# The Oil and Gas Fields of Southeastern New Mexico

1960 Supplement

## A SYMPOSIUM

Edited by

Henry N. Sweeney, Editor-in-Chief

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R. D. Holt

W. G. McCampbell

T. F. Stipp

BEFORE THE OIL CONSERVATION COMMISSION Santa Fe, New Merrico Case No. <u>9337</u> Exhibit No. <u>5</u> Submitted by <u>MOBIL</u> Hearing Date <u>4-21-88</u>

Published by the **ROSWELL GEOLOGICAL SOCIETY** (A New Mexico Corporation)

Roswell, New Mexico, U.S.A. 1960

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Data prepared by: G. E. Upp Affiliation: Mobil Oil Company Date: July 15, 1960 Field Name: South Vacuum Devonian Location: T.18 S., R.35 E. County & State: Lea Co., N. Mex. Unit

DISCOVERY WELL: Union of Calif. #1-35 South Vacuum COMPLETION DATE: Jan 26, 1958 PAY ZONE: Devonian dolomite, fine to coarse crystalline, light gray to white,

fractured, with vuggy and intercrystalline porosity.

#### TYPICAL CORE ANALYSIS OF A PAY INTERVAL IN THIS FIELD:

Perm. in n	nillidarcys	% Porasity	Liquid Satu	iration (% of pore space)
Horizontal	Vertical		Water	Oil
116	86	5.9	32.3	25.3

OTHER SHOWS ENCOUNTERED IN THIS FIELD: Bone Spring (See South Vacuum-Bone Spring data sheet), Wolfcamp, Pennsylvanian, McKee.

TRAP TYPE: Faulted Anticline NATURE OF OIL: Gravity 48° API

NATURE OF GAS: Sweet

NATUR	OF PRODUCING ZO	DNE WATER	:			Resistivity:	0.26	0	hm-meters (	₽_ <u>68</u>	°F.
	Total Solids	Na+K	Ca	Mg	Fe	SO4	CI	CO2	HCO <sub>3</sub>	ОН	H₂S
ppm	27121	4868	3996	783	2	1444	15504				

INITIAL FIELD PRESSURE: 4800 psi

TYPE OF DRIVE: Water Drive

NORMAL COMPLETION PRACTICES: Set casing through pay zone, perforate and acidize if necessary.

necessury.

PRODUCTION DATA: No. of wells @ yr. end Production Oil in barrels Shut in Gas in MMCF Year Type Producing or Abnd. Cumulative Annual oil 1956 905 oil 1957 gas oil 4 139.773 139,773 1958 aas 7 7. oil 10 257 442. 592.663 1959 gas 43 <u>35</u> 9 927,836 oil 13 335.173 1960\* gas 26. 70.0 5

\* 1960 Figure is production to July 1, 1960.



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March 2, 1988

P.O. BOX 633 MIDLAND, TEXAS 79702

MIDLAND DIVISION

Oil Conservation Division P. O. Box 2088 Sante Fe, New Mexico, 87501

> WATER DISPOSAL WELL STATE SEC. 27 LEASE WELL NO. 2 VACUUM DEVONIAN, SOUTH FIELD LEA COUNTY, NEW MEXICO

Gentlemen:

Mobil Exploration & Producing U.S. Inc., as agent for Mobil Producing Texas & New Mexico, Inc. (MPTM), respectfully requests authority to dispose of produced water into the Devonian formation in the subject well.

Conversion of this well to a water disposal well is necessary to economically dispose of lease and off lease water.

The supporting information for this application is organized in accordance with Form C-108.

If any further information is needed concerning this application, please call C. A. Moore at (915) 688-1772.

BEFORE THE OIL CONSERVATION COMMISSION Santa Fal New Mexico
- N 0721 - UN N- 9
Case No. <u>7357</u> Exhibit No. <u>1</u>
Submitted by <u>MOBIL</u>
Hearing Date <u>4-21-88</u>
and the second statement of the second statement of the second statement of the second statement of the second

CAM/jlt

attachments

cc: w/attach Offset Operators Surface Owner New Mexico State Land Office Distist Director OCD - Hobbs

A:M804749E.CAM (3)

Yours very truly,

ME Anney

M. E. Sweeney Environmental & Regulatory Manager

Mobil Exploration & Producing U.S. Inc. as Agent for Mobil Producing Texas & New Mexico, Inc.

bcc: Central Files
 Proration Acct. - Houston
 Reservoir Engr. Mgr.
 Dist. Op. Mgr. - Hobbs
 Area Prod. Supv. - Buckeye
 Prod. Geology Mgr.

March 2, 1988

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M. E. Sweeney Environmental & Regulatory Manager

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CAM/jlt

attachments

cc: w/attach Offset Operators Surface Owner New Mexico State Land Office Distist Director OCD - Hobbs

A:M804749E.CAM (3)

POST OFFICE DOX 20198 STATE LAND OFFICE HER DING SANTA FL NEW MEXICO #/501

#### APPLICATION FOR AUTHORIZATION TO INJECT

- Pressure Maintenance L] Storage Secondary Recovery X Discosal Ι. Purpose: Application qualifies for administrative approval? 🗌 y e s XX no II. Operator: Mobil Producing Texas & New Mexico, Inc. P. O. Box 633 Address: c/o Mobil Exploration & Producing U.S. Inc. Midland, Texas 79702 Contact party: C. A. Moore Phone: (915) 688-1772
- Well data: Complete the data required on the reverse side of this form for each well 111. proposed for injection. Additional sheets may be attached if necessary.
- Is this an expansion of an existing project? \_\_\_\_ yes IV. x no If yes, give the Division order number authorizing the project
- ۷. Attach a map that identifies all wells and leases within two miles of any proposed injection well with a one-half mile radius circle drawn around each proposed injection well. This circle identifies the well's area of review.
- VI. Attach a tabulation of data on all wells of public record within the area of review which penetrate the proposed injection zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of completion, and a schematic of any plugged well illustrating all plugging detail.
- Attach data on the proposed operation, including: VII.
  - Proposed average and maximum daily rate and volume of fluids to be injected; 1.
  - 2. Whether the system is open or closed;
  - 3.
  - Proposed average and maximum injection pressure; Sources and an appropriate analysis of injection fluid and compatibility with 4. the receiving formation if other than reinjected produced water; and 5.
  - If injection is for disposal purposes into a zone not productive of oil or gas at or within one mile of the proposed well, attach a chemical analysis of the disposal zone formation water (may be measured or inferred from existing literature, studies, nearby wells, etc.).
- +VIII. Attach appropriate geological data on the injection zone including appropriate lithologic detail, geological name, thickness, and depth. Give the geologic name, and depth to bottom of all underground sources of drinking water (aquifers containing waters with total dissolved solids concentrations of 10,000 mg/l or less) overlying the proposed injection zone as well as any such source known to be immediately underlying the injection interval.
  - Describe the proposed stimulation program, if any. IX.
- Attach appropriate logging and test data on the well. (If well logs have been filed Χ. with the Division they need not be resubmitted.)
- XI. Attach a chemical analysis of fresh water from two or more fresh water wells (if available and producing) within one mile of any injection or disposal well showing location of wells and dates samples were taken.
  - Applicants for disposal wells must make an affirmative statement that they have XII. examined available geologic and engineering data and find no evidence of open faults or any other hydrologic connection between the disposal zone and any underground source of drinking water.
- XIII. Applicants must complete the "Proof of Notice" section on the reverse side of this form.
- XIV. Certification

I hereby certify that the information submitted with this application is true and correct to the best of my knowledge and belief. M. E. Sweeney

Name: Signature:

Date: <u>March 2, 1988</u>

\_ Title \_ Environmental & Regulatory, Manager

\* If the information required under Sections VI, VIII, X, and XI above has been previously submitted, it need not be duplicated and resubmitted. Please show the date and circumstance of the earlier submittal.

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DISTRIBUTION: Original and one copy to Santa Fe with one copy to the appropriate Division district office.

III. WELL DATA

- A. The following well data must be submitted for each injection well covered by this application. The data must be both in tabular and schematic form and shall include:
  - Lease name; Well No.; location by Section, Township, and Range; and footage location within the section.
  - (2) Each casing string used with its size, setting depth, sacks of cement used, hole size, top of cement, and how such top was determined.
  - (3) A description of the tubing to be used including its size, lining material, and setting depth.
  - (4) The name, model, and setting depth of the packer used or a description of any other sen1 system or assembly used.

Division District offices have supplies of Well Data Sheets which may be used or which may be used as models for this purpose. Applicants for several identical wells may submit a "typical data sheet" rather than submitting the data for each well.

- B. The following must be submitted for each injection well covered by this application. All items must be addressed for the initial well. Responses for additional wells need be shown only when different. Information shown on schematics need not be repeated.
  - (1) The name of the injection formation and, if applicable, the field or pool name.
  - (2) The injection interval and whether it is perforated or open-hole.
  - (3) State if the well was drilled for injection or, if not, the original purpose of the well.
  - (4) Give the depths of any other perforated intervals and detail on the sacks of cement or bridge plugs used to seal off such perforations.
  - (5) Give the depth to and name of the next higher and next lower oil or gas zone in the area of the well, if any.

XIV. PRODE OF NOTICE

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All applicants must furnish proof that a copy of the application has been furnished, by certified or registered mail, to the owner of the surface of the land on which the well is to be located and to each leasehold operator within one-half mile of the well location.

Where an application is subject to administrative approval, a proof of publication must be submitted. Such proof shall consist of a copy of the legal advertisement which was published in the county in which the well is located. The contents of such advertisement must include:

- (1) The name, address, phone number, and contact party for the applicant;
- (2) the intended purpose of the injection well; with the exact location of single wells or the section, township, and range location of multiple wells;
- (3) the formation name and depth with expected maximum injection rates and pressures; and
- (4) a notation that interested parties must file objections or requests for hearing with the Oil Conservation Division, P. O. Box 2088, Santa Fe, New Mexico 87501 within 15 days.

NO ACTION WILL BE TAKEN ON THE APPLICATION UNTIL PROPER PROOF OF NOTICE HAS BEEN SUBMITTED.

NOTICE: Surface owners or offset operators must file any objections or requests for hearing of administrative applications within 15 days from the date this application was mailed to them.



- 1. State Sec. 27 #2, 660' FEL & 1980' FNL, Sec. 27, T-18-S, R-35-E
- 2. 13-3/8" Csg. @ 422' cemented with 465 sx. of cmt did not circulate but calculates to surface in a 17-1/2" hole.

9-5/8" Csg. @ 3900' cemented with 2270 sx. in a 12-1/4" hole. Top of cmt @ 308' as determined by temperature survey.

7" Csg. @ 11,950' cmt with 476 sx. of cmt in a 8-3/8" hole. Top of cmt @ 3850' as determined by temperature survey.

- 3. 4-1/2" lined with Douline 20 and set @ approx. 11,875'.
- 4. 7" permanent packer & seal assembly set @ approx. 11,875'.

#### Β.

- 1. Devonian, South Vacuum
- 2. Open hole interval from 11,950' to 13,718'.
- 3. Well originally drilled as a Devonian producer.
- Bone Spring perfs. @ 8823'-8968' sqz w/100 sx. cement; Devonian Perfs @ 11,570'-11,600' and 11,473'-11,513' sqz'd w/300 sx. cmt. each.
- 5. The next higher zone is the Bone Spring @ 8850'; there is no zone below the Devonian that is productive.

V. Map attached, Exhibit "A"

#### VII.

- 1. Average rate: 9,000 Maximum rate: 12,000
- 2. Closed system
- 3. Avg. injection pressure: 200 PSI

Maximum injection pressure: 2390 PSI

- 4. Attached, EXHIBIT "B", chemical analysis of source waters and statement from Reservoir Engineer;
- 5. Attached, "EXHIBIT "C", chemical analysis of disposal zone formation water and compatibility statement from N. L. Treating Chemical Co.

A:M804749F.CAM (3)

III.

Α.

#### VIII.

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- 1. Lithologic detail
  - a. Composition Devonian, white to tan, medium to coarse crystalline with muggy to cavernous porosity;
  - b. Type structure Faulted anticline;
  - c. Average porosity 13%;
  - d. Average of Permeability 5 to 30 md
- 2. Geological Name Devonian;
- 3. Thickness Average 500';
- 4. Depth Average to top of pay 12,000';
- Overlying fresh water zones; (10,000 ml/l or less TDS)
  - a. Ogalalla @ 300'
  - b. Santa Rosa @ 1400'
- 6. There are no fresh waters immediately underlying the injection zone.
- IX. Acidize 02/27/88 the Lower Devonian (11,950'-13,718') w/14,000 gals. of 15% HCL + 10,000 lbs. of rock salt as follows:
  - (a) Load the backside w/fresh water and pressure up to 300 psi.
  - (b) Pump 14,000 gals. of 15% HCL in four stages w/2500 lbs. rock salt per stage;
  - (c) Flush to 13,718' w/300 bbls. fresh water and 600 bbls. produced water;
  - (d) Maximum TTP 5190 PSI; Form broke @ 1200 PSI; AIR 15 BPM @ 3800 PSI.
  - (e) Well went on strong vacuum.
- X. Logs already submitted to District NMOCD w/original drill & completion, September, 1959.
- XI. Analyses attached, EXHIBIT "D";
- XII. MPTM has examined the available geological and engineering data and finds no evidence of open faults or any other hydrological connection between the Devonian zone and any underground source of drinking water.
- XIII.Proof of Notice attached, EXHIBITS "E" AND "F"

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Exhibit "B"

#### INTEROFFICE CORRESPONDENCE

#### DATE: Feb. 15, 1988

CC:

TO: Ann Moore

With regards to the water capatability test conducted on fluids to be injected into the State 27 well #2 SWDW, the following statement can be made :

A composite of produced water which represents the typical injection fluid consists of Abo (46%), San Andres (48%), Glorieta (2%), Pennsylvania (3%), and Blinebry (1%). This water was combined with Devonian produced water in varying amounts. In summary, the Devonian water alone, and mixtures of Devonian from 0 to 50% with the proposed injection fluid formed carbonate scale. Calcium sulfate becomes evident in the high percent composite range of 80 - 100%. Thus a scale prevention program is needed and chemical treatment of the well will be done as required to control both types of scale.

Ann, attached is a copy of the analysis performed by NL Treating Chemicals. If you have any questions, please give me a call at ext. 2076.

Thanks

Jack Hamner RM - 240 Project Reservoir Engineer

## NL Treating Chemicals/NL industries, inc. P.O. Box 60020, Houston, Texas 77205 Tel. (713) 987-5400 Telex: 4620243 NLOS UI

## Water Analysis Report

\_\_ mçii

\_\_\_\_\_ ppm(Vol/Vc!)

Residual Hydrocarbons

				SHEET NUMBER
				2
LOWPANY				DATE
Mobil Producing Te	exas & New Mexico			
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Fe <sup>+++</sup>	<u>, , , , , , , , , , , , , , , , , , , </u>		<u>, , ) , , , , , , , , , , , , , , , , ,</u>	1 + 1 + 1 + 1 + 1 = 1 = 1 = 0 = =
DISSOLVED SOLIDS			DISSOLVED GASES	
CATIONS	me/l	mg/l	Hydrogen Sulfide, H <sub>2</sub> S	mg/i
fotal Hardness	128		Carbon Dioxide, CO2	mg/l
Calcium, Ca + +	50	1,000	Oxygen, O2	mg/l
Jagnesium, Mg + +	78	952		
ron (Total) Fe + + +			PHYSICAL PROPERTIES	
arium, Ba + +	·····	·····	pH (Field)	7.2
odium, Na + (Calc.)	75.1	1,727	Eh (Redox Potential)	MV
			Specific Gravity	
NIONS			Turbidity, FTU Units	
hiaride. Cl	169.0	6,000	Total Dissolved Solids (Calc.)	11,361 ma/l
	30.7	1,475	Stability Index @ 80 °F	+0.81
			@100 •F	+0.30
carponate HCDo	3.4	207	@120 •F	+0.45
Verovi OH			CaSOA Solubility @ °F	
			@ *F	mo/
			Max, CaSO <sub>4</sub> Possible (Calc.)	mg/l
			Max. BaSO4 Possible (Calc.)	

#### JSPENDED SOLIDS (QUALITATIVE)

- --

in Sulfide 🔲 Iron Oxide 🗇 Calcium Carbonate 🗇 Calcium Sulfate 🗇 Acid Insoluble 🗔 EMARKS AND RECOMMENDATIONS: .

CENGINEER	DIST. NO.	ADDRESS		CFFICE PHONE	HOME PHONE
Dickerson/Slyker	821	1			
LY2ED BY	DATE	DISTRIEUTION	I CUSTOMER	C REGION	Z DISTRICT
· -	· - / - / :	: - <sup>`</sup>			-



.

#### NL Treating Chemicals/NL Industries, Inc. P.O. Box 60020, Houston, Texas 77205 Tel. (713) 987-5400 Telex: 4620243 NLOS UI

## Water Analysis Report

					SHEET NUMBER
					1
COMPANY					DATE
Mobil Producing Tex	as & New Mexico				
FIELD			NTY OR PARISH		STATE
Vacuum		L	ea		New Mexico
LEASE OR UNIT	SAMPLE SOURCE			WATER SOURCE (FO	DRMATION)
Bridges-State Lease	s#193			San Andres	
DEPTH. FT. BHT. *F	SAMPLE SOURCE	темр, •F wati 70	ER, BBL/DAY OIL B	BL/DAY	GAS, MMCF/DAY
DATE SAMPLED	TYPE OF WATER: D PRODUC	ED I SUPPLY I WA	TERFLOOD D SALT W	ATER DISPOSAL	
12-16-87	TYPE OF PRODUCTION: D PP	RIMARY D WATERFLOOD	C CO2FLOOD G	POLYMER FLOOD	C STEAMFLOOD
Na + 20 15	W. (NUMBER BESID 10 5	ATER ANALYSIS PA DE ION SYMBOL INDICA 0	TTERN TES me/I SCALE UNIT	10 15	5 <sup>20</sup> ci <sup>–</sup>
				1 1 1 1 1 1	· · · · · · · · · · · · · · · · · · ·
Ca <sup>+</sup> +	┽┽┽┽┽┼┼┼	┼┼┼┼┼┤	+++++		нсо3
Mg++	╶┼╌┼╌┼╌┼╌┼╌┼	$\frac{1}{1} + \frac{1}{1} + \frac{1}$			
Fe <sup>+++</sup>					co <sub>3</sub> =
DISSOLVED SOLIDS			DISSOLVED GAS	ES	
CATIONS Total Hardness Dalcium, Ca + + Magnesium, Mg + + ron (Total) Fe + + + Barium, Ba + + odium, Na + (Calc.)	974.7	mg/l . 3,120 1,537 22,418	Hydrogen Sulfide, H Carbon Dioxide, CO Oxygen, O <sub>2</sub> PHYSICAL PROPER pH (Field) Eh (Redox Potential)	2 <sup>S</sup> 2 TIES	mg/l mg/l mg/l 6.63 MV
NIONS hloride, Cl <sup>-</sup> ulfate, SO <sub>4</sub> = arbonate, CO <sub>2</sub> = carbonate, HCO <sub>3</sub> <sup>-</sup> vdroxyl, OH <sup>-</sup> ulfide, S =	$     \begin{array}{r}         1.193.1 \\         57.3 \\         12.2 \\         4.1 \\         4.1         $	<u>42.000</u> 2.750 744 <u>65</u>	Specific Gravity Turbidity, FTU Units Total Dissolved Solid Stability Index @ @ CaSO4 Solubility @ @ Max. CaSO4 Possibl	25 (Calc.) <u>80</u> •F <u>100</u> •F <u>120</u> •F  •F e (Calc.)	72_634 mg/l +0.21 +0.35 +0.52 mg/l mg/l
			Max. BaSO4 Possibl Residual Hydrocarb	e (Caic.) ons	mg/! ppm(Vol/Vol)

JSPENDED SOLIDS (QUALITATIVE)

In Sulfide 
If Iron Oxide 
Calcium Carbonate 
Calcium Sulfate 
Acid Insoluble 
If SMARKS AND RECOMMENDATIONS:

 DENGINEER
 DIST. NO.
 ADDRESS
 IOFFICE PHONE
 HOME PHONE

 Dickerson/Slyker
 821
 IOFFICE PHONE
 HOME PHONE

 LYZED BY
 IOATE
 IOUSTONIE
 TRACTON
 TRACTON



Carbonate, CO3 =

Hydroxyl, OH

Sulfide, S =

Bicarbonate, HCO3

. .....

#### NL Treating Chemicals/NL Industries, Inc. P.O. Box 60020, Houston, Texas 77205 Tel. (713) 987-5400 Telex: 4620243 NLOS UI

+0.96

+1.21

\_\_\_\_\_ mg/l

\_\_\_\_\_ mg/l

\_\_\_\_\_ mg/l

\_\_\_\_ mg/l

\_\_\_\_\_ ppm(Vol/Vol)

@ 100 °F

@ 120 °F

C\_\_\_\_•F

CaSO₄ Solubility @\_\_\_\_\_•F

Max. CaSO4 Possible (Calc.)

Max. BaSO<sub>4</sub> Possible (Calc.)

Residual Hydrocarbons

<u> </u>																			<u></u>												<del></del>					SHI 3	EET	NUM	BER	
COMPANY				•	1		<u></u>																													DA	TE			
Mobil P	rodu	ci	ng	Te	exa	as	3	N	lew	M	ex	ic	່												_					_						ĺ				
FIELD		_																			10	OUI	NIY	OR	PAR	ISH						_				ST/	ATE.			
Vacium																						Le	ea													Ne	:W	Me>	xico	
EASE OP UNIT					~					SAM	APLE	SO	URC	E	_														W.	ATE	RS	DUP	CE	(FC	)RM	ATIC	(NC			
Bridge	s-St	at	e	Lea	ase	e s				#1	14			_															G	10	rì	et	a							
DEPTH. FT.		E	SHT.	•F			SAN	MPL	.E S	OUF	CE		_				TE	мр. 53	•F		1	ATE	R, 8	180	DAY		0	IL, E	BU	DAY	,	-				GAS	5, M	MCF	/DAY	
DATE SAMPLED						1	TY	PE	OFV	VAT	ER:	C	PR	CDI	UCE	D	D	รบ	PPL	Y		NAI	FERF	LO	co	C	SA	۲Y,	ATE	RC	ISP	OS/	AL.				-			
12-16-	37					Γ	TY	PE	OF F	PRO	DUC	TIO	N:	٥	PRI	MAI	ΡΫ́		W/	ATE	RFU	200		D C	:0 <sub>2</sub> F	٢0	QC	G	PC	LYN	<b>JER</b>	FLO	200	2	וס	STE	AMF	100	D	
										_	(NU	мВ	ERI	BES	WA SIDI	TE E IC	R /	AN SYN	IAL VBC	YS DL I	SIS NDI	PA CAI	TTE res	ERI me	N /1 SC	CAL	ΕU	NIT	)											
Na + 2	0			1	5		<del>,</del>	<del></del> _		10	<del>.</del>			-5	5 	<u> </u>			(	)	, —_,			5					10				<u> </u>	15	; 	<u> </u>		;	20 ci -	_
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ca++	Ι.	•	,	,		1	1	1 -	1		1				1	1	1		,		1 1	1	1		1	1	1	1		,	,	۱	1	-	1	,	1	1	НСС	22
Va		1	1	1			1	T	T	Γ						1	1					1	T	T	1	T	T	ī	T	1	T	Т	1	T	1	-	1	T	7	3
Mg <sup>++</sup>		+	<u>!</u>	$\left  - \right $	$\vdash$	├	╞╌	+	+-	╀	+										$\left  - \right $		+	+	-+	+	+	+	+	+	+	+	+	+	+	+	+	+	_  so4	=.
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Fe <sup>+++</sup>		1	1	,	1	1	١	1	1		1				1	ł	•		۱ ا		11	1	1		١	1	1	i		1	ì	۱	ł		۱	ŧ	١	1	0	=
							_	_		_	_	_				_			_	_																				
DISSOLVED	SOLI	DS																					DI	ISS	OL	VEI	G	AS	ES											
CATIONS											me	n							ma	4			н	dro	haer	s Su	fid	e. H	12S									m	oil	
Cotol Hardnesi	c										276	Ś						_		•			Ca	irbr	n D	ioxi	de.	-,. CO	20									. m	9/1 a/1	
Calcium Ca+	<b>+</b> .										188	3		_		_			3.5	760	)	_	Öx	VG	вл. (	22			2						_			_ m	o/l	
Jaonesium, M	ia + +										88	3		_					1	0	7				•	-												•	•	
ron (Total) Fe	+ + +													_		_					<u> </u>	_	PH	(YS		LP	RO	PER	ITIE	s										
Barium, Ba + •	+															_						_	pН	1	(F	ie	۱d	)							_6	<u> </u>	5	-		
Sodium Na <sup>+</sup> (Calc.) <u>3.698.9</u>			_		8	5.0	27	5		Eħ	(Re	edo:	c Pc	ten	ential)					_	MV																			
														_		-					Specific Gravity									-										
ANIONS																							Τu	rbio	dity,	FT	JU	nits										-		
Chloride, Cl 🗖										3.	910	55	5	_		-	_1	30	<u> </u>	000	<u>)</u>	-	То	tal	Diss	olv	ed S	Soli	ds (I	Cal	<b>:.)</b>				23	1,	71	2 m	g/I	
Sulfate, SO <sub>4</sub> =								4			_		_	2,275 Stability Index @						x	¢	!	Ba	۴				+	<u>0.</u>	<u>77</u>										

USPENDED SOLIDS (QUALITATIVE) on Sulfide 
Iron Oxide 
Calcium Carbonate 
Calcium Sulfate 
Acid Insoluble 
REMARKS AND RECOMMENDATIONS:

7.5

4.5

TO ENGINEER	DIST. NO.	ADDRESS	OFFICE PHONE	HOMEPHONE
Dickerson/Slyker	821			
ALYZED BY	I DATE	DISTRIBUTION COUSTOWER	I REGION	I DISTRICT
-	• • •			

458

72

#### NL Treating Chemicals/NL Industries, Inc. P.O. Box 60020, Houston, Texas 77205 Tel. (713) 937-5400 Telex: 4620243 NLOS UI

\_\_\_\_\_ ppm(VolA/al)

B-4

				SHEET NUMBER
				15
CMPANY				DATE
Mobil Producing Texa	s & New Mexico			
IELD			NTY OR PARISH	STATE
Vacuum		Le	a	New Mexico
EASE OR UNIT	SAMPLE SOURCE		WATER SOURCE	(FORMATION)
Bridges-State Leases	#120		Upper Pe	enn
EPTH. FT. BHT, *F	SAMPLE SOURCE	TEMP. *F WATE	ER. BBL/DAY OIL, BBU/DAY	GAS, MMCF/DAY
ATE SAMPLED	TYPE OF WATER: D PRODUC	ED D SUPPLY D WAT		
12-16-87	TYPE OF PRODUCTION: D PP	MARY D WATERFLOOD	D CO2 FLOOD C POLYMER FLOOD	D I STEAMFLOOD
. 20 15	W. (NUMBER BESIC	ATER ANALYSIS PA DE ION SYMBOL INDICAT	TTERN TES me/I SCALE UNIT)	15 20 -
$- Na^{+} 20 15$ $- Ca^{+} + - + + + + + + + + + + + + + + + + +$		<del>╴╴╴</del> ╷╷╷╷		
Mg <sup>+</sup> +				
ISSOLVED SOLIDS			DISSOLVED GASES	
ATIONS otal Hardness alcium, Ca + + agnesium, Mg + + on (Total) Fe + + + arium, Ba + + sdium, Na + (Calc.)	me/l 246 132 114 2,197	mg/l 2,640 1,391 50,531	Hydrogen Sulfide, H <sub>2</sub> S Carbon Dioxide, CO <sub>2</sub> Oxygen, O <sub>2</sub> PHYSICAL PROPERTIES pH (Field) Eh (Redox Potential)	mg/l mg/l mg/l MV
HONS Horide, CI Hate, SO <sub>4</sub> = Honate, CO <sub>3</sub> = Darbonate, HCO <sub>3</sub> GroxyI, OH	<u>2,366.2</u> <u>46.4</u> <u>12</u> <u>18.4</u>	<u>84,000</u> <u>3,225</u> <u>732</u> 294	Specific Gravity Turbidity, FTU Units Total Dissolved Solids (Calc.) Stability Index @80°F @100°F @120°F CaSO4 Solubility @°F	$\frac{141, 813 \text{ mg/l}}{\pm 0.13}$ $\frac{\pm 0.03}{\pm 0.22}$ $\frac{-10.22}{\text{mg/l}}$
			ح ۲ Max. CaSO∠ Possible (Calc.) Max. BaSO∠ Possible (Calc.)	mg/l

SPENDED SOLIDS (QUALITATIVE)

- Sulfide 🔲 Iron Oxide 🔲 Calcium Carbonate 🖾 Calcium Sulfate 🖾 Acid Insoluble 🗔

MARKS AND RECOMMENDATIONS:

DENGINEER	DIST. NO.	ADDRESS	CFFICE PHONE	HOME PHONE
ickerson/Slyker	821			
LYZED BY	DATE	DISTRIBUTION I CUSTOMER	D REGION	Z DISTRICT
· =	12/17/8	T NUTO SALES EN BINEER		

\_ Residual Hydrocarbons

#### NL Treating Chemicals/NL Industries, Inc. P.O. Box 60020, Houston, Texas 77205 Tel. (713) 987-5400 Telex: 4620243 NLOS UI

B-5

						SHEET NUMBER
COMPANY			······································		<u></u>	DATE
Mobil Producing	Texas & New Me	xico				
FIELD			- <u>- </u>	COUNTY OR PARISH		STATE
Vacuum				Lea		New Mexico
LEASE OR UNIT	SAMP	LE SOURCE			WATER SOURCE (FO	RMATION)
Bridges-State Le	ases #	165			Middle Penn	
DEPTH. FT. BHT, 1	F SAMPLE SCURC	:	TEMP. •F	VATER, BBUDAY	OIL BBL/DAY	GAS, MMCF/DAY
DATE SAMPLED	TYPE OF WATER	E PRODUCED	SUPPLY D	WATERFLOOD D S	ALT WATER DISPOSAL	
12-16-87	TYPE OF PRODU	CTION: D PRIMAR	Y D WATERFL	COD D CO2 FLOOD	D C POLYMER FLOOD	3 STEAMFLOOD
	(N	WATER	R ANALYSIS	PATTERN ICATES me/I SCALE	UNIT)	
Na + 20	15 10	5		5		
Ca <sup>+</sup> +						HCO3
M9 <sup>+</sup> +	┽┼┼┼┼┼┼	++++++	$-\frac{1}{1}$	┟╌╁╌┼╴┼╶┼╶╴		SO <sub>4</sub> =
Fe <sup>+++</sup>						$1 1 1 1 00_3 = $
DISSOLVED SOLIDS				DISSOLVED	GASES	
CATIONS	۳ 172	ie/I	mg/i	Hydrogen Sulfi	ide, H <sub>2</sub> S	mg/l
otal Hardness	100		2.000		e, CO2	mg/l
	72		878	Oxygen, 02		mg/i
					ODSETIER	
			······································	- $ (1ab)$	OFERIES	77
adium Na † (Calc.)				Eb /Bedox Pote	ficitor	MV
ooioin, na (oaic.)				Specific Gravit	v	
NIONS	•			Turbidity FTU	Units	<u></u>
	647.	.9 2	23.000	Total Dissolved	Solids (Calc.)	mc/i
lifate SOr =	33.	9	1,625	Stability Index	æ .°F	
arbonate. COa =					@•F	
carbonate, HCOn					¢°F	
droxyl, OH				CaSO₄ Solubili	ty @•F	mg/l
ulfide, S=					¢•F	mg/l
				Max. CaSO4 Po	ossible (Calc.)	mg/l
				Max. BaSO4 Po	cssible (Calc.)	mg/l
				Residual Hydro	carbons	

JSPENDED SOLIDS (QUALITATIVE)

In Sulfide D Iron Oxide D Calcium Carbonate D Calcium Sulfate D Acid Insoluble D SMARKS AND RECOMMENDATIONS:

Sote: Small sample of water obtained.

TO ENGINEER	DIST. NO.	ADDRESS	OFFICE PHONE	HOME PHONE
lckerson/Slyker	821			•
JYZED BY	IDATE	DISTRIBUTION I DUSTOMER	D REGICH	C DISTRICT
		-		



#### NL Treating Chemicals/NL Industries, Inc. P.O. Box 60020, Houston, Texas 77205 Tel. (713) 987-5400 Telex: 4620243 NLOS UI

## Water Analysis Report

													_				_	_																				S:н 4	EET	NUI	ABE	R		
COMPANY Mobil Pr	od	uc	in	g 1	re>	ka	s	3	Ne	w	Me	xi	cc	)																								DA	TE				_	
FIELD Vacuum																						TC	CU Le	NT a	Y OF	PA	RIS	н										ST. N	ATE ew	Me	exi	l co	;	
LEASE OR UNIT Bridges -	St	ati	e	Lea	256	es				SA #	мрі 27	LES	sou	RCE																	/w/ B	ATE	R SO	our e b i		(FC	DRM	ATI	(NC					_
DEFTH. FT.			BHI	', <b>∙</b> F		_	SA	MP	LES	οū	PCE							TEI	мр. 52	•F		١	AT/AT	ER.	891	JDA	Y		01	B	87/1	DAI	<i>.</i>					GÀ	<u></u> . м	MCI	E 'OA	λΥ		
DATE SAMPLED							ר ר	PE	OF OF	NA PR(	TER	: ICTI		PRO : C	0U 3 P	RIN	) AAR	G	su D	PPL W/	Y	AFL	WA 00	TEF D			FL	3 S 00	SAL D	TW C	ATE PO		NSP ZEF	OS.	AL 001	D		STE	AMI	LO	20			
											(N	UN	IBE	RB	M ESI	/A <sup>·</sup> DE	TE 10	R A N S	AN SYN	IAL //BC	YS DL II		PA CA	TE	TEF Sm	RN e/I S	SCA	LE	Ur	TI)														
Na + 20			-		15	7-	-	-	-	10		-			5	$\overline{}$	-1	-1			)			1	1	5		1	1		10	Ŧ	-	-7		15	5	<u></u>			20	CI		
Ca++	<u> </u>		+	- <del> </del>			1	+-		$\downarrow$		+-	+			-+-	-+	-+						<u>-</u>	<u>}</u>		<u>.</u>	<u> </u>	<u> </u>	<u>+</u> -		+	+	-+	-+							нс	03	
ма++	•	•		1		1	;					, ,								1	1			1			!	1	1	1			•	1			!	1		1		so,	.=.	
		1	1	1		1	1	1	1		•	•	1	•		1	•	1		د د		 	1	1	، ۱		1	1 1	1	1		י ו	•	1	•	•	1	1	•	( 1		~~	_	
		DS		 	<u></u>				_ <u>_</u>	<u> </u>					 		<u> </u>			~~~~				 		so		ED	G		ES										' '		3	
CATIONS Total Hardness Calcium, Ca + H											т 7 5	e/I 34 46			-		-	1	LO	mg.	1 20			i C	lyd Carr Oxyd	rogi on ten	en S Dic , Og	Sull Ixid	ide e, (	, н СО	2S 2									_ n _ n	ng/l ng/l ng/l			

Aagnesium, Mg + +	188	2.294		
ron (Total) Fe <sup>+</sup> + + Barium, Ba <sup>+</sup> + Bodium, Na <sup>+</sup> (Calc.)	2,665.7	61,311	PHYSICAL PROPERTIES pH (Field) Eh (Redox Potential) Specific Gravity	<u>7.05</u> MV
-NIONS Shloride, Cl <sup>-</sup> ulfate, SO <sub>4</sub> = Jarbonate, CO <sub>3</sub> =	<u>3.352.1</u> <u>41.7</u>	119,000	Turbidity, FTU Units Total Dissolved Solids (Calc.) Stability Index @ <u>-80</u> °F @ <u>100</u> °F	$\frac{195,885}{\pm 1,55}$ mg/l $\frac{1}{\pm 1}$
scarbonate, HCO3 sydroxyl, OH ulfide, S =	<u> </u>	350	@ <u>120</u> °F CaSO₄ Solubility @°F @°F Max. CaSO₄ Possible (Calc.)	<u>+1_C7</u> mg/l mg/l mg/l
			Max. BaSO4 Possible (Calc.)	mc/l ppm(Vcl/Vcl)

#### JSPENDED SOLIDS (QUALITATIVE)

on Sulfide II Iron Oxide II Calcium Carbonate II Calcium Sulfate II Acid Inscluble II EMARKS AND RECOMMENDATIONS:

TO ENGINEER	DIST. NO.	ADDRESS		CFFICE PHONE	HOME PHONE	
ickerson/Slvker	821					
ALYZED BY	DATE	DISTRIBUTION	C CUSTOMER	Z PEGION	E DISTRICT	
<u>.</u>	1.0 / / 9	- '	— Miller of Brievier and		-	

Exhibit "C"



January 20, 1988

Mr. David Howell Mobil Producing Texas & New Mexico P. O. Box 1800 Hobbs, New Mexico 88240

Subject: Vacuum Area Waters - Compatibility Study with Devonian Brine

Dear Mr. Howell:

Appended are individual produced water analyses pertaining to those Mr. Dickerson and I took with you on December 16, 1987. Also included is the Union's Devonian water analysis.

A mixture of your produced water was made as follows:

Abo	46%
San Andres	48%
Glorieta	2%
Pennsylvania	3%
Blinebry	15

That mixture was blended with Devonian water in 10% increments. Samples were placed in an oven for 5 days at 100°.

The "Compatibility" appendage describes how samples reacted. Brief general summary comments are these:

- No major initial incompatibility was seen at the time of mixing.
- 2. Moderate calcium carbonate deposition was found in the Devonian by itself (100%).
- 3. Mixtures were stable and stayed clear in the 90%-60% Devonian range.
- Calcium carbonate deposition was seen in all samples from 50% Devonian to 0% (or 100% composite produced water mixture).
- 5. Calcium sulfate deposition was observed in the 80%-100% composite produced water ratios.

Mobil Producing Texas & New Mexico Page Two

In summary, the Devonian alone, and mixtures of Devonian from 50% to 0% formed carbonate scale. Calcium sulfate becomes a known in the high percent composite mixture range.

In other words, scale prevention treatment is advisable throughout most of the mixing range. One treatment can handle both kinds of scale.

. We would be pleased to discuss this report with you at a mutually agreeable time.

Very truly yours,

Wayne Dickerson John V. Slyker

Sales Engineer Sales Representative

/cg

cc: W. Reeves D. Seale

#### NL Treating Chemicals/NL Industries, Inc. P. O. Box 4305 Houston. Texas 77210

### REPORT OF TEST

			SHEET NUMBER
COMPANY			DATE
Mobil Producing Texas	& New Mexico		12-16-87
FIELD OR PLANT		COUNTY OR PARISH	STATE
Vacuum Area Leases		Lea	New Mexico
LEASE OR UNIT	WELLIS) NAME & NO.	SAMPLE SOURCE	
		See Below	
TYPE SAMPLE		TYPE TEST	
		Compatibility of	Devonian with Mix
REASON FOR TEST			

Possible Salt Water Disposal

#### RESULTS:

Compati	bility Mixture % Composite	Observations (100	D <sup>o</sup> F)
Devonian	Produced Waters	Appearance	5 days
100	0	Clear	Moderate calcium carbonate Deposition
90	10	Clear	No deposition
80	20	Clear	No deposition
70	30	Clear	No deposition
60	40	Slightly hazy	No deposition
50	50	Slightly hazy	Moderate calcium carbonate deposition
40	60	Slightly hazy; slight	Slight calcium carbonate deposition
		gray cast	
30	70	Slightly hazy, slight	Slight calcium carbonate deposition
-		gray cast	5
20	80	Slightly hazy, slight	Moderate calcium sulfate & slight
		gray cast	calcium carbonate depositions: slight
			iron compounds precipitated.
10	90	Slightly hazy; slight	Heavy calcium sulfate deposition;
		gray cast	moderate calcium carbonate formed.
			+ moderate iron compounds deposited.
0	100	Slightly hazy, slight	Heavy calcium sulfate deposited:
		gray cast	moderate calcium carbonate precipitation
			moderate amount of insoluble iron
			compounds formed

#### REMARKS & RECOMMENDATIONS:

Composite Produce Source	ed Water Ratios <u>Mixture %</u>			
Abo	46			
San Andres	48			
Glorieta	2			
Pennsylvania	3			
Elinebry	1			
-les engineer 11 cketsor	EIST NO. 821	ACORESS	OFF.CE PHONE	I HOME PHONE



#### NL Treating Chemicals/NL Industries, Inc. P.O. Box 60020, Houston, Texas 77205 Tel. (713) 987-5400 Telex: 4620243 NLOS UI

														SHEET I D	NUME	ER
COMPANY	<u></u> ,						······							DATE		
Mobil Producing Texas	E Nev	v Mexico											1			•
FIELD						001	INTY OR PA	RISH						STATE		
Vacuum						lle	a						_ 1	New I	Mex	ico
LEASE OF UNIT UNION Oil Co.		SAMPLE SOURCE	ε							WATE	SOU	RCE (F	ORMA	TION)		
-Brides-State Leases		Lee "J"	Stat.	<u>e #1</u>						Deva	onia	<u>n</u>				
DEPTH, FT. BHT, F	SAMPLE S			26	(P, •F	WAT	ER, BBUDA	ΥΥ		BU/DAY	· - ·			GAS, MA	ACF/C	)AY
DATE SAMPLED	TYPE OF	WATER: D PRO	DUCED		SUPPLY	D WA	TERFLOOD		SALTW	ATER D	ISPOS	SAL				
12-16-87	TYPE OF	PRODUCTION: I			D WATI	RFLOO		FLOO		POLYN	IER FL	100D		TEAMFI	LOOD	
		(NUMBER B	WA <sup>-</sup> BESIDE	TER A	NALY YMBOL	SIS PA	TTERN	SCALE	UNIT)							
Na+ 2015	,,	10	5		0	<del></del>	5			10		1	15		21	°a
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Fe <sup>+++</sup>				<u> </u>					1.1.		1_1			1_1		∞ <sub>3</sub> =
DISSOLVED SOLIDS					•	<u></u>	DISSOL	LVED	GASE	S			_			
CATIONS Total Hardness Calcium, Ca $+$ $+$ Magnesium, Mg $+$ $+$ Iron (Total) Fe $+$ $+$ $+$ Barium, Ba $+$ $+$		me/l 142 68 74 405, 8	- - -		mg/l ,360 903		Hydroge Carbon I Oxygen, PHYSIC pH (F	en Sulf Dioxid O2 AL PRO	ide, H2 e, CO2 OPERT d)	S TIES	·		6.3	2	mg/ mg/	1 1 1
	 		-				Specific	Gravit	enciaci) (y				<u> </u>	·····	MV	
ANIONS Chloride, Cl <sup>-</sup> Sulfate, SO <sub>4</sub> = Carbonate, CO <sub>3</sub> =		507.0 27.1	-	<u>18</u>	,000 ,300		Total Dis Stability	r, FIU solved Index	Units Solid C – C –	s (Caic <u>80</u> • <u>100</u> •	.) F F		31 . _+0 _+0	542 41 28	mg/	1
Bicarbonate, HCO3		9.5	-		580				¢_	<u>120</u> •	F		<u>+0</u>	12		
Hydroxyl, OH	•	<u> </u>	-		(-		CaSO <sub>4</sub> S	Solubili	ity @_	•	F				mg/	1
Sulfide, S =		<u>4.2</u>	-	<del></del>	67				G_	<u> </u>	F		<u></u>		mg/	l
			-				Max. Cas	504 P	ossib <del>le</del>	(Calc.	)				mp/	1
· ·			-				Max, Bat	SO4 Po	DSSIDIE	(Calc.	)				mg/l	A fait (al)
			-				Residual	Hyero	carco	(1S					ppm	(YOUYC!)

#### SUSPENDED SOLIDS (OUALITATIVE)

tron Sulfide II Iron Oxide II Calcium Carbonate II Calcium Sulfate II Acid Insoluble II

ILTO ENGINEER	DIST. NO.	ADDRESS		CFFICE PHONE	HOME PHONE
Dickerson/Slyker= Sister	821		· .		
NALYZED BY	IDATE	POISTE BUTION	C CUSTONER	C REGION C	

NL Treating Chemicals/NL Industries, Inc. Treating -----P.O. Box 60020, Houston, Texas 77205 Tel. (713) 987-5400 Telex: 4620243 NLOS UI Chemicals .... SHEET NUMBER 9 OMPANY DATE Mobil Producing Texas & New Mexico COUNTY OR PARISH STATE Vacuum Lea

New Mexico WATER SOURCE (FORMATION) LASE OR UNIT SAMPLE SOURCE Simulated Production Water Mixture Bridges-State Leases BHT. \*F SAMPLE SOURCE TEMP, \*F WATER, BBUDAY OIL BBUDAY GAS, MMCF/DAY EPTH. FT. ATE SAMPLED TYPE OF WATER: D PRODUCED SUPPLY WATERFLOOD SALT WATER DISPOSAL TYPE OF PRODUCTION: D PRIMARY D WATERFLOOD D CO2 FLOOD D POLYMER FLOOD D STEAMFLOOD 12-

#### WATER ANALYSIS PATTERN INDICATES MALE UNIT

(NUMBER BESIDE ION ST MOUL INDICATES MEN SOALE UNIT)																																				
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#### ISSOLVED SOLIDS

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#### **DISSOLVED GASES**

ATIONS Ital Hardness Ilcium, Ca + +	188 <sup>me/1</sup>	mg/i	Hydrogen Sulfide, H <sub>2</sub> S Carbon DioxIde, CO <sub>2</sub> Oxygen, O <sub>2</sub>	mg/l mg/l mg/l
:gnesium, Mg + + n (Total) Fe + + + rium, Ba + + dium, Na + (Calc.)	654.4	15,051	<ul> <li>PHYSICAL PROPERTIES</li> <li>pH (Lab)</li> <li>Eh (Redox Potential)</li> <li>Specific Gravity</li> </ul>	MV
HONS Horide, CI Hate, SO $_4$ = bonate, CO $_3$ =	$     \begin{array}{r} 788.7 \\                                    $	<u>28.000</u> 2.200 <u>96</u> 286	Turbidity, FTU Units Total Dissolved Solids (Calc.) Stability Index @ *F &*F @*F	<u>48,739</u> mg/l
proxyl, OHT ande, ST			CaSO <sub>4</sub> Solubility @ °F @ °F Max, CaSO <sub>4</sub> Possible (Calc.)	mg/l mg/l mg/l
			Max. BaSO4 Possible (Calc.) Residual Hydrocarbors	mg/l ppm(Vo!/Vol)

SPENDED SOLIDS (QUALITATIVE)

, Sulfide 🔲 Iron Oxide 🗆 Calcium Carbonate 🗇 Calcium Sulfate 🗇 Acid Insoluble 🗇 MARKS AND RECOMMENDATIONS:

ource	Mix &
00	46
an Andres	48
lorieta	2
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angy Manta	÷

Exhibit	"D"
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NL Treating Chemicals/NL Industries, Inc. P.O. Box 60020, Houston, Texas 77205

Water Analysis Re Tel. (713) 987-5400 Telex: 4620243 NLOS UI SHEET NUMBER COMPANY DATE FIELD COUNTY OR PARISH STATE  $\mathcal{L}$ WATER SOURCE (FORMATION) LEASE OR UNIT SAMPLE SOURCE DEPTH. FT. SAMPLE SOURCE OIL, BBUDAY TEMP. WATER, BBUDAY GAS MUCFIDAY BHT. DATE SAMPLED TYPE OF WATER: D PRODUCED D SUPPLY D WATERFLOOD D SALT WATER DISPOSAL TYPE OF PRODUCTION: D PRIMARY D WATERFLOOD D CO2 FLOOD D POLYMER FLOOD C STEVMFLOOD WATER ANALYSIS PATTERN (NUMBER BESIDE ION SYMBOL INDICATES me/I SCALE UNIT) Na + 20 10 <sup>20</sup> Cl <sup>-</sup> 15 5 0 5 10 15 T Ca + н $\infty_3$ T τ .Mg+ so₄ = Fe<sup>++</sup>  $co_3 =$ DISSOLVED GASES **DISSOLVED SOLIDS** 

CATIONS Total Hardness Calcium, Ca + +	me/l 5.C 4.2	mg/l	Hydrogen Sulfide, H <sub>2</sub> S Carbon Dioxide, CO <sub>2</sub> Oxygen, O <sub>2</sub>	mg/i mg/i mg/i
Iron (Total) Fe + + + Barium, Ba + + Sodium, Na + (Calc.)	<u> </u>	4.3	PHYSICAL PROPERTIES pH Eh (Redox Potential)	<u>7. /</u>
ANIONS Chloride, Cl <sup><math>-</math></sup> Sulfate, SO <sub>4</sub> =	16.9	600	Specific Gravity Turbid:ty, FTU Units Tota! Dissolved Solids (Calc.) Stability Index @•F	1425. cmg/
Carbonate, CO <sub>3</sub> = Bicarbonate, HCO <sub>3</sub> =		262.3	ۥF ۥF (aSQ) Salubility ۥ5	
Sulfide, S=	~/		@*F	mg/i
			Max. CaSO4 Possible (Calc.)	mg/i
	<u></u>		Max. E. SO4 Possible (Calc.)	mg/i
······································	·		nesious nyuroczidons	

SUSPENDED SOLIDS (QUALITATIVE) Iron Sulfide 🔲 Iron Oxide 🔲 Calcium Carbonate 🗇 Calcium Sulfate 🗇 Acid Insoluble 🗇 REMARKS AND RECOMMENDATIONS:

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#### NL TREATING CHEMICALS NL INDUSTRIES. INC.

SCALING TENDENCIES OF WATERS

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COMPANY: MOBIL PRODUCING TEXAS& N.M. SAMFLE FOINT: WATER WELL LOCATION: SNYDER RANCH DATE: 1/13/89

WATER ANALYSIS (MG/L):

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SODIUM	400.2
CALCIUM	84.0
MAGNESIUM	9.8
CHLORIDE	600. Q
SULFATE	65.0
BICARBONATE	262.3
IRON	4.3
BARIUM	0.0
STRONTIUM	0.0
PH:	7.1
IONIC STRENGTH =	0.0260

INDEX VALUES GREATER THAN ZERO INDICATE SCALING CONDITIONS INDEX VALUES OF ZERO OR LESS INDICATE A STABLE WATER

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	CALCITE	GYFSUM	ANHYDRITE	BARITE	STRONTIUM
TEMP.	INDEX	INDEX	INDEX	INDEX	INDEX
60	-0.38	-1.92	-2.17	-40.64	-1.00
80	-0.27	-1.97	-2.11	-40.79	-1.00
100	-0.15	-1.99	-2.04	-40.91	-1.00
120	-0.04	-1.99	-1.95	-41.00	-1.00
140	0.09	-1.97	-1.85	-41.07	-1.00
160	0.22	-1.95	-1.74	-41.11	-1.00
180	0.35	-1.92	-1.61	-41.14	-1.00
EØØ	0.49	-1.88	-1,48	-41.16	-1.00
220	0.64	-1.83	-1.33	-41.16	-1.00
240	Ø.79	-1.79	-1.17	-41.15	-1.00
2EØ	Ø.95	-1.74	-1.00	-41.13	-1.00

## Affidavit of Publication

) ) ss.

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Exhibit "E"

STATE OF NEW MEXICO

#### COUNTY OF LEA

Joyce Clemens being first duly sworn on oath deposes and says that he is Adv. Director of THE LOVINGTON DAILY LEADER, a daily newspaper of general paid circulation published in the English language at Lovington, Lea County, New Mexico; that said newspaper has been so published in such county continuously and uninterruptedly for a period in excess of Twenty-six (26) consecutive weeks next prior to the first publication of the notice hereto attached as hereinafter shown; and that said newspaper is in all things duly qualified to publish legal notices within the meaning of Chapter 167 of the 1937 Session Laws of the State of New Mexico.

That the notice which is hereto attached, entitled

## Application For Authorization

To Inject
and numbered in the
Court of Lea
County, New Mexico, was published in a regular and
entire issue of THE LOVINGTON DAILY LEADER and
not in any supplement thereof, once each week on the
same day of the week, for
consecutive weeks, beginning with the issue of
December 29
and ending with the issue of
December 29 19 <sup>87</sup>

And that the cost of publishing said notice is the 9.10 sum of \$.....

LEGALNOTICE APPLICATION FOR AUTHORIZA TION TO INJECT 1. Mobil Producing TX & NM Inc., P.O. Box 633, Midland, Texas 79702 Attention: M.E. Sweeney, (915)688-1772 will apply for permission to inject produced water into the following well/wells for the purpose of Disposal. 2. Well Name and Number: State Sec. 27 No. 2 Location: 660' FEL & 1980' FNL of Sec. 27 Section: 27, T 18-S, R 35-E County: Lea methode Martin State 3. Formation Name: Devonian Injection Interval: 11,950 to 13,708' Maximum Injection Rate: 12,000 BWPD A B LAND LAND AND AND A PARTY (. Maximum Pressure: 2390 PSI 4. Interested parties, who can show that they are adversely affected by, this application, must file objections or requests for hearing with the Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico 87501 within 15 days after this publication. Published in the Lovington Daily Leader December 29, 1987.

> RECEIVED JAN 1 1 1988 ENV. & REG.

MOBIL PRODUCING TEXAS & NEW MEXICO, INC. STATE SEC. 27, WELL #2 SOUTH VACUUM (DEVONIAN) FIELD LEA COUNTY, TEXAS

#### EXHIBIT "F"

#### OFFSET OPERATORS

Arco Oil & Gas Co. P. O. Box 1710 1515 Caller Service Hobbs, New Mexico 88240

Hanley Petroleum 1500 Wilco Bldg. Midland, Tx. 79701

•

UNOCAL Corporation P. O. Box 671 Midland, Texas 79702 Exxon Company, USA P. O. Box 1600 Midland, Texas 79702

Hondo Oil & Gas P. O. Box 2819 Dallas, Tx.

.

Yates Energy Southwest Centre, Ste 1010 Roswell, N.M. 88201

#### SURFACE OWNER

SNYDER RANCHES, INC. P. O. BOX 726 Lovington, New Mexico 88260

A:M804749G.CCS (3)

March 2, 1988

P.O. BOX 633 MIDLAND, TEXAS 79702

MIDLAND DIVISION

CERTIFIED MAIL RETURN RECEIPT REQUESTED

Śnyder Ranches, Inc. P. O. Box 726 Lovington, New Mexico 88260

> 7.01 NOTICE OF APPLICATION FOR WATER DISPOSAL WELL STATE SEC. 27 LEASE, WELL NO. 2 VACUUM DEVONIAN, SOUTH FIELD LEA COUNTY, NEW MEXICO

Gentlemen:

Mobil Exploration & Producing U.S. Inc., as agent for Mobil Producing Texas & New Mexico, Inc., (MPTM), has made application to the Oil Conservation Division of New Mexico for authority to dispose of produced water into a reservoir not productive of oil or gas in the above captioned well.

A copy of this application is furnished to you for your information.

Yours very truly,

ME Sunny

M. E. Sweeney Environmental & Regulatory Manager

Mobil Exploration & Producing U. S. Inc. as Agent for Mobil Producing Texas & New Mexico, Inc.

CAM/jlt

attachments

cc: Oil Conservation Division

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RECEIBTFOR BERTFIEL No INSURANCI COVERAGE FROVI NOT FOR INTELINATIONAL MAIL (See Reverse)	Sout to Snyder Ranches, Inc.,	Street and No P. 0. Box 726	P.O. State and ZIP Code Lovington, N.M. 88260	Postage	Centilied Fee	Special Delivery Fee	Restricted Delivery Fee	Return Receipt showing to whom and Date Delivered	Return Recent showing to whom. Date: and Address of Delivery	FOTAL, Postage and Fees	Postniank or Date		A CANADA AND A CANAD
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A:N306249B.CAM (3)

March 2, 1988

P.O. BOX 633 MIDLAND, TEXAS 79702

MIDLAND DIVISION

CERTIFIED MAIL RETURN RECEIPT REQUESTED

Hondo Oil & Gas P. O. Box 2819 Dallas, Texas

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E & mune

M. E. Sweeney Environmental & Regulatory Manager

Mobil Exploration & Producing U. S. Inc. as Agent for Mobil Producing Texas & New Mexico, Inc.

CAM/jlt

attachments

cc: Oil Conservation Division



March 2, 1988

P.O. BCX 633 MIDLAND, TEXAS 79702

MIDLAND DIVISION

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Yates Energy Southwest Centre Suite 1010 Roswell, New Mexico 88201

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M. E. Sweeney Environmental & Regulatory Manager

Mobil Exploration & Producing U. S. Inc. as Agent for Mobil Producing Texas & New Mexico, Inc.

CAM/jlt

attachments

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March 2, 1988

P.O. BOX 633 MIDLAND, TEXAS 79702

MIDLAND DIVISION

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Exxon Company, USA P. O. Box 1600 Midland, Texas 79702

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M. E. Sweeney / Environmental & Regulatory Manager

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CAM/jlt

attachments

cc: Oil Conservation Division



A:M8C5249B.CAM (3)

· · ·

March 2, 1983

P.O. BOX 633 MIDLAND, TEXAS 79702

MIDLAND DIVISION

CERTIFIED MAIL RETURN RECEIPT REQUESTED

ÚNOCAL Corporation P. O. Box 671 Midland, Texas 79702

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E Summing

M. E. Sweeney Environmental & Regulatory Manager

Mobil Exploration & Producing U. S. Inc. as Agent for Mobil Producing Texas & New Mexico, Inc.

CAM/jlt

attachments

cc: Oil Conservation Division

RECEIPT FOR CERFIFIED MAIL NO INSURANCE COVERAGE PROVIDED NO 1 FOR INTERNATIONAL MAIL (See Reverse) to whom P.O.Box 671, P.O. State and 71P Code Midland, Tx, 79702 UNOCAL Corporation Return Receipt showing to whom and Date Deliv Restricted Delivery Fee 5 PUH Beturn Reeript's Postage Special Delivery Street and No Centiled Fee Ξ ostage PS Form 3800, June 1985

March 2, 1988

P.O. BOX 633 MIDLAND, TEXAS 79702

MIDLAND DIVISION

CERTIFIED MAIL RETURN RECEIPT REQUESTED

Hanley Petroleum 1500 Wilco Bldg. Midland, Texas 79701

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Mobil Exploration & Producing U. S. Inc. as Agent for Mobil Producing Texas & New Mexico, Inc.

CAM/jlt

attachments

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March 2, 1988

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