

**STATE OF NEW MEXICO  
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT  
OIL CONSERVATION DIVISION**

**APPLICATION OF OXY USA INC. FOR APPROVAL OF A PRESSURE  
MAINTENANCE PROJECT, EDDY COUNTY, NEW MEXICO.**

**CASE NO.** 20195

**APPLICATION**

OXY USA Inc. ("OXY") through its undersigned attorneys, hereby files this application with the Oil Conservation Division for an order approving a pressure maintenance project in the Bone Spring formation underlying a project area comprised of Section 34, Township 23 South, Range 29 East, NMPM, Eddy County, New Mexico. In support of its application, OXY states:

1. OXY USA Inc., (OGRID No. 16696) is the operator of the following six horizontal wells drilled and completed in the Bone Spring formation (Cedar Canyon Bone Spring Pool (Pool Code 11520)) underlying Section 34, Township 23 South, Range 29 East, NMPM, Eddy County, New Mexico:

- The Cypress 34 Federal 1 well (30-015-35053) dedicated to the S/2 S/2 of Section 34 and completed in the 1st Bone Spring interval;
- The Cypress 34 Federal 2 well (30-015-35413) dedicated to the S/2 NE/4 and the SE/4 NW/4 of Section 34 and completed in the 1st Bone Spring interval;
- The Cypress 34 Federal 3H well (30-015-35692) dedicated to the N/2 SE/4 and the NE/4 SW/4 of Section 34 and completed in the 1st Bone Spring interval;
- The Cypress 34 Federal 8H well (30-015-39430) dedicated to the W/2 E/2 of Section 34 and completed in the 2nd Bone Spring interval;
- The Cypress 34 Federal 9H well (30-015-42088) dedicated to the E/2 E/2 of Section 34 and completed in the 2nd Bone Spring interval; and
- The Cypress 34 Federal 11H well (30-015-42920) dedicated to the E/2 W/2 of Section 34 and completed in the 2nd Bone Spring interval.

2. OXY seeks approval to inject produced gas, produced water and carbon dioxide into the First Bone Spring interval through the **Cypress 34 Federal 3H well** at a total vertical depth of approximately 7896 feet to approximately 7949 feet along the horizontal portion of this wellbore and into the 2nd Bone Spring interval through the **Cypress 34 Federal 8H well** at a total vertical depth of approximately 8658 feet to approximately 8910 feet along the horizontal portion of this wellbore. Oxy anticipates injection through these wells will provide pressure maintenance support in the 1st Bone Spring interval for the offsetting Cypress 34 Federal Nos. 1 and 2 wells and in the 2nd Bone Spring interval for the offsetting Cypress 34 Federal 9H and 10H wells.

3. Oxy seeks authority to inject produced gas, produced water and carbon dioxide in these wells at the following maximum surface injection pressures:

<u>Cypress 34 Federal 3H (1st BS interval)</u>		<u>Cypress 34 Federal 8H (2nd BS interval)</u>	
Produced gas:	3850 psi	Produced gas:	4350 psi
Produced water:	1,580 psi	Produced water:	1730 psi
Carbon dioxide:	2000 psi	Carbon dioxide:	2300 psi

The source of the produced gas and the produced water will be the Bone Spring and Delaware formations. The source of the carbon dioxide is unknown.

4. Oxy seeks to place the packer in the vertical portion of the production casing which is significantly above the first perforations. Oxy therefore seeks an exception to the 100-foot packer setting depth requirement applied to vertical injection wells.

5. Oxy requests allowance to use unlined tubing in the injection wells, which has previously been approved by the Division for a similar injection project. *See* Order R-14322.

6. A copy of the Form C-108 for this injection project is provided with this application as Attachment A.



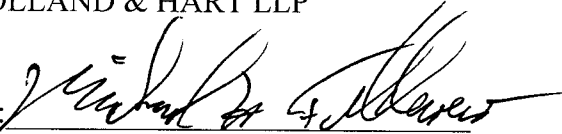
7. A copy of this Application has been provided to all affected parties as required by Division Rules and notice of the hearing on this application will be provided in a newspaper of general circulation in Eddy County.

8. Approval of this pressure maintenance project will result in the production of substantially more hydrocarbons from the project area than would otherwise be produced, will prevent waste and will not impair correlative rights.

WHEREFORE, OXY USA, Inc. requests that this application be set for hearing before an Examiner of the Oil Conservation Division on January 10, 2019, and, after notice and hearing as required by law, the Division approve this application.

Respectfully submitted,

HOLLAND & HART LLP

By: 

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**ATTORNEYS FOR OXY USA, INC.**

**Case No.:**     **Application of OXY USA Inc. for Approval of a Pressure Maintenance Project, Eddy County, New Mexico.** Applicant in the above-styled cause seeks an order approving a pressure maintenance project in the Bone Spring formation (Cedar Canyon Bone Spring Pool (Pool Code 11520)) underlying Section 34, Township 23 South, Range 29 East, NMPM, Eddy County, New Mexico. Produced gas, produced water and carbon dioxide may be injected into the First Bone Spring interval through the **Cypress 34 Federal 3H** well (API No. 30-015-35692) at a total vertical depth of approximately 7896 feet to approximately 7949 feet along the horizontal portion of this wellbore and into the Second Bone Spring interval through the **Cypress 34 Federal 8H** well (API No. 30-015-39430) at a total vertical depth of approximately 8658 feet to approximately 8910 feet along the horizontal portion of this wellbore. Oxy seeks approval to inject at the following surface injection pressures:

Cypress 34 Federal 3H (First BS)

Produced gas:     3850 psi  
Produced water:  1,580 psi  
Carbon dioxide:  2000 psi

Cypress 34 Federal 8H (Second BS)

Produced gas:     4350 psi  
Produced water:   1730 psi  
Carbon dioxide:   2300 psi

The source of the produced gas and produced water will be the Bone Spring and Delaware formations. The source of the carbon dioxide is unknown. Oxy also seeks an exception to the packer setting depth for these injection wells and for allowance to use unlined tubing. The proposed project is located approximately six miles southeast of Loving, New Mexico.

**APPLICATION FOR AUTHORIZATION TO INJECT**

- I. PURPOSE: \_\_\_\_\_, Secondary Recovery ☒ Pressure Maintenance \_\_\_\_\_ Disposal \_\_\_\_\_ Storage \_\_\_\_\_  
Application qualifies for administrative approval? \_\_\_\_\_ Yes ☒ No
- II. OPERATOR: Oxy USA Inc  
ADDRESS: P.O. Box 4294 Houston, TX 77210  
CONTACT PARTY: Kelley Montgomery PHONE: 713-366-5716
- III. WELL DATA: Complete the data required on the reverse side of this form for each well proposed for injection.  
Additional sheets may be attached if necessary.
- IV. Is this an expansion of an existing project? \_\_\_\_\_ Yes ☒ No  
If yes, give the Division order number authorizing the project: \_\_\_\_\_
- V. 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.
- VII. Attach data on the proposed operation, including:
1. Proposed average and maximum daily rate and volume of fluids to be injected;
  2. Whether the system is open or closed;
  3. Proposed average and maximum injection pressure;
  4. Sources and an appropriate analysis of injection fluid and compatibility with 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 geologic data on the injection zone including appropriate lithologic detail, geologic 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 sources known to be immediately underlying the injection interval.
- IX. Describe the proposed stimulation program, if any.
- \*X. Attach appropriate logging and test data on the well. (If well logs have been filed 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.
- XII. Applicants for disposal wells must make an affirmative statement that they have 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 sources 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.
- NAME: Kelley Montgomery TITLE: Regulatory Mgr.  
SIGNATURE: [Signature] DATE: 11/30/18  
E-MAIL ADDRESS: kelley-montgomery@oxy.com
- \* If the information required under Sections VI, VIII, X, and XI above has been previously submitted, it need not be resubmitted.  
Please show the date and circumstances of the earlier submittal: \_\_\_\_\_

DISTRIBUTION: Original and one copy to Santa Fe with one copy to the appropriate District Office

C-108 Application  
OXY USA Inc.  
Cypress 34 Federal 3H and 8H  
Eddy County, NM

- I. This is a pressure maintenance project.
- II. OXY USA Inc.  
P.O. Box 4294  
Houston, TX 77210  
Contact Party: Kelley Montgomery, Oxy (713) 366-5716
- III. Injection well data sheets and wellbore schematic diagrams have been attached for the injection wells covered by this application.
- IV. This is not an expansion of an existing project.
- V. The map with a two-mile radius surrounding the injection wells and a one-half mile radius for area of review is attached.
- VI. The tabular format of the area of review is attached.
- VII. The proposed operations data sheet is attached.
- VIII. Please see attached signed statement on geologic data for the Bone Spring formation.
- IX. The proposed Cypress 34 Federal 3H well is an existing horizontal producing well that was hydraulically fractured with 5000 gal of 7.5% HCL, 500,000# 20/40 Ottawa and an additional 50,000# 20/40 RCS was used.  
The proposed Cypress 34 Federal 8H well is an existing horizontal producing well that was hydraulically fractured with 153,622 gal of treated water, 24,000 gal of 15% HCL, 107,579 gal WaterFrac GR15, 1,093,251 gal Delta Frac 140-R15 and 1,907,514# sand.
- X. Logs were filed for the existing well at the time of drilling.

Well Name	Date Submitted
Cypress 34 Federal 3H	10/01/2007
Cypress 34 Federal 8H	06/24/2013
- XI. Per our field personnel, no fresh water wells were found within one-mile of these wells.
- XII. N/A. These are not disposal wells.
- XIII. Attached please find the Proof of Notice.



## INJECTION WELL DATA SHEET

OPERATOR: Oxy USA Inc.

WELL NAME &amp; NUMBER: Cypress 34 Federal 3H

WELL LOCATION: 2100' FSL & 1650' FWL  
FOOTAGE LOCATION

UNIT LETTER K SECTION 34 TOWNSHIP 23S RANGE 29E

WELLBORE SCHEMATICCypress 34 Federal 3H Proposed Wellbore Diagram

Elevation: GL 3,035' KB 3,057'  
 API: 30-015-35692  
 Surface Location: 2,100' FSL & 1,650' FWL  
 Sec 34 T23S R29E  
 Eddy County, NM

13 3/8" set @ 550'  
 600 SX Circ.

9 5/8" set @ 3,000'  
 1,100 SX Circ.

5 1/2" set @ 11,062'  
 2,325 SX Circ.

\*Note: Diagram not to scale

PSTD - 10,985' MD  
 TD - 11,065' MD

WELL CONSTRUCTION DATASurface Casing

Hole Size: 17 1/2" Casing Size: 13 3/8"

Cemented with: 600 sx. or ft<sup>3</sup>

Top of Cement: Surface Method Determined: Circulated

Intermediate Casing

Hole Size: 12 1/4" Casing Size: 9 5/8"

Cemented with: 1100 sx. or ft<sup>3</sup>

Top of Cement: Surface Method Determined: Circulated

Production Casing

Hole Size: 8 1/2 - 7 7/8" Casing Size: 5 1/2"

Cemented with: 2325 sx. or ft<sup>3</sup>

Top of Cement: Surface Method Determined: Circulated

Total Depth: 11065' MD 7949' TVD

Injection Interval

8102' MD/7896' TVD feet to 10,950' MD/7949' TVD

(Perforated)



### INJECTION WELL DATA SHEET

Tubing Size: 2 7/8" PH6 7.90# L-80 tubing Lining Material: None (Will use lined tubing if injecting water)

Type of Packer: 5-1/2" Weatherford 10k ASIX Nickel coated packer

Packer Setting Depth: 7400' (Set packer in vertical section of well) \_\_\_\_\_

Other Type of Tubing/Casing Seal (if applicable): \_\_\_\_\_

#### Additional Data

1. Is this a new well drilled for injection? \_\_\_\_\_ Yes X No

If no, for what purpose was the well originally drilled? Producer-Oil \_\_\_\_\_

2. Name of the Injection Formation: Bone Spring \_\_\_\_\_

3. Name of Field or Pool (if applicable): Cedar Canyon Bone Spring \_\_\_\_\_

4. Has the well ever been perforated in any other zone(s)? List all such perforated intervals and give plugging detail, i.e. sacks of cement or plug(s) used. No \_\_\_\_\_

5. Give the name and depths of any oil or gas zones underlying or overlying the proposed injection zone in this area: \_\_\_\_\_

Brushy Canyon Formation (Delaware) (overlying) (5165') \_\_\_\_\_

Wolfcamp Formation (underlying) (10,085') \_\_\_\_\_



## INJECTION WELL DATA SHEET

OPERATOR: OXY USA Inc.WELL NAME & NUMBER: Cypress 34 Federal 8HWELL LOCATION: 575 FSL & 1980 FEL

FOOTAGE LOCATION

UNIT LETTER O SECTION 34 TOWNSHIP 23S RANGE 29EWELLBORE SCHEMATICCypress 34 Federal 8H Proposed Wellbore Diagram

Elevation: GL 3,041.3' KB 3,065.3'  
 API: 30-015-39430  
 Surface Location: 575' FSL & 1,980' FEL  
 Sec 34 T23S R29E  
 Eddy County, NM

13 3/8" set @ 408'  
 350 SX Circ.

9 5/8" set @ 3,100'  
 1145 SX Circ.

5 1/2" set @ 13,073'  
 2280 SX Circ.

\*Note: Diagram not to scale

P8TD - 12,969' MD  
 TD - 13,073' MD

WELL CONSTRUCTION DATASurface CasingHole Size: 16" Casing Size: 13 3/8"Cemented with: 350 sx. or ft<sup>3</sup>Top of Cement: Surface Method Determined: CirculatedIntermediate CasingHole Size: 12 1/4" Casing Size: 9 5/8"Cemented with: 1145 sx. or ft<sup>3</sup>Top of Cement: Surface Method Determined: CirculatedProduction CasingHole Size: 8 1/2" Casing Size: 5 1/2"Cemented with: 2280 sx. or ft<sup>3</sup>Top of Cement: Surface Method Determined: CirculatedTotal Depth: 13073' MD 8910' TVDInjection Interval8725'MD/8658' TVD feet To 12,910'MD/8910' TVD

(Perforated)



### INJECTION WELL DATA SHEET

Tubing Size: 2 7/8" PH6 7.90# L-80 tubing Lining Material: None (Will use lined tubing if injecting water)

Type of Packer: 5-1/2" Weatherford 10K AS1X Nickel coated packer

Packer Setting Depth: 8200' (Set packer in vertical section of well) \_\_\_\_\_

Other Type of Tubing/Casing Seal (if applicable): \_\_\_\_\_

#### Additional Data

1. Is this a new well drilled for injection? \_\_\_\_\_ Yes X No

If no, for what purpose was the well originally drilled? Producer-Oil

2. Name of the Injection Formation: Bone Spring

3. Name of Field or Pool (if applicable): Cedar Canyon Bone Spring

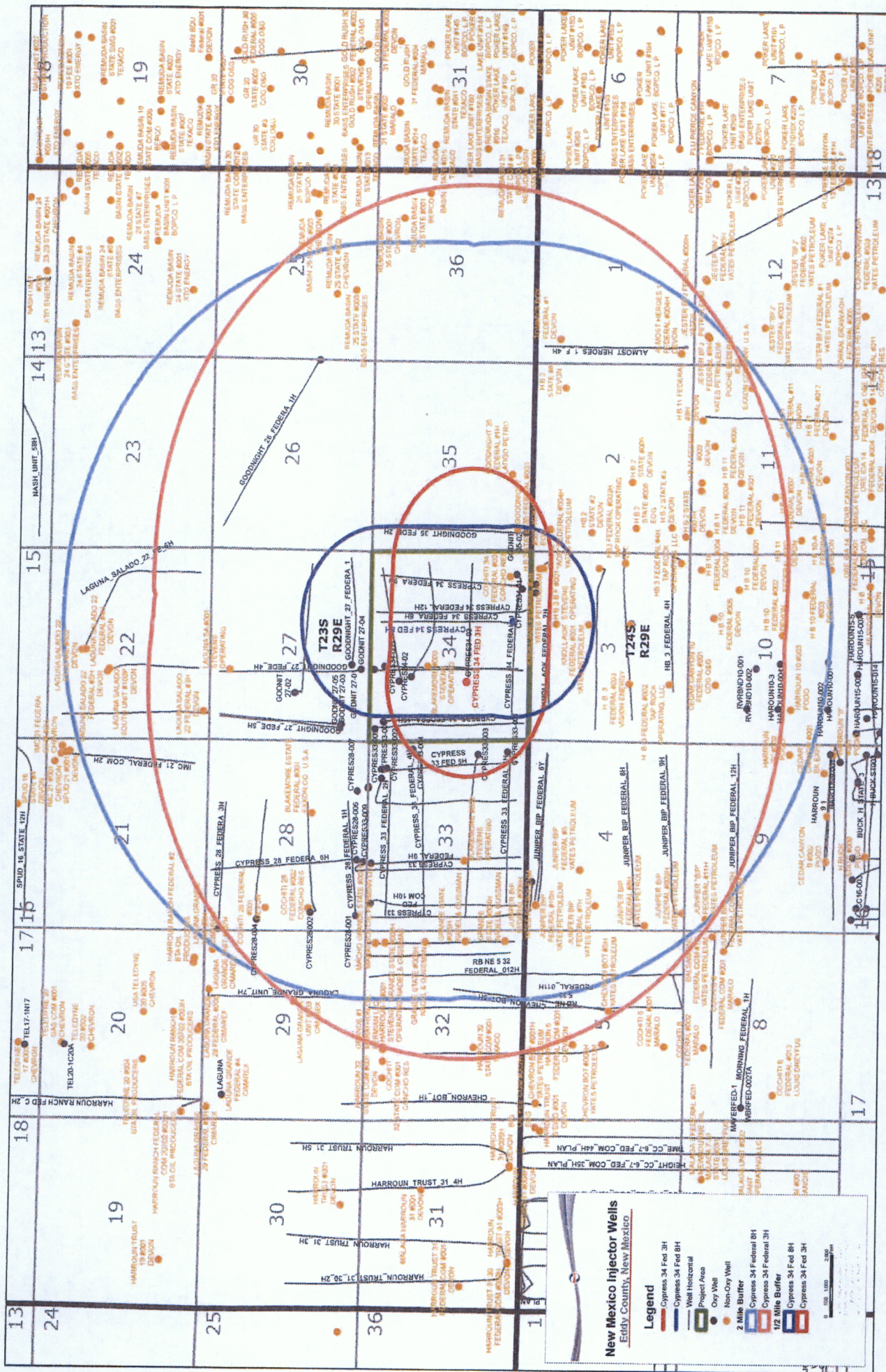
4. Has the well ever been perforated in any other zone(s)? List all such perforated intervals and give plugging detail, i.e. sacks of cement or plug(s) used. No

5. Give the name and depths of any oil or gas zones underlying or overlying the proposed injection zone in this area: \_\_\_\_\_

Brushy Canyon Formation (Delaware) (overlying) (5165')

Wolfcamp Formation (underlying) (10061')

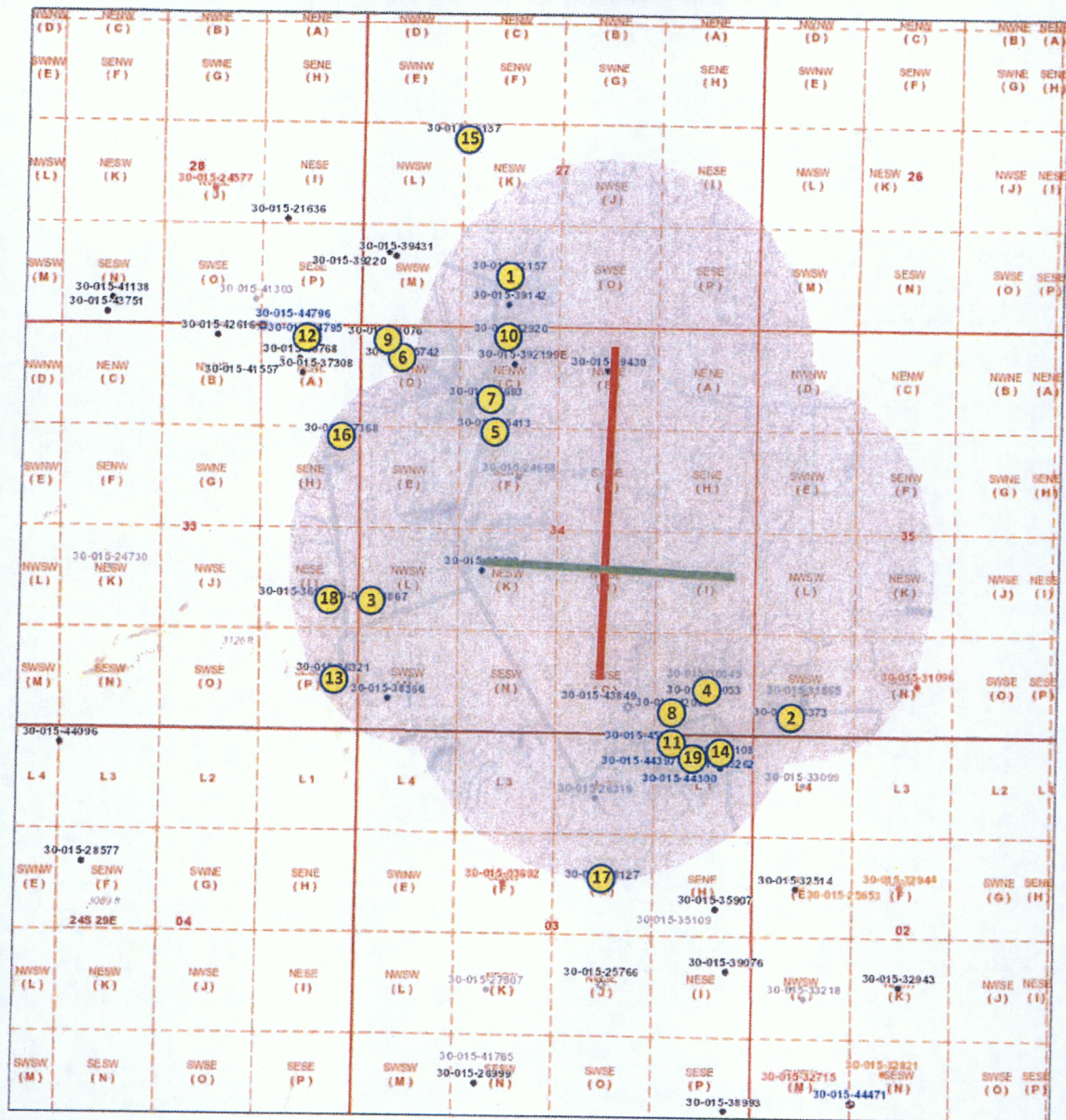




12/2



# CYPRESS 34 FED #3H & #8H AOR MAP



11/13/2018 11:50:52 AM

1:18,056

## Well Locations - Small Scale

- Active
- New
- Plugged
- Cancelled
- Temporarily Abandoned
- Well Locations - Large Scale
- Miscellaneous
- CO2 Active
- CO2 Cancelled
- CO2 New
- CO2 Plugged
- CO2 Temporarily Abandoned
- Gas Active

- Gas, Cancelled, Never Drilled
- Gas, New
- Gas, Plugged
- Gas, Temporarily Abandoned
- Injection, Active
- Injection, Cancelled
- Injection, New
- Injection, Plugged
- Injection, Temporarily Abandoned
- Oil, Active
- Oil, Cancelled
- Oil, New
- Oil, Plugged

- Oil, Temporarily Abandoned
- Salt Water Injection, Active
- Salt Water Injection, Cancelled
- Salt Water Injection, New
- Salt Water Injection, Plugged
- Salt Water Injection, Temporarily Abandoned
- Water, Active
- Water, Cancelled
- Water, New
- Water, Plugged
- Water, Temporarily Abandoned
- OGD Districts
- OGD District Offices

1/2 Mile Area of Review

Well ID on AOR Table

Cypress 34 Federal #8H

Cypress 34 Federal #3H

Bureau of Land Management, Texas Parks & Wildlife, Est. HERE, Gamin, INCREMENT P, USGS, METINASA, EPA, USDA, OGD, BUM

New Mexico Oil Conservation Division  
 NM OGD Oil and Gas Map: [http://nm-ogd.map2.org/oil\\_gas/mapviewer/](http://nm-ogd.map2.org/oil_gas/mapviewer/) New Mexico Oil Conservation Division



**Cypress 34 Fed 3H (API#30-015-35892) and 8H (API# 30-015-39430)**

**FOR INJECTOR:**  
**TOP OF HS IS 6807'**

[illegible]

8/24

[illegible]

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9/21

Item VII  
Proposed Operations

The Cypress 34 Federal 3H will inject in the 1<sup>st</sup> Bonespring and the Cypress 34 Federal 8H will inject in the 2<sup>nd</sup> Bonespring.

**Gas Injection**

1.

Well Name	Average Daily Rate of Gas to be Injected	Maximum Daily Rate of Gas to be Injected
Cypress 34 Federal 3H	6000 MCFD	20,000 MCFD
Cypress 34 Federal 8H	9000 MCFD	20,000 MCFD

2. This will be a closed system

3.

Well Name	Average Injection Pressure	Maximum Injection Pressure
Cypress 34 Federal 3H	3500 psi	3850 psi
Cypress 34 Federal 8H	4000 psi	4350 psi

4. The source of the injected gas will be produced gas from the Cedar Canyon Central Delivery Point integration system which is comprised of nearby Delaware, 1<sup>st</sup> and 2<sup>nd</sup> Bone Spring wells. Please see the attached gas analysis.

5. N/A

**Water Injection**

1.

Well Name	Average Daily Rate of Water to be Injected	Maximum Daily Rate of Water to be Injected
Cypress 34 Federal 3H	5000 BWIPD	10,000 BWIPD
Cypress 34 Federal 8H	5000 BWIPD	10,000 BWIPD

2. This will be a closed system

3.

Well Name	Average Injection Pressure	Maximum Injection Pressure
Cypress 34 Federal 3H	1450 psi	1580 psi
Cypress 34 Federal 8H	1650 psi	1730 psi

4. Water used for injection will be treated produced water from wells drilled in the Bone Springs and Delaware Formations. Water is treated chemically to reduce scale. Please see the attached water compatibility study.

5. N/A

Item VII  
Proposed Operations

**CO2 Injection**

1.

Well Name	Average Daily Rate of Water to be Injected	Maximum Daily Rate of Water to be Injected
Cypress 34 Federal 3H	6000 MCFD	20,000 MCFD
Cypress 34 Federal 8H	9000 MCFD	20,000 BWIPD

2. This will be a closed system

3.

Well Name	Average Injection Pressure	Maximum Injection Pressure
Cypress 34 Federal 3H	1700 psi	2000 psi
Cypress 34 Federal 8H	2000 psi	2300 psi

4. Oxy currently does not have a source for CO2 for this project area. However, Oxy would like to have the ability to inject CO2 when a source becomes available.

5. N/A

**Calculation for Surface Injection Pressure Limits**

**For Water Injection:**

Calculation for surface pressure limit:

- Cypress 34 Federal 3H:  $0.2 \text{ psi/ft} * 7896 \text{ ft (TVD of first perf)} = 1580 \text{ psi}$
- Cypress 34 Federal 8H:  $0.2 \text{ psi/ft} * 8658 \text{ ft (TVD of first perf)} = 1730 \text{ psi}$

**Produced Gas and CO2 Injection:**

Based on the surface pressure limit for water and assuming a fresh water gradient of 0.433 psi/ft. The bottom hole pressure (BHP) limit is:

- Cypress 34 Federal 3H:  $1580 + 0.433 * 7896 = 4998 \text{ psi (or } 0.633 \text{ psi/ft)}$
- Cypress 34 Federal 8H:  $1730 + 0.433 * 8658 = 5480 \text{ psi (or } 0.633 \text{ psi/ft)}$

A Petroleum Expert Prosper Model was used to calculate the surface pressure with 2.875" tubing, reservoir depth, injection gas composition and the BHP limit shown above.

\*Prosper Model is an industrial standard nodal analysis software for pressure calculation and includes phase behavior change and friction loss.

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**Atchafalaya Measurement, Inc.**416 East Main Street  
Artesia, NM 88210 575-746-3481*Injection Gas  
Sample***Sample Information**

	Sample Information
Sample Name	OXY__Cedar Canyon 16 State 12H LP__GC1-110117-06
Station Number	14910TD
Lease Name	Cedar Canyon 16 State 12H LP
Analysis for	OXY USA
Producer	OXY USA
Field Name	NM South
County	Eddy
State	NM
Frequency	Spot
Sample Deg F	52
Atmos Deg F	46
Flow Rate	2155.9
LinePSIG	123
Date Sampled	10/31/17
Sampled By	Jacob Marquez
Analysis By	Chris Myers
Report Date	2017-11-01 10:13:39

**Component Results**

Component Name	Ret. Time	Peak Area	Norm%	PPMV	GPM (Dry) (Gal. / 1000 cu.ft.)
Nitrogen	21.960	8052.1	1.62059	16205.900	0.178
H <sub>2</sub> S	46.000	0.0	0.00000	0.000	0.000
Methane	22.780	299373.1	77.19299	771929.900	13.058
Carbon Dioxide	26.480	1127.8	0.18594	1859.400	0.032
Ethane	36.800	81412.7	12.57474	125747.400	3.356
Propane	79.140	48829.2	5.73143	57314.300	1.576
i-Butane	28.720	41559.0	0.58209	5820.900	0.190
n-Butane	30.320	97200.6	1.33268	13326.800	0.419
Pentane	35.360	20267.2	0.24488	2448.800	0.089
n-Pentane	37.420	20835.3	0.24103	2410.300	0.087
Hexanes Plus	120.000	27727.0	0.29363	2936.300	0.127
Total:			100.00000	1000000.000	19.112

**Results Summary**

Result	Dry	Sat. (Base)
Total Raw Mole% (Dry)	101.22347	
Pressure Base (psia)	14.650	
Temperature Base	60.0	
Gross Heating Value (BTU / Ideal cu.ft.)	1239.4	1217.7
Gross Heating Value (BTU / Real cu.ft.)	1243.8	1222.5
Relative Density (G), Ideal	0.7239	0.7221
Relative Density (G), Real	0.7261	0.7246
Compressibility (Z) Factor	0.9965	0.9961

## Water Compatibility Analysis

Scale precipitation due to incompatibility of mixing different waters is simulated using ScaleSoftPitzer™ (SSP) developed by Rice University Brine Chemistry Consortium. Compatibility simulations between (a) 1<sup>st</sup> Bone Spring (BS) formation water and treated produced water (TPW) from Cedar Canyon Water Treatment Facility (CC WTF), (b) 2<sup>nd</sup> BS formation water and TPW, and (c) 3<sup>rd</sup> BS formation water and TPW were performed. Table 1 shows the water analysis from the 4 waters.

Table 1. Water analysis from 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> BS water and TPW from CC WTF

Cations / Anions (mg/L)	1 <sup>st</sup> BS	2 <sup>nd</sup> BS	3 <sup>rd</sup> BS	CC15 SWD Treatment Facility
Na <sup>+</sup>	62,308	53,400	38,000	46,315
Mg <sup>2+</sup>	360	1,320	767	1,399
Ca <sup>2+</sup>	1,098	9,220	4,970	9,569
Sr <sup>2+</sup>	267	688	1,030	893
Ba <sup>2+</sup>	0.84	1.15	3.45	2.6
Fe <sup>2+</sup>	15.9	40.6	19.1	25.3
Cl <sup>-</sup>	90,167	98,451	74,630	97,632
SO <sub>4</sub> <sup>2-</sup>	531	417	236	389
HCO <sub>3</sub> <sup>-</sup>	561.2	146.4	109.8	119
TDS	155,309	165,620	119,767	157,193
pH	7	7	6.8	5.3

The various waters are input into SSP at different ratios to calculate scaling index (SI) and potential precipitation (ppt) in pound per thousand barrels (ptb). Bottom hole temperature of 122 F and bottom hole pressures of 5,000 psi were used in the modeling. Results are summarized in Tables 2 to 4.

### 1<sup>st</sup> BS + Treated Produced Water:

In general, there is a slight, inherent calcite scaling tendency with the 1<sup>st</sup> BS water itself. The predicted SI is 0.87 as shown in Table 2. Any scaling index above zero indicates a supersaturation condition of the scale. By mixing TPW with the 1<sup>st</sup> BS formation it is observed that the scaling index of calcite became slightly higher first at 25% TPW and 75% 1<sup>st</sup> BS and then becoming smaller as the ratio of TPW increases. However, the maximum, predicted precipitation is less than 50 ptb. Therefore, a slight amount of scale inhibitor is recommended for the injection of the TWP into the 1<sup>st</sup> BS. The exact amount of scale inhibitor can be determined by lab tests. Both Barite and Celestite are not expected to precipitate at all ratios of mixing.

Table 2. Prediction of Scaling Index (SI) and potential precipitation (PPT) of 3 common oilfield scales by mixing the 1<sup>st</sup> BS water and TPW at different ratios

% treated PW	Cypress 33-3H	Calcite		Barite		Celestite	
	% 1st BS	SI	ppt (ptb)	SI	ppt (ptb)	SI	ppt (ptb)
100	0	-1.49	0.0	-0.28	0.0	-0.54	0.0
75	25	0.13	4.2	-0.22	0.0	-0.44	0.0
50	50	0.66	29.8	-0.18	0.0	-0.36	0.0
25	75	0.95	49.1	-0.18	0.0	-0.30	0.0
0	100	0.87	41.8	-0.22	0.0	-0.25	0.0



## Water Compatibility Analysis

### 2<sup>nd</sup> BS + Treated Produced Water:

In general, there is an inherent calcite scaling tendency with the 2<sup>nd</sup> BS water itself. The predicted SI is 1.21 and the predicted precipitation is 18.6 ptb as shown in Table 3. By mixing TPW with the 2<sup>nd</sup> BS formation it is observed that the scaling index of calcite becomes smaller as the ratio of TPW increases. In other words, by injecting TPW we expect a reduction of incompatibility between the two waters. Both Barite and Celestite are not expected to precipitate at all ratios of mixing.

Table 3. Prediction of SI and potential PPT of 3 common oilfield scales by mixing the 2<sup>nd</sup> BS water and TPW at different ratios

% treated PW	CC20-25H % 2nd BS	Calcite		Barite		Celestite	
		SI	ppt (ptb)	SI	ppt (ptb)	SI	ppt (ptb)
100	0	-1.49	0.0	-0.28	0.0	-0.54	0.0
75	25	-0.69	0.0	-0.56	0.0	-0.39	0.0
50	50	-0.15	0.0	-0.55	0.0	-0.26	0.0
25	75	0.43	7.7	-0.54	0.0	-0.15	0.0
0	100	1.21	18.6	-0.53	0.0	-0.05	0.0

### 3<sup>rd</sup> BS + Treated Produced Water:

In general, there is a slight, inherent calcite scaling tendency with the 3<sup>rd</sup> BS water itself. The predicted SI is 0.59 and the predicted precipitation is 8.8 ptb as shown in Table 4. By mixing TPW with the 3<sup>rd</sup> BS formation it is observed that the scaling index of calcite becomes smaller as the ratio of TPW increases. In other words, by injecting TPW we expect a reduction of incompatibility between the two waters. Both Barite and Celestite are not expected to precipitate at all ratios of mixing.

Table 4. Prediction of SI and potential PPT of 3 common oilfield scales by mixing the 3<sup>rd</sup> BS water and TPW at different ratios

% treated PW	CC22-15 32H % 3rd BS	Calcite		Barite		Celestite	
		SI	ppt (ptb)	SI	ppt (ptb)	SI	ppt (ptb)
100	0	-1.49	0.0	-0.28	0.0	-0.54	0.0
75	25	-0.88	0.0	-0.56	0.0	-0.39	0.0
50	50	-0.44	0.0	-0.12	0.0	-0.28	0.0
25	75	0.02	0.3	-0.04	0.0	-0.18	0.0
0	100	0.59	8.8	0.05	0.2	-0.08	0.0



Permian Basin Area Laboratory  
2101 Market Street,  
Midland, Texas 79703

reated produced water  
for Injection  
Upstream Chemicals

REPORT DATE: 2/8/2017

# COMPLETE WATER ANALYSIS REPORT SSP v.2010

CUSTOMER: OXY USA INCORPORATED  
DISTRICT: WATER MANAGEMENT - PERMIAN  
AREA/LEASE: CC  
SAMPLE POINT NAME: CC15SWD  
SITE TYPE: FACILITY  
SAMPLE POINT DESCRIPTION: NOT PROVIDED

ACCOUNT REP: LARRY G HINES  
SAMPLE ID: 201701004772  
SAMPLE DATE: 2/2/2017  
ANALYSIS DATE: 2/8/2017  
ANALYST: JK

## OXY USA INCORPORATED, CC, CC15SWD

FIELD DATA			ANALYSIS OF SAMPLE							
			ANIONS:		mg/L	meq/L	CATIONS:		mg/L	meq/L
Initial Temperature (°F):	250	Chloride (Cl <sup>-</sup> ):	97631.8		2754.1	Sodium (Na <sup>+</sup> ):	46314.8	2015.4		
Final Temperature (°F):	80	Sulfate (SO <sub>4</sub> <sup>2-</sup> ):	389.2		8.1	Potassium (K <sup>+</sup> ):	846.2	21.6		
Initial Pressure (psi):	100	Borate (H <sub>3</sub> BO <sub>3</sub> ):	319.4		5.2	Magnesium (Mg <sup>2+</sup> ):	1399.5	115.2		
Final Pressure (psi):	15	Fluoride (F <sup>-</sup> ):	ND			Calcium (Ca <sup>2+</sup> ):	9568.9	477.5		
		Bromide (Br <sup>-</sup> ):	ND			Strontium (Sr <sup>2+</sup> ):	893.0	20.4		
pH:		Nitrite (NO <sub>2</sub> <sup>-</sup> ):	ND			Barium (Ba <sup>2+</sup> ):	2.6	0.0		
pH at time of sampling:	5.3	Nitrate (NO <sub>3</sub> <sup>-</sup> ):	ND			Iron (Fe <sup>2+</sup> ):	25.3	0.9		
		Phosphate (PO <sub>4</sub> <sup>3-</sup> ):	ND			Manganese (Mn <sup>2+</sup> ):	2.4	0.1		
		Silica (SiO <sub>2</sub> ):	ND			Lead (Pb <sup>2+</sup> ):	0.0	0.0		
						Zinc (Zn <sup>2+</sup> ):	0.0	0.0		
ALKALINITY BY TITRATION:			mg/L	meq/L						
Bicarbonate (HCO <sub>3</sub> <sup>-</sup> ):	119.4		2.0							
Carbonate (CO <sub>3</sub> <sup>2-</sup> ):	ND									
Hydroxide (OH <sup>-</sup> ):	ND									
			ORGANIC ACIDS:		mg/L	meq/L				
aqueous CO <sub>2</sub> (ppm):	ND	Formic Acid:	ND							
aqueous H <sub>2</sub> S (ppm):	ND	Acetic Acid:	ND							
aqueous O <sub>2</sub> (ppb):	ND	Propionic Acid:	ND							
		Butyric Acid:	ND							
		Valeric Acid:	ND							
Calculated TDS (mg/L):	157193									
Density/Specific Gravity (g/cm <sup>3</sup> ):	1.1015									
Measured Specific Gravity	1.1114									
Conductivity (mmhos):	ND									
Resistivity:	ND									
MCF/D:	No Data									
BOPD:	No Data									
BWPD:	No Data									
		Anion/Cation Ratio:		1.04	ND = Not Determined					

SCALE PREDICTIONS BASED ON FIELD PROVIDED DATA: FURTHER MODELING MAY BE REQUIRED FOR VALIDATION OF SCALE PREDICTION RESULTS.

Conditions		Barite (BaSO <sub>4</sub> )		Calcite (CaCO <sub>3</sub> )		Gypsum (CaSO <sub>4</sub> ·2H <sub>2</sub> O)		Anhydrite (CaSO <sub>4</sub> )	
Temp	Press.	Index	Amt (ptb)	Index	Amt (ptb)	Index	Amt (ptb)	Index	Amt (ptb)
80°F	15 psi	0.48	1.023	-0.24	0.000	-0.49	0.000	-0.65	0.000
99°F	24 psi	0.35	0.854	-0.19	0.000	-0.48	0.000	-0.56	0.000
118°F	34 psi	0.24	0.650	-0.12	0.000	-0.47	0.000	-0.46	0.000
137°F	43 psi	0.14	0.415	-0.03	0.000	-0.46	0.000	-0.36	0.000
156°F	53 psi	0.04	0.150	0.06	2.244	-0.45	0.000	-0.26	0.000
174°F	62 psi	-0.04	0.000	0.15	5.282	-0.44	0.000	-0.16	0.000
193°F	72 psi	-0.11	0.000	0.24	8.298	-0.43	0.000	-0.05	0.000
212°F	81 psi	-0.18	0.000	0.34	11.016	-0.43	0.000	0.06	23.450
231°F	91 psi	-0.24	0.000	0.43	13.409	-0.42	0.000	0.17	60.325
250°F	100 psi	-0.29	0.000	0.53	15.533	-0.42	0.000	0.27	88.895

Conditions		Celestite (SrSO <sub>4</sub> )		Halite (NaCl)		Iron Sulfide (FeS)		Iron Carbonate (FeCO <sub>3</sub> )	
Temp	Press.	Index	Amt (ptb)	Index	Amt (ptb)	Index	Amt (ptb)	Index	Amt (ptb)
80°F	15 psi	0.22	82.616	-1.07	0.000	-10.65	0.000	-1.19	0.000
99°F	24 psi	0.24	86.393	-1.08	0.000	-10.71	0.000	-1.09	0.000
118°F	34 psi	0.25	89.399	-1.09	0.000	-10.69	0.000	-0.96	0.000
137°F	43 psi	0.26	92.391	-1.10	0.000	-10.66	0.000	-0.84	0.000
156°F	53 psi	0.27	95.852	-1.11	0.000	-10.61	0.000	-0.74	0.000
174°F	62 psi	0.28	100.037	-1.11	0.000	-10.55	0.000	-0.65	0.000
193°F	72 psi	0.30	105.016	-1.12	0.000	-10.48	0.000	-0.56	0.000
212°F	81 psi	0.32	110.708	-1.12	0.000	-10.41	0.000	-0.48	0.000
231°F	91 psi	0.34	116.922	-1.12	0.000	-10.34	0.000	-0.42	0.000
250°F	100 psi	0.37	123.390	-1.13	0.000	-10.27	0.000	-0.37	0.000

Note 1: When assessing the severity of the scale problem, both the saturation index (SI) and amount of scale must be considered

Note 2: Precipitation of each scale is considered separately. Total scale will be less than the sum of the amounts of the eight (8) scales.

Note 3: Saturation Index predictions on this sheet use pH and alkalinity; %CO<sub>2</sub> is not included in the calculations.

ScaleSoft  
ScaleSoft  
SSP2010

Comments:

W2C3

15/21

1 3/15. S.  
Native Water

# NALCO Champion

An Ecolab Company

## Water Analysis Report

Attention: ljsandmann@ecolab.com

Location Code: 374553

Sample ID: AK17198

Login Batch: 2018-02-05-001\_ACC

Collection Date: 01/29/2018

Receive Date: 02/02/2018

Report Date: 02/07/2018

Customer: OXY USA WTP LP

Region: Carlsbad NM

Location: Cypress 33 Federal Lease

System: Production System

Equipment: Well 003H

Lab ID: ABU-1031

Sample Point: Well Head

Analyses	Result	Unit
Calculated pH	7.00	
Dissolved CO2	270	mg/L
Dissolved H2S	0	mg/L
Gas per Day	169	Mcf/D
Oil per Day	31	B/D
Pressure	500	psi
Temperature	61	° F
Water per Day	37	B/D

Analyses	Result	Unit
Bicarbonate	561.2	mg/L
Conductivity (Calculated)	242645	µS - cm3
Ionic Strength	2.73	
Resistivity	0.041	ohms - m
Specific Gravity	1.110	
Total Dissolved Solids	155309.3	mg/L

Cations	Result	Unit
Iron	15.89	mg/L
Manganese	0.38	mg/L
Barium	0.84	mg/L
Strontium	266.6	mg/L
Calcium	1097.65	mg/L
Magnesium	360.47	mg/L
Sodium	62308.26	mg/L
Potassium	1273.71	mg/L
Boron	13.92	mg/L
Lithium	92.65	mg/L
Copper	0.05	mg/L
Zinc	0.01	mg/L
Lead	0.09	mg/L
Cobalt	0.03	mg/L
Chromium	0.03	mg/L
Silicon	8.07	mg/L
Aluminum	0.05	mg/L
Molybdenum	0.04	mg/L
Phosphorus	0.06	mg/L

Anions	Result	Unit
Bromide	879	mg/L
Chloride	90167	mg/L
Sulfate	531	mg/L

Scaling predictions calculated using Scale Soft Pitzer 2017

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02/12/2018

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L'Am B.S.  
Native Water

# NALCO Champion

An Ecolab Company

## Water Analysis Report

Attention: Ramon.Artalejo@ecolab.com

Location Code: 395860

Sample ID: AL86756

Login Batch: 2018-10-30-001 GC

Collection Date: 10/18/2018

Receive Date: 10/30/2018

Report Date: 10/31/2018

Customer: OXY PERMIAN RES - NEW MEXICO

Region: Delaware Basin

Location: Cedar Canyon 20 Lease

System: Production System

Equipment: Cedar Canyon 20-25H

Lab ID: ABU-1031

Sample Point: Wellhead

Analyses	Result	Unit
Dissolved CO2	400	mg/L
Dissolved H2S	0.1	mg/L
pH	7.0	
Pressure	160	psi
Temperature	54	° F

Analyses	Result	Unit
Bicarbonate	146.4	mg/L
Conductivity (Calculated)	255694	µS - cm3
Ionic Strength	3.14	
Resistivity	0.039	ohms - m
Specific Gravity	1.119	
Total Dissolved Solids	165620	mg/L

Cations	Result	Unit
Iron	40.6	mg/L
Manganese	0.972	mg/L
Barium	1.15	mg/L
Strontium	688	mg/L
Calcium	9220	mg/L
Magnesium	1320	mg/L
Sodium	53400.00	mg/L
Potassium	890	mg/L
Boron	41.8	mg/L
Lithium	29.3	mg/L
Copper	0.042	mg/L
Zinc	0.171	mg/L
Lead	0.128	mg/L
Cobalt	0.022	mg/L
Chromium	0.014	mg/L
Silicon	6.44	mg/L
Aluminum	Not Detected	mg/L
Molybdenum	0.03	mg/L
Phosphorus	Not Detected	mg/L

Anions	Result	Unit
Bromide	964.15	mg/L
Chloride	98451.27	mg/L
Fluoride	2.4470	mg/L
Sulfate	417.39	mg/L

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10/31/2018

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3<sup>rd</sup> B.S.  
Native Water

# NALCO Champion

An Ecolab Company

## Complete Water Analysis Report

Customer: OXY USA WTP LP  
Region: Delaware Basin  
Location: Cedar Canyon 22 Lease  
System: Production System

Equipment: Cedar Canyon 22-15 Fee 32H  
Sample Point: Wellhead  
Sample ID: AL71401  
Acct Rep Email: Ramon.Artalejo@ecolab.com

Collection Date: 10/03/2018  
Receive Date: 10/04/2018  
Report Date: 10/12/2018  
Location Code: 394555

### Field Analysis

Bicarbonate	109.8 mg/L	Dissolved CO2	280 mg/L	Dissolved H2S	8.55 mg/L
Pressure Surface	200 psi	Temperature	83° F	pH of Water	6.8

### Sample Analysis

Calculated Gaseous CO2	0.62 %	Calculated pH	6.80	Conductivity (Calculated)	187104 µS - cm3
Ionic Strength	2.22	Resistivity	0.053 ohms - m	Specific Gravity	1.085
Total Dissolved Solids	119766.6 mg/L				

### Cations

Iron	19.1 mg/L	Manganese	0.899 mg/L	Barium	3.45 mg/L
Strontium	1030 mg/L	Calcium	4970 mg/L	Magnesium	767 mg/L
Sodium	38000.00 mg/L	Potassium	664 mg/L	Boron	87.3 mg/L
Lithium	20.6 mg/L	Copper	0.328 mg/L	Nickel	0.042 mg/L
Zinc	0.396 mg/L	Lead	0.144 mg/L	Cobalt	0.021 mg/L
Chromium	0.004 mg/L	Silicon	10.2 mg/L	Aluminum	Not Detected mg/L
Molybdenum	0.012 mg/L	Phosphorus	0.1 mg/L		

### Anions

Bromide	575.661 mg/L	Chloride	74630 mg/L	Sulfate	236.327 mg/L
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### PTB Value

	Barite PTB	Calcite PTB	Celestite PTB	Gypsum PTB	Halite PTB	Iron Carbonate PTB	Iron Sulfide PTB
50°	1.74	7.35	16.12	0.00	0.00	0.00	7.70
75°	1.81	10.25	17.01	0.00	0.00	0.00	7.70
100°	1.19	12.64	23.75	0.00	0.00	0.00	7.83
125°	0.78	14.64	33.70	0.00	0.00	0.00	8.02
150°	0.29	16.35	45.15	0.00	0.00	0.00	8.25
175°	0.00	17.65	56.88	0.00	0.00	1.84	8.48
200°	0.00	19.20	68.07	0.00	0.00	3.48	8.72
225°	0.00	20.42	78.34	0.00	0.00	4.78	8.95
250°	0.00	21.54	87.50	0.00	0.00	5.76	9.17
275°	0.00	22.59	95.55	0.00	0.00	6.51	9.37
300°	0.00	23.55	102.58	0.00	0.00	7.03	9.55
325°	0.00	24.43	108.73	0.00	0.00	7.35	9.70
350°	0.00	25.22	114.10	0.00	0.00	7.46	9.83
375°	0.00	25.92	118.76	0.00	0.00	7.34	9.93
400°	0.00	26.66	122.72	0.00	0.00	7.76	9.89

### Saturation Index

	Barite SI	Calcite SI	Celestite SI	Gypsum SI	Halite SI	Iron Carbonate SI	Iron Sulfide SI
50°	0.82	0.31	0.06	-0.91	-1.32	-0.78	1.45
75°	0.58	0.44	0.06	-0.93	-1.34	-0.55	1.39
100°	0.38	0.56	0.08	-0.93	-1.35	-0.35	1.37
125°	0.21	0.67	0.12	-0.92	-1.36	-0.17	1.38
150°	0.07	0.78	0.17	-0.91	-1.37	-0.02	1.40
175°	-0.05	0.89	0.23	-0.92	-1.38	0.12	1.44
200°	-0.14	1.00	0.23	-0.94	-1.38	0.24	1.50
225°	-0.22	1.11	0.34	-0.97	-1.38	0.35	1.56
250°	-0.30	1.22	0.40	-1.01	-1.38	0.43	1.64
275°	-0.38	1.33	0.46	-1.05	-1.37	0.50	1.72
300°	-0.42	1.43	0.52	-1.08	-1.37	0.55	1.80
325°	-0.48	1.53	0.57	-1.08	-1.38	0.58	1.88
350°	-0.55	1.63	0.62	-1.04	-1.35	0.58	1.96
375°	-0.62	1.71	0.68	-0.93	-1.33	0.56	2.03
400°	-0.70	1.86	0.72	-0.73	-1.32	0.60	2.16

Scaling predictions calculated using Scale Soft Pitzer 2017

Scaling predictions dependent on provided field data. Incomplete/partial field data may impact results generated by scaling software.

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10/12/2018

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## Part VIII- Geologic Information for Cypress 34 Fed 3H

The Cypress 34 Fed 3H will be injecting into the 1st Bone Spring Sandstone of the Bone Spring Formation. The well has a TVD of approximately 7,949 ft. with a lateral length of approximately 3,300 ft. It will be injecting into a reservoir composed of tight siltstone. Core data indicates that the grain sizes range from coarse siltstone to very-fine-grained subarkose (Folk, 1980) sandstone. Samples show evidence of moderate compaction. Minor amounts of illite and smectite clays are found throughout the samples ranging from 5% to 15%. Cements are Fe-calcite, Fe-dolomite, with some quartz overgrowths. Minor amounts of pyrite (<1%) are present. The resulting reservoir rock has porosity of 8-18% with an average porosity of 11.7%. Permeability measured by injection fall-off tests conducted within the reservoir ranges from 0.02 millidarcies to 0.001 millidarcies.

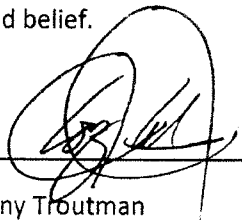
The injection area for this well is bounded by two producing wells in the same reservoir interval that is 300 ft. thick. Low-permeability barriers act as seals above and below the reservoir. These barriers consist of carbonate mudstone, dolomudstone, and shales that are 130 ft. thick above and 455 ft. thick below. Laterally the injection will be primarily contained by the reservoir volume that has been previously and partially depleted by the adjacent producing wells. The tight low-permeability reservoir and the production from the adjacent wells will be the primary constraints on the conformance of the injection to the project area and are expected to contain the injected gas.

The top of the Bone Spring Formation is at 6,826 ft. (log depth) with over 1,660 ft. of carbonate mudstones and shales acting as permeability barriers to upward migration of injected gas. Above that the Delaware Mountain Group consists of connate-water bearing and hydrocarbon-bearing sands, with minor limestone and shale intervals and is 3,700 ft. thick. Above that is the Castile Formation consisting of very low permeability anhydrite, gypsum, and calcite that acts as another 1,500 ft. thick barrier to upward movement of fluids. The Salado overlies the Castile and forms a 1,000 ft. thick barrier of salt. The top of the Salado is at 650 ft. and the deep aquifers found just above the Salado at the base of the Rustler are saline water. The top of Rustler Formation is at 261 ft. The Rustler top is a continuous anhydrite layer that acts as another permeability barrier creating a perched aquifer above it that is the lowest level where fresh water is known in the area. Water wells drilled in the area typically have not reached this depth. Because of the thickness of multiple impermeable rock layers above the injection reservoir there is no possible path for migration upward into freshwater aquifers where they exist.

### Locate freshwater wells within two miles:

An investigation of existing shallow water wells has not found any freshwater wells within a two mile radius of this injector.

I hereby certify that the information presented above is true and correct to the best of my knowledge and belief.

  
\_\_\_\_\_  
Tony Troutman  
Geological Advisor

11/30/2018  
Date

## Part VIII- Geologic Information for Cypress 34 Federal 8H

The Cypress 34 Federal 8H will be injecting into the 2<sup>nd</sup> Bone Spring Sandstone of the Bone Spring Formation. The well has a TVD of approximately 8,910 ft. with a lateral length of approximately 4,163 ft. It will be injecting into a reservoir composed of tight siltstone. Core data indicates that the grain sizes range from coarse siltstone to very-fine-grained subarkose (Folk, 1980) sandstone. Samples show evidence of moderate compaction. Minor amounts of illite and smectite clays are found throughout the samples ranging from 5% to 15%. Cements are Fe-calcite, Fe-dolomite, with some quartz overgrowths. Minor amounts of pyrite (<1%) are present. The resulting reservoir rock has porosity of 8-18% with an average porosity of 11.7%. Permeability measured by injection fall-off tests conducted within the reservoir ranges from 0.02 millidarcies to 0.001 millidarcies.

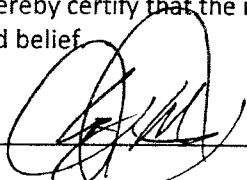
The injection area for this well is bounded by two producing wells in the same reservoir interval that is 320 ft. thick. Low-permeability barriers act as seals above and below the reservoir. These barriers consist of carbonate mudstone and dolomudstone that are 455 ft. thick above and 795 ft. thick below. Laterally the injection will be primarily contained by the reservoir volume that has been previously and partially depleted by the adjacent producing wells. The tight low-permeability reservoir and the production from the adjacent wells will be the primary constraints on the conformance of the injection to the project area and are expected to contain the injected gas.

The top of the Bone Spring Formation is at 6,807 ft. (log depth) with over 2,000 ft. of carbonate mudstones and shales acting as permeability barriers to upward migration of injected gas. Above that the Delaware Mountain Group consists of connate-water bearing and hydrocarbon-bearing sands, with minor limestone and shale intervals and is 3,700 ft. thick. Above that is the Castile Formation consisting of very low permeability anhydrite, gypsum, and calcite that acts as another 1,500 ft. thick barrier to upward movement of fluids. The Salado overlies the Castile and forms a 1,000 ft. thick barrier of salt. The top of the Salado is at 655 ft. and the deep aquifers found just above the Salado at the base of the Rustler are saline water. The top of Rustler Formation is at 551 ft. The Rustler top is a continuous anhydrite layer that acts as another permeability barrier creating a perched aquifer above it that is the lowest level where fresh water is known in the area. Water wells drilled in the area typically have not reached this depth. Because of the thickness of multiple impermeable rock layers above the injection reservoir there is no possible path for migration upward into freshwater aquifers where they exist.

### Locate freshwater wells within two miles:

An investigation of existing shallow water wells has not found any freshwater wells within a two mile radius of this injector.

I hereby certify that the information presented above is true and correct to the best of my knowledge and belief.

  
\_\_\_\_\_  
Tony Troutman  
Geological Advisor

11/30/2018  
Date

**C-108 Injection Application**  
**Item XIII - Proof of Notice**  
**OXY USA Inc.**  
**Cypress 34 Federal 3H and 8H**

New Mexico Oil Conservation Division  
811 S. First St.  
Artesia, NM 88210

New Mexico Oil Conservation Division  
1220 South St. Francis Dr.  
Santa Fe, NM 87505

United State Dept of Interior  
Bureau of Land Management  
620 E. Greene Street  
Carlsbad, NM 88220

Allar Company  
P.O. Box 1567  
Graham, TX 76450

Animas Energy LLC  
P.O. Box 369  
Ignacio, CO 81137

Chesapeake Exploration LLC  
P.O. Box 18496  
Oklahoma City, OK 73154

Chevron Midcontinent LP  
6301 Deauville  
Midland, TX 79706

Chevron USA Inc.  
6301 Deauville  
Midland, TX 79706

Echo Production Inc.  
P.O. Box 1210  
Graham, TX 76450

EOG Y Resources Inc.  
104 S. Fourth Street  
Artesia, NM 88210

EOG A Resources Inc.  
104 S. Fourth Street  
Artesia, NM 88210

EOG M Resources Inc.  
104 S. Fourth Street  
Artesia, NM 88210

Devon Energy Production CO LP  
6100 N. Western  
Oklahoma City, OK 73118

Highland Texas Energy Company  
7557 Rambler Road, Ste 918  
Dallas, TX 75231

Strategic Energy Income Fund IV LP  
2350 North Forest Road  
Getzville, NY 14063

Tap Rock Resources, LLC  
602 Park Point Drive  
Golden, CO 80401

Vision Energy, Inc.  
P.O. Box 2459  
Carlsbad, NM 88221

State of New Mexico  
P.O. Box 1148  
Santa Fe, NM 87504

Mesquite SWD, Inc  
PO Box 1479  
Carlsbad, NM 88221

24/21