of slug injected was 10.2% and 10.0% for the 2.5 and 5.0-acre patterns, respectively. The standard deviation from the mean value was computed to be 1.1% and 0.4% for the 2.5 and 5.0-acre patterns.

Polymer Injection

Introduction

Injection of 1,156-ppm polymer was initiated November 21, 1978, and has continued until May 20, 1979, in the 2.5-acre pattern. Injection of 1,156 ppm polymer will continue until approximately December 22, 1979, in the 5.0-acre pattern.

Discussion

Injection of Dow Pusher 700 1,156-ppm polymer (spike) began November 21, 1978, in both the 2.5 and 5.0-acre patterns of the project. Prior to changeover, all injection wells were equipped with a predetermined amount of coiled copper tubing to control individual well rates at an injection plant pressure of 400 psi. The 2.5-acre pressure stabilized between 370 and 395 psi with an average injection rate of 8,295 BPD (3.2 BDPF). The 5.0-acre pattern pressure stabilized at approximately 450 psi with an average injection rate of 2,153 BPD (2.9 BDPF).

POLYMER INJECTION, (Continued)

Discussion (Continued)

During the first nine days of 1,156-ppm polymer injection, Brookfield viscosity at 6 rpm and 68° F. averaged 52 cp. The screen factor³ averaged 22.9 at 77° F. Screen factor is defined as the ratio of polymer solution to water flow through the porous medium of a screen viscometer. The porous medium is generally five closely packed, 100-mesh stainless steel screens. Screen factors and viscosity are reported on the fluid summary data sheet.

In the months following polymer injection start-up, the average plant pressure in the 2.5 and 5.0-acre patterns gradually rose to a level exceeding the reservoir parting pressure (approximately 650 psi). This pressure rise was a result of extensive addition of coiled copper tubing to maintain proper regulation of the individual wells. As of September, 1979, the injection rate and pressure in the 2.5-acre pattern was 1.86 BPDPF and 627 psi, respectively. In the 5.0-acre pattern, the injection rate and pressure was 1.90 and 625 psi, respectively.

Injection of Dow Pusher 700 at 800 ppm concentration began May 20, 1979, in the 2.5-acre pattern of the project. During the first week of operation, the plant pressure was 632 psi at an injection rate of 4,851 BPD (1.87 BPDPF). The Brookfield viscosity at 6 rpm and 72° F. averaged 37.69 cp. The screen factor averaged 23.4 at 77° F.

At current desired injection rates, completion of the 1,156 ppm phase of polymer injection on the 5.0-acre pattern is scheduled for December 22, 1979.

FIELD POLYMERIZATION OPERATIONS

Introduction

In order to evaluate the economic and operational feasibility of field polymerization of acrylamide monomer, a pilot unit was installed adjacent to the M-1 Project during November, 1978. The polyacrylamide polymer solution was injected into five 2.5-acre spacing wells (Q-3, Q-5, Q-7, O-3 and O-5). Injection data were gathered and reported monthly along with 2.5 and 5.0-acre pattern injection data for comparison. On July 29, 1979, Marathon's Denver Research Center personnel completed test work on the field polymerization facility.

³Knight, B. L., "Reservoir Stability of Polymer Solutions," Journal of Petroleum Technology (May, 1973), pp. 618-626.

FIELD POLYMERIZATION OPERATIONS (Continued)

Discussion

During 1974 and 1975, Marathon Oil Company constructed and tested a pilot facility at the 119-R Maraflood Process Project for the polymerization of acrylamide monomer and the partial hydrolysis of the resulting homopolymer. The experience gained from this facility suggested on-site polymerization was feasible and adequate product control could be achieved in relatively simple manufacturing equipment.

Marathon was also able during these early runs to define the essential parameters for the polymerization and hydrolysis reactions. Reaction time and temperature, catalyst levels and solution concentrations were established to provide a polymer solution product within the desired viscosity and screen factor ranges required for mobility control.

However, the testing of prolonged injectivity had to be executed in the M-1 Project because of the limited availability of wells. The large number (114) of injection wells in the M-1 allowed the use of five wells for field manufactured polymer testing without jeopardizing the Project's performance even if seriously restricted injectivities should be encountered. Furthermore, the injectivity could be compared over a relatively long history directly with Dow Pusher 700 solution injection.

The Pilot Facility

The pilot equipment was moved to a location near the M-1 Unit in October, 1978, and, after some limited modifications, a series of shakedown runs was made. The facility consists essentially of three vessels, two mixers, and several transfer pumps (see Figure 17).

The reactor is an 800-gallon capacity fiberglass tank, externally insulated and equipped with a top-mounted mixer and necessary charge lines. A standard insulated 100-barrel, mild steel, internally epoxy-coated tank is used for hydrolysis. A propeller-type mixer is mounted on the top. A surplus 300-barrel internally coated steel tank with no mixing capability proved satisfactory for a product storage tank.

An ion-exchange column is used to remove copper ions from the monomer solution. Copper ion is incorporated to prevent auto-polymerization of the monomer during shipping and storage. The ion-exchange resin is identical to that used routinely in the water softeners at the M-1 Project.

Moyno pumps transferred the highly viscous product from reactor to hydrolysis tank to product storage. The dilution of the product concentrate to injection

FIELD POLYMERIZATION OPERATIONS (Continued)

The Pilot Facility (continued)

concentration is accomplished with a product metering pump feeding into the water stream at the suction of the triplex pump. A static in-line mixer is installed on the high pressure side of the triplex to insure adequate mixing upstream of the wellheads.

The Process

Acrylamide monomer, received as a 50% solution, is diluted further with water and ion-exchanged to remove the cupric ion inhibitor. Air is added during ion exchange to prevent the onset of premature polymerization. The ion-exchanged monomer solution is charged to the polymerization reactor together with softened fresh dilution water warmed to a pre-determined temperature. Once the polymerization reaction has been initiated, as indicated by a moderate exotherm, the reaction is allowed to continue essentially unattended. For the sake of convenience, an overnight reaction time is usually chosen. The next morning the polymer solution product is transferred to the hydrolysis reactor. The polymerization reactor is then washed and the next polymerization batch initiated.

This polymerization reaction mixture is diluted with water and charged together with stoichiometric amount of sodium hydroxide to the hydrolysis reactor while a new batch of polymer solution is being prepared. Again, for convenience, an overnight reaction time is used. The quantity of sodium hydroxide utilized is dependent upon the degree of hydrolysis (normally in excess of 20%) to be achieved.

The Product

The general results of 51 pilot runs are summarized in Table 1. Some of the proprietary aspects of this technology such as catalyst concentration and detailed reaction conditions are coded. The monomer supplier is also coded because it is not the intent of this report to discuss the relative merits of one monomer source vs. another.

One of the objectives of this pilot plant work was to manufacture a product in the field which would have bench properties comparable to Dow 700 Pusher at the same concentrations. When examining the data in Table 1, it should be noted that Dow 700, at a concentration of 1,324 ppm in softened fresh water, exhibits a screen factor of approximately 29-32 when measured on the same screen viscometer as the field polymer measurements. The screen factor data listed in Table 1 show comparable products can be obtained with either monomer source if the proper conditions and catalyst level (4,5,6, and 7) are employed.

FIELD POLYMERIZATION OPERATIONS (Continued)

The Product (Continued)

Note that the Brookfield viscosities for field polymer are higher than for Dow 700 (which is about 50-55 cps at 1,324 ppm, measured at 6 rpm). The viscosity of the field manufactured material was generally over 100 cps at 6 rpm and, therefore, had to be measured at lower spindle speeds.

The reproducibility obtained in pilot runs has proven to be most satisfactory. Runs 37-40 were specifically intended as checks of reproducibility. These runs produced a mean screen factor of 50.95 with a standard deviation of 2.80. This is very acceptable because modest variations are easily "blended out" during the final in-line dilution of the product stream before injection. By way of comparison the weekly average screen factor of the 1,156 ppm Dow 700 solutions injected into the 2.5-acre patterns was 29.1 with a standard deviation of 2.20. The reproducibility of a field manufactured polymer is comparable to our ability to prepare a solution from dry polymer. The ultimate reproducibility of a field manufactured polymer solution as blended just prior to injection should be considerably better than solutions prepared from a dry polymer.

Product Injectivity

Essentially all the polymer produced in the field pilot plant was injected into five wells in the M-1 Project. These five test wells were O-3, O-5, Q-3, Q-5, and Q-7. Selection of these wells was based on the following criteria.

- 1) Convenience of location.
- 2) Maintaining desired injection schedule.
- 3) Representative range of permeability, sand thickness and desired injection rates.
- 4) Maintaining reasonable wellhead pressures.

The polymer solution was diluted to the desired injection concentration by in-line blending. Product in a concentrated form was metered into a water stream immediately upstream of the injection pump suction. A static in-line mixer was installed downstream of the injection pump to further aid in mixing. A Cuno filtration cartridge was used in the injection system. Screen factor data taken at the injection pump discharge and compared to data taken at individual wellheads indicate very little loss of polymer quality from pump to well. This suggests that the polymer was being adequately mixed and no significant amount of degradation was occurring.

FIELD POLYMERIZATION OPERATIONS (Continued)

Product Injectivity (Continued)

The injection of field manufactured polymer solution into the five test wells has been regularly reported and is summarized on a weekly basis in Table 2. The 5.0-acre patterns are also included for comparison purposes in Table 2. Although these data would not suggest material differences in the injectivity characteristics of the field manufactured polymer and Dow 700, the conclusions which can be drawn from these data alone must be considered tentative. A more rigorous approach was to follow the injection of the field manufactured polymer in these five wells with Dow 700 solution and then compare injectivity characteristics.

Analysis of these injectivity data by the Hall⁴ method results in Figures 18 through 22. These analyses show no significant injectivity changes in four of the five wells when the change from field manufactured polymer to Dow 700 was made. The differences in injection concentrations between field polymer (1,000 ppm) and Dow 700 (800 ppm) was small and screen factors for each were comparable. The data analyzed by the Hall method represent the final ten days of field polymer injection and the first ten days of Dow 700 injection. The conclusions can be drawn that the field manufactured polymer had injectivity characteristics at least as good as those of Dow 700.

There were some variations in injected polymer concentration during the period January, 1979, through mid-March, 1979. These were a result of the use of an improper pump for feeding the highly viscous concentrate into the injection system. Beginning in March, with the delivery of a new pump, the variations in injection concentrations became very acceptable. Most major changes made after March 13, 1979, were done manually in order to see if the injectivity changed as a function of concentration--which it did not.

⁴Hall, H. N., "How to Analyze Waterflood Injection Well Performance," World Oil (October, 1963), pp. 128-130.

PRESSURE PARTED INJECTION WELLS

Introduction

From January to the middle of March, 1979, several M-1 injection wells had shown evidence of formation pressure parting. As a result, the flow rate and pressure for these wells have been decreased.

Discussion

On March 7, 1979, polymer and fresh polymer makeup water was found in the produced fluid of oil wells J-8 and J-12 (both wells are indicated by squares in Figure 23). Surrounding injection wells I-15 and K-7 were believed to have pressure parted thereby creating a channel to the producers J-8 and J-12. As a result, injection wells I-15 and I-7 were temporarily shut in until April 1, 1979, and the injection rate was decreased from 2.5 to 2.0 BDPNF.

Thirteen additional injection wells (C-1, C-13, E-3, I-5, K-1, K-13, M-3, M-9, O-13, O-15, U-9, W-9, and W-15) on the 2.5-acre and two injection wells (GG-13 and II-15) on the 5.0-acre had also shown possible pressure parting. These wells are indicated by circles in Figure 23. Pressure parting is usually indicated by a rapid rise in injection rate and a drop in injection pressure. Rate reduction has proven to be a satisfactory technique for restoring the well to normal operating conditions.

FLUID TREATING

Introduction

An integral feature of Maraflood process projects is the treatment of produced fluids. The construction of the M-1 Project main stream treating facility has been under way for several months and is now complete. The 2.5-acre and 5.0-acre produced fluids will be treated on separate, parallel flow streams. The separate flow streams will facilitate collection of production data and enable accurate monitoring of the two patterns. See Figure 24 for a schematic drawing of the M-1 Project fluid treatment facility.

Oil Quality

The 119-R and 219-R Maraflood process projects encountered both "wet oil" and "dirty water" (reverse emulsion) treating problems. Of these two generic types

FLUID TREATING (Continued)

Oil Quality (Continued)

of problems, "wet oil" seems more prevalent, especially during the major portion of oil production history. Also, "wet oil" presents the most potential risk to refining operations. "Wet oil" cannot always be visually detected and can be missed by some common, less rigorous analytical techniques such as the use of a centrifuge (grind-out).

Accurate measurement of water in crude oil produced from the Maraflood process has been accomplished by the Karl Fischer analysis technique. It is recognized, however, that other techniques might be calibrated against this method. Pipeline quality oil (sell oil) for the Illinois Basin crude would nominally contain 0.3% water (actually BS&W) or less. However, it is observed the achievement of such a water content is not always sufficient to assure an acceptable crude oil has been produced. Therefore it is important to assess the potential behavior of the crude oil in an electrical desalter. Adequate dehydration of the crude oil does not necessarily mean all of the components (presumably sulfonates) which might upset a desalter have been removed.

A proprietary, laboratory-scale desalter test has been devised by the Tretolite Division of the Petrolite Corporation. This so-called EDDA (Electric Desalting and Dehydration Apparatus) Test is useful in anticipating the behavior of a crude oil in a refinery's desalter. Several semi-quantitative observations are made during this test including rapidity of breakout of the added water, quality of the water phase, and type of interface. A quantitative measurement found useful in establishing the quality of a crude oil is the water content of the oil after it has been through the EDDA Test.

Thus, a crude oil showing a low water content before EDDA can sometimes show too high a water content after the test. This means the crude has taken up a large quantity of water during the test and its desalting process at the refinery could be suspect. Presumably, the tendency to take up water during the EDDA test is related to the residual sulfonate content of the oil. However no quantitative evidence of this is available and it is believed the "EDDA test" approach is more pragmatic than sulfonate analyses.

The question arises as to how low the water content should be after EDDA. While attaining the original pipeline specification would seem to be the conservative approach, it is possible that such a level may be unnecessarily rigorous, and necessitate excessive treating costs. Working closely with refining personnel during the M-1 Project will establish a realistic specification.

FLUID TREATING (Continued)

Production Facility

The original production treating system constructed for the M-1 Project was described in the Facilities Report.⁵ It consisted basically of retention tankage and electrostatic oil processing units (Chem-Electrics). Small quantities of treating chemicals were added as required and heat was provided by the Chem-Electrics. Provisions for drawing and recycling emulsions and non-specification crude oil were made available. Produced water was piped to salt-water disposal wells. This system, with a few minor modifications proved adequate for treating M-1 produced fluids through May, 1979.

Experience gained in the 219-R Project indicated more elaborate treating facilities would likely be required for the M-1 Project. These facilities have been under construction for the past several months and are now complete. It is probable the size of certain vessels and the configuration of other parts of the facility will be changed as it comes on stream and specific experience is acquired. For that reason only a block diagram, Figure 24 is shown at this time. It is estimated that it will be several months before the final configuration is evolved. A detailed schematic will be published at that time.

The principal features of the facility are 1) retention, 2) chemical treatment, 3) fresh water wash capability, 4) heat, 5) electrostatic separation, and 6) a separate emulsion treating unit for recycling emulsion effluents to extinction. There are two main production treating trains, one each for the 2.5-acre and the 5.0-acre spacing patterns. They are sized according to the relative volumes of these two streams. The emulsion treating unit will handle effluent from both trains. Design and construction of the emulsion treating facility is still underway. It, too, will be described in detail at a later date.

As of September 30, 1979, treatment of 2.5-acre produced fluids includes addition of 1,500 ppm of Tretolite RP-578 ahead of two horizontal free water knockouts. The oil off of the free water knockouts flows to an insulated 800-barrel tank after being heated to 150° F. Prior to a second heating of this fluid is an addition of 1,500 ppm RP-578 and 25% fresh water wash. The oil off of the second heater is piped directly to sell tanks.

Treatment of 5.0-acre fluids includes addition of 1,500 ppm to the fluid off the top of the free water knockouts. To date, no chemical has been found that aids in fluid separation in the free water knockouts; therefore, it has been necessary to bypass a portion of the total produced fluid stream to the first heater where separation occurs. After being heated to approximately 150° F. and retention,

⁵Knight, Bruce L., Editor, "M-1 Project Facilities Report BERC/TPR-77/2", ERDA Technical Information Center (1977) 7-9.

FLUID TREATING (Continued)

Production Facility (Continued)

another 1,000 ppm of RP-578 plus 25% water wash is added. The oil off of the second heater is sent directly to the sell tank battery and then to the LACT. Because of changes in both 2.5 and 5.0-acre produced fluids, it is sometimes necessary to vary chemical concentrations and treatment configuration to meet the immediate needs.

A trailer-mounted pilot treating facility was constructed some time ago and tested extensively in the 219-R Project. It is now being used to anticipate future M-1 treating requirements using produced fluids from Well No. L-12. Well No. L-12 has been showing an oil cut and sulfonate kick for several months and should reflect behavior of the composite fluids for the Project at some future date when sulfonate content of produced fluids becomes a treating factor.

WBS No. 2300 - Performance Monitoring

ROUTINE DATA PRESENTATION

Introduction

In order to effectively monitor the progress of the M-1 Project, Summary Data are presented in Tables and Figures.

Disussion

The Fluid Summary Data Sheet on Pages 4 and 5 presents data for the month ending September, 1979. This sheet contains monthly and cumulative oil production, total fluid production, and fluid injection data for both the 2.5 and 5.0-acre portions of the project.

Figures 1 through 16 show a map of the project area, and plots of various injection and production data.

TRANSIENT TESTING

Introduction

Six injection wells are to be transient tested regularly, and six oil wells are to be tested annually.

Discussion

Twelve wells have been selected for regular pressure monitoring. Six injection wells (C-3, I-7, O-13, S-7, GG-13, and QQ-13) and six producing wells (D-4, H-8, P-12, T-8 HH-12, and PP-12) will be monitored. The criteria utilized to select these wells were discussed in the previous annual report.⁶ The location of these wells may be found in Figure 25.

Amerada pressure gauges were used to collect pressure buildup and falloff data for each injection well. The pressure gauges were set at an approximate depth of 800 feet below the surface. The results were then analyzed using a Miller-Dyes-Hutchinson⁷ plot.

⁶Burdge, D. N., "Enhanced Oil Recovery by Micellar-Polymer Flood Annual Report for October 1976 - September 1977" US DOE Technical Information Center, (1978) P. 19.

⁷Miller, C. C., Dyes, A. B., and Hutchinson, C. A., Jr., "The Estimation of Permeability and Reservoir Pressure from Bottom Hole Pressure Buildup Characteristics," SPE Transactions, Vol. 189 (1950), pp. 91-104.

TRANSIENT TESTING, (Continued)

Discussion (Continued)

Table 3 summarizes the results of the injection well transient tests. Also included in this table are the results of past transient tests conducted in these wells.

Injection well transient tests immediately subsequent to the initiation of slug injection have shown that the apparent skin factor increases and the mobility decreases during slug injection compared to waterflood test results. These are expected trends during injection of viscous fluids.

A series of injection well tests conducted during October of 1978 before the completion of slug injection indicate mobility values (k/u) higher than those calculated previously during slug injection. This trend may have been caused by the injection of a new slug that was highly non-Newtonian. In addition, injection wells GG-13 and QQ-13 were fracture stimulated prior to these tests possibly causing the marked increase in mobility.

The latest series of injection well tests were taken during injection of 1,156 ppm polymer. In general, the results have shown slightly lower mobility values (k/u). The skin factors have remained constant or have decreased indicating no apparent wellbore damage has occurred.

During the interim period of this publication, two series of oil well transient tests were conducted. Oil well pressure transient tests are based on the measurement of fluid levels using an echometer. The fluid levels are interpreted as hydrostatic head produced from the bottom hole pressure of the well.

This technique eliminates the need to pull rods as would be necessary if a pressure bomb was used. Similar to the injection well test, the Miller-Dyes-Hutchinson plot method of analysis was used.

Table 4 summarizes the result of the six oil well transient tests. Table 4 also contains tests made during slug injection and before the start of the M-1 Project.

The latest test show the fluid mobility (k/u) is basically unchanged from the previous test. Test results indicate that skin damage has increased slightly although no serious damage has occurred.

TRITIATED WATER INJECTION PROGRAM

Introduction

In order to analyze the parameters controlling fluid communication, such as directional permeability, fracture orientation, and fluid conformance, a radioactive tracer (tritiated water) was injected into selected injection wells in the M-1 Project prior to slug injection. Produced fluid samples from oil wells are analyzed monthly to determine the presence of radioactive material.

Discussion

Ten injection wells were selected on the basis of spacing, reservoir parameters, well status, stimulation history, and location with respect to fresh water wells. Wide ranges of permeability and net sand thickness are represented. See Figure 26 for the location of these tritiated water injection wells. Selected wells include those shot, hydraulically fractured, and shot and fractured. Both new wells and conversions are included. Wells were chosen so that no oil well adjacent to two tritiated water injection wells. Table 5 lists the wells and parameters, as described above.

On January 29, 1977, tritiated water was injected into the wells shown on Figure 26 by representatives of Nuclear Sources and Services, Inc., Houston, Texas. A total of 140 curies of radioactive material was injected, in varying amounts, into the wells based on their respective pattern pore volumes.

A computer printout listing all wells showing tritiated water contents higher than background levels is shown on pages 116 and 117. Ten wells (XA-14, H-8, J-6, L-6, L-12, N-6, P-12, PP-12, RR-2 and TT-4) indicate the presence of tritiated water in the produced fluid stream in September, 1979. As of September 1979, 31 wells have shown the presence of tritiated water. Of these 31 wells, 11 wells have shown a tritiated water content higher than background levels for six or more months. Eighteen of the 31 wells are adjacent to a well in which tritiated water was injected.

A detailed analysis of this data is now under way; however, no conclusions have been reached. A discussion of any significant finding will be included in a monthly report.

HIGH SULFONATE CONTENT WELLS

Introduction

As part of routine performance analysis, produced water from each oil well is sampled monthly and analyzed for sulfonate at Marathon's Denver Research center.

HIGH SULFONATE CONTENT WELLS

Introduction (Continued)

Test for sulfonate as well as chloride content for the month of September, 1979, are shown on pages 92 - 115.

Beginning in March, 1977, produced water samples from each M-1 Project well have been analyzed to determine sulfonate content. The results are reported in values equivalent to the concentration in water divided by the concentration of a standard 1% solution of crude oil sulfonate slug (COSS). Because of the characteristics of surfactant components interacting with the reservoir, these analytical data are not suitable for material balance calculations. However, these data are useful for observing trends.

For the month of September, 1979, 79 wells in the 2.5-acre pattern show sulfonate levels which are significantly higher than the background level (.5%). This compares to 71 in August and 68 in July, 1979. These data indicate that sulfonate production is continuing to increase in the 2.5-acre pattern. Field-wide slug cut for the 2.5-acre pattern indicates an increase in overall sulfonate production for the past four months. This behavior generally accompanies a field-wide production response. Slug cut is tabulated in the Data Summary, pages 68 and 69.

Eleven wells (DD-16, DD-18, FF-16, FF-18, HH-16, NN-12, PP-12, RR-4, RR-6, SC-14, and TT-14) in the 5.0-acre pattern show sulfonate levels for the month of September which are significantly higher than background levels. This compares with eight wells reported in August and eight reported in July.

OIL CUT MONITORING

Introduction

In order to detect production responses resulting from the Maraflood process, individual oil cuts are monitored on a monthly basis.

Discussion

A continued increase in oil cut is interpreted as a production response resulting from Maraflood process fluid injection. During September, 1979, 58 wells on the 2.5-acre pattern and 18 wells on the 5.0-acre pattern produced at or above a 5% oil cut. This compares to 50 wells and 15 wells, respectively, in August, 1979. Currently, the 2.5-acre and 5.0-acre patterns are producing oil cuts of 8.6% and 5.2%, respectively. Individual well oil cuts are reported on the five-spot reports, pages 77 - 91.

OIL CUT MONITORING (Continued)

Discussion (Continued)

Examination of the oil cut curve on Figure 14 for the 2.5-acre pattern shows that the oil cut has increased continuously from 4.8% to 8.6% during the past six months. In addition, the slope of the data parallels the predicted curve. This is also a strong indication of increasing oil production resulting from injection of Maraflood process fluids.

LOGGING OBSERVATIONS WELLS

Introduction

Logging observation wells are being experimentally used to monitor flood fronts in the M-1 project. Two fiberglass-cased logging observation wells (GI-7 and GI-8) were drilled and completed in the Fall of 1977 while a third well (GI-3) was converted to an open-hole logging observation well in January of 1978. Figure 27 shows the location of the logging observation wells and Figure 28 shows the completion diagram for the logging observation wells in the M-1 Project.

Discussion

Logging of observation wells has been ongoing in the M-1 Project since the Fall of 1977. The project consists of three logging observation wells GI-3, GI-7, and GI-8, that are roughly in line between an injection well and a producing well.

Observation well GI-3 is 72 feet bottom-hole location (BHL) from the injector O-9. Well GI-3 was open-hole completed in 1973 as a test well and has been used as a logging observation well since January of 1978. The open-hole completion permits reservoir fluids to continuously exchange in the GI-3 wellbore, but changes in the wellbore fluid do not appear to be detrimental to the response of the induction sonde and good logs have been obtained from well GI-3.

The GI-7 observation well is 97 feet BHL from the injection well O-9. This well was completed in August of 1977 with fiberglass casing cemented across the interval being flooded with the micellar-polymer solution. Excellent results have been extracted from the induction logs run in the GI-7 wellbore.

Well GI-8 is 147 feet BHL from the injector O-9. This well was completed in September of 1977 and also has fiberglass casing cemented across the interval being flooded with the micellar-polymer solution. Again, good well logs have been extracted from the GI-8 wellbore.

LOGGING OBSERVATIONS WELLS (Continued)

Discussion (Continued)

When the observation well log was run in GI-3, the leading edge of the oil bank had already passed the wellbore. The evidence used to confirm the presence of the oil bank was twofold. First, the post waterflood resistivity of the Robinson sandstone is about 20 to 23 ohm-meters; but, the first observation well log run in GI-3 showed a resistivity of between 30 and 40 ohm-meters. The increase in resistivity is believed to have been caused by the increased oil saturation in the flowing oil bank preceding the slug front. Secondly, a material balance calculation places the front of the flowing oil bank beyond the GI-3 wellbore at the time of the first logging.

The GI-3 wellbore is the closest of the three observation wells to the injection well and, as expected, is responding to fluid injection before the other two observation wells, GI-7 and GI-8. In response to the oil bank, the resistivity in GI-3 increased to a maximum by the end of April, 1978. Well GI-3 began to show the presence of the saline micellar solution in July of 1978. From July of 1978 until July of 1979, the GI-3 observation logs have shown decreasing resistivities which are indicative of the saline micellar solution passing through the area surrounding the GI-3 wellbore.

Well GI-7 is located at about two times the pore volume radius from the injector as GI-3 and is responding to fluid injection later than GI-3. GI-7 has shown a response to a building oil bank in the upper half of the sand since the first induction log was run in August of 1977. The presence of the oil bank caused the resistivity to continue to increase until October of 1978. In October of 1978, the upper portion of the sand started to record the arrival of the saline micellar solution by showing a drop in resistivity. The resistivity in the upper portion of the sand has dropped continuously up to the time of the last logging run in July of 1979.

Well GI-8 did not show any change from a post-waterflood resistivity of 20 to 23 ohm-meters from time of the first logging run in September of 1977 until June of 1979. Since June, 1979, the top portion of the sand has shown an increase in resistivity. The increasing resistivity is attributed to the leading edge of the oil bank.

ECONOMIC ANALYSIS

Introduction

An economic analysis of the M-1 Project has been conducted in compliance with the Department of Energy contractual requirements. The analysis is based on historic costs and crude oil prices through 1979. After 1979, both costs and crude prices are escalated using three escalation rate cases (8, 10 and 12% per year). This method is preferable over a constant dollar analysis which would mix historical costs with unescalated costs.

Discussion

Economic and project physical data are input into a proprietary computer program (OILPATCH) generating the economic calculations. The physical data on the M-1 Project may be found in several previous reports. Economic parameters may be divided into four categories: development costs, slug costs, polymer costs and operating costs.

The development costs include all drilling costs and the costs of injection, production and disposal facilities. Some detail of these costs are shown on Table 6. Development costs will total \$8.3 million, most of which was spent prior to 1977. Well costs amount to almost 70% of all development costs. The development costs for 2.5-acre spacing and 5.0-acre spacing patterns in terms of unit costs (\$/10 acres) have also been included in Table 6.

The average micellar solution (slug) cost for the M-1 Project was \$6.17/barrel. During the 22 months of slug manufacture, two different slug formulations were prepared, manufacturing rates had to be varied widely, two different methods of insuring good slug filterability were used, and other minor variations were imposed by seasonal temperature changes. Table 7 shows an analysis of slug cost contributions averaged over the total slug manufacturing period.

The average slug manufacturing rate was about one-half the design capacity of the plant. The slug cost data show that if the new slug formulation had been manufactured at the design plant capacity of 150,000 BPM, the cost would have been about \$5.53/barrel of slug. A breakdown of this implied cost is given in Table 7.

It is estimated that the total project polymer cost (including freight and sales tax) will average \$1.28/pound. This cost should not be construed as an indication of current polyacrylamide prices, since over 40% of the M-1 Project's polymer requirement was purchased in 1975-1977.

An estimate of the operating costs used in this economic analysis is based on the first two years of the M-1 Project. The 2.5-acre spacing operates at a cost of

ECONOMIC ANALYSIS, (Continued)

Discussion (Continued)

\$329/injection well/month and the 5.0-acre spacing operates at a cost of \$444/injection well/month. These values unlike the historical data above are expressed in 1979 dollars.

These parameters and other important input parameters used in the economic analysis are listed in Table 8. Three crude oil prices (\$20/barrel, \$24/barrel, and \$28/barrel) were selected as the average 1979 price. These are then escalated at the same rate as the M-1 Project costs. However, the economic analysis does not assume any future Federal excise tax levied on crude oil produced from this project.

The economic analysis has been restricted to a before-income tax basis. The reasons are: (1) After-tax economic analyses require the input of a corporation's total income tax situation. This can vary from one organization to another. (2) After-tax calculations require that a determination be made as to whether such large costs as slug and polymer are expensed or invested (or a combination of both). For before-tax rate of return calculations, this distinction is immaterial.

A discounted cash flow rate of return is a common method for evaluating a project's viability and was used for this analysis. Figure 29 shows rate of return as a function of oil recovery at three different 1979 crude prices, each escalated at three different yearly rates over the remaining life of the project.

Treating cost (i.e., oil-water separation costs) have been included in Figure 29 economics. An example of the relative effect of such treating costs is given in Figure 30. Historical slug costs (\$6.17/barrel) have been applied in Figure 29. However, an analysis of the sensitivity of project economics to slug costs is shown in Figure 31. Slug costs of actual +25%, actual, and actual -25% are shown.

Correlations of profit and project payout with rate of return are given in Figures 32 and 33, respectively. Both of these values are actually complicated functions of rate of return even for a given project. However, Figures 32 and 33 present reasonable approximations of the relationships for the M-1 Project.

The general conclusion that can be drawn from this economic analysis is that project economics are most sensitive to recovery, crude oil price and slug cost. Only the latter is known with any certainty in 1979. Obviously, future analyses will become more reliable as assumptions are replaced with facts.

MARATHON OIL COMPANY
 MARAFLOOD PROCESS - M-1 PROJECT
 CRAWFORD COUNTY, ILLINOIS
 DE-AC19-78ET-13077-36

TABLE 1

Polymer Manufacturing Pilot Runs

Run No.	Monomer Source ⁽²⁾	Catalyst Level	Process Conditions	Comments	Solution Properties ⁽¹⁾ @ 1,324 ppm	
					Screen Factor	Brookfield Viscosity (RPM)
1	A	1	I		59.9	74.5 (0.6)
2	A	1	I		63.0	--
3	A	1	II		40.7	84.0 (1.5)
4	A	2	I		35.0	78.0 (1.5)
5	A	2	I		37.0	85.0 (1.5)
6	A	3	I		36.5	85.5 (1.5)
7	A	4	?	Problem Run	20.6	31.5 (1.5)
8	A	4	III		20.4	34.2 (1.5)
9	A	4	I		29.0	56.5 (1.5)
10	A	4	I		28.4	57.5 (1.5)
11	A	4	IV		28.5	79.8 (1.5)
12	A	4	V		34.7	74.6 (1.5)
13	A	4	II		33.7	74.2 (1.5)
14	A	4	VI		39.8	83.5 (1.5)
15	A	4	VII		42.6	100.0 (1.5)
16	A	4	VIII		41.0	94.7 (1.5)
17	A	5	I	Solid monomer	34.4	65.0 (1.5)
18	A	5	I	Solid monomer	27.2	71.5 (3.0)
19	A	6	I		33.3	70.0 (1.5)
20	A	6	I		28.4	66.0 (3.0)
21	A	6	I		33.5	86.3 (3.0)
22	A	6	I		29.2	57.2 (1.5)
23	A	6	I		27.0	55.0 (1.5)
24	A	6	I		25.7	47.5 (1.5)
25	A	6	I		33.9	77.0 (3.0)
26	A	6	I		34.0	77.4 (3.0)

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
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TABLE 1

Polymer Manufacturing Pilot Runs (Continued)

Run No.	Monomer Source ⁽²⁾	Catalyst Level	Process Conditions	Comments	Solution Properties ⁽¹⁾ @ 1,324 ppm	
					Screen Factor	Brookfield Viscosity (RPM)
27	A	6	I		36.8	83.0 (1.5)
28	A	6	IX		31.5	68.0 (1.5)
29	A	6	X		28.7	54.5 (1.5)
30	A	6	XI		26.8	52.4 (1.5)
31	A	6	XII		27.1	53.0 (1.5)
32	A	6	I		31.4	56.5 (1.5)
33	A	6	I		32.7	67.5 (1.5)
34	A	6	XIII		15.1	28.5 (1.5)
35	A	7	I		33.1	64.7 (1.5)
36	B	4	I		44.9	88.4 (1.5)
37	B	5	I		50.3	92.7 (1.5)
38	B	5	I		53.6	91.4 (1.5)
39	B	5	I		52.6	97.4 (1.5)
40	B	5	I		47.3	98.4 (1.5)
41	B	5	I	Electrical failures	71.5	79.4 (0.6)
42	B	5	XIII		58.2	--
43	B	5	XIV		59.9	--
44	B	6	I	Uncertain monomer charge	30.1	57.0 (1.5)
45	B	6	I		43.0	80.0 (3.0)
46	B	6	I		40.0	89.4 (3.0)
47	B	6	I		44.4	81.0 (1.5)
48	B	8	I		43.0	80.0 (1.5)
49	B	9	I		40.1	80.6 (1.5)
50	B	10	I		27.0	51.4 (1.5)
51	B	11	I		15.3	26.5 (1.5)

(1) All solutions were prepared in 4 parts softened fresh water + 1 part unsoftened fresh water.

(2) Unless otherwise noted, monomer was obtained as a 50% aqueous solution.

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077-36

TABLE 2

Weekly Average Polymer Properties
and Injection Data

Week Ending	Polymerization Test			2.5-Acre Wells			5.0-Acre Wells		
	Screen Factor	Injection Rate B/D	Injection Pressure psig	Screen Factor	Injection Rate B/D	Injection Pressure psig	Screen Factor	Injection Rate B/D	Injection Pressure psig
12/07/78	21.9	388	453	22.3	8,108	405	22.2	2,032	470
12/14/78	26.6	356	451	25.7	7,663	418	25.1	1,905	480
12/21/78	33.1	355	450	31.0	8,011	458	28.7	2,006	503
12/28/78	29.4	399	491	30.9	8,045	499	29.6	1,998	513
1/07/79	22.2	386	508	31.7	7,050	510	29.4	1,965	521
1/14/79	22.3	392	531	29.8	7,146	560	28.9	2,023	512
1/21/79	17.8	382	523	29.6	7,083	603	28.4	2,004	553
1/28/79	21.8	369	544	28.6	7,118	622	26.9	2,027	593
2/04/79	29.3	346	571	28.0	7,104	680	27.3	2,026	620
2/11/79	26.1	355	590	27.3	7,096	708	26.5	2,030	630
2/18/79	22.2	311	601	28.3	7,031	700	25.6	2,001	625
2/25/79	20.7	340	600	29.5	7,068	717	27.2	2,009	633
3/04/79	5.7	93	183	13.0	2,972	272	11.8	903	247
3/11/79	21.4	319	650	29.2	6,054	649	28.8	1,938	647
3/18/79	27.9	352	646	29.5	5,240	630	28.1	2,034	673
3/25/79	32.9	391	631	30.1	4,776	588	30.2	2,027	670

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
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TABLE 2

Weekly Average Polymer Properties
and Injection Data (Continued)

	Polymerization Test			2.5-Acre Wells			5.0-Acre Wells			
	Week Ending	Screen Factor	Injection Rate B/D	Injection Pressure psig	Screen Factor	Injection Rate B/D	Injection Pressure psig	Screen Factor	Injection Rate B/D	Injection Pressure psig
-27-	4/01/79	30.5	387	606	31.0	4,844	588	28.6	2,075	669
	4/08/79	24.2	368	570	28.7	4,842	612	27.4	2,038	676
	4/15/79	23.1	387	589	28.0	4,635	606	28.2	1,912	682
	4/22/79	21.6	382	600	28.9	4,548	603	26.9	1,691	660
	4/29/79	27.2	379	612	27.5	4,525	613	27.7	1,605	658
	5/06/79	26.1	385	626	33.1	4,635	608	30.0	1,583	663
	5/13/79	27.8	324	622	30.7	4,690	586	29.1	1,532	639
	5/20/79	35.1	243	583	30.5	4,585	570	29.8	1,452	577
	5/27/79	33.9	245	590	23.4	4,851	564	26.9	1,433	578
	6/03/79	30.4	249	571	23.1	4,857	568	28.5	1,427	588
	6/10/79	26.6	242	568	23.8	4,795	567	28.9	1,416	615
	6/17/79	25.7	239	570	24.0	4,840	561	28.8	1,428	598
	6/24/79	24.6	236	551	23.3	4,868	556	28.7	1,427	588
	7/01/79	21.3	243	559	29.7	4,922	564	29.1	1,427	586
	7/08/79	23.8	235	593	30.1	4,791	556	29.5	1,423	592
	7/15/79	23.7	231	570	31.6	4,579	573	29.2	1,358	595
	7/22/79	23.1	237	611	33.4	4,810	571	28.3	1,409	584
	7/29/79	24.7	242	601	31.2	4,758	587	31.7	1,426	600

MARATHON OIL COMPANY
 MARAFLOOD PROCESS - M-1 PROJECT
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TABLE 2

Weekly Average Polymer Properties
 and Injection Data (Continued)

Week Ending	Polymerization Test			2.5-Acre Wells			5.0-Acre Wells		
	Screen Factor	Injection Rate B/D	Injection Pressure psig	Screen Factor	Injection Rate B/D	Injection Pressure psig	Screen Factor	Injection Rate B/D	Injection Pressure psig
8/05/79				26.4	4,500	584	30.0	1,394	599
8/12/79				26.9	4,706	583	30.4	1,416	614
8/19/79				23.4	4,659	587	27.7	1,427	620
8/26/79				23.6	4,679	596	27.7	1,428	632

MARATHON OIL COMPANY
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TABLE 3

Injection Well Transient Tests

Well No.	Stimulation		Skin Factor, S						Mobility, k/ μ (md/cp)					
			Water (12/76)	Slug				1156 ppm Polymer (6/79)	Water (12/76)	Slug				1156 ppm Polymer (6/79)
				(4/77)	(10/77)	(3/78)	(10/78)			(4/77)	(10/77)	(3/78)	(10/78)	
S-7	S, F ¹	BU ²	-4.0	-1.2	-2.1	-3.5	0.74	-2.1	10.4	8.1	4.8	2.4	4.0	2.4
		FO ²	-2.5	0.6	-3.0	-3.2	0.64	-3.3	7.1	5.3	5.4	2.3	4.0	1.8
GG-13	S, F	BU	-2.7	-2.6	3.4	-2.4	-2.23	-2.7	7.8	1.0	2.5	0.6	1.8	1.1
		FO	-3.0	1.4	6.9	-2.6	-0.75	-2.9	6.2	3.0	3.5	0.5	2.7	1.2
C-3	S, F	BU	-3.1	-2.5	1.5	1.6	-0.19	-3.6	5.0	1.0	2.3	1.4	1.7	3.8
		FO	-3.2	3.7	-2.7	-3.8	-4.18	-3.8	6.5	2.5	0.7	0.4	0.4	3.2
QQ-13	F, F	BU	-4.9	-5.1	-4.7	-4.4	-4.08	-4.2	2.7	0.6	0.7	0.9	2.5	3.4
		FO	-4.8	-5.0	-4.6	-4.7	-4.69	-5.3	3.8	0.8	0.6	0.6	2.5	2.3
O-13	S	BU	-4.1	0.7	-2.3	-2.4	2.67	--*	5.8	3.2	0.9	1.1	4.5	--*
		FO	-3.5	-2.0	-3.4	-2.7	-1.31	-3.5	5.2	2.2	0.8	1.7	2.8	1.9
I-7	S, F	BU	-3.7	-2.6	-3.1	-2.9	-1.55	-2.0	4.6	3.4	1.4	1.7	1.8	1.3
		FO	-4.0	-2.4	1.0	-0.5	-1.08	-2.4	3.9	3.5	3.7	3.3	2.5	1.2

¹S = Shot, F = Fracture

²BU = Buildup, FO = Falloff

*Data uninterpretable

MARATHON OIL COMPANY
 MARAFLOOD PROCESS - M-1 PROJECT
 CRAWFORD COUNTY, ILLINOIS
 DE-AC19-78ET-13077-36

TABLE 4

Pressure Monitoring - Oil Wells

Well No.	Test Date	Test Type	Mobility k/u, md/cp	Skin Factor s	Wellbore Radius, rw, ft	Isogeometric Permeability k, md	Net Thickness h, ft	Stimulation
D-4	11/76	Buildup	6.4	2.4	0.25	75	12	None Frac
	12/77	Buildup	1.3	-5.2				
	11/78	Buildup	1.1	-5.6				
	8/79	Buildup	0.5	-4.8				
H-8	11/76	Buildup	2.6	0.9	0.25	80	28	None Frac
	11/77	Buildup	5.4	-4.9				
	11/78	Buildup	2.0	-5.7				
	8/79	Buildup	3.6	-3.8				
P-12	11/76	Buildup	11.3	-1.3	0.25	100	46	Shot Shot
	12/77	Buildup	4.1	-3.6				
	11/78	Buildup	1.8	-5.3				
	8/79	Buildup	2.2	-3.3				
PP-12	11/76	Buildup	1.9	0.8	0.25	75	27	None Frac
	12/77	Buildup	5.9	-6.5				
	11/78	Buildup	6.2	-6.7				
	8/79	Buildup	2.0	-5.6				
HH-12	11/76	Buildup	5.5	1.7	0.25	90	21	None Frac
	11/77	Buildup	19.8	-6.4				
	11/78	Buildup	9.4	-6.3				
	8/79	Buildup	8.8	-4.9				
T-8	11/76	Buildup	15.0	*	0.25	60	39	None None
	11/77	Buildup	*	*				
	11/78	Buildup	4.2	-2.7				
	8/79	Buildup	5.3	-0.5				

*Uninterpretable

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077-36

TABLE 5

Tritiated Water Injection Wells

	<u>Isogeometric Permeability k, md</u>	<u>Net Thickness h, ft</u>	<u>Stimulation*</u>	<u>Well Status</u>	<u>Dosage Curies</u>
<u>2.5 Acre</u>					
A-13	85	21	S, ST	New well	10
E-5	115	11	S, H	New well	5
I-7	75	29	S, L	Conv. oil well	10
K-13	85	29	S	New well	10
O-13	100	54	S	Conv. WF inj.	20
M-5	70	46	S, ST	New well	15
S-5	30	16	S, ST	New well	5
<u>5.0 Acre</u>					
GG-15	90	39	S	New well	25
SS-3	65	21	G, H	New well	15
QQ-13	60	32	G, H	New well	25

*G = Gauge

S = Shot

L = Fraced with low viscosity fluids

H = Fraced with high viscosity fluids

ST = Staged frac with moth balls

MARATHON OIL COMPANY
 MARAFLOOD PROCESS - M-1 PROJECT
 CRAWFORD COUNTY, ILLINOIS
 DE-AC19-78ET-13077-36

TABLE 6

M-1 Development Costs

Wells

New Injectors	\$2,277,591	
New Producers	2,516,947	
Conversions and Reconditionings	142,089	
Abandonments and Reabandonments	662,655	
Miscellaneous	<u>48,066</u>	
Sub Total		\$5,647,348

Surface Facilities

Salt Water Disposal System	\$ 193,881	
Production Facility and Lead Lines	1,203,055*	
Injection Facility and Lines	815,794	
Staging Area (roads, electrical, etc.)	353,306	
Miscellaneous	<u>72,327</u>	
Sub Total		<u>\$2,638,363</u>

Total Costs		\$8,285,711
-------------	--	-------------

Unit Breakdown

2.5-Acre = \$236,756/10 Acres
 5.0-Acre = \$151,834/10 Acres

*A portion of this cost is estimated.

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077-36

TABLE 7

Slug Costs

Period of Slug Manufacture: February, 1977 - November, 1978
Average Slug Manufacturing Rate: 74,387 BPM
Total Slug Manufactured: 1,636,504 barrels

Crude Oil ¹	\$ 3,405,943 (\$2.081/Bbl. Slug)
Other Raw Materials	4,023,292 (\$2.458/Bbl. Slug)
Fixed Costs ²	<u>2,673,921 (\$1,634/Bbl. Slug) (\$121,542/Mo.)</u>
Total	\$10,103,156 (\$6.173/Bbl. Slug)

Estimated costs for new slug formulation at 150,000 BPM
manufacturing rate:

Crude Oil ¹	\$2.46/Bbl. Slug
Other Raw Materials	2.26/Bbl. Slug
Fixed Costs ²	<u>0.81/Bbl. Slug</u>
Total	\$5.53/Bbl. Slug

¹Includes gathering and tariff.

²Includes depreciation.

MARATHON OIL COMPANY
 MARAFLOOD PROCESS - M-1 PROJECT
 CRAWFORD COUNTY, ILLINOIS
 DE-AC19-78ET-13077- 36

TABLE 8

Economic Program Input Summary

<u>Parameter</u>	<u>Value</u>	<u>Basis</u>
Development Costs		
2.5-Acre	\$236,756/10 acres	Historic
5.0-Acre	\$151,834/10 acres	Historic
Slug Cost	\$6.17/Bbl.	Historic
Polymer Cost	\$1.28/Lb.	Average*
Water Cost	\$0.10/Bbl.	Average*
Injection Costs		
Slug	\$0.44/Bbl.	Average*
Mobility Buffer	\$0.106/Bbl.	Average*
Salt Water Disposal	\$0.0146/Bbl.	Average*
Treating Costs	\$0.96/B0	1979
Operating Costs		
2.5-Acre	\$329/Inj. Well-Mo.	1979
5.0-Acre	\$444/Inj. Well-Mo.	1979
Royalty	12.5%	Actual
Escalation (after 1979)	Variable	Assumed
Crude Oil Price	Variable	1979
Completion Date		
2.5-Acre	1983	Assumed
5.0-Acre	1988	Assumed
Recovery	Variable	

*"Average" indicates the total escalated cost divided by the total volume or weight involved.

R.13W.

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

FIGURE 1

M-1 Project Wells

T.6N

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MARATHON OIL COMPANY
 MARAFLOOD PROCESS - M-1 PROJECT
 CRAWFORD COUNTY, ILLINOIS
 DE-AC19-78ET-13077

FIGURE 5

2.5-Acre Spacing

Injection Rate vs. Time
Plant Pressure vs. Time

DAILY INJECTION RATE - THOUSANDS OF BARRELS

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 MARAFLOOD PROCESS - M-1 PROJECT
 CRAWFORD COUNTY, ILLINOIS
 DE-AC19-78ET-13077

FIGURE 9

2.5-Acre Spacing

Injection/Production vs. Time

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MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

FIGURE 12

5.0-Acre Spacing

Oil Rate vs. Pore Volume Injected

OIL RATE - BPD

— Actual

1200

1000

800

600

400

200

0

10

20

30

40

50

60

70

PORE VOLUME INJECTED - %

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MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

FIGURE 14

2.5-Acre Spacing

Oil Cut vs. Pore Volume Injected

— Actual
----- Predicted

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MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

FIGURE 15

5.0-Acre Spacing

Oil Cut vs. Pore Volume Injected

— Actual
----- Predicted

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MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

— Actual

FIGURE 16

Total M-1 Project

Oil Cut vs. Pore Volume Injected

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MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

FIGURE 17

Schematic of M-1
Field Polymerization Facility

Σ Pressure (psi-days $\times 10^{-3}$)

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MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

FIGURE 20

Injectivity of Field Manufactured Polymer
Well No. Q-3

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MARAFLOOD PROCESS M-1 PROJECT
 Crawford County, Illinois
 DE-AC19-78ET13077

PRESSURE PARTED M-1 INJECTION WELLS

FIGURE 23

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 MARAFLOOD PROCESS - M-1 PROJECT
 CRAWFORD COUNTY, ILLINOIS
 DE-AC19-78ET-13077

FIGURE 24

Schematic of M-1
Production Treating Facility

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NOTE: If this system are duplicated to allow segregation of production from the 2.5 acre and 5.0 acre producing patterns

R.13 W.

MARATHON OIL COMPANY, INC.
MARAFLOOD PROCESS-MH PROJECT
Crawford County, Illinois
FE-4208-6

Transient Testing Wells

FIGURE 25

T. 6 N

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- LEGEND**
- - Oil Well
 - ✦ - Abandoned Hole
 - ✧ - Injection Well
 - ✧ - Oil Well Converted to Injection Well
 - SWD - Salt Water Disposal Well
 - ✧ - Core Test
 - - TRANSIENT TESTING INJECTION WELLS

**MARATHON OIL COMPANY
MARAFLOOD PROCESS-M1 PROJECT
Crawford County, Illinois
FE-4208-6**

TRITIATED WATER INJECTION WELLS

FIGURE 26

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

FIGURE 27

2.5-Acre Spacing

M-1 Observation Wells

MARATHON OIL COMPANY
 MARAFLOOD PROCESS - M-1 PROJECT
 CRAWFORD COUNTY, ILLINOIS
 DE-AC19-78ET-13077

FIGURE 28
Completion Diagram

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MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

FIGURE 29

Economic Monitoring

DCF RATE OF RETURN, %
(BEFORE INCOME TAX)

\$28/BBL

\$24/BBL

\$20/BBL

AVERAGE 1979 CRUDE PRICE

COSTS AND CRUDE PRICE
ESCALATION AFTER 1979

--- 8%/YR

— 10%/YR

... 12%/YR

RECOVERY, % OF OIL IN PLACE

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

FIGURE 30

Economic Monitoring
Effect of Treating Costs
on Rate of Return

DCF Rate of Return, %
(Before Income Tax)

Treating Costs Included

No Treating Costs Included

Avg. 1979 Crude Price = \$20/Bbl
Escalation After 1979 = 8%/Yr.

Recovery, % of Oil In Place

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

FIGURE 31

Economic Monitoring
Effect of Micellar Solution
Costs on Rate of Return

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MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

FIGURE 32

Economic Monitoring
Estimation of Before Tax
Profit from Rate of Return

DCF Rate of Return, %
(Before Income Tax)

35
30
25
20
15
10
5
0

10 20 30 40 50 60 70

Before Tax Profit, MM\$

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
CRAWFORD COUNTY, ILLINOIS
DE-AC19-78ET-13077

FIGURE 33

Economic Monitoring
Estimation of Payout
From Rate of Return

MARATHON OIL COMPANY
MARAFLOOD PROCESS M-1 PROJECT
2.5 ACRE PATTERN
DATA SUMMARY

PAGE 1

MONTH AND YEAR	INJ. RATE (B/D)	CUM. INJ. (BBL)	% CUM. INJ./ PORE. VOL.	WGTD. AVG. BHP.	CUMULATIVE (BHP*HOURS)	INJ. (B/D) /BHP	% POLY CUT	% SLUG CUT	% OIL CUT	OIL RATE (B/D)	INJ./ PROD. RATIO	WGTD. AVG. CHLD. CONT. (PPM)	VISC. (CP)	SCREEN FACTOR
FEB. 1977	2246	40428	.4	588	10584	3.82	**	.09	4.5	102	.89	9586	36.0	**
MAR. 1977	2392	114580	1.1	633	30207	3.78	**	.39	3.8	102	.90	9709	30.7	**
APR. 1977	2547	190990	1.8	665	50157	3.83	**	.07	3.9	103	1.08	9179	32.5	**
MAY 1977	2642	279108	2.6	653	70400	4.05	**	.11	4.7	117	1.08	9282	35.5	**
JUN. 1977	2488	353736	3.3	628	89240	3.96	**	.14	5.8	136	.96	9469	34.4	**
JUL. 1977	2487	430820	4.1	630	108770	3.95	**	.08	4.2	129	.73	8954	31.9	**
AUG. 1977	2451	506787	4.8	633	128393	3.87	**	.12	4.9	151	.77	9185	35.3	**
SEP. 1977	2372	577961	5.4	621	147023	3.82	**	.10	4.8	132	.82	9524	32.1	**
OCT. 1977	2418	652907	6.1	612	165995	3.95	**	.07	4.9	132	.86	9495	32.6	**
NOV. 1977	2448	726345	6.8	525	181745	4.66	**	.13	4.6	122	.85	9773	31.0	**
DEC. 1977	977	756628	7.1	433	195168	2.26	**	.13	4.8	106	.48	9358	30.0	**
JAN. 1978	928	785397	7.4	456	209304	2.04	**	.26	4.7	81	.55	8814	28.9	**
FEB. 1978	912	810925	7.6	440	221624	2.07	**	.17	4.9	80	.54	9550	28.0	**
MAR. 1978	791	835457	7.9	428	234892	1.85	**	.12	5.2	66	.60	9488	27.0	**
APR. 1978	730	857365	8.1	444	248212	1.64	**	.22	5.0	62	.56	10033	26.7	**
MAY 1978	825	882933	8.3	522	264394	1.58	**	.21	5.1	58	.66	9604	59.3	**
JUN. 1978	994	912743	8.6	522	280054	1.9	**	.24	5.3	65	.90	9534	69.6	**
JUL. 1978	1030	944661	8.9	494	295368	2.09	**	.25	5.7	65	.91	9818	77.1	**
AUG. 1978	1017	976185	9.2	512	311240	1.99	**	.29	5.7	67	.88	9764	79.4	**
SEP. 1978	1084	1008699	9.5	516	326720	2.1	**	.31	5.9	67	1.01	10277	78.7	**
OCT. 1978	1114	1043246	9.8	492	341972	2.26	**	.41	6.0	66	.97	10185	71.4	**
NOV. 1978	3162	1138100	10.7	722	363632	4.64	**	.32	7.1	80	2.63	9452	54.1	22.9
DEC. 1978	8247	1393747	13.1	852	390044	9.68	**	.47	5.6	206	2.08	10191	52.3	28.4
JAN. 1979	7480	1625621	15.3	816	415340	9.17	**	.54	5.0	275	1.27	9589	51.1	29.6
FEB. 1979	7436	1811525	17.0	791	435115	9.4	**	.49	4.8	271	1.19	9445	52.0	28.7
MAR. 1979	5454	1980605	18.6	702	456877	7.77	**	.92	5.5	306	.90	9072	52.5	29.9
APR. 1979	5020	2131216	20.1	762	479737	6.59	**	1.10	6.0	287	.97	9275	54.9	28.7
MAY 1979	5018	2286412	21.5	774	503731	6.48	**	1.58	6.9	341	.94	9364	36.1	23.3
JUN. 1979	5099	2439395	23.0	791	527461	6.45	**	1.97	7.2	352	.97	9426	31.4	23.3
JUL. 1979	4977	2593670	24.4	858	554059	5.8	**	2.48	8.6	378	1.04	9626	31.5	24.8
AUG. 1979	4865	2744493	25.8	856	580595	5.68	**	2.91	8.6	400	.96	9220	33.2	24.8
SEP. 1979	4820	2889080	27.2	863	606485	5.59	**	3.89	8.6	395	.97	9204	30	23.8

** INDICATES DATA NOT APPLICABLE

MARATHON OIL COMPANY
MARAFLOOD PROCESS M-1 PROJECT
5.0 ACRE PATTERN
DATA SUMMARY

PAGE 1

MONTH AND YEAR	INJ. RATE (B/D)	CUM. INJ. (BBLs)	% CUM. INJ./ PORE. VOL.	WGTD. AVG. BHP.	CUMULATIVE (BHP*HOURS)	INJ. (B/D) /BHP	% POLY CUT	% SLUG CUT	% OIL CUT	OIL RATE (B/D)	INJ./ PROD. RATIO	WGTD. AVG. CHLD. CONT. (PPM)	VISC. (CP)	SCREEN FACTOR
FEB. 1977	675	12150	.2	585	10530	1.15	**	.15	6.6	44	.90	8319	36.0	**
MAR. 1977	822	37632	.6	575	28535	1.43	**	.33	3.5	44	.87	9776	30.7	**
APR. 1977	826	62412	1.0	634	47375	1.3	**	.24	3.7	60	.78	9920	32.5	**
MAY 1977	818	88069	1.5	633	66998	1.29	**	.28	4.2	79	.65	9918	35.5	**
JUN. 1977	738	110196	1.8	624	85718	1.18	**	.26	4.0	68	.64	8551	34.4	**
JUL. 1977	709	132173	2.2	648	105806	1.09	**	.20	4.1	65	.67	9221	31.9	**
AUG. 1977	666	152823	2.5	579	123755	1.15	**	.18	5.0	65	.85	9560	35.3	**
SEP. 1977	652	172381	2.9	603	141845	1.08	**	.15	5.1	67	.88	9132	32.1	**
OCT. 1977	670	193151	3.2	589	160104	1.14	**	.12	4.7	64	.89	10556	32.6	**
NOV. 1977	647	212554	3.5	543	176394	1.19	**	.19	4.3	62	.86	8089	31.0	**
DEC. 1977	622	231830	3.9	564	193878	1.1	**	.11	4.9	74	.69	9517	30.0	**
JAN. 1978	627	251261	4.2	564	211362	1.11	**	.21	4.4	62	.79	9362	28.9	**
FEB. 1978	670	270012	4.5	560	227042	1.2	**	.18	4.3	59	.74	9503	28.0	**
MAR. 1978	810	295132	4.9	614	246076	1.32	**	.15	4.8	63	.85	10260	27.0	**
APR. 1978	862	320987	5.4	615	264526	1.4	**	.14	5.5	68	.92	11115	26.7	**
MAY 1978	823	346499	5.8	570	282196	1.44	**	.20	4.4	56	.84	10177	59.3	**
JUN. 1978	1302	385567	6.4	576	299476	2.26	**	.21	4.3	63	1.03	12675	69.9	**
JUL. 1978	1382	428403	7.1	639	319285	2.16	**	.23	4.2	62	1.04	10269	77.1	**
AUG. 1978	1402	471866	7.9	723	341698	1.94	**	.27	4.2	57	1.16	9885	79.4	**
SEP. 1978	1599	519836	8.7	755	364348	2.12	**	.24	4.1	63	1.15	10537	78.7	**
OCT. 1978	1642	570751	9.5	782	388590	2.1	**	.37	4.0	67	1.13	10336	71.4	**
NOV. 1978	1610	619060	10.3	819	413160	1.97	**	.26	4.5	82	1.09	9995	49.8	22.9
DEC. 1978	1978	680367	11.3	843	439293	2.35	**	.32	5.6	115	1.37	9881	51.7	27.2
JAN. 1979	2007	742572	12.4	840	465333	2.39	**	.62	4.7	129	1.04	10111	51.3	28.2
FEB. 1979	2024	793171	13.2	851	486608	2.38	**	.64	4.2	119	1.11	10080	51.8	26.7
MAR. 1979	1927	852907	14.2	857	513175	2.25	**	.90	4.3	117	.99	9982	52.5	28.8
APR. 1979	1812	907262	15.1	845	538525	2.14	**	.86	5.3	144	.92	10289	55.6	27.5
MAY 1979	1486	953342	15.9	761	562116	1.95	**	.93	5.0	119	.89	10348	56.0	28.9
JUN. 1979	1425	996090	16.6	768	585156	1.86	**	.86	3.7	99	.80	10113	54.1	28.8
JUL. 1979	1406	1039687	17.3	792	609708	1.78	**	.88	4.1	87	.95	9996	54.1	29.6
AUG. 1979	1418	1083641	18.1	804	634632	1.76	**	.75	5.4	112	.99	9603	54.4	28.7
SEP. 1979	1417	1126151	18.8	829	659502	1.71	**	1.13	5.2	111	.95	10451	51.1	27.9

** INDICATES DATA NOT APPLICABLE

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE INJECTION REPORT
SEPTEMBER, 1979 (30 DAYS)

WELL	DAYS ACTIVE	(FT) NET SAND	PRESS	(BBL/S) PORE VOL	*****PERCENT PV . PV SLUG 1156	INJECTED*****PREV PV PV 800 TOTAL	MON. RATE	(B/D) CURRENT RATE	REC RATE (B/D)
A-11	30	25	620	96308	9.5 10.7	7.5 27.7	52	53	51
A-13	30	21	120	126637	9.7 11.5	8.3 29.6	84	67	42
A-15	30	45	300	144717	9.4 12.4	6.7 28.5	69	68	64
C-1	30	37	640	217157	9.7 9.6	5.7 24.9	136	85	183
C-3	* 30	14	640	65219	8.8 9	5.4 23.1	25	25	35
C-5	30	14	640	63152	9 8.7	4.4 22.1	18	19	72
C-7	* 30	13	640	67774	5.8 1.1	.8 7.7	4	4	14
C-9	* 30	19	640	78428	9.2 2.5	1.9 13.7	11	12	22
C-13	30	28	540	115337	9.8 13.1	4.3 27.3	49	47	67
E-1	30	18	640	53939	11.5 8.5	5.5 25.5	21	22	42
E-3	30	11	640	40348	14.7 11	6.1 31.9	18	18	5
E-5	30	11	0	57323	12 12.8	1 25.8	5	5	42
E-7	30	31	400	99647	10.6 11.6	5.5 27.7	40	47	53
E-9	* 30	23	640	90585	10.9 3.2	2.2 16.3	15	16	26
G-1	* 30	19	640	73828	12 6.4	4.1 22.5	23	20	30
G-3	30	26	620	68910	11.6 10	5.7 27.3	27	27	39
G-5	30	32	120	99291	10.1 14.1	5.3 29.5	35	16	33
G-7	30	31	320	106308	10.5 9.3	9.5 29.3	55	48	38
G-9	30	20	640	74975	11.5 8.2	5.9 25.7	29	33	56
G-11	30	18	640	74257	10.8 10.2	6.3 27.3	32	36	42
G-13	30	9	420	43871	11.2 8.8	7.2 27.1	25	24	26
I-1	* 30	20	640	88728	10.2 8.3	5.5 23.9	36	33	43
I-3	30	21	460	75579	11.5 11.6	5.7 28.7	31	31	31
I-5	30	30	420	108764	10 13.3	6.3 29.6	46	44	35
I-7	* 30	29	640	107842	10 7.4	6.6 24	47	45	55
I-9	30	29	340	96849	9.6 11.7	7.9 29.2	54	49	35
I-11	30	23	520	84025	9.8 14.7	3.3 27.8	18	39	44
I-13	30	17	600	76063	11.2 12.1	6.1 29.4	30	32	26
I-15	30	37	600	241350	9.6 10.6	7.5 27.7	133	139	129
K-1	30	20	640	127844	9.5 12.6	5.3 27.4	49	55	73
K-3	30	40	220	94488	10 12.6	6.8 29.4	63	57	33
K-5A	30	35	620	121286	9.7 12.9	5.3 27.9	48	78	63
K-7	30	39	620	136240	10.4 9.7	4.1 24.2	41	41	125
K-9	30	22	620	100351	10.2 11.5	5.4 27.1	37	36	60
K-11	30	24	440	98538	9.8 13.4	5.9 29	39	35	38
K-13	30	29	440	121990	9.5 10.6	6.6 26.8	51	54	78
K-15	30	31	420	172949	9.9 11.8	7 28.6	86	75	75
M-1	30	32	600	111924	9.9 11.8	5.6 27.3	46	49	64
M-3	30	32	340	114918	10.1 11.4	8.8 30.3	65	52	28
5	30	46	200	161274	10 9.2	9.5 28.6	90	92	-
7	30	49	620	175213	9.9 10.9	7.1 27.9	87	84	-

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE INJECTION REPORT
SEPTEMBER 1979 (30 DAYS)

WELL	DAYS ACTIVE	(FT) NET SAND	PRESS	(BBL/S) PORE VOL	*****PERCENT PV SLUG	PV 1156	INJECTED***** PV 800	PREV PV TOTAL	PREV MON. RATE	(B/D) CURRENT RATE	REC RATE (B/D)
M-9	30	55	620	192610	9.9	11.7	5.8	27.3	80	84	111
M-11	30	42	500	175452	9.7	10.7	6.5	26.9	80	82	110
M-13	30	56	400	205655	9.4	8.6	9.4	27.4	125	124	118
M-15	30	43	520	156515	9.8	12.8	5.5	28.1	83	80	77
O-1	30	21	480	96744	9.6	12.1	6.6	28.3	49	45	45
O-3	30	23	640	84546	11.3	11.6	1.8	24.8	8	8	72
O-5	30	47	540	153062	9.9	15.1	6.7	31.7	89	91	14
O-7	30	47	460	182713	9.9	13.1	4.9	27.9	75	72	94
O-9	30	48	360	199141	9.8	12.9	5.8	28.4	86	87	91
O-11	30	53	460	213746	9.7	11.8	6.7	28.1	112	123	104
O-13	30	54	320	197371	10	12.4	5.7	28	55	137	99
O-15	30	46	560	276396	9.8	11.8	6.1	27.7	142	142	148
O-1	30	22	580	113178	9.7	12.7	6.7	29	60	57	44
O-3	* 30	19	620	73931	10.6	3.8	3.7	18.1	26	26	36
O-5	30	29	580	99629	10	7.1	3.8	20.9	28	29	127
O-7	30	48	540	156289	9.8	16.3	9.4	35.6	108	110	5
O-9	30	48	340	172832	10.3	11.2	7	28.6	90	93	76
O-11	30	45	380	178375	9.9	12.5	5.9	28.4	78	73	82
O-13	30	37	220	148301	9.9	12.5	6.5	28.9	58	62	60
O-15	30	52	520	160565	9.6	11.9	5.8	27.4	77	85	92
S-1	30	23	460	105303	10.3	10.9	7.5	28.7	56	51	45
S-3	30	19	300	54587	11.1	11.6	3.8	26.4	17	17	36
S-5	30	16	340	53993	11.4	10.8	3.9	26.1	7	44	38
S-7	30	37	260	119153	9.9	12.6	5.7	28.2	56	52	57
S-9	30	47	200	170003	9.8	13.6	5.9	29.4	93	81	60
S-11	30	45	340	168556	10.1	11.1	7.4	28.6	82	74	76
S-13	30	43	260	150413	10.1	12.6	6.3	29	69	62	60
S-15	30	44	460	261128	9.9	11.6	6.5	27.9	134	138	135
U-1	30	21	540	83846	11.9	9.5	7.4	28.9	53	53	35
U-3	* 30	18	620	57713	10.8	9	5.3	25.1	26	26	36
U-5	30	12	0	53089	13.8	9.4	6.9	30.1	33	7	15
U-7	30	19	600	77484	11.3	10.6	6.8	28.6	43	47	34
U-9	30	32	240	123821	10.4	12.3	6.7	29.4	58	54	44
U-11	30	47	240	161693	10.1	12.9	6.2	29.1	70	63	62
U-13	30	43	420	151555	9.3	9.6	9.1	28	101	93	78
U-15	30	29	460	172084	9.8	12.5	6.6	28.9	84	83	71
W-1	* 30	26	600	184594	9.6	5.6	3.5	18.7	57	55	65
W-3	* 30	19	620	125054	9.8	4.2	.4	14.5	0	0	10
W-5	30	19	0	65971	10.2	13.4	4.5	28.2	10	11	32
W-7	30	14	260	86599	9.5	11.9	7.8	29.2	49	45	33
W-9	30	17	480	89129	9.7	9.9	8.1	27.8	60	30	47

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE INJECTION REPORT
SEPTEMBER, 1979 (30 DAYS)

WELL	DAYS ACTIVE	(FT)	PRESS	(BBLs)	*****PERCENT INJECTED*****				PREV	(B/D)	REC RATE (B/D)
		NET SAND		PORE VOL	PV SLUG	PV 1156	PV 800	PV TOTAL	MON. RATE	CURRENT RATE	
W-11	30	35	600	177292	9.8	11.5	6.9	28.2	110	71	87
W-13	30	37	600	187643	9.4	8.7	7.6	25.8	101	117	142
W-15	30	31	540	235533	9.9	11.6	6.6	28.1	114	130	117
TOTAL		2598		1.06275E+7	10	11	6.2	27.2	4865	4820	5196

TARGETS (P.V. INJECTED): 10.0 11.0 19.0
BBLs. OF 800 PPM POLYMER REMAINING TO BE INJECTED : 1.36321E+6
DAYS REMAINING TO COMPLETE 800 PPM POLYMER INJECTION: 262.358

* PROBLEM WELLS

2.5-ACRE INJECTION DATA SUMMARY

73	FLUID TYPE	PV	PROJECTED INJECTION HISTORY		INJECTION RATE DEVIATION REC RATE BASIS	THIS REPORT	LAST REPORT
			START	FINISH			
	SLUG	10	2/10/77	11/20/78	NO. WELLS WITHIN 5 % OF REC. RATE :	12	13
	1156	11	11/20/78	5/20/79	NO. WELLS WITHIN 20 % OF REC. RATE :	35	30
	800	19	5/20/79	6/12/80	NO. WELLS WITHIN 50 % OF REC. RATE :	57	56
					AVERAGE VISCOSITY :	30	
					AVERAGE SCREEN FACTOR :	23.8	
					TOTAL POLYMER INJECTED (LBS.) :	40484	
					TOTAL POLYMER CONCENTRATION (PPM):	800	

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
5.0-ACRE INJECTION REPORT
SEPTEMBER, 1979 (30 DAYS)

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WELL	DAYS ACTIVE	(FT) NET SAND	PRESS	(BBLs) PORE VOL	*****PERCENT INJECTED***** PV SLUG	PV 1156	PV TOTAL	PREV MON. RATE	(B/D) CURRENT RATE	REC RATE (B/D)
CC-11	30	32	0	179070	9.9	8.9	18.8	20	22	50
CC-13	30	36	440	330722	10.1	9.3	19.4	105	109	71
CC-15	30	10	200	166984	10	9.9	19.9	11	10	27
CC-17	30	21	520	232323	9.9	9.2	19.1	68	69	56
EE-11	30	24	320	186979	9.9	8.8	18.7	12	30	53
EE-13	30	45	280	335370	10	10	20	96	87	49
EE-15	30	42	240	313883	9.9	9.6	19.5	85	82	62
EE-17	30	22	0	149259	10.1	10	20	14	8	21
GG-13	30	33	380	290091	10.1	9.3	19.4	48	49	63
GG-15	30	39	340	310349	10.1	9.5	19.6	80	74	58
GG-17	30	25	300	196177	10.2	9.1	19.3	4	23	44
GG-19	30	35	500	271277	10.2	8.8	19	87	91	68
II-13	30	24	620	208574	10.1	9.1	19.3	52	57	47
II-15	30	20	520	203893	9.9	9.8	19.7	53	53	37
II-17	30	13	600	130776	10	9.7	19.6	75	78	24
KK-13	30	13	600	149688	10.2	8.7	18.9	54	54	39
KK-15	30	23	500	162784	10	8.3	18.3	44	45	55
MM-13	30	20	620	175026	10.3	7	17.3	47	50	77
MM-15	30	19	600	121753	10.1	6.3	16.4	23	18	66
OO-13	30	29	580	254995	10	9.2	19.2	67	67	59
OO-15	30	28	540	185573	10	8.7	18.7	59	61	53
OO-13	30	32	540	249117	10.2	8.7	18.9	79	62	65
OO-15	30	28	520	153960	10.2	8.7	18.8	44	42	42
SS-1 *	30	18	600	162464	8.3	4.6	12.9	18	16	26
SS-3 *	30	21	620	170972	9.9	6.5	16.4	39	34	44
SS-5	30	15	320	122640	10.3	9.3	19.6	15	14	23
SS-7	30	15	240	115206	10	9.1	19.1	9	10	28
SS-9	30	38	580	263508	9.9	7.8	17.7	63	57	105
SS-11	30	25	620	203122	10	7.3	17.3	47	45	89
TOTAL		745		5.99653E+6	10	8.8	18.8	1418	1417	1500

TARGETS (P.V. INJECTED): 10.0 11.0
BBLs. OF 1156 PPM POLYMER REMAINING TO BE INJECTED : 133146
DAYS REMAINING TO COMPLETE 1156 PPM POLYMER INJECTION: 88.764

* PROBLEM WELLS

5.0-ACRE INJECTION DATA SUMMARY

FLUID TYPE	PV	PROJECTED INJECTION HISTORY		INJECTION RATE DEVIATION REC RATE BASIS	THIS REPORT	LAST REPORT
=====				=====		
		START	FINISH			
SLUG	10	2/10/77	11/20/78	NO. WELLS WITHIN 5 % OF REC. RATE :	1	2
1156	11	11/20/78	12/22/79	NO. WELLS WITHIN 20 % OF REC. RATE :	6	11
				NO. WELLS WITHIN 50 % OF REC. RATE :	15	18
				AVERAGE VISCOSITY :	51.1	
				AVERAGE SCREEN FACTOR :	27.9	
				TOTAL POLYMER INJECTED (LBS.) :	17200	
				TOTAL POLYMER CONCENTRATION (PPM):	1156	

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
PERIPHERAL INJECTION WELL REPORT
SEPTEMBER, 1979 (30 DAYS)

WELL		DAYS ACTIVE	(FT) NET. SAND	PRESS	CUM.# PROJECT INJ.	PREV. RATE (B/D)	CURRENT RATE (B/D)	REC'D RATE (B/D)
UU-1	*	30	11	650	15320	29	10	48
UU-5	*	30	10	640	23228	0	24	62
X-88		30	19	400	6395	31	13	14
X-91		0	30	0	97	0	0	82
X-94		30	23	675	11403	0	0	84
X-97		30	27	675	8596	48	0	130
X-3		30	29	650	11307	8	18	116
X-6		30	26	650	14498	42	8	72
X-9	**	--	9	--	17020	--	--	--
X-12	**	--	32	--	3868	--	--	--
A-12		30	51	620	39882	175	127	200
P-12	*	30	13	540	42478	39	66	94
Q-12	*	30	9	580	48822	74	70	56
R-12	*	30	26	700	17774	64	54	56
PERIPHERAL TOTALS			315		260688	561	390	1378
5.0-ACRE TOTALS					147622	206	224	316
2.5-ACRE TOTALS					113066	355	166	1062

* INDICATES 5.0-ACRE WELLS

** INDICATES WELL PLUGGED & ABANDONED

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE - FIVE SPOT REPORT
SEPTEMBER, 1979 (30 DAYS)

WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
XA-10	30	29.6 327.4 1	0 20.6 0	29.6 348 1	1E-3 1.4E-2	397.3 6671.3 13.2	23252	1	1.4E-2	.286	7E-2 5E-2
XA-12	30	408.7 7167.3 13.6	751.8 11894.3 25.1	1160.5 19061.6 38.7	2E-2 .33	901.5 16030.2 30.1	57623	.352	.124	.278	1.29 1.19
XA-14	30	139.2 2184.2 4.6	229.8 17946.9 7.7	369 20131.1 12.3	5E-3 .28	1015.3 19687 33.8	71828	.377	3E-2	.274	.36 1.02
AA-11	30	174.8 4472 5.8	2351.8 27803.1 78.4	2526.6 32275.1 84.2	8E-2 1.026	511 10328 17	31456	6.9E-2	.142	.328	4.94 3.13
B-0	30	65.2 808.9 2.2	2783 65780.3 92.8	2848.2 66589.2 94.9	4.4E-2 1.051	3514 47767.8 117.1	63309	2.2E-2	1.2E-2	.754	.81 1.39
EB-5	30	29.6 1276.3 1	1866.7 36850.1 62.2	1896.3 38126.4 63.2	2.2E-2 .462	1783 37242.1 59.4	82486	1.5E-2	1.5E-2	.451	1.06 1.02
B-4	30	23.7 700 .8	127.7 7611 4.3	151.4 8311 5	6E-3 .329	329 7258.5 11	25188	.156	2.7E-2	.288	.46 1.15
B-6	30	11.8 283.2 .4	39.7 1944.6 4.3	51.6 2227.8 1.7	1E-3 8.1E-2	174.8 4797.8 5.8	27488	.229	1E-2	.174	.3 .46
B-8	30	23.7 1112.5 .8	99.3 3637.6 3.3	123 4750 4.1	3E-3 .154	119 3996.3 4	30786	.192	3.6E-2	.129	1.03 1.19
B-10	30	20.7 133.9 .7	14.2 209.6 .5	34.9 343.5 1.2	1E-3 1.4E-2	484.5 9359 16.2	23297	.593	5E-3	.401	7E-2 4E-2

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE - FIVE SPOT REPORT
SEPTEMBER, 1979 (30 DAYS)

WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
B-12	30	447.2 10081.7 14.9	1029.8 22293.7 34.3	1477 32375.4 49.2	1.5E-2 .336	1366.1 26403.8 45.5	96079	.302	.104	.274	1.08 1.23
B-14	30	100.7 491.3 3.4	1075.2 23044.1 35.8	1175.9 23535.4 39.2	8E-3 .17	1642.9 38469.9 54.8	138324	8.5E-2	3E-3	.278	.72 .61
B-16	30	44.4 533.9 1.5	1367.4 34065.9 45.6	1411.8 34599.8 47.1	9E-3 .243	1243 34754 41.4	142341	3.1E-2	3E-3	.244	1.14 1
D-0	30	11.8 479.4 .4	743.3 24822.1 24.8	755.1 25301.5 25.2	1.4E-2 .501	1475.3 29738.1 49.2	50426	1.5E-2	9E-3	.589	.51 .85
D-2	30	97.7 1091.3 3.3	522 16233.6 17.4	619.7 17324.9 20.7	6E-3 .192	1130.3 23950.7 37.7	90143	.157	1.2E-2	.265	.55 .72
D-4	30	154 4054.1 5.1	439.7 13126.9 14.7	593.7 17181 19.8	1.2E-2 .358	504.5 14179.3 16.8	47861	.259	8.4E-2	.296	1.18 1.21
D-6	30	127.4 2188.5 4.2	1239.7 24475.3 41.3	1367.1 26663.8 45.6	1.4E-2 .278	562 15399 18.7	95658	9.3E-2	2.2E-2	.16	2.43 1.73
D-8	30	23.7 385.6 .8	232.6 8480.5 7.8	256.3 8866.1 8.5	3E-3 .11	584.3 14587 19.5	79988	9.2E-2	4E-3	.182	.44 .61
D-10	30	53.3 855.1 1.8	269.5 10498.1 9	322.8 11353.2 10.8	8E-3 .308	203.5 6381.3 6.8	36821	.165	2.3E-2	.173	1.59 1.78
F-0	30	100.7 2761 3.4	584.4 16666.6 19.5	685.1 19427.6 22.8	1.7E-2 .49	376.3 14835.7 12.5	39598	.146	6.9E-2	.374	1.82 1.31

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE - FIVE SPOT REPORT
SEPTEMBER, 1979 (30 DAYS)

WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
F-2	27	96 2019.9 3.2	186.4 7282.4 6.2	282.3 9302.3 9.4	4E-3 .159	659 15507.2 22	58501	.339	3.4E-2	.265	.43 .6
F-4	30	0 176.1 0	62.4 2999.1 2.1	62.4 3175.1 2.1	1E-3 7.2E-2	503 18959 16.8	43996	0	4E-3	.43	.12 .17
F-6	30	65.2 745.4 2.2	1988.7 47643.9 66.3	2053.8 48389.3 68.5	2E-2 .48	871.8 25725.4 29.1	100749	3.1E-2	7E-3	.255	2.36 1.88
F-8	30	8.9 125.5 .3	476.6 9385.9 15.9	485.5 9511.3 16.2	5E-3 .109	1071.8 23190 35.7	86889	1.8E-2	1E-3	.266	.45 .41
F-10	30	23.7 374.5 .8	317.7 6491.3 10.6	341.4 6865.8 11.4	6E-3 .133	630 13577.3 21	51403	6.9E-2	7E-3	.264	.54 .51
F-12	30	0 156.2 0	258.2 6269.8 8.6	258.2 6426.1 8.6	7E-3 .198	446 8047.5 14.9	32366	0	4E-3	.248	.58 .8
F-14	30	17.8 694.2 .6	153.2 5328.7 5.1	171 6022.9 5.7	4E-3 .149	537.4 16988.1 17.9	40285	.103	1.7E-2	.421	.32 .35
H-0	30	370.2 8368.3 12.3	1821.3 44508.9 60.7	2191.5 52877.2 73.1	5.7E-2 1.376	496.8 15916.5 16.6	38404	.168	.217	.414	4.41 3.32
H-2	30	109.6 1268.3 3.7	212.8 6189.4 7.1	322.4 7457.7 10.7	4E-3 9.8E-2	835 19599.5 27.8	76083	.339	1.6E-2	.257	.39 .38
H-4	30	219.2 1748.7 7.3	1350.4 32529.5 45	1569.5 34278.2 52.3	1.6E-2 .364	890.3 25513.7 29.7	94033	.139	1.8E-2	.271	1.76 1.34

MARATHON OIL COMPANY
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WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
H-6	30	29.6 295.8 1	641.1 26371.5 21.4	670.8 26667.3 22.4	6E-3 .242	1155 29642.2 38.5	109986	4.4E-2	2E-3	.269	.58 .9
H-8	30	44.4 664.4 1.5	1463.9 32980.4 48.8	1508.3 33644.8 50.3	1.5E-2 .35	1310 26145.1 43.7	95901	2.9E-2	6E-3	.272	1.15 1.29
H-10	30	130.3 1082.9 4.3	1214.2 20860.8 40.5	1344.5 21943.7 44.8	1.7E-2 .286	1167.5 22790.7 38.9	76555	9.6E-2	1.4E-2	.297	1.15 .96
H-12	30	195.5 1156.8 6.5	1319.2 23793.9 44	1514.6 24950.7 50.5	2.6E-2 .43	973.3 19464.3 32.4	57907	.129	1.9E-2	.336	1.56 1.28
H-14	30	393.9 3341 13.1	1798.6 34585.6 60	2192.5 37926.6 73.1	2.4E-2 .421	1859.3 32371.2 62	90003	.179	3.7E-2	.359	1.18 1.17
J-0	30	50.4 643.8 1.7	473.8 10091.9 15.8	524.1 10735.7 17.5	1.2E-2 .258	731 16883.3 24.4	41558	9.6E-2	1.5E-2	.406	.72 .64
J-2	30	127.4 2012.7 4.2	819.9 23791.8 27.3	947.2 25804.5 31.6	1.1E-2 .317	1320.3 26433.8 44	81310	.134	2.4E-2	.325	.72 .98
J-4	30	154 1040.8 5.1	1861 35880.3 62	2015 36921.1 67.2	1.5E-2 .291	1571.8 28870.7 52.4	126673	7.6E-2	8E-3	.227	1.28 1.28
J-6	30	88.9 544.5 3	709.2 25855.3 23.6	798.1 26399.8 26.6	6E-3 .207	1560 31200.7 52	127371	.111	4E-3	.244	.51 .85
J-8	30	305.1 2580.2 10.2	1495.1 33041.7 49.8	1800.1 35621.9 60	1.4E-2 .286	1277.3 28573.3 42.6	124459	.169	2E-2	.229	1.41 1.25

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WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
J-10	30	65.2 427.9 2.2	244 8209.7 8.1	309.1 8637.6 10.3	3E-3 8.5E-2	1187 26849.9 39.6	101349	.21	4E-3	.264	.26 .32
J-12	30	11.8 340.5 .4	1117.7 15299.8 37.3	1129.6 15640.3 37.7	1.1E-2 .158	1198.3 26730.5 39.9	98442	1E-2	3E-3	.271	.94 .59
J-14	30	20.7 438.1 .7	3160.3 64695 105.3	3181.1 65133.1 106	2.3E-2 .486	2689.6 50368.4 89.7	133805	6E-3	3E-3	.376	1.18 1.29
L-0	30	80 1157.4 2.7	1151.8 23938.9 38.4	1231.8 25096.3 41.1	2.1E-2 .44	913.8 23473.3 30.5	57036	6.4E-2	2E-2	.411	1.35 1.07
L-2	30	68.1 813.7 2.3	411.4 15649.8 13.7	479.5 16463.5 16	6E-3 .213	1592.8 32051.5 53.1	77129	.142	1E-2	.415	.3 .51
L-4	30	29.6 309.7 1	1478 22625.7 49.3	1507.6 22935.4 50.3	1.1E-2 .171	2088.5 35640.3 69.6	133876	1.9E-2	2E-3	.266	.72 .64
L-6	28	113.3 1321.6 3.8	712.3 23645.4 23.7	825.6 24967 27.5	5E-3 .178	2208 40424.4 73.6	139935	.137	9E-3	.288	.37 .62
L-8	30	139.2 1501.2 4.6	910.6 22046.3 30.4	1049.9 23547.5 35	7E-3 .164	1829.3 40404.7 61	143466	.132	1E-2	.281	.57 .58
L-10	29	20 233.8 .7	880.3 23091.7 29.3	900.3 23325.5 30	8E-3 .222	1777.8 38897.8 59.3	105002	2.2E-2	2E-3	.37	.51 .6
L-12	30	568.7 6105.2 19	1880.9 47656.3 62.7	2449.5 53761.5 81.7	1.7E-2 .38	2217 41182.4 73.9	141141	.232	4.3E-2	.291	1.1 1.31

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WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
L-14	30	219.2 986.3 7.3	1923.4 46965.5 64.1	2142.6 47951.8 71.4	1.6E-2 .36	2501.7 45437.3 83.4	132995	.102	7E-3	.341	.86 1.06
N-0	30	65.2 826.5 2.2	2113.5 23826 70.5	2178.7 24652.5 72.6	2.8E-2 .322	703.8 17361.2 23.5	76442	2.9E-2	1E-2	.227	3.1 1.42
N-2	30	195.5 2680.7 6.5	2323.4 57366.5 77.4	2518.9 60047.2 84	2.5E-2 .614	1149.8 28450.5 38.3	97694	7.7E-2	2.7E-2	.291	2.19 2.11
N-4	30	915.2 12027.9 30.5	3137.6 59552.6 104.6	4052.8 71580.5 135.1	2.9E-2 .516	1817.5 37626.5 60.6	138627	.225	8.6E-2	.271	2.23 1.9
N-6	30	524.3 5209.8 17.5	3846.9 64047.1 128.2	4371.1 69256.9 145.7	2.5E-2 .407	2537.8 48637.8 84.6	169978	.119	3E-2	.286	1.72 1.42
N-8	30	349.5 4675.5 11.7	2845.4 72569.1 94.8	3194.9 77244.6 106.5	1.7E-2 .412	2450.8 52289.2 81.7	187415	.109	2.4E-2	.279	1.3 1.48
N-10	30	349.5 1842.5 11.7	4014.2 64933.7 133.8	4363.7 66776.2 145.5	2.4E-2 .379	2823.3 54155 94.1	175851	8E-2	1E-2	.307	1.55 1.23
N-12	29	0 133.5 0	3556.8 52822.5 118.6	3556.8 52956 118.6	1.7E-2 .258	3494 54743.1 116.5	204686	0	0	.267	1.02 .97
N-14	30	0 105.5 0	4349 59707.4 145	4349 59812.9 145	1.8E-2 .26	4023.7 65398.3 134.1	229987	0	0	.284	1.08 .91
P-0	30	109.6 898.4 3.7	1736.2 14549.7 57.9	1845.8 15448.1 61.5	3.9E-2 .333	770.3 17934.7 25.7	46305	5.9E-2	1.9E-2	.387	2.4 .86

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WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
P-2	30	44.4 898.2 1.5	1549 24443.9 51.6	1593.4 25342.1 53.1	1.7E-2 .272	1021.3 23658.2 34	92938	2.7E-2	9E-3	.254	1.56 1.07
P-4	30	82.9 993.2 2.8	533.3 15747.7 17.8	616.3 16740.9 20.5	6E-3 .165	1148 25946 38.3	100901	.134	9E-3	.257	.54 .65
P-6	25	17.3 131.1 .6	1657.2 28732.3 55.2	1674.5 28863.4 55.8	1E-2 .172	2260 43999.8 75.3	167022	1E-2	0	.263	.74 .66
P-8	30	0 60.7 0	2269.5 35469.1 75.7	2269.5 35529.8 75.7	1.3E-2 .213	2712.8 53144.8 90.4	166037	0	0	.32	.84 .67
P-10	26	64.2 573.3 2.1	1472.7 28760.4 49.1	1536.9 29333.7 51.2	8E-3 .155	2820.8 54210 94	188735	4.1E-2	3E-3	.287	.54 .54
P-12	30	88.9 732.6 3	1756.1 39160.4 58.5	1844.9 39893 61.5	1.1E-2 .252	2959 52262.5 98.6	157985	4.8E-2	4E-3	.33	.62 .76
P-14	29	42.9 185.7 1.4	4324.7 72523.5 144.2	4367.6 72709.3 145.6	2.1E-2 .363	3563.7 61274.3 118.8	200173	9E-3	0	.306	1.23 1.19
R-0	27	18.7 257 .6	431.5 4869.2 14.4	450.2 5126.2 15	9E-3 .102	809.5 22898.7 27	49932	4.1E-2	5E-3	.458	.56 .22
R-2	30	14.8 105.5 .5	893.6 15161.9 29.8	908.4 15267.4 30.3	9E-3 .163	1129.8 22722.1 37.7	93453	1.6E-2	1E-3	.243	.8 .67
R-4	30	23.7 840 .8	431.2 9503.8 14.4	454.9 10343.7 15.2	8E-3 .183	865.8 15696 28.9	56261	5.2E-2	1.4E-2	.278	.53 .66

MARATHON OIL COMPANY
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WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
R-6	30	127.4 2460.5 4.2	1398.6 25828 46.6	1526 28288.5 50.9	1.5E-2 .283	1759.5 31030.7 58.7	99678	8.3E-2	2.4E-2	.311	.87 .91
R-8	30	370.2 2566.2 12.3	3327.7 58923.4 110.9	3697.9 61489.6 123.3	2.3E-2 .389	2513 47126.6 83.8	157827	.1	1.6E-2	.298	1.47 1.3
R-10	30	20.7 697.6 .7	1821.3 38583.9 60.7	1842 39281.5 61.4	1.1E-2 .245	2399 49530.4 80	160116	1.1E-2	4E-3	.309	.77 .79
R-12	30	130.3 5095.6 4.3	2720.6 41873.3 90.7	2850.9 46968.9 95	1.7E-2 .289	2026.8 46326.5 67.6	162359	4.5E-2	3.1E-2	.285	1.41 1.01
R-14	30	666.4 8189.5 22.2	2706.4 53471.2 90.2	3372.8 61660.7 112.4	2E-2 .374	3048.2 58745.5 101.6	164729	.197	4.9E-2	.356	1.11 1.05
T-0	30	14.8 283.6 .5	1211.4 21131.6 40.4	1226.2 21415.2 40.9	3E-2 .541	779.8 19302 26	39555	1.2E-2	7E-3	.487	1.57 1.11
T-2	30	0 90.4 0	431.2 22901.7 14.4	431.2 22992.1 14.4	5E-3 .311	1102.5 20828.1 36.8	73817	0	1E-3	.282	.39 1.1
T-4	30	47.4 312.2 1.6	204.3 10600.7 6.8	251.6 10912.9 8.4	4E-3 .182	704.3 14743.5 23.5	59636	.188	5E-3	.247	.36 .74
T-6	30	222.1 2310.4 7.4	905 14227 30.2	1127.1 16537.4 37.6	1.5E-2 .22	1123.5 21465.7 37.5	74961	.197	3E-2	.286	1 .77
T-8	30	171.8 716.7 5.7	1100.7 29458.5 36.7	1272.5 30175.2 42.4	9E-3 .214	1752.5 35536.4 58.4	140819	.134	5E-3	.252	.73 .85

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WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
T-10	30	65.2 1188.2 2.2	2783 50387.2 92.8	2848.2 51575.4 94.9	1.7E-2 .32	2034 45389.4 67.8	160801	2.2E-2	7E-3	.282	1.4 1.14
T-12	30	0 135.8 0	4683.7 55178.3 156.1	4683.7 55314.1 156.1	3.3E-2 .398	2181.5 45304.4 72.7	138801	0	0	.326	2.15 1.22
T-14	30	14.8 472 .5	1100.7 21415.2 36.7	1115.5 21887.2 37.2	6E-3 .119	2687.5 49680.3 89.6	182561	1.3E-2	2E-3	.272	.42 .44
V-0	30	0 29.3 0	1225.5 24188 40.9	1225.5 24217.3 40.9	1.7E-2 .353	908.8 16820.3 30.3	68550	0	0	.245	1.35 1.44
V-2	30	29.6 230.4 1	496.5 16619.6 16.5	526.1 16850 17.5	5E-3 .187	1071.3 24229 35.7	89783	5.6E-2	2E-3	.269	.49 .7
V-4	30	32.6 392 1.1	490.8 14237.5 16.4	523.4 14629.5 17.4	7E-3 .223	327.3 16785.3 10.9	65527	6.2E-2	5E-3	.256	1.6 .87
V-6	30	305.1 8656.6 10.2	1716.3 34879.7 57.2	2021.4 43536.3 67.4	3.5E-2 .76	821.5 20505.7 27.4	57221	.15	.151	.358	2.46 2.12
V-8	30	29.6 169.8 1	334.8 11068.8 11.2	364.4 11238.6 12.1	4E-3 .138	1317.5 27163.5 43.9	81115	8.1E-2	2E-3	.334	.28 .41
V-10	30	254.7 2127.1 8.5	1764.6 50356.2 58.8	2019.3 52483.3 67.3	1.6E-2 .423	1629.3 39556.7 54.3	123793	.126	1.7E-2	.319	1.24 1.33
V-12	30	370.2 2751.2 12.3	2073.8 58178.6 69.1	2444 60929.8 81.5	1.6E-2 .419	2575.5 46940.6 85.9	145395	.151	1.8E-2	.322	.95 1.3

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WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
V-14	28	204.6 2939.3 6.8	2616 56637.1 87.2	2820.6 59576.4 94	1.9E-2 .407	3407 56297.6 113.6	146174	7.2E-2	2E-2	.385	.83 1.06
TOTAL		11838 159054 395	126616 2.571E+6 4221	138454 2.73007E+6 4615	1.5E-2 .301	133618 2.71441E+6 4454	9.0662E+6	5.8E-2	1.7E-2	.299	1.03 1

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WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
AS-35	30	75.6 2680.4 2.5	486.9 22738 16.2	562.4 25418.4 18.7	7E-3 .348	1388 45546.1 46.3	72916	.134	3.6E-2	.624	.41 .56
AS-36	30	0 1357.3 0	2359.2 147224 78.6	2359.2 148581 78.6	1.9E-2 1.203	1609.3 65043.2 53.6	123442	0	1E-2	.526	1.47 2.28
DD-10	30	89.3 1874.2 3	401.8 16855.9 13.4	491.1 18730.1 16.4	5E-3 .216	704.7 21549.7 23.5	86394	.181	2.1E-2	.249	.7 .87
DD-12	30	34.3 363.9 1.1	1082.1 53408.2 36.1	1116.4 53772.1 37.2	3E-3 .157	1860.5 49943.1 62	340851	3E-2	1E-3	.146	.6 1.08
DD-14	30	68.7 3478.6 2.3	1475.6 86782.6 49.2	1544.2 90261.2 51.5	5E-3 .305	2164.8 56394.1 72.2	295683	4.4E-2	1.1E-2	.19	.71 1.6
DD-16	30	34.3 1202.9 1.1	910.3 43972 30.3	944.7 45174.9 31.5	4E-3 .193	1270.5 42200.2 42.4	234062	3.6E-2	5E-3	.18	.74 1.07
DD-18	30	6.9 748.3 .2	421.8 33207.6 14.1	428.7 33955.9 14.3	4E-3 .341	578.5 18580.8 19.3	99411	1.6E-2	7E-3	.186	.74 1.83
FF-12	30	0 390.9 0	1033.7 65592.4 34.5	1033.7 65983.3 34.5	3E-3 .225	1910.2 50267.6 63.7	292955	0	1E-3	.171	.54 1.31
FF-14	30	50.4 419.7 1.7	1630.6 65464.7 54.4	1681 65884.4 56	4E-3 .189	2186.8 61340.1 72.9	347235	2.9E-2	1E-3	.176	.77 1.07
FF-16	0	686.1 1897 22.9	0 72850.8 782.8	0 74747.8 805.7	.103 .32	1399 47467.8 46.6	233092	2.8E-2	8E-3	.203	17.28 1.57

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WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
FF-18	30	174 4612.4 5.8	713.6 43263.4 23.8	887.6 47875.8 29.6	5E-3 .29	911 29828.5 30.4	164544	.196	2.8E-2	.181	.97 1.61
FF-20	30	22.9 1867.7 .8	25 1415.4 .8	47.9 3283.1 1.6	0 5.7E-2	679.8 12905 22.7	57048	.477	3.2E-2	.226	7E-2 .25
HH-12	30	34.3 732 1.1	1450.6 42217.1 48.4	1484.9 42949.1 49.5	5E-3 .157	2224.6 51633.8 74.2	272292	2.3E-2	2E-3	.189	.67 .83
HH-14	30	0 338 0	1967.4 57855.5 65.6	1967.4 58193.5 65.6	7E-3 .207	1742 49336.9 58.1	280397	0	1E-3	.175	1.13 1.18
HH-16	30	148.8 4289.8 5	491.9 35442 16.4	640.7 39731.8 21.4	2E-3 .178	1895.7 43162.8 63.2	222864	.232	1.9E-2	.193	.34 .92
HH-18	30	0 101.2 0	1132.1 47086.5 37.7	1132.1 47187.7 37.7	6E-3 .257	1626.9 30825.1 54.2	183019	0	0	.168	.7 1.53
HH-20	30	45.8 2482.8 1.5	26.7 2283.8 .9	72.5 4766.6 2.4	1E-3 7E-2	679.8 12905 22.7	67865	.631	3.6E-2	.19	.11 .37
JJ-12	30	66.4 2289.2 2.2	1582.3 67280.4 52.7	1648.7 69569.6 55	5E-3 .238	2982.7 57516.6 99.4	292199	4E-2	7E-3	.196	.55 1.21
JJ-14	30	11.4 757.4 .4	395.2 18845.2 13.2	406.6 19602.6 13.6	2E-3 .132	1678.3 36972.1 55.9	147711	2.8E-2	5E-3	.25	.24 .53
JJ-16	30	185.4 5038.5 6.2	848.7 39331.9 28.3	1034.1 44370.4 34.5	6E-3 .266	1641.8 28568.5 54.7	166634	.179	3E-2	.171	.63 1.55

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
5.0-ACRE - FIVE SPOT REPORT
SEPTEMBER, 1979 (30 DAYS)

WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
LL-12	30	16 583 .5	1168.8 30487.3 39	1184.8 31070.3 39.5	3E-3 9.4E-2	3242.7 58086.3 108.1	327428	1.3E-2	1E-3	.177	.37 .53
LL-14	30	29.8 542 1	515.2 17549.4 17.2	545 18091.4 18.2	3E-3 .118	1512.3 34740.3 50.4	152809	5.4E-2	3E-3	.227	.36 .52
NN-12	30	135.1 4118.7 4.5	2457.6 69168.9 81.9	2592.7 73287.6 86.4	1E-2 .302	2458.5 48958.1 82	242122	5.2E-2	1.7E-2	.202	1.05 1.5
NN-14	30	16 833.5 .5	775.3 26661.1 25.8	791.3 27494.6 26.4	2E-3 .102	1513.9 31978.3 50.5	268441	2E-2	3E-3	.119	.52 .86
PP-12	30	304.5 3479.2 10.1	1548.9 53500.1 51.6	1853.4 56979.3 61.8	8E-3 .268	3140.8 68455.6 104.7	212400	.164	1.6E-2	.322	.59 .83
PP-14	30	137.4 1056.8 4.6	2455.9 69039.6 81.9	2593.3 70096.4 86.4	8E-3 .242	1736.3 39971.1 57.9	288920	5.2E-2	3E-3	.138	1.49 1.75
PP-16	30	0 344.8 0	371.8 14546.7 12.4	371.8 14891.5 12.4	2E-3 .119	1161.1 23760.1 38.7	124520	0	2E-3	.19	.32 .63
RR-2	30	89.3 1599.1 3	525.2 24935.3 17.5	614.5 26534.4 20.5	2E-3 .127	851.8 27729.9 28.4	208887	.145	7E-3	.132	.72 .96
RR-4	30	281.6 8506.5 9.4	418.5 19943.3 13.9	700.1 28449.8 23.3	3E-3 .155	831 31764.3 27.7	182551	.402	4.6E-2	.174	.84 .9
RR-6	30	112.2 4586.3 3.7	541.9 29609.2 18.1	654.1 34195.5 21.8	4E-3 .24	1117.7 33727.2 37.3	141948	.171	3.2E-2	.237	.59 1.01

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
5.0-ACRE - FIVE SPOT REPORT
SEPTEMBER, 1979 (30 DAYS)

WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
RR-8	30	50.4 942.7 1.7	1242.1 29427.2 41.4	1292.5 30369.9 43.1	5E-3 .131	1926.7 45906.4 64.2	230914	3.8E-2	4E-3	.198	.67 .66
RR-10	30	0 934.9 0	1375.5 39487.3 45.9	1375.5 40422.2 45.9	5E-3 .151	3126.1 56406.2 104.2	266817	0	3E-3	.211	.44 .72
RR-12	28	94 1680.2 3.1	1076.9 39648.2 35.9	1170.9 41328.4 39	5E-3 .184	1566.1 35110.7 52.2	223502	8E-2	7E-3	.157	.75 1.18
RR-14	30	71 2199.8 2.4	171.7 6758.7 5.7	242.7 8958.5 8.1	3E-3 .111	978.8 23685.1 32.6	80481	.292	2.7E-2	.294	.25 .38
TT-2	30	0 310.7 0	623.6 29111.9 20.8	623.6 29422.7 20.8	5E-3 .269	572.3 32829.8 19.1	109198	0	2E-3	.3	1.09 .9
TT-4	30	107.6 3351.8 3.6	1493.9 37913.7 49.8	1601.5 41265.5 53.4	2E-2 .515	545 24650 18.2	80067	6.7E-2	4.1E-2	.307	2.94 1.67
TT-6	30	0 293.3 0	1180.5 45847.2 39.3	1180.5 46140.5 39.3	2.2E-2 .875	363 23119.5 12.1	52686	0	5E-3	.438	3.25 2
TT-8	30	9.2 143.6 .3	361.8 15581.8 12.1	371 15725.4 12.4	3E-3 .143	501.5 17155.7 16.7	109336	2.4E-2	1E-3	.156	.74 .92
TT-10	27	144.2 2984 4.8	420.2 20610.1 14	564.4 23594 18.8	4E-3 .17	931.7 24694 31.1	138176	.255	2.1E-2	.178	.61 .96
SC-14	30	9.2 837.1 .3	240.1 25706.1 8	249.2 26543.2 8.3	2E-3 .302	402 15488.1 13.4	87710	3.6E-2	9E-3	.176	.62 1.71

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
5.0-ACRE - FIVE SPOT REPORT
SEPTEMBER, 1979 (30 DAYS)

WELL	DAYS ACTIVE	OIL PROD CUM OIL DAILY AVE	WATER PROD CUM WATER DAILY AVE	FLUID PROD CUM FLUID DAILY AVE	FLD(PV) CUM FLD(PV)	INJECTION CUM INJ DAILY AVE	PORE VOL	OIL CUT	CUM OIL/ PORE VOL	CUM INJ/ PORE VOL	FLD/INJ CUM FLD/ CUM INJ
BP-18	30	0 26.9 0	50 5999.9 1.7	50 6026.8 1.7	0 7.3E-2	1444.3 53288 48.1	82228	0	0	.648	3E-2 .11
TOTAL		3342 76277 111	60936.1 1.61465E+6 2031	64278.1 1.69094E+6 2143	8E-3 .222	61057.8 1.56349E+6 2035	7.59175E+6	4.5E-2	1E-2	.205	1.05 1.08

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE SULFONATE REPORT

* SULFONATE IN WATER, %

WELL NO.	2-77	3-77	4-77	5-77	6-77	7-77	8-77	9-77	10-77	11-77
XA-10	.20	**	**	0.0	.04	0.0	**	**	.68	.09
XA-12	.05	.36	**	0.0	.04	.01	0.0	.04	.07	.08
XA-14	.02	.36	.03	0.0	.04	.02	.01	.04	.01	.05
AA-11	**	**	.37	0.0	.05	.03	.08	.02	.01	.05
B-0	.06	.36	.03	0.0	.07	.03	0.0	.01	.01	.05
EB-5	**	**	**	0.0	**	**	**	.03	.01	**
B-4	.04	.36	.03	0.0	.05	.03	.14	.04	.03	.40
B-6	.06	.36	.03	0.4	.25	.08	0.0	.07	.05	.07
B-8	.09	.36	**	0.1	.04	.03	.01	.06	.09	.05
B-10	**	.45	.07	**	**	**	.07	.17	2.50	.41
B-12	.10	.63	.07	0.0	.16	.10	**	**	.25	.44
B-14	.07	.36	.03	0.1	.13	.09	.09	.10	.07	.07
B-16	.06	.36	.07	0.05	.09	.08	.03	.03	.02	.05
D-0	.04	.36	.03	.05	.05	.03	.03	.01	.01	.04
D-2	.05	.36	0.0	0.0	**	.03	.07	.04	**	.32
D-4	.04	.36	.07	0.0	.05	.03	.09	.18	.10	.39
D-6	.25	.63	.23	.4	.27	.10	.20	.16	.14	.24
D-8	.14	.45	.13	.1	.22	.22	.11	.09	.07	.13
D-10	.06	.35	.03	.02	.05	.03	.02	.04	.00	.05
F-0	.06	**	.07	0.0	.05	.05	.05	.02	.00	.04
F-2	.04	.36	.07	0.0	.13	.08	.05	.03	.01	**
F-4	.11	.45	.1	.14	.1	.12	.12	.11	**	.05
F-6	.18	.63	.20	.3	.34	.14	.18	.20	.10	.20
F-8	.09	.36	.13	.1	.14	.22	.09	.08	.02	.09
F-10	.05	.36	.07	.07	.09	.08	.06	.07	.00	.08
F-12	.05	.36	.03	.5	.29	.07	.05	.04	.02	.08
F-14	.06	**	.03	.8	.20	.03	5.94	4.56	5.93	6.8
H-0	.04	.36	.03	.3	.27	0.0	.05	.04	.00	**
H-2	.10	**	**	.1	.27	.08	.08	.11	.14	.23
H-4	.08	.36	.07	.1	.20	.08	.11	.21	.03	.08
H-6	.14	.45	.10	.2	.25	.17	.12	.10	.03	.11
H-8	.14	.36	.13	.2	.24	.14	.15	.16	.13	.29
H-10	.08	.27	.07	.02	.09	.02	.07	.08	.07	.17
H-12	.06	.27	.03	0.0	.09	.02	**	.05	.00	.07
H-14	.06	.36	.07	**	.20	.08	.12	.13	.08	.19
J-0	.04	.27	.03	.0	.05	0.0	.06	.05	**	.08
J-2	.07	.36	.07	.07	.07	0.0	.07	.04	**	.08
J-4	.08	.36	.13	**	.14	.05	.12	.12	**	.13
J-6	.06	.36	.07	.07	.13	.04	.10	.08	.00	.08
J-8	.96	.98	.07	.02	.07	.05	.07	.06	.00	.08
J-10	.06	.45	.07	0.0	.07	.05	.11	.07	**	.08
J	.41	.36	.10	.7	.74	.49	.49	.43	**	.08
J-14	.70	.45	.13	.2	.29	.16	.17	.13	.08	.16

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MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE SULFONATE REPORT

* SULFONATE IN W R. %

WELL NO.	12-77	1-78	2-78	3-78	4-78	5-78	6-78	7-78	8-78	9-78
XA-10	.09	**	0.0	**	.17	3.5	3.2	**	**	**
XA-12	.11	.11	.08	.04	.17	0.0	.07	.08	**	.11
XA-14	.07	.12	.08	.01	.17	.05	.14	.14	.18	.23
AA-11	.05	0.0	.05	**	.16	0.0	**	**	.09	.13
B-0	.05	.70	.05	0.0	.12	0.0	.07	.03	.05	.09
EB-5	**	1.02	.07	0.0	**	0.0	.04	.03	.08	.09
B-4	.27	.26	.37	.54	.42	.9	1.1	1.1	2.84	1.53
B-6	.11	.13	.08	0.0	.13	0.0	.88	.07	**	.08
B-8	.07	.11	.28	.18	.10	.23	.41	**	.53	.56
B-10	2.0	4.11	0.0	**	**	0.0	**	**	**	**
B-12	.83	.55	.11	.03	.94	.6	**	1.3	1.00	.88
B-14	.12	.16	.14	**	.18	.06	.14	.14	.13	.15
B-16	.07	.13	.07	0.0	.12	0.0	.10	.07	.08	.09
D-0	.08	.14	.07	0.0	.13	0.0	.12	.09	.13	.15
D-2	.96	.47	.32	.21	.39	.17	.27	.03	.34	.38
D-4	.37	1.29	.05	.21	.70	1.67	**	2.7	**	3.94
D-6	.13	.25	.50	0.0	.73	.4	.59	.70	.68	.79
D-8	.05	.17	.11	.01	.17	0.0	.10	.11	.13	.11
D-10	.05	.14	.08	0.0	.09	0.0	.03	.03	.07	.04
F-0	.23	.12	.09	0.0	.10	0.0	.08	**	.08	.09
F-2	.14	.14	.16	**	.10	0.0	**	.07	.11	.15
F-4	.09	1.4	1.22	1.20	1.49	1.22	1.9	2.2	2.80	2.89
F-6	.05	.22	.16	.21	.23	.1	.22	.22	.25	.25
F-8	.07	.15	.05	0.0	.12	0.0	.10	.09	.12	.13
F-10	.05	.16	.05	0.0	.11	0.0	.08	.05	.09	.10
F-12	.07	.14	.36	0.0	.09	0.0	.08	.03	.07	.05
F-14	7.1	8.36	10.6	.26	9.52	8.8	5.7	8.0	9.60	9.7
H-0	.17	.13	.06	0.0	.08	0.0	.10	.07	.09	.11
H-2	.08	.16	.18	0.0	.22	0.0	.23	.22	.22	.28
H-4	.08	.17	.09	0.0	.14	.07	.12	.11	.37	.19
H-6	.34	.12	.13	.12	.21	.36	.29	.23	.21	.25
H-8	.15	.13	.08	0.0	.60	.20	.66	.95	1.17	1.38
H-10	.07	.18	.18	0.0	.25	.16	.40	**	**	.30
H-12	.20	.14	.07	0.0	.09	0.0	.10	.06	.11	.11
H-14	.07	.26	.20	.16	.22	.16	.41	.41	.47	.40
J-0	.07	.13	.07	0.0	.09	0.0	.08	.05	.08	.07
J-2	.14	.11	.16	.04	.10	.16	.08	.06	.08	.13
J-4	.06	.16	.14	.03	.17	.07	.16	.15	.14	.18
J-6	.37	.12	.09	0.0	.10	0.0	.08	.09	.09	.10
J-8	.08	.14	.07	0.0	.09	0.0	.08	.09	.09	.11
J-10	.36	.14	.38	0.0	.08	.35	.04	.08	.09	.10
J-12	.15	.46	.39	.34	.43	.33	.49	.49	.47	.49
J-14	.05	.22	.22	.09	.18	.13	.21	.23	.22	.19

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MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE SULFONATE REPORT

* SULFONATE IN WATER, %

WELL NO.	10-78	11-78	12-78	1-79	2-79	3-79	4-79	5-79	6-79	7-79	8-79	9-79
XA-10	**	**	**	**	**	**	2.67	**	**	**	**	**
XA-12	.17	.19	.28	.24	.82	1.8	3.06	11.7	6.06	8.53	9.39	**
XA-14	0.0	.30	.43	.67	.65	.91	.90	.99	**	1.09	.95	1.39
AA-11	.14	.19	.63	.39	.76	1.33	1.61	**	6.22	9.98	**	**
B-0	.07	.15	.10	.32	.06	.25	.51	.28	**	0.55	.37	.50
EB-5	.10	**	5.7	3.0	.08	**	**	.10	.12	0.09	.13	.20
B-4	1.96	1.4	**	4.3	5.3	.29	6.58	.15	11.4	12.6	12.3	**
B-6	.14	.18	5.5	.35	.8	.28	1.37	.35	1.62	0.91	.67	.94
B-8	.96	.61	.80	1.1	1.2	2.03	1.93	2.64	2.63	2.96	**	3.90
B-10	**	**	**	**	**	**	2.39	.21	**	**	**	**
B-12	1.29	.69	.8	.62	**	2.46	2.64	4.64	5.56	8.44	**	10.2
B-14	.17	.09	.16	.30	.11	.28	.31	.16	.57	.82	.63	1.50
B-16	.12	.10	.10	.32	.13	.22	.17	**	.20	.21	.06	.36
D-0	.22	.13	.35	.37	.23	.32	.43	.43	.46	.42	.51	.52
D-2	.46	.24	.25	.57	.61	1.33	1.03	1.42	1.36	1.54	1.15	2.01
D-4	.09	2.03	.51	4.0	5.1	5.48	6.12	7.5	10.0	11.5	**	**
D-6	**	.62	.51	.24	3.5	**	6.09	6.89	8.34	8.44	8.36	10.2
D-8	.16	.10	.18	.25	.13	.38	.72	.43	.41	.39	**	.52
D-10	4.3	**	.10	**	.06	**	.18	.20	.16	.30	.46	**
F-0	.09	.08	**	.39	.12	.19	.21	.18	.18	.24	.22	.44
F-2	.20	.11	**	.37	.57	.42	.31	.5	.74	.62	.79	1.01
F-4	3.19	1.87	**	**	4.1	5.09	3.67	5.5	5.24	9.42	**	4.69
F-6	.33	.16	.25	.30	.39	.87	1.38	2.25	2.14	2.01	2.29	2.91
F-8	.13	.06	.10	.25	.06	**	.41	.89	1.62	2.64	3.70	4.42
F-10	.09	.11	.13	.32	.11	.36	.17	.25	.20	.22	.30	.57
F-12	.10	.10	.13	.25	.14	.25	.19	.25	.23	.19	.11	**
F-14	9.8	6.0	18.3	9.6	**	3.81	6.60	7.78	8.9	9.52	8.41	9.66
H-0	.10	.10	.13	.32	.16	.57	.79	.78	.76	.87	.89	1.49
H-2	.29	.20	.16	.21	.67	.28	1.22	1.78	1.95	2.34	2.59	3.47
H-4	.30	.17	.16	.38	.25	.33	.32	.88	1.34	2.35	3.38	5.26
H-6	.43	.23	.23	.70	**	.75	1.27	1.45	2.61	3.21	3.56	5.71
H-8	2.06	1.25	1.75	.78	1.2	.69	1.52	1.88	2.03	1.74	1.73	2.39
H-10	.36	.18	.10	.25	1.4	2.54	**	5.21	3.03	4.06	4.61	4.19
H-12	.13	.10	.12	.27	.17	.56	1.23	2.88	4.54	6.82	8.95	7.27
H-14	.52	.31	.35	.57	1.4	2.88	2.48	7.45	10.7	12.6	12.2	14.3
J-0	.09	.10	.16	.26	.16	.22	.29	.5	.55	.60	.56	1.04
J-2	.16	.11	.23	.33	.27	1.74	2.21	3.24	3.27	3.70	2.40	2.94
J-4	.19	.12	.20	.35	.91	.35	.46	.61	.82	1.02	.91	1.50
J-6	.32	.10	.18	.30	**	.20	.20	.21	.28	.21	.71	.37
J-8	.17	.09	.20	.36	.11	.69	.43	.58	.76	1.09	1.54	2.21
J-10	.13	.11	.13	.32	.26	.33	.31	.58	.78	.94	1.36	2.04
J-12	.52	.24	.18	.34	.29	.13	.30	.45	.35	.33	.30	.55
J-14	.22	.15	.18	.27	.11	.20	.19	.38	.51	.57	1.03	1.82

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE SULFONATE REPORT

* SULFONATE IN W R. %

WELL NO.	2-77	3-77	4-77	5-77	6-77	7-77	8-77	9-77	10-77	11-77
L-0	.06	.36	.07	0.0	.09	.01	.07	**	.00	.07
L-2	.04	**	.07	.02	.09	.02	.07	.03	.00	.08
L-4	.04	.54	.07	.05	.09	.04	.08	.07		.08
L-6	.04	.63	.07	0.0	.14	.06	.07	.07	.02	.08
L-8	.15	.98	.17	.1	.14	.08	.13	.13	.05	.17
L-10	.06	.45	.07	.02	.11	.09	.10	.07	.01	.13
L-12	.08	.45	.10	.1	.16	.07	.14	.10	.05	.19
L-14	.09	.45	.13	.1	.20	.07	.12	.09	.02	.13
N-0	.03	.36	.03	0.	.07	.02	.06	.03	.00	.08
N-2	.03	.45	.03	.02	.09	0.0	.08	.09	.02	.11
N-4	.03	.45	.10	.07	.11	**	.05	.04	.01	.13
N-6	.04	**	.03	0.0	**	.03	.05	.04	.00	.07
N-8	.06	.45	.07	.07	.13	.04	.08	.10	.00	.13
N-10	.10	.45	.10	.07	.13	.06	.12	.08	.02	.08
N-12	.06	.54	.03	0.0	.09	.03	.07	.07	.03	.12
N-14	.08	.45	.07	.02	.16	.07	.09	.08	.02	.11
P-0	.04	.36	.03	.1	.05	0.0	.05	.04	.00	.04
P-2	.02	**	.03	0.0	.07	.02	.05	.03	.00	.04
P-4	.02	.45	.03	0.0	.13	.02	.06	.04	.00	.07
P-6	.03	.45	.03	0.0	.09	.05	.05	.05	.00	.05
P-8	.08	.45	.03	0.0	.20	.05	.08	.07	.00	.08
P-10	.06	.45	.07	.07	.11	.06	**	.06	.01	.08
P-12	.06	.36	.07	.05	.09	.04	.08	.08	.00	.07
P-14	.06	.45	.07	0.0	.09	.04	.06	.05	.01	.07
R-0	.12	.54	.03	.05	.13	.05	.18	.13	.08	.19
R-2	.04	.45	.03	.20	.09	.09	.04	.06	.00	.08
R-4	.04	.45	.03	.07	.07	0.0	.05	.04	.00	.04
R-6	.04	.45	.13	0.0	**	.04	.05	.05	.02	.08
R-8	.10	.45	.07	0.0	.11	.04	.08	.10	.02	.09
R-10	.10	.54	.10	.07	.16	.10	.12	.11	.06	.13
R-12	**	1.52	**	**	.89	.56	.65	.54	.40	.59
R-14	.10	.45	.07	.1	.14	.06	.16	.13	.07	.08
T-0	.06	.36	.03	.02	.07	0.0	.05	.07	.00	.07
T-2	.04	**	.03	0.0	.05	.04	.05	.06	.00	.07
T-4	.04	.36	0.0	0.0	.05	0.0	.08	**	.03	.11
T-6	.04	.45	0.0	0.0	.07	.10	.06	.06	.01	.08
T-8	.05	.45	.03	.05	.02	.16	.05	.05	.01	.17
T-10	.06	**	.07	.05	.11	.07	.12	.13	.08	.12
T-12	.06	**	.07	.05	.09	.10	.10	.10	.10	.08
T-14	.06	.45	.07	.02	.09	.07	.05	.05	.06	.07
V-0	.07	.45	.10	.07	.07	.06	.08	.10	.05	.08
V-2	.04	.36	.07	.02	.05	.03	.03	.04	.01	.08
V-4	.02	.36	.03	0.0	.05	.10	.07	.05	.02	.05

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MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE SULFONATE REPORT

* SULFONATE IN WATER, %

WELL NO.	12-77	1-78	2-78	3-78	4-78	5-78	6-78	7-78	8-78	9-78
L-0	.07	.14	.09	0.0	.10	0.0	.11	.06	.12	.09
L-2	.08	.13	.05	0.0	.08	0.0	.08	.07	.09	.09
L-4	.08	.15	.07	0.0	.11	0.0	.12	.07	.09	.10
L-6	.10	.15	.05	0.0	.11	0.0	.23	.08	.12	.11
L-8	.07	.19	.13	.03	.17	.05	.18	.12	.14	.16
L-10	.12	.17	.13	0.0	.14	.04	.12	.11	.14	.14
L-12	.05	.22	.28	.24	.49	.31	.49	.54	.84	1.00
L-14	.04	.13	.11	0.0	.12	.04	.05	.11	.13	.14
N-0	.11	.13	.07	0.0	.08	0.0	.07	.06	.08	.09
N-2	.07	.23	.21	.12	.06	.28	.44	.46	.54	.64
N-4	.04	.16	.08	0.0	.09	0.0	.10	.11	.14	.19
N-6	.07	.13	.03	0.0	.04	0.0	.09	.07	.08	.10
N-8	.06	.16	.08	0.0	.12	.07	.12	.11	.12	.18
N-10	.07	.13	.08	0.0	.08	.05	.14	.11	.12	.14
N-12	.07	.15	.08	0.0	.04	.06	.12	.11	.12	.16
N-14	.04	.15	.09	0.0	.09	.06	.14	.11	.12	.14
P-0	.05	.11	.05	0.0	.07	0.0	.05	.07	.11	.10
P-2	.06	.09	.04	.18	.08	0.0	.05	.08	.11	.08
P-4	.04	.13	.05	0.0	.09	0.0	.05	.06	.09	.09
P-6	.06	.10	.07	0.0	.08	0.0	.08	.07	.09	.10
P-8	.06	.13	.08	.01	.10	.06	.08	.08	.14	.13
P-10	.04	.13	.09	0.0	.08	.07	.08	.09	.12	.04
P-12	.04	.12	.07	0.0	.08	0.0	.10	.08	.11	.13
P-14	.04	.12	.05	.07	.04	0.0	.05	.07	.11	.10
R-0	.05	.22	.17	.07	.04	.13	.18	.16	.18	.20
R-2	.05	.11	.05	0.0	.04	.06	.05	.06	.11	**
R-4	.06	.12	.04	0.0	**	0.0	.05	.06	.21	.09
R-6	.07	.13	.11	0.0	.04	.10	.15	.15	.25	.23
R-8	.10	.14	.09	0.0	.04	.05	.12	.11	.13	.15
R-10	.11	.57	.11	.04	.07	.07	.14	**	.14	.15
R-12	.11	.15	.55	.25	.16	.48	.60	.62	.66	.69
R-14	.03	.22	.17	.07	.09	.12	.22	.01	.25	.29
T-0	.11	.12	.09	0.0	.01	.06	0.0	.05	.09	.11
T-2	.11	.11	.04	0.0	**	0.0	.05	.06	.05	.06
T-4	.05	.20	.37	0.0	.57	.56	.60	.64	.58	.64
T-6	.05	.11	.05	0.0	**	0.0	.10	.08	.08	.08
T-8	.11	.11	.05	0.0	**	0.0	.05	.08	.09	.10
T-10	.16	.19	.22	.07	.10	.12	.19	.19	.01	.21
T-12	.07	.27	.25	.13	.17	.16	.23	.24	.30	.31
T-14	.04	.14	.08	.01	**	.05	.08	.08	.11	.11
V-0	.04	.16	.09	.07	**	.07	.11	.09	.11	.15
	.04	.13	.08	0.0	**	.06	.08	.09	.12	.14
	.58	.30	.05	**	**	0.0	.04	.04	.08	.06

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MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE SULFONATE REPORT

* SULFONATE IN WATER, %

WELL NO.	10-78	11-78	12-78	1-79	2-79	3-79	4-79	5-79	6-79	7-79	8-79	9-79
L-0	.13	.12	.15	.31	.60	.81	1.11	1.94	1.77	2.06	2.28	2.52
L-2	.12	.09	.15	.32	.19	.47	.60	1.36	1.51	2.51	3.79	5.81
L-4	.16	.11	.11	.33	.15	.31	.17	.3	.21	.20	.19	.83
L-6	.16	.14	.18	.29	.25	.33	.33	.58	.47	.84	1.62	3.10
L-8	.17	.14	.22	.37	.18	.20	.16	.28	.25	.24	**	.77
L-10	.23	.12	.20	.30	.14	.47	.46	7.4	.72	.67	.77	1.01
L-12	1.39	1.13	1.24	2.2	**	**	6.23	1.21	8.63	11.1	10.7	12.7
L-14	.16	.09	.14	.24	.12	.53	.69	.23	1.09	.01	2.04	2.90
N-0	.10	.06	.13	.23	**	**	.18	6.78	.15	.15	.17	.37
N-2	.88	.60	1.14	1.3	3.0	6.38	6.33	1.96	6.83	8.27	8.53	9.45
N-4	.19	.12	.20	.39	.31	.63	.89	.78	2.37	3.57	4.91	7.86
N-6	.13	**	.20	.25	.20	.45	.58	1.75	2.3	1.38	2.68	5.60
N-8	.20	.09	.22	.35	.21	.54	.71	1.0	2.28	2.74	3.38	7.20
N-10	.16	.09	.18	.33	.14	.33	.43	.46	1.17	1.58	3.59	4.35
N-12	.16	.09	.20	.33	.12	.26	.35	**	.71	.71	.69	1.09
N-14	.13	.09	.09	.31	.08	.19	.18	1.83	.43	.58	1.04	.90
P-0	.12	.08	.10	.23	.17	.36	.48	.2	.13	2.08	2.02	2.24
P-2	.12	.09	.11	.29	.05	.19	.16	.41	.10	.15	5.39	.35
P-4	.13	.07	.11	.22	.08	.22	.22	.18	**	.51	.76	1.22
P-6	.11	.08	.13	.23	.08	.17	.14	.33	.14	.19	.13	.37
P-8	.13	.07	.11	.24	.08	**	.16	.28	.27	.33	.44	.94
P-10	.16	.10	.11	.23	.13	.22	.22	**	.24	.27	.37	.60
P-12	.13	.10	.18	.23	.63	2.03	2.61	2.98	2.49	**	**	3.37
P-14	.12	.07	.10	.32	.06	.20	.30	.4	.36	.54	.86	1.58
R-0	.22	.11	.20	.35	.13	.26	.14	.24	.37	.63	1.15	1.05
R-2	.16	**	.08	.30	.06	.20	.20	.33	.47	.57	.95	1.97
R-4	.15	.08	.15	.32	.08	.19	.22	**	.29	.34	.39	.91
R-6	.22	.31	1.22	1.1	.98	1.44	1.95	3.08	.28	4.78	5.36	5.86
R-8	.18	.12	.23	.22	.26	.48	.61	.98	1.08	1.52	1.87	3.25
R-10	.18	.10	.15	.33	.17	.25	.43	.95	1.39	2.51	3.37	5.27
R-12	1.07	.53	1.34	2.9	.99	1.69	2.16	2.48	4.26	5.89	6.24	11.9
R-14	.44	.18	.42	.52	.76	6.16	1.55	2.53	2.9	**	5.23	8.03
T-0	.13	.08	.10	.31	.08	**	.22	.44	.44	.53	.71	1.18
T-2	.13	.08	.13	.30	.06	**	.12	.21	.28	.29	.41	.50
T-4	.83	.39	**	.82	.99	1.69	1.41	1.41	1.42	1.74	1.58	2.85
T-6	.16	.25	.18	.36	.29	.81	.70	1.6	1.49	**	2.26	4.01
T-8	.12	.14	.13	.31	.07	.26	.30	.68	.44	1.98	1.97	3.91
T-10	.26	.33	.25	.33	.16	.32	.25	.43	.39	.46	**	.91
T-12	.45	.55	.43	.51	1.2	2.39	2.64	3.55	3.45	3.66	4.11	3.22
T-14	.13	.18	.13	.31	.09	.44	.53	1.18	1.03	.98	.90	1.11
V-0	.18	.19	.13	.23	.12	.25	.27	.41	.35	.69	.86	1.50
V-2	.21	.31	.22	.37	.16	.29	.34	.60	.54	.69	.61	.79
V-4	.11	.18	.13	.30	.15	.39	.47	.7	.54	.55	.74	1.21

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE SULFONATE REPORT

* SULFONATE IN WATER, %

WELL NO.	2-77	3-77	4-77	5-77	6-77	7-77	8-77	9-77	10-77	11-77
V-6	.04	**	.03	0.0	.07	.09	**	.04	.01	.13
V-8	.04	.30	.07	.02	.07	.03	.04	.05	.02	.07
V-10	.06	.36	.07	.05	.13	.05	.15	.13	.14	.20
V-12	.06	.36	.07	.02	.09	.16	.08	.08	.08	.12
V-14	.06	.36	0.0	.02	.09	.03	.03	.06	.02	.07

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* CONCENTRATION IN WATER DIVIDED BY CONCENTRATION OF STANDARD 1 % SOLUTION OF M-1 SLUG.

** DATA NOT AVAILABLE

ANALYSIS INDICATES LEVEL DUE TO OTHER THAN CRUDE OIL SULFONATE.

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE SULFONATE REPORT

* SULFONATE IN WATER, %

WELL NO.	12-77	1-78	2-78	3-78	4-78	5-78	6-78	7-78	8-78	9-78
W-6	0.0	.50	.99	.74	.75	.83	1.08	1.2	1.37	1.39
W-8	.05	.13	.05	.03	**	0.0	.08	.08	.08	.01
W-10	.20	.21	.20	.13	.10	.12	.16	.19	.18	.25
W-12	.10	.17	.16	.01	.07	.08	.16	.16	.18	.19
W-14	.05	.14	.09	.07	**	0.0	.08	.08	.11	.13

PAGE 3

* CONCENTRATION IN WATER DIVIDED BY CONCENTRATION OF STANDARD 1 % SOLUTION OF M-1 SLUG.

** DATA NOT AVAILABLE

ANALYSIS INDICATES LEVEL DUE TO OTHER THAN CRUDE OIL SULFONATE.

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE SULFONATE REPORT

* SULFONATE IN WATER, %

WELL NO.	10-78	11-78	12-78	1-79	2-79	3-79	4-79	5-79	6-79	7-79	8-79	9-79
V-6	1.9	2.9	1.84	.23	2.2	3.65	4.38	6.9	7.15	7.79	**	9.25
V-8	.10	.19	.10	.33	.06	.25	.30	.58	.59	.62	.56	1.61
V-10	.33	.40	**	.38	.14	.32	.30	.55	.58	.98	**	2.46
V-12	.22	**	.23	.40	.25	.42	.51	.95	.93	1.22	1.47	2.34
V-14	.16	.29	.23	.98	.17	.42	.25	.31	.96	.35	**	.68

* CONCENTRATION IN WATER DIVIDED BY CONCENTRATION OF STANDARD 1 % SOLUTION OF M-1 SLUG.

** DATA NOT AVAILABLE

ANALYSIS INDICATES LEVEL DUE TO OTHER THAN CRUDE OIL SULFONATE.

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
5.0-ACRE SULFONATE REPORT

* SULFONATE IN WATER, %

WELL NO.	2-77	3-77	4-77	5-77	6-77	7-77	8-77	9-77	10-77	11-77
AS-35	**	**	**	**	**	**	**	**	.02	**
AS-36	**	**	**	**	**	**	**	.05	.02	**
DD-10	.23	.71	.13	.2	.16	.10	.12	.11	.06	.12
DD-12	.06	.45	.07	.09	.09	.15	.07	.07	.03	.07
DD-14	.06	.45	**	.05	.09	.17	.07	.07	.05	.08
DD-16	.06	.45	.07	.09	.11	.05	.11	.08	.07	.48
DD-18	.18	.71	.23	.3	.29	.05	.17	.18	.11	.21
FF-12	.06	.45	.07	.07	.09	.06	.07	.07	.05	.08
FF-14	.06	.36	.03	.05	.09	.15	.08	.07	.05	.07
FF-16	.74 #	1.34#	.83 #	.8 #	.84 #	1.49#	.49 #	.46 #	.35	.49 #
FF-18	.06	.36	.07	.3	.25	.07	.16	.17	.14	.21
FF-20	**	**	**	.1	**	.36	.07	.09	.13	.09
HH-12	.06	.36	.07	.07	.11	.02	.06	.08	.03	.08
HH-14	.06	.36	.07	.07	.11	.54	.09	.08	.03	.08
HH-16	.10	.36	.07	.2	.13	.03	.07	.11	.07	.11
HH-18	.06	.36	.13	0.0	.09	.92	.15	.08	.13	.08
HH-20	.08	**	.07	**	.07	.10	.10	.08	.11	.08
JJ-12	.06	.36	.07	0.0	.05	.34	.07	.05	.03	.07
JJ-14	.40 #	.89 #	.03	.6	.67 #	.03	.35	.35	.65 #	.36
JJ-16	.44 #	1.07#	.50 #	.8 #	.82 #	.53 #	.40	.50 #	.44 #	.56 #
LL-12	.04	.36	.07	.05	.07	.05	.12	**	.03	.09
LL-14	.74 #	1.34#	.93 #	1.7 #	1.5 #	.80 #	.83 #	.77 #	.58 #	.71 #
NN-12	.06	.54	.03	.1	.14	.13	.12	.17	.10	.15
NN-14	.95 #	1.79#	1.1 #	2.1 #	1.9 #	1.26#	1.33#	1.24#	.91 #	1.2 #
PP-12	.06	2.32	.03	.09	.09	0.0	.09	.08	.06	.11
PP-14	.42 #	.89 #	**	.7 #	.80 #	.03	.55 #	.56 #	.43 #	.57 #
PP-16	1.39#	.45 #	**	2.7 #	2.5 #	.10	1.45#	1.42#	1.11#	1.3 #
RR-2	.02	.27	.03	.02	.05	.03	.07	.05	.03	.08
RR-4	.04	**	.03	**	.11	.04	.07	.06	.03	.08
RR-6	.03	**	.03	.02	.05	.03	.06	.06	.05	.16
RR-8	.05	.36	.07	.05	.07	.03	.07	.07	.07	.07
RR-10	.06	2.77	.60	.20	.31	.13	.17	**	.10	2.1
RR-12	.06	.45	.03	.05	.07	.04	.07	.07	**	**
RR-14	.32	.45	**	0.0	.07	.14	.08	.52	.06	.51
TT-2	.05	.45	.07	0.0	.07	.05	.09	.07	.02	.08
TT-4	.06	.45	.03	.02	.07	.05	.08	.09	.03	.12
TT-6	.06	.45	.07	.02	.09	.04	**	.08	.05	.05
TT-8	.04	.45	.03	.02	.07	.04	.07	.05	.06	.04
TT-10	.05	**	.03	.20	.05	.11	.07	.05	.06	.08
SC-14	**	**	**	.20	**	0.0	.14	.14	.08	.17
BP-18	**	**	**	**	**	**	**	**	**	**

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* CONCENTRATION IN WATER DIVIDED BY CONCENTRATION OF STANDARD 1 % SOLUTION OF M-1 SLUG.
** DATA NOT AVAILABLE
ANALYSIS INDICATES LEVEL DUE TO OTHER THAN CRUDE OIL SULFONATE.

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
5.0-ACRE SULFONATE REPORT

* SULFONATE IN WATER, %

WELL NO.	12-77	1-78	2-78	3-78	4-78	5-78	6-78	7-78	8-78	9-78
AS-35	.13	.09	.01	0.0	0.0		.08	.06	.09	.09
AS-36	.04	.15	.08	0.0	**	0.0	.08	.07	.08	.10
DD-10	**	.14	.42	.01	.25	.31	.37	.38	.39	.41
DD-12	.04	.13	.09	0.0	**	0.0	.10	.07	.11	.13
DD-14	.05	.14	.09	0.0	**	0.0	.10	.07	.11	.11
DD-16	.10	.21	.17	.07	.06	.12	.19	.20	.22	.24
DD-18	.14	.19	.22	.16	.12	.19	.34	.42	.64	.86
FF-12	.06	.13	.16	0.0	**	0.0	.10	.08	.17	.11
FF-14	.04	.15	.11	.03	**	0.0	.15	.08	.12	.11
FF-16	.10	.43 #	.49 #	.38	.38	.43 #	.51 #	.47 #	.53 #	.51 #
FF-18	.13	.22	.18	.05	.11	.16	.23	.18	.26	.25
FF-20	.02	.21	0.0	.08	.04	.09	**	.14	.14	.13
HH-12	.04	.13	0.0	.03	**	0.0	.08	.08	.12	.14
HH-14	.04	.13	.09	.03	**	.09	.14	.09	.12	.13
HH-16	.08	.17	.12	.05	.06	.10	.18	.14	.14	.18
HH-18	.05	.16	.21	0.0	.03	.09	.10	.11	.12	.11
HH-20	.03	.20	.36	.03	.05	0.0	**	.12	.13	.16
JJ-12	.06	.14	.08	0.0	.02	.09	.12	.09	.14	.48
JJ-14	.21	.26	.55 #	**	.05	.33	.34	.34	.37	.38
JJ-16	.35	.38	.55 #	.46 #	.40 #	.51 #	.58 #	.53 #	.61 #	.53 #
LL-12	.03	.13	.04	.01	**	0.0	.10	.08	.12	.10
LL-14	.44 #	.69 #	.72 #	.04	.49 #	.62 #	.63 #	.57 #	.55 #	.54 #
NN-12	.13	.25	.20	.12	.17	.28	.45	.49	.78	.66
NN-14	.77 #	1.14#	1.21#	1.17#	1.00#	1.19#	1.18#	1.2 #	1.18#	1.13#
PP-12	.18	.36	.25	.21	.35	.47	.84	.65	.67	.65
PP-14	.34 #	.51 #	.58 #	.51 #	.45	.64 #	.60 #	.64 #	.64 #	.01 #
PP-16	.79 #	1.08#	1.14#	1.14#	1.00#	1.14#	1.30#	1.3 #	1.29#	1.29#
RR-2	.06	.14	.07	.03	**	0.0	.08	.11	**	.11
RR-4	**	.17	.11	.03	.04	0.0	.16	.19	.13	.13
RR-6	.08	.16	.11	0.0	**	0.0	.11	.08	.11	.09
RR-8	.06	.14	.05	0.0	0.0	0.0	.07	.07	.08	.09
RR-10	.04	.11	.08	0.0	0.0	.05	.08	.08	.09	.10
RR-12	.05	.13	.08	0.0	0.0	0.0	.07	.08	.08	.10
RR-14	.50	1.12	.09	0.0	0.0	1.23	.05	.22	**	.16
TT-2	.07	.14	.11	0.0	0.0	.15	.08	.08	.09	.10
TT-4	.09	.20	.14	.05	.04	.09	.16	.12	.21	**
TT-6	.05	.14	.08	0.0	.02	0.0	.10	.08	.12	.13
TT-8	.06	.13	.09	0.0	0.0	0.0	.10	.09	.08	.09
TT-10	.18	.13	.09	0.0	0.0	0.0	**	.07	.08	.10
SC-14	.21	.38	.34	**	.25	.37	.53	**	**	.79
BP-18	**	**	**	**	**	**	**	**	**	**

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* CONCENTRATION IN WATER DIVIDED BY CONCENTRATION OF STANDARD 1 % SOLUTION OF M-1 SLUG.
** DATA NOT AVAILABLE
ANALYSIS INDICATES LEVEL DUE TO OTHER THAN CRUDE OIL SULFONATE.

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
5.0-ACRE SULFONATE REPORT

* SULFONATE IN WATER, % PAGE 1

WELL NO.	10-78	11-78	12-78	1-79	2-79	3-79	4-79	5-79	6-79	7-79	8-79	9-79
AS-35	.11	.13	.18	.30	.11	**	.17	**	.18	.12	.24	.18
AS-36	.10	.13	.13	.30	.15	**	.16	.18	.20	.19	.24	.30
DD-10	.52	.28	.16	.37	.15	.33	.48	.50	.33	.31	.28	.35
DD-12	.13	.08	.14	.23	.15	.17	.18	.18	.14	.09	.05	.23
DD-14	.13	.15	.14	.22	.35	.19	.16	.23	.16	.12	.08	.21
DD-16	.32	.28	.25	.24	**	.36	.25	.46	.40	.12	.48	.74
DD-18	1.65	2.61	1.86	2.0	4.2	4.55	4.36	**	4.07	4.73	4.24	4.68
FF-12	.12	.13	.13	.30	.15	.20	.22	.19	.27	.27	.19	.35
FF-14	.13	.15	.16	.31	.24	**	.29	.30	.28	.27	.21	.44
FF-16	.61 #	.48 #	.42 #	.50 #	.67 #	.87 #	.75 #	.88 #	** #	.98 #	.66 #	1.09
FF-18	.28	.23	.24	.21	**	.38	.35	.25	.18	.35	.32	.67
FF-20	.22	.28	.26	**	**	**	.34	**	**	**	**	**
HH-12	.12	.13	.14	.32	.23	.20	.33	.23	.18	.21	.14	.18
HH-14	.11	.13	.16	.30	.19	.19	.18	.20	.15	.17	.09	.28
HH-16	.19	.16	.19	.34	.34	.31	.29	.40	.41	.51	.50	.99
HH-18	**	.14	**	.29	.18	**	.18	.20	.23	**	.19	.41
HH-20	.22	**	.26	.38	.33	.38	.30	**	**	**	.01	**
JJ-12	.16	**	.19	.51	.33	.25	.21	.24	.35	.42	.39	.33
JJ-14	.49	.25	.28	.35	.35	.31	.38	.31	.29	.30	.24	.42
JJ-16	.68 #	.35 #	.38 #	.47 #	**	.45 #	.39 #	.51 #	.45 #	.57 #	.50 #	.62 #
LL-12	.11	.10	.14	.22	.25	.19	.18	.16	.12	.17	.41	.20
LL-14	.74 #	.19 #	.42 #	.31 #	.44 #	.41 #	.48 #	.43 #	.41 #	.42 #	.31 #	.57 #
NN-12	1.35	1.37	.98	5.7	**	**	3.94	4.51	3.07	2.82	2.21	2.34
NN-14	1.43#	.48 #	.71 #	.65 #	.72 #	**	.63 #	.83 #	.82 #	.84 #	.71 #	.84 #
PP-12	1.09	.82	.89	.22	**	5.68	5.52	6.38	5.84	5.85	4.65	6.31
PP-14	.88 #	.76 #	.58 #	.83 #	1.5 #	1.95#	2.22#	2.68#	2.77#	3.16#	3.24#	4.19#
PP-16	1.64#	.61 #	.80 #	.32 #	.65 #	.63 #	.59 #	.65 #	.57 #	.55 #	.44 #	.67 #
RR-2	.13	.15	.19	.32	**	.17	.21	.15	.15	.17	.08	.13
RR-4	.16	.20	.25	.38	**	.78	1.28	1.48	1.67	2.24	1.36	1.91
RR-6	.11	.16	.19	.23	.27	.28	.29	.03	1.58	2.03	1.88	2.15
RR-8	.06	.10	.14	.22	**	.20	.16	.21	.18	.17	.06	.25
RR-10	.11	.13	**	.23	.20	.14	.15	.13	.14	.15	.06	.25
RR-12	.09	.10	.16	.22	.19	.20	.18	.16	.18	.17	.13	.30
RR-14	.20	.20	.21	.36	.39	**	.26	**	.26	.25	.19	.19
TT-2	.13	.10	.15	.32	.18	.19	.18	.20	.18	.17	.11	.17
TT-4	.38	.62	.36	.45	.39	.62	.58	.63	.55	.96	1.36	1.06
TT-6	.16	.10	.15	.31	.21	.25	.14	.21	.20	.20	.11	.15
TT-8	.11	.13	.13	.27	.19	.19	.16	0.0	.13	.37	.06	.23
TT-10	.11	.10	.15	.32	.21	**	.18	.23	.27	.35	.26	.46
SC-14	.93	.68	.86	.22	1.3	**	**	1.98	**	**	**	**
BP-18	**	**	**	.22	.23	**	.18	.19	.17	.13	.02	.30

* CONCENTRATION IN WATER DIVIDED BY CONCENTRATION OF STANDARD 1 % SOLUTION OF M-1 SLUG.
 ** DATA NOT AVAILABLE
 # ANALYSIS INDICATES LEVEL DUE TO OTHER THAN CRUDE OIL SULFONATE.

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE CHLORIDE REPORT

CHLORIDES (PPM)

WELL NO.	2-77	3-77	4-77	5-77	6-77	7-77	8-77	9-77	10-77	11-77
XA-10	23560	**	**	21600	11210	10214	**	**	12800	21943
XA-12	23710	24700	**	21700	11570	13584	21059	22320	9820	21943
XA-14	10380	10500	10850	11100	10780	10319	10564	10400	9780	10473
AA-11	**	**	10450	11400	11140	10776	9891	10870	10670	11363
B-0	8920	8890	8800	9110	9520	9302	9040	9180	9000	9582
EB-5	**	**	**	**	**	**	**	9180	9280	**
B-4	7980	7770	7930	7990	8230	7897	10175	9210	15160	13429
B-6	23350	20200	20870	10400	9270	20008	19818	9560	19310	4096
B-8	9320	13200	**	11200	19760	10776	18790	19330	18850	11791
B-10	**	9730	10560	**	**	**	9714	14900	15650	14427
B-12	9470	13400	11720	11800	10420	9337	**	**	13840	14391
B-14	9360	9180	12150	9440	10670	9091	10104	9320	9250	11078
B-16	14170	13800	11900	11200	11680	10986	11061	10980	10490	11007
D-0	8270	8240	9010	8570	9590	8424	9572	8460	8500	9440
D-2	10560	10200	10090	9800	**	9828	10104	9000	**	9653
D-4	14570	12400	13700	12700	8870	11618	11557	9610	12520	13287
D-6	9180	9980	10270	10200	9380	9337	10458	9540	10030	10900
D-8	11000	11100	11030	11100	11280	11759	11025	11010	10880	11506
D-10	12780	12000	12440	12100	12320	11759	11203	12060	10850	11897
F-0	12750	**	10820	10700	10600	8354	8685	10400	10390	10758
F-2	14020	13500	14060	13200	11170	9723	13472	13320	13300	**
F-4	10200	9870	10170	9910	10380	9582	10033	10470	**	13892
F-6	8270	8600	8330	8530	8730	8529	8331	8460	8250	8692
F-8	8160	8170	10850	8570	9410	8213	8154	9110	8000	8442
F-10	9320	9660	9520	9620	10350	9266	10245	9720	9530	9867
F-12	14900	12900	12440	16200	9920	8915	8615	14200	12310	13037
F-14	20180	**	18820	19100	9560	8986	17088	17920	16570	18701
H-0	12020	11400	11070	13000	13190	10425	10210	10040	13370	**
H-2	8090	**	**	11000	13190	8494	11167	8530	13160	13678
H-4	8050	8020	7970	8280	8980	8951	8721	13120	8390	8834
H-6	8340	8530	8360	8750	8990	8459	8508	8030	7680	8193
H-8	8740	8788	8900	9110	9770	8915	8934	8640	8540	8727
H-10	8270	8200	8290	8420	10100	8389	8934	8500	8220	8585
H-12	9510	9290	9300	9580	9340	8951	**	8570	8610	9119
H-14	8010	9170	8440	**	9770	9126	9217	8960	8890	9618
J-0	11290	11300	11360	11100	11460	10741	10884	9470	**	10651
J-2	10490	9800	9730	9470	10280	10776	9572	9570	**	10402
J-4	9290	9440	9450	**	9880	8599	9040	8820	**	8638
J-6	9360	9330	9340	9260	10130	9266	8012	9860	9430	9898
J-8	10600	10700	10670	19100	12610	7406	10281	9750	9350	9574
J-10	10270	9980	10270	10400	12610	10109	10458	10470	**	36
J-12	10160	8170	10240	12000	13370	12390	13046	12060	**	36
J-14	9800	8600	8470	9070	9450	8740	8792	8460	8180	8458

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MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE CHLORIDE REPORT

CHLORIDES (PPM)

WELL NO.	12-77	1-78	2-78	3-78	4-78	5-78	6-78	7-78	8-78	9-78
XA-10	21590	**	0	**	9390	24600	25500	**	**	**
XA-12	21730	9525	20533	10553	20540	21000	20500	20900	**	21930
XA-14	10190	10057	10000	10720	20650	10200	10300	10300	10740	11170
AA-11	10980	**	10730	**	20880	11000	**	**	**	11720
B-0	9213	12386	9060	10025	9240	9100	9800	9600	9880	9780
EB-5	**	**	9210	9543	9940	9300	9300	9900	9880	9810
B-4	9079	6129	7870	8554	8830	8000	8700	9000	11880	8580
B-6	10870	19848	19450	19419	19390	19300	**	19700	**	19980
B-8	8540	11695	18600	20320	10800	19600	20900	**	21000	8580
B-10	16150	17909	0	**	**	10800	**	**	**	**
B-12	16480	15619	7700	12875	15130	15900	**	16200	18040	18680
B-14	9390	8508	9670	**	9185	9000	9800	9100	8900	10150
B-16	10470	9816	10040	10429	10080	10200	9800	10500	10080	10650
D-0	8100	7586	8250	9848	8330	8100	8400	8500	9270	8400
D-2	8420	9260	7790	9384	8950	8500	9400	9000	8820	8690
D-4	12050	11426	19370	9589	10280	11200	**	11600	**	12180
D-6	10420	7966	11230	19437	10270	9800	12000	10300	11130	11870
D-8	10560	10252	10730	10865	10790	10200	11300	11300	12170	12840
D-10	11810	11355	11290	8618	10770	10600	10100	11800	11010	10410
F-0	10250	10766	9560	9763	9680	9700	11100	**	9650	10040
F-2	11690	13918	13430	**	13380	13600	**	14100	14800	14800
F-4	13770	11294	11210	12386	11040	10700	12300	9300	12150	12140
F-6	7970	7654	7880	8182	8240	7700	8500	8600	8840	9040
F-8	8060	7235	7630	8887	7820	7500	8500	7700	8670	8130
F-10	12240	9777	8020	9458	9960	9200	9700	9000	2220	10570
F-12	12030	9582	11550	9699	10110	12500	11400	13000	13190	12680
F-14	18250	19072	17090	11925	18290	17800	18700	19900	19500	19220
H-0	9710	8512	9030	9437	9580	9500	9800	10400	9670	10110
H-2	12750	9922	12770	9501	13750	13100	13300	13900	14850	15280
H-4	8520	9855	7890	8125	8840	11200	8700	9000	9670	8930
H-6	7690	4881	9070	8129	8530	9700	8900	7900	7740	9360
H-8	8490	6650	8580	7842	8160	8200	8300	8400	8660	8570
H-10	8130	8224	7880	9161	7830	8100	8400	**	**	8810
H-12	8560	8926	8480	9125	8700	8700	9000	8800	8880	8980
H-14	9140	9355	8980	8948	9060	8900	9500	9500	9290	9130
J-0	10250	10380	10320	8710	10350	10100	10600	11300	11230	10230
J-2	9360	8274	7710	8689	10500	9300	10000	10400	11250	10610
J-4	8460	5871	8050	9394	8690	8500	8600	9400	9400	8970
J-6	9470	8292	9190	9238	8840	9200	9500	8500	10090	10210
J-8	8060	8327	8970	8958	9580	9100	9200	9500	9810	9290
J-10	9860	10298	11080	10238	8700	10800	**	10900	11180	10790
J-12	11710	11677	10640	11355	11980	11100	10900	10800	12340	13300
J-14	8260	8100	7970	8409	8640	8000	8100	8500	8720	8730

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MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE CHLORIDE REPORT

CHLORIDES (PPM)

WELL NO.	10-78	11-78	12-78	1-79	2-79	3-79	4-79	5-79	6-79	7-79	8-79	9-79
XA-10	**	**	**	**	**	**	21240	**	**	**	**	**
XA-12	22040	19240	20970	21820	23600	22940	22230	20360	20000	18363	16782	**
XA-14	10480	10310	10980	11440	11680	10780	11270	10850	**	11766	11667	13080
AA-11	11040	12080	11200	10220	11320	11610	11310	**	10760	9706	**	**
B-0	9940	9790	9580	8710	8850	9450	9470	9730	9500	9568	9692	9680
EB-5	9310	**	11540	9140	9070	**	**	9270	9370	8937	8707	9240
B-4	8540	9770	**	9140	8470	16800	8470	12210	7620	6672	4945	**
B-6	20570	19770	11460	18300	18080	17170	17380	19530	18980	19434	19076	8510
B-8	21380	21360	11740	20160	19420	19270	19110	18870	19950	18601	**	17830
B-10	**	**	**	**	**	**	19190	12190	**	**	**	**
B-12	17510	18110	22830	19270	19270	17880	19370	19320	18860	19058	**	17130
B-14	9050	8540	8780	8840	9320	9080	9600	9090	9670	9437	9302	10070
B-16	10840	9820	10530	9170	9430	10170	9270	**	9750	10245	8990	9580
D-0	9390	8410	15050	8350	8160	8240	8310	8120	8330	8348	8497	8320
D-2	10410	9250	15010	8270	8990	9210	8850	8660	8650	8735	8870	9040
D-4	9850	10750	18090	10800	10430	9310	9310	8770	8620	7530	**	**
D-6	**	10590	13230	9740	9400	**	9500	9150	9040	8526	8444	8050
D-8	12100	11760	12120	10730	10500	10650	10880	10660	10780	10454	**	11140
D-10	11420	**	9360	**	8130	**	10640	10580	9980	11103	11305	**
F-0	9500	9770	**	9750	9980	10710	10410	10660	10620	10181	10185	10590
F-2	14980	14910	**	14480	14210	14250	14180	14710	13970	14308	14148	14500
F-4	11900	13560	**	**	10740	10050	8550	10410	10440	10043	**	10870
F-6	9230	8340	8860	8800	8000	8010	7810	7780	7720	7632	7824	7810
F-8	7810	8370	7900	6760	7780	**	7530	7480	7240	7111	7175	7110
F-10	9700	10310	10480	8210	10140	9360	9470	9840	9750	9579	9681	9840
F-12	12500	13120	12540	11500	12440	12520	11840	11850	11380	10933	11351	**
F-14	19990	19430	17870	16660	**	12270	14190	14030	13910	14201	14361	14000
H-0	10440	10390	10300	10500	11100	10640	8810	10760	10870	10982	10894	11140
H-2	14460	15250	10300	15000	14370	10740	14500	15490	14400	13946	13801	14080
H-4	8110	9040	8710	8710	8740	8870	10760	9580	8860	8586	8685	8650
H-6	10280	8950	9180	7830	**	7680	7590	7490	7700	7133	7037	7000
H-8	8410	8170	7970	6850	7920	6730	8160	8450	8920	8132	8299	8580
H-10	9010	8840	8760	7950	7920	7650	**	7420	8490	7586	7608	7760
H-12	8880	8560	8860	9220	9270	9260	8840	8680	8460	8171	7342	8200
H-14	9770	9150	8660	8670	9360	9470	8970	8020	7670	6466	5778	4880
J-0	10180	10320	9090	9860	**	10090	10050	10080	10780	9632	9745	10000
J-2	11230	12270	10240	9930	8390	7140	9060	9010	9480	9362	9316	9680
J-4	10340	9710	9150	8950	7740	8080	8410	8560	9000	8646	8253	8200
J-6	10140	9480	8770	8370	**	9010	8980	9110	9470	9061	8827	9420
J-8	8730	9060	9460	10580	8750	6640	8110	8340	8960	8738	8671	8280
J-10	11860	10340	10670	8950	10500	10390	9360	8820	8920	8504	8565	8690
J-12	12660	11980	8040	12470	12370	4400	10150	**	10320	10323	10181	10280
J-14	8720	9250	8040	7540	7720	7890	7870	8040	7910	7767	8083	8050

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE CHLORIDE REPORT

CHLORIDES (PPM)

WELL NO.	2-77	3-77	4-77	5-77	6-77	7-77	8-77	9-77	10-77	11-77
L-0	8740	8780	8510	9070	9950	9021	9501	**	9110	9358
L-2	8920	**	8830	9040	8590	8705	8579	8100	8000	8674
L-4	8780	8490	8690	9110	9410	8599	9253	8710	8540	8638
L-6	8740	8530	8400	8710	9660	8424	8544	8280	8040	8350
L-8	8090	8170	8150	8310	9380	8389	8544	8310	8070	8278
L-10	8120	8170	8110	8530	8870	8179	8225	8060	8000	8674
L-12	9180	9260	9230	9980	9880	9302	9359	9030	8890	9034
L-14	8010	8020	8150	8530	9590	8424	8508	8240	8180	8278
N-0	8740	8460	8440	9040	9380	9056	8969	9030	7220	8358
N-2	7360	7330	7280	7990	9410	7546	8047	7920	7650	12058
N-4	13150	12400	9050	9260	10670	**	12018	9860	11920	8746
N-6	9830	**	9730	9980	**	9372	10033	12240	10310	10078
N-8	9360	9150	9340	9260	10420	9056	8934	8890	10240	8998
N-10	8010	8130	8470	8530	9380	8740	9040	9000	9670	9574
N-12	8230	8390	8290	8350	9630	8213	8508	8280	8220	8278
N-14	8520	8420	8440	8460	10240	8459	8863	8670	8390	8278
P-0	10160	10000	9080	10200	10530	9723	9785	10110	9780	10042
P-2	8920	**	8650	8930	9410	8670	9005	10190	8710	10152
P-4	10200	10100	8290	12000	9200	9617	9891	10150	10350	10473
P-6	8270	8200	8150	9760	8800	8248	8615	8280	8220	8513
P-8	8160	8130	8110	9510	8770	8284	8437	8240	7860	8335
P-10	8920	8930	9050	9840	10060	9266	**	9650	9750	9938
P-12	8190	8170	8470	9110	8410	8178	8118	7160	8000	8371
P-14	8410	8350	8830	10600	9200	8354	7941	8280	8220	8549
R-0	9980	9980	9730	11000	9770	7827	9643	10080	9820	10010
R-2	8410	8530	8900	9470	8800	7862	8544	8670	8360	8371
R-4	11840	11300	11790	12200	12860	12180	9572	13010	12200	12574
R-6	16100	16100	10450	14200	**	13303	9926	13680	9640	14035
R-8	9650	9840	10090	10900	10100	9512	10068	10040	9780	9974
R-10	10020	10100	10310	10900	10350	9477	10387	10080	9820	10294
R-12	**	14900	**	**	15810	13900	13897	13680	13160	13714
R-14	14640	14200	14100	14500	14340	13163	14145	13210	12240	8513
T-0	8740	8310	8760	9600	8690	7968	8331	8280	8180	8478
T-2	7580	7660	8040	9200	8050	7546	8012	7740	17070	7943
T-4	11840	11600	11100	11900	10780	8951	11167	**	10350	10686
T-6	16390	**	16620	16900	8800	16568	17903	17490	16930	17454
T-8	8090	8240	8650	8780	16850	8319	8650	8460	8180	8763
T-10	9030	**	9190	9470	8800	8354	8969	8640	8430	12717
T-12	8230	**	8510	9070	8440	8178	8508	8130	8000	17490
T-14	7870	7800	8470	8530	7330	8178	8508	8240	8040	8349
V-0	8190	8160	8470	9110	7760	8284	8898	8130	8040	9012
V-2	8340	8930	8260	10200	8190	8494	8296	9360	9600	9404
V-4	11800	11200	11570	11700	8410	11127	**	10800	9280	10508

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MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE CHLORIDE REPORT

CHLORIDES (PPM)

WELL NO.	12-77	1-78	2-78	3-78	4-78	5-78	6-78	7-78	8-78	9-78
L-0	9380	8249	9190	9334	9600	8900	9300	9200	10040	9430
L-2	8020	7746	7760	8487	8330	7900	8800	8200	8550	8340
L-4	8220	7650	8290	8249	8180	8100	8300	8400	8460	8800
L-6	8360	8051	7450	7767	7880	7700	8100	8800	7690	8720
L-8	8390	8309	7850	8738	8660	8000	8300	8900	8480	9150
L-10	7660	7604	7930	8026	8010	7400	7000	8800	7490	7680
L-12	8700	7289	8650	9738	8490	8600	8400	10000	9890	9200
L-14	7820	5977	7380	9029	7800	7200	8600	8600	8320	8240
N-0	8760	9057	9100	9398	8790	8700	8300	10000	8990	9770
N-2	7820	7998	7910	7937	9150	7900	7900	8100	8780	8500
N-4	11880	11979	11850	12858	12070	12700	13700	12700	13670	13220
N-6	10250	9912	9210	9362	9660	9600	10000	11200	10240	10760
N-8	8570	9554	8340	8919	8400	8400	8700	9300	9130	8950
N-10	9480	9050	8680	9455	9810	9400	10100	10500	9560	8920
N-12	8180	7866	7940	7923	3230	8400	8600	7800	8140	8260
N-14	8210	8487	8080	8402	8320	8100	8400	9000	8930	8890
P-0	9950	9873	9840	10401	10220	9900	10100	10700	10210	10490
P-2	8630	5442	9780	11280	8590	8400	9300	8300	9350	9190
P-4	9870	**	9800	10203	8410	10400	10400	8900	10530	10890
P-6	8012	5715	8040	8785	8010	7900	8400	8500	8550	8650
P-8	7810	7533	7810	7983	9590	7800	7700	8200	7720	8340
P-10	9540	9572	9190	9416	9450	9700	10400	10000	10450	**
P-12	7960	6463	7770	7987	5920	7900	8100	9000	8560	8790
P-14	8250	6845	8230	8270	8430	8100	8400	9500	8960	8250
R-0	9840	9749	9630	10692	8770	9700	10400	10900	10770	10920
R-2	8250	7891	11990	8256	11480	8000	8500	8800	8940	**
R-4	12410	10717	12110	13226	12780	12300	13400	12700	11710	14040
R-6	13730	13542	12170	11901	13930	10700	13400	14500	13530	14730
R-8	9760	9593	9306	9072	9470	9300	10100	9700	10170	9590
R-10	10020	13237	9830	10217	10090	9600	10300	**	10770	10340
R-12	**	6452	12540	11684	10930	13100	14300	14100	14000	14440
R-14	12110	12624	12130	11507	13500	12600	12500	14100	12920	12950
T-0	8240	7491	8230	8940	9700	8500	9200	8900	9030	8860
T-2	10430	6129	7920	8714	8160	7900	8500	8700	8830	8900
T-4	10260	9270	10500	8451	11140	10000	11600	11800	11600	11370
T-6	8440	7852	17370	8614	17090	16800	17200	17500	17060	17470
T-8	8300	7576	8370	8788	8400	7900	8500	9400	9290	9180
T-10	8530	6899	8090	9713	8670	8100	8700	9100	9010	8340
T-12	7820	7678	7710	7940	8100	7600	7900	8900	8000	8450
T-14	9630	6661	7890	8855	7490	8000	7700	8500	8600	8360
V-0	8150	7824	7800	10837	12360	8100	8700	9100	8370	8780
V-2	9570	9444	9060	9805	9270	8000	8900	9300	9100	9860
V-4	9360	9979	9830	**	10530	9300	10300	9900	10070	10530

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MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE CHLORIDE REPORT

CHLORIDES (PPM)

WELL NO.	10-78	11-78	12-78	1-79	2-79	3-79	4-79	5-79	6-79	7-79	8-79	9-79
L-0	9720	9380	9380	9050	8890	8830	8820	8640	8570	8295	8551	8390
L-2	8960	8190	8120	7670	8340	8250	8020	8010	7800	7370	7214	7150
L-4	9040	9040	8250	7440	7720	7740	7960	7850	7840	8083	6714	7740
L-6	8140	9350	8930	8660	8300	8680	8560	8150	8350	8068	7608	7400
L-8	9100	9344	8750	8990	9110	6880	8680	8110	8160	7799	**	7670
L-10	7730	9060	7890	7650	7930	7580	7770	7680	7630	7643	7849	7740
L-12	10160	9730	9940	9170	**	**	8600	8640	8710	8455	9026	8130
L-14	8680	8740	8660	8000	8130	8020	8250	7860	7580	7480	7512	6670
N-0	9180	9170	9500	8350	**	**	8430	8380	8460	8356	8458	8390
N-2	9040	9040	7960	8120	8320	7290	6830	6870	6870	6080	5959	5910
N-4	12796	14050	12510	13620	13980	12290	12290	12380	12260	11699	10869	10780
N-6	10510	**	10200	11940	9140	8920	8870	9130	12350	9217	9252	9110
N-8	8650	9680	9840	9260	8330	8050	8040	7910	7950	7907	8306	7540
N-10	9800	11370	9630	10830	8950	9140	9310	9040	9100	9164	8738	8690
N-12	8820	9340	9610	8300	8130	7900	8280	8300	7920	8015	8476	13680
N-14	8540	8060	9290	8270	8230	8270	8230	8380	8400	8377	8214	8930
P-0	10570	10520	9930	9340	8990	9290	9970	9370	8580	7951	8458	8720
P-2	10500	10400	8860	7890	8240	8090	8820	8760	8520	8604	11089	8550
P-4	10430	11730	11680	10030	9620	9810	9420	9590	**	9618	9600	10150
P-6	8210	8140	8320	7130	7620	7890	7970	7910	7930	7728	7795	8640
P-8	8840	9270	7910	9030	7950	**	7990	8270	7820	7707	7749	7780
P-10	10810	9500	10150	10000	10100	10160	10850	10500	10030	10117	10319	10250
P-12	8600	7950	7910	7550	7540	7650	7480	7440	7370	**	**	7350
P-14	8460	8880	8890	8680	8570	8390	8060	8040	8360	7785	8458	8300
R-0	11060	11980	11120	9590	8960	9060	9150	9260	8900	9040	9011	8640
R-2	9910	**	8400	7920	8890	8150	8180	7700	8030	7888	7608	7870
R-4	13990	8050	13750	10990	12500	12290	12330	**	11980	12291	12581	12370
R-6	10940	13930	13840	15130	12650	12780	12580	12350	11820	12032	12361	11690
R-8	9670	9810	9280	8710	9840	8880	9110	8830	8780	8912	9196	9000
R-10	10530	10750	11250	9480	10580	10240	10390	10560	10610	10185	9922	9920
R-12	12650	13120	14670	11010	11990	11690	12000	12120	11600	11596	11794	10470
R-14	12870	13880	14390	11820	13000	8750	12840	12880	12610	**	12386	10970
T-0	8800	9160	10420	8710	8780	**	8540	8700	8570	8235	8795	8670
T-2	8940	10430	9520	9650	8390	**	8160	8580	8470	8366	8554	9040
T-4	12790	12270	**	12820	10470	10890	11560	11650	11620	11776	10525	11320
T-6	17120	17140	17360	16630	17230	16060	16900	16820	16110	**	15020	14670
T-8	8840	9930	8810	7890	8320	8700	8260	8640	8560	8327	14946	8210
T-10	8360	8530	9620	8192	8010	8100	7990	8190	8150	8051	**	8290
T-12	8000	8000	8750	6850	7590	7110	7290	7410	7470	7342	7498	8200
T-14	9710	9470	9120	9000	8910	7850	7870	7980	7800	7707	7615	7640
V-0	8610	9450	8970	7830	7630	7680	7890	7940	9320	7739	7618	7770
V-2	10600	10840	9780	9050	8830	9530	9710	9900	10040	10036	**	9540
V-4	11370	11330	10040	11030	11170	10030	10470	10590	11100	11227	10990	11400

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE CHLORIDE REPORT

CHLORIDES (PPM)

WELL NO.	2-77	3-77	4-77	5-77	6-77	7-77	8-77	9-77	10-77	11-77
V-6	14170	**	13880	12400	8690	14953	**	13570	9390	13429
V-8	8230	8680	8580	9300	8050	8529	9395	8420	9320	8513
V-10	8560	8970	9010	9180	8120	8775	9005	9210	8570	8870
V-12	9650	9660	9880	10900	8840	9442	9714	9390	9430	9582
V-14	10780	11100	11000	12000	9950	10951	10671	10900	10710	11256

** DATA NOT AVAILABLE

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
2.5-ACRE CHLORIDE REPORT

CHLORIDES (PPM)

WELL NO.	12-77	1-78	2-78	3-78	4-78	5-78	6-78	7-78	8-78	9-78
V-6	9890	12489	12220	14017	15190	13800	13800	13900	13460	14590
V-8	8000	6938	4860	8012	8200	7900	8000	8900	8340	8480
V-10	8610	6969	8610	8976	9350	8600	9300	9700	8880	9170
V-12	8800	7803	8940	12489	9900	9100	9600	9500	8990	10160
V-14	10690	10642	10160	9029	10810	10500	11000	11400	10550	11200

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** DATA NOT AVAILABLE

MARATHON OIL COMPANY
 MARAFLOOD PROCESS - M-1 PROJECT
 2.5-ACRE CHLORIDE REPORT

CHLORIDES (PPM)

WELL NO.	10-78	11-78	12-78	1-79	2-79	3-79	4-79	5-79	6-79	7-79	8-79	9-79
V-6	13780	15470	13600	14830	13870	13790	13740	13040	13050	12606	**	12100
V-8	7930	8550	8520	7520	7290	7710	7870	7880	7950	7629	7870	8390
V-10	9010	9010	**	8830	8420	8430	8910	8840	8780	9033	**	8640
V-12	8530	**	9260	9330	8880	8860	9090	9080	9220	8962	8650	8700
V-14	11520	11970	11430	8650	10060	10020	10100	9790	9050	10149	**	10310

** DATA NOT AVAILABLE

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
5.0-ACRE CHLORIDE REPORT

CHLORIDES (PPM)

WELL NO.	2-77	3-77	4-77	5-77	6-77	7-77	8-77	9-77	10-77	11-77
AS-35	**	**	**	**	**	**	**	**	12730	**
AS-36	**	**	**	**	**	**	**	8670	8540	**
DD-10	12240	12300	9010	9980	8440	9056	9714	9360	9070	9760
DD-12	8310	8730	8830	9690	8190	9021	9714	9210	9250	9725
DD-14	9870	9840	**	11600	9520	9231	11415	10400	9070	10758
DD-16	10130	10200	10420	10900	9700	10600	10919	10330	10280	11612
DD-18	13000	13100	12980	10900	10200	10741	10919	10760	10740	10900
FF-12	8330	8280	8650	9290	7470	8108	8366	8170	8360	8335
FF-14	8600	8570	8830	9150	7650	4142	7303	9180	8680	9155
FF-16	12460	12700	12830	10700	9880	10635	11947	11340	11380	11612
FF-18	12890	12900	12800	10900	9700	11267	11132	11630	11080	11434
FF-20	**	**	**	19900	**	10846	26377	9770	15290	10900
HH-12	8700	8600	8700	9400	8840	8915	9572	8640	8860	8763
HH-14	8560	8390	8470	8710	8120	8424	9678	8530	8430	8727
HH-16	12640	13100	12730	14000	12860	12145	12266	11880	11700	11897
HH-18	9140	9290	9410	10000	9130	9863	11699	10110	11200	9974
HH-20	9470	**	29920	**	28530	29275	28362	9790	14940	10579
JJ-12	8520	8640	9630	10200	8590	9407	9714	9140	9070	8941
JJ-14	9400	9260	11250	9470	8690	9126	9430	9290	11450	9475
JJ-16	11110	11800	11570	12300	10310	11794	11451	12310	11950	12432
LL-12	8740	8750	8830	9800	8720	8705	7303	**	8710	8976
LL-14	11730	11700	11610	12500	11530	12355	10848	12270	12310	12717
NN-12	10630	10500	10270	11300	9410	10249	11132	11550	10140	10544
NN-14	13440	13200	13520	13600	13510	14181	14216	14220	13870	14783
PP-12	9650	11100	**	10500	9490	9582	10848	9570	9250	9582
PP-14	8920	9080	**	8700	8980	8915	9607	9210	9070	9511
PP-16	10890	9620	**	12000	11860	11373	8366	11770	11560	12325
RR-2	11470	11500	11570	11600	11140	11092	11380	11450	11100	11399
RR-4	15330	**	11540	**	000	21201	10210	20570	11200	20625
RR-6	15300	**	11570	15000	14910	15269	7338	14870	14940	9261
RR-8	9320	9180	9590	10090	8910	9021	10884	8710	23190	8727
RR-10	8190	9220	8830	8780	8480	8178	8189	**	8360	7979
RR-12	8740	8750	9190	9840	8770	9021	7338	8780	**	**
RR-14	8920	9040	**	25230	24650	11653	23611	9020	22980	9760
TT-2	9470	9800	9880	10310	9740	8073	9962	9900	9430	9404
TT-4	14420	14500	10270	13210	12750	11057	11451	9680	9780	13251
TT-6	9110	9150	9700	10850	10280	9758	**	9790	9600	10045
TT-8	8810	8930	9230	9870	9160	9231	10175	9390	22760	9475
TT-10	16830	**	16800	9470	17390	8143	9040	16130	22910	9938
SC-14	**	**	**	9290	**	9126	9785	10260	9530	9333
BP-18	**	**	**	**	**	**	**	**	**	**

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** DATA NOT AVAILABLE

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
5.0-ACRE CHLORIDE REPORT

CHLORIDES (PPM)

WELL NO.	12-77	1-78	2-78	3-78	4-78	5-78	6-78	7-78	8-78	9-78
AS-35	14280	12156	13520	13762	14470	13900	13900	13800	13550	14040
AS-36	8670	8614	6050	8799	9120	8800	8900	8300	8930	9210
DD-10	**	10242	11430	8086	11640	10900	12000	11800	11350	12560
DD-12	9360	9490	9280	9447	10260	9200	9700	9900	9590	9950
DD-14	10120	10529	10190	10227	10180	10200	10400	9100	10300	11390
DD-16	10540	10628	10510	10543	11010	10300	11000	11200	10170	10920
DD-18	10970	7473	10360	10724	10930	10600	10900	10900	10340	11130
FF-12	8180	7214	9360	8217	8125	8000	8200	8400	9480	8720
FF-14	8810	8469	8680	9259	9170	8900	8700	8500	8850	9050
FF-16	11480	9933	11240	8111	11920	11500	12400	11500	11740	13020
FF-18	11230	10032	11030	9869	12060	11200	12200	11000	11270	12420
FF-20	8756	10458	**	26261	29540	26800	**	25600	27540	29580
HH-12	8680	6349	**	8685	9221	8600	8800	9100	8880	9200
HH-14	8230	6002	8170	8756	8990	8400	8700	9200	8580	9020
HH-16	11600	10851	11230	12291	11360	10900	11700	12800	11460	11250
HH-18	9810	10249	11210	**	9970	9500	9100	9000	8930	9200
HH-20	8470	9043	8300	26981	27630	25500	**	26400	26500	14660
JJ-12	9300	9412	9093	9511	9270	9300	9300	9600	9590	9340
JJ-14	8760	6377	6740	**	10080	8800	9100	10000	8980	10320
JJ-16	12130	9866	12170	13205	13120	12900	13300	12800	13270	13820
LL-12	8620	7586	5920	8728	**	8800	9100	9000	9110	9510
LL-14	12540	11993	11990	12149	13330	12100	13200	13100	12460	12750
NN-12	11110	10082	9500	9912	10510	9500	9600	10300	9660	10330
NN-14	14510	14889	13570	14024	15180	14300	15500	14700	14960	15240
PP-12	10270	10061	9060	10373	10640	9700	9900	9900	10260	9680
PP-14	9320	9135	8820	9267	9470	9200	10000	9600	9760	10870
PP-16	10730	11362	10620	11567	11170	11300	11600	11600	11930	12050
RR-2	11150	10227	10980	10387	10040	10500	10500	10500	**	10710
RR-4	**	19412	18560	18905	11640	17200	18100	16000	16770	18450
RR-6	14730	15105	14400	15378	20590	15700	16800	15600	15590	15580
RR-8	8070	8827	5090	8721	16340	8600	9300	9200	8500	9210
RR-10	8670	4630	8780	8178	8780	7700	8100	8000	8140	8610
RR-12	9380	8650	21430	9589	8000	9400	9600	9500	9980	10230
RR-14	9054	11426	9710	9614	9500	11200	20500	13400	**	22930
TT-2	9810	8703	11340	9958	22220	9700	10300	10200	9960	9860
TT-4	12770	12344	8500	11546	10040	11500	12100	11900	11720	**
TT-6	9940	9125	8590	11411	12480	10700	11200	10900	9930	10500
TT-8	9460	7235	21560	10472	11580	8900	9200	14100	9170	9430
TT-10	10610	6711	9070	15286	9490	13500	**	14000	13900	13190
SC-14	9040	9284	8910	**	14860	9300	9800	**	**	10580
BP-18	**	**	**	**	**	**	**	**	**	**

PAGE 1

** DATA NOT AVAILABLE

MARATHON OIL COMPANY
MARAFLOOD PROCESS - M-1 PROJECT
5.0-ACRE CHLORIDE REPORT

CHLORIDES (PPM)

WELL NO.	10-78	11-78	12-78	1-79	2-79	3-79	4-79	5-79	6-79	7-79	8-79	9-79
AS-35	14660	14620	13080	14720	12880	**	8970	8960	12810	12468	11947	12660
AS-36	9170	9040	9150	8990	9260	**	13060	**	9160	9054	8922	9180
DD-10	10930	11380	11230	10720	11870	10170	10180	10130	10810	10032	11050	10290
DD-12	9800	9660	9390	9760	8960	9250	9420	9530	9700	9309	9501	9620
DD-14	10730	11870	10850	9410	10370	10320	10490	10460	10580	10465	10436	11340
DD-16	12920	10730	10680	11790	**	10110	9340	10850	10360	10256	10213	10330
DD-18	10450	10120	10680	9540	9290	9670	9830	**	9590	9944	10057	10130
FF-12	8090	8360	8450	7100	8080	8320	8180	8690	8440	8370	8409	8490
FF-14	9510	8610	9400	9590	9230	**	9260	9080	9470	8831	8785	8860
FF-16	11360	11360	12830	11730	11530	11750	11140	11630	11730	11996	11621	11520
FF-18	11050	11570	11250	11430	**	10760	10740	10970	11110	11124	12464	11430
FF-20	27420	27310	26990	**	**	**	26870	**	**	**	**	**
HH-12	8330	8600	9220	8610	8230	8830	9200	8800	9010	9100	8905	8930
HH-14	8650	9660	9170	8460	8330	8800	8740	8820	8950	8728	8806	8810
HH-16	9180	11330	10180	10010	11600	10630	10950	11060	11420	10380	10486	11490
HH-18	**	**	9010	9050	8370	**	8650	8770	8920	**	8299	9460
HH-20	25900	25650	**	25740	25600	26560	25080	**	**	**	425	**
JJ-12	9710	8950	**	11240	9820	7940	8460	8580	8010	8086	8104	7620
JJ-14	9570	9580	9040	9290	8900	9100	11570	9440	10290	9334	9387	9270
JJ-16	13490	13230	13700	13290	**	14370	13620	13340	13600	13861	12645	12420
LL-12	9320	9090	8870	8670	8380	8640	8780	8660	9340	8930	936	8740
LL-14	11600	12350	9660	11880	12040	11310	11060	11510	11360	11301	10862	10980
NN-12	10440	9570	9650	8670	**	**	8520	8410	8160	8554	7845	7900
NN-14	14810	14660	11500	13450	14070	**	13600	13890	13800	13584	14340	13810
PP-12	9770	9410	9280	9760	**	8470	8510	8180	8200	7994	8281	7740
PP-14	10900	11070	9410	9514	9470	9240	9480	9470	9490	9380	9586	9060
PP-16	12800	11290	10700	10250	10000	10360	10830	10710	10870	9954	10472	10340
RR-2	11270	10340	10040	10330	**	10480	10400	10920	10610	10475	10291	10290
RR-4	18130	18190	18020	17830	**	17570	16900	17083	17570	16488	17654	16980
RR-6	16300	16100	16070	16240	14750	14960	14850	14610	14420	14765	13428	13110
RR-8	8880	8810	8560	8580	**	8670	8600	8820	8830	8703	8625	8710
RR-10	8780	**	8530	7780	8220	8110	7930	7960	8240	8345	7732	8100
RR-12	10440	9370	8880	9080	9110	9090	9390	9420	9580	9398	9341	9710
RR-14	24740	23490	23080	22810	21380	**	21670	**	21840	20366	19388	20970
TT-2	11330	10340	10020	10210	9380	9870	9750	9950	10260	10529	10465	10790
TT-4	12670	11730	11780	10220	9880	10160	11040	11260	11040	11344	10490	10600
TT-6	10870	11090	10840	10210	10540	10760	10250	10420	10110	10603	9894	10660
TT-8	9140	9650	9310	9340	9080	9280	9110	9220	9530	11791	9320	9560
TT-10	13120	12900	12760	12750	12210	**	12160	12450	12140	13046	12181	12050
SC-14	10720	10170	9930	9510	10000	**	**	9670	**	**	**	**
BP-18	**	**	**	**	**	**	**	**	**	**	**	**

** DATA NOT AVAILABLE

MARATHON OIL COMPANY
MARAFLOOD PROCESS M-1 PROJECT
TRITIATED WATER REPORT

WELL NO.	6-77	7-77	8-77	9-77	10-77	11-77	12-77	1-78	2-78	3-78	4-78	5-78	6-78	7-78
B-4	**	**	**	**	**	350	**	**	**	**	**	**	**	**
D-4	1703	1336	970	**	290	347	431	447	**	**	**	401	**	460
H-8	**	**	**	**	**	**	**	**	125	138	**	**	**	**
J-8	**	**	**	**	**	**	**	**	123	136	181	130	252	220
L-4	47	**	**	**	**	**	**	232	**	**	355	**	**	**
L-6	**	205	196	204	219	210	337	290	**	372	351	338	**	300
L-12	**	**	**	**	190	411	526	676	922	957	1112	806	809	790
N-8	**	**	**	**	**	**	**	**	**	**	134	**	**	**
RR-2	**	**	**	**	**	188	304	**	463	454	698	849	947	990
TT-2	**	**	**	165	165	**	**	**	**	**	**	**	**	**
TT-4	**	**	**	168	168	203	253	211	**	**	**	156	155	160
TT-10	**	**	**	**	**	251	**	**	**	**	**	**	**	**
XA-12	**	**	**	**	2020	**	**	3670	**	**	**	**	**	**
XA-14	**	**	426	1182	2127	2745	3538	3662	3721	3791	**	4196	3819	3700
ECB-5	**	**	**	**	**	**	**	248	**	**	**	**	**	**
N-6	**	**	**	**	**	**	**	**	**	**	**	147	204	280
J-6	**	**	**	**	**	**	**	**	**	**	**	**	168	150
PP-12	**	**	**	**	**	**	**	**	**	**	**	**	171	190

(DATA REPORTED AS DPM/ML--DISINTEGRATIONS PER MINUTE/MILLILITER OF TEST FLUID)

** BELOW BACKGROUND LEVEL

MARATHON OIL COMPANY
MARAFLOOD PROCESS M-1 PROJECT
TRITIATED WATER REPORT

WELL NO.	8-78	9-78	10-78	11-78	12-78	1-79	2-79	3-79	4-79	5-79	6-79	7-79	8-79	9-79
XA-10	**	**	**	**	**	**	**	**	146	**	**	**	**	**
XA-12	**	**	**	**	**	**	**	**	**	**	**	**	**	**
XA-14	3689	4161	4146	4095	4112	3849	4872	4379	4057	4638	**	5000	4250	3400
AA-11	**	**	**	**	**	**	**	**	316	**	**	445	**	**
B-4	489	**	**	**	**	**	**	**	**	**	858	201	**	**
D-4	**	475	**	560	**	431	484	484	269	**	385	351	**	**
D-10	**	**	511	**	**	**	**	**	**	**	**	**	**	**
ECB-5	**	**	**	**	**	**	**	**	**	**	**	**	**	**
F-4	**	**	**	**	**	**	**	**	**	**	**	201	**	**
H-8	**	**	**	**	**	**	**	**	**	**	**	**	**	365
J-0	**	**	**	**	214	**	**	**	**	**	**	**	**	**
J-4	**	**	**	**	212	**	**	**	**	**	**	**	**	**
J-6	174	171	150	204	207	474	**	338	281	172	206	226	460	230
J-8	231	212	223	231	324	**	384	**	**	**	197	262	330	**
L-4	**	**	**	**	**	**	**	**	**	**	**	**	**	**
L-6	326	316	326	315	341	404	143	**	131	**	187	241	275	255
L-12	838	1010	860	971	477	686	**	**	1442	1517	1244	758	540	355
L-14	**	**	**	**	**	**	**	**	**	**	1236	**	**	**
N-2	**	**	**	**	**	**	**	**	**	**	**	284	**	**
N-6	384	478	537	**	569	1048	246	199	146	212	**	1684	2560	2290
N-8	**	**	**	**	**	**	**	**	**	**	**	**	**	**
N-10	**	**	**	**	**	**	**	**	**	**	**	**	270	**
P-12	**	**	**	**	**	**	213	563	398	884	1003	**	**	1090
R-14	**	**	**	**	**	**	**	1517	**	**	**	**	**	**
T-6	**	**	**	**	**	**	**	315	**	**	**	**	**	**
T-8	**	**	**	**	**	**	443	**	225	182	**	226	**	**
PP-12	371	905	1445	1137	1081	666	**	671	439	416	430	564	620	1070
RR-2	**	1197	1165	1069	832	648	**	383	370	340	271	254	230	255
TT-2	**	**	**	**	**	**	**	**	**	**	**	**	**	**
TT-4	489	**	294	327	415	347	178	300	304	261	192	155	180	160
TT-10	**	**	**	**	**	**	**	**	**	**	**	**	**	**

(DATA REPORTED AS DPM/ML--DISINTEGRATIONS PER MINUTE/MILLILITER OF TEST FLUID)
** BELOW BACKGROUND LEVEL

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