



August 29, 2023

Oil Conservation Division
New Mexico Energy, Minerals and
Natural Resources Department
Attn: Million Gebrimichael
1220 S. St. Francis Drive
Santa Fe, NM 87505

Re: **Pretty Lady 30-11-34 #1 SWD (30-045-30922)**

Mr. Gebrimichael,

Agua Moss would like to request an increase in our Maximum Surface Injection Pressure (MSIP) on the Pretty Lady #1 SWD from **1350 psi** to **1435 psi**. Agua Moss recently completed a workover on the well to address a mechanical integrity issue. We ran a 7" liner inside the 9-5/8" casing and cemented it to surface. With the smaller ID of the 7" Liner, we had to downsize our injection string from 5-1/2" to 4-1/2". The request for an increase in the MSIP is based on the additional friction pressure that is generated with the smaller injection string.

A step rate test was performed on the well in 2006 to establish the formation fracture pressure. Surface and bottom hole pressures were obtained during the test and can be used to obtain the friction pressure of the 5-1/2" injection string configuration. The formation fracture pressure obtained was 2980 psi bottom hole. The corresponding surface pressure was 1399 @ 6 bpm. With an average hydrostatic pressure of 1629 psi the friction pressure obtained was 48 psi. To calculate the new friction pressure, the Hazen-Williams correlation was used. The pipe coefficient was calculated to match the actual friction pressure measured during the 2006 step rate test. The calculated coefficient was 94 is very close to the 100 number referenced for steel pipe. The lower coefficient makes sense as the pipe utilized as our injection string is epoxy-lined steel pipe, and the coated is rougher than the bare steel pipe. The injection string utilized during the 2006 step rate test was epoxy-lined steel pipe.

Using the Hazen-Williams Correlation, the friction pressure was calculated with the new downhole configuration. The new friction pressure calculated for the 4-1/2" injection string configuration is 133 psi at 6 bpm, which is an **85 psi net increase in friction**. With the known formation fracture pressure obtained in 2006 of 2980 psi, the new corresponding surface pressure would be 1484 psi. Knowing that our current limit of 1350 psi and the net friction pressure increase of 85 psi, Agua Moss is requesting 1435 psi, which is well under the 1484 psi surface formation fracture pressure.

The calculations mentioned above are shown below and attached as an Excel file for reference.



2023 Pretty Lady #1 Friction Calculations (Hazen-Williams Correlation)

$$F = \frac{2.083 \left(\frac{100}{C} \right)^{1.852} (Q)^{1.852}}{ID^{4.8665}}$$

F: Friction Losses (feet/1000 feet)

C: Pipe Coefficient

Q: Flow Rate (GPM)

ID: Tubing Inside Diameter (inches)

Friction Calculations:

6 bbl/m								
C	Length	OD	ID	Rate gal/m	ft H2O/1000ft	ft H2O	PSI	Sum
Original 2006 Configuration (5-1/2")								
94	3687	5.5"	4.876	252	29.38	108.3	46.96	
94	10.44	6" Locator	4.750	252	33.37	0.3	0.15	
94	10.26	6" Packer SB	6.000	252	10.71	0.1	0.05	
94	0.65	4-1/2" Pump out	3.880	252	89.31	0.1	0.03	
94	17.66	4.5"	4.000	252	77.01	1.4	0.59	47.78
New 2023 Configuration (4-1/2")								
94	3612.94	4.5"	3.942	252	82.68	298.7	129.50	
94	21.88	3-1/2"	2.990	252	317.30	6.9	3.01	
94	2.28	SN (2.81)	2.810	252	429.21	1.0	0.42	
94	1.75	3-1/2" On/Off	3.700	252	112.53	0.2	0.09	
94	0.95	3-1/2" XN	2.580	252	650.30	0.6	0.27	
94	10.44	6" Locator	4.750	252	33.37	0.3	0.15	
94	10.26	6" Packer SB	6.000	252	10.71	0.1	0.05	133.49

Added to the Injection String 2023

Still in wellbore configuration from 2006

C (match 2006 SRT data)

85.71 Net Friction Increase



2023 Pretty Lady #1 Friction Calculations (Hazen-Williams Correlation)

The Hazen-Williams Coefficient was calculated to match the calculated friction to the measured friction pressure of the 2006 SRT for that configuration. The friction pressure was then calculated for the 2023 configuration using 94 as the coefficient. The new surface pressure inflection point was calculated by reference to the 2006 bottom hole formation fracture pressure of 2980 psi.

2006 Step Rate Test		
Avg. Hydrostatic	1629	
Inflection Point	2980	psi BH
Surface Pressure (Inflection Point)	1399	
Average Friction (Measured)	48	psi @ 6 bpm

5-1/2" Operating Parameters		
Surface Inj. Pressure	1320	psi
Surface Inj. Pressure limit	1350	psi

4-1/2" Operating Parameters		
New Friction	133.49	psi @ 6 bpm
New Inflection point (Surface)	1484	psi
Inflection Point Bottomhole	2980	psi BH
New Surface Injection Pressure Limit	1436	psi

Requested MSIP	1435 psi
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Agua Moss is currently operating at approximately 1320 psi and diverting fluid to our Sunco Facility to handle the current volumes being received. By increasing our MSIP we should be able to handle all of the normal Class II volume at the Pretty Lady Facility. The Sunco Facility is primarily for the Class I volume but does serve as backup for Class II when we have a surge in volume. This occurs when new wells are brought online, and we take flow back fluid.

I have attached the pertinent plots from the 2006 step rate test. The dataset for the step rate test and friction calculations are provided as well.

Thank you for your time and consideration. If you have any questions or concerns, please contact me at rdavis@merrion.bz or 505-215-3292.

Sincerely,

Ryan Davis
Operations Manager

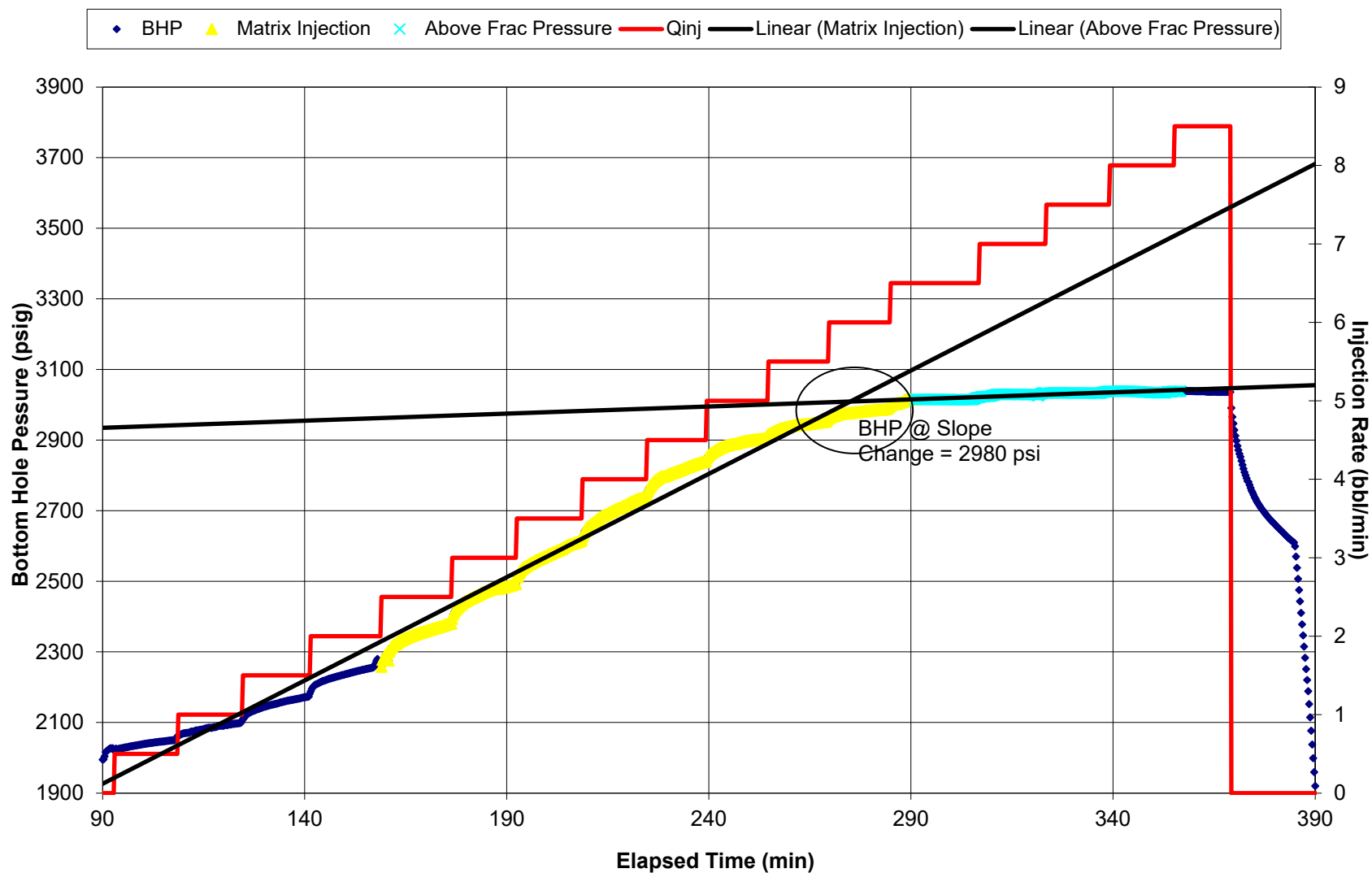


(W) [505-215-3292](tel:505-215-3292)



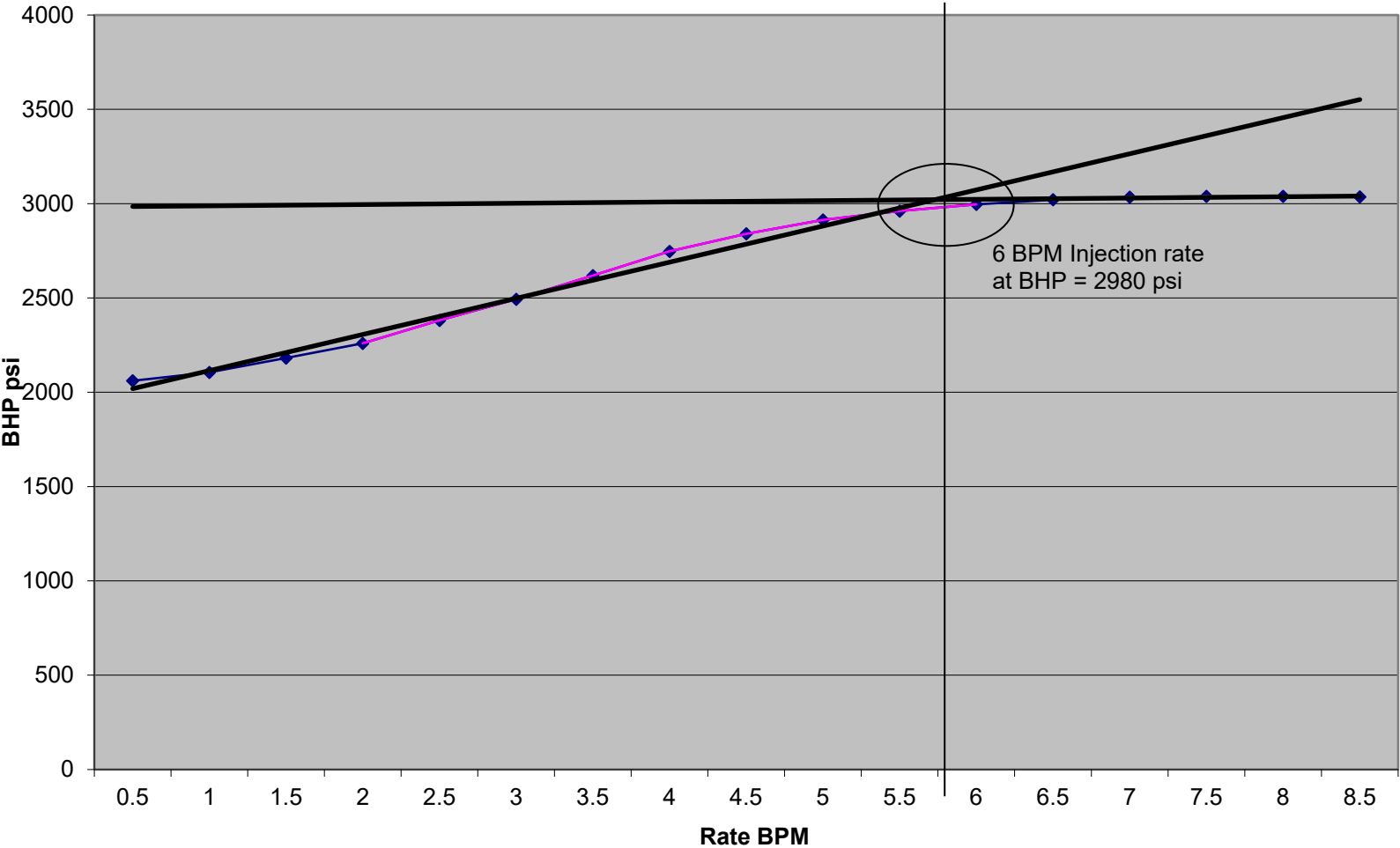
Pretty Lady 30-11-34 #1 Step Rate Test

Chart 1





BHP vs. Rate





2023 Pretty Lady #1 Friction Calculations (Hazen-Williams Correlation)

Material	Hazen-Williams Coefficient
- C -	
Plastic	130 - 150
Polyethylene, PE, PEH	140
Polyvinyl chloride, PVC, CPVC	150
Smooth Pipes	140
Steel new unlined	140 - 150
Steel, corrugated	60
Steel, welded and seamless	100
Steel, interior riveted, no projecting rivets	110
Steel, projecting girth and horizontal rivets	100
Steel, vitrified, spiral-riveted	90 - 110
Steel, welded and seamless	100

$$F = \frac{2.083 \left(\frac{100}{C} \right)^{1.852} (Q)^{1.852}}{ID^{4.8665}}$$

F: Friction Losses (feet/1000 feet)
 C: Pipe Coefficient
 Q: Flow Rate (GPM)
 ID: Tubing Inside Diameter (inches)

Pipe Size	Weight	ID
2-7/8"	10.40#	2.151
3-1/2"	9.3#	2.990
4.5"	13.75#	3.958
5.5"	17#	4.892

Epoxy Coating

8 mils

TK-2

[Fluid Flow Friction Loss - Hazen-Williams Coefficients \(engineeringtoolbox.com\)](http://www.engineeringtoolbox.com)

0.016 inch reduction in ID

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New Surface Injection Pressure Limit	1436 psi

Requested MSIP 1435 psi
PO Box 600 • Farmington, New Mexico 87499 • 505-324-5324

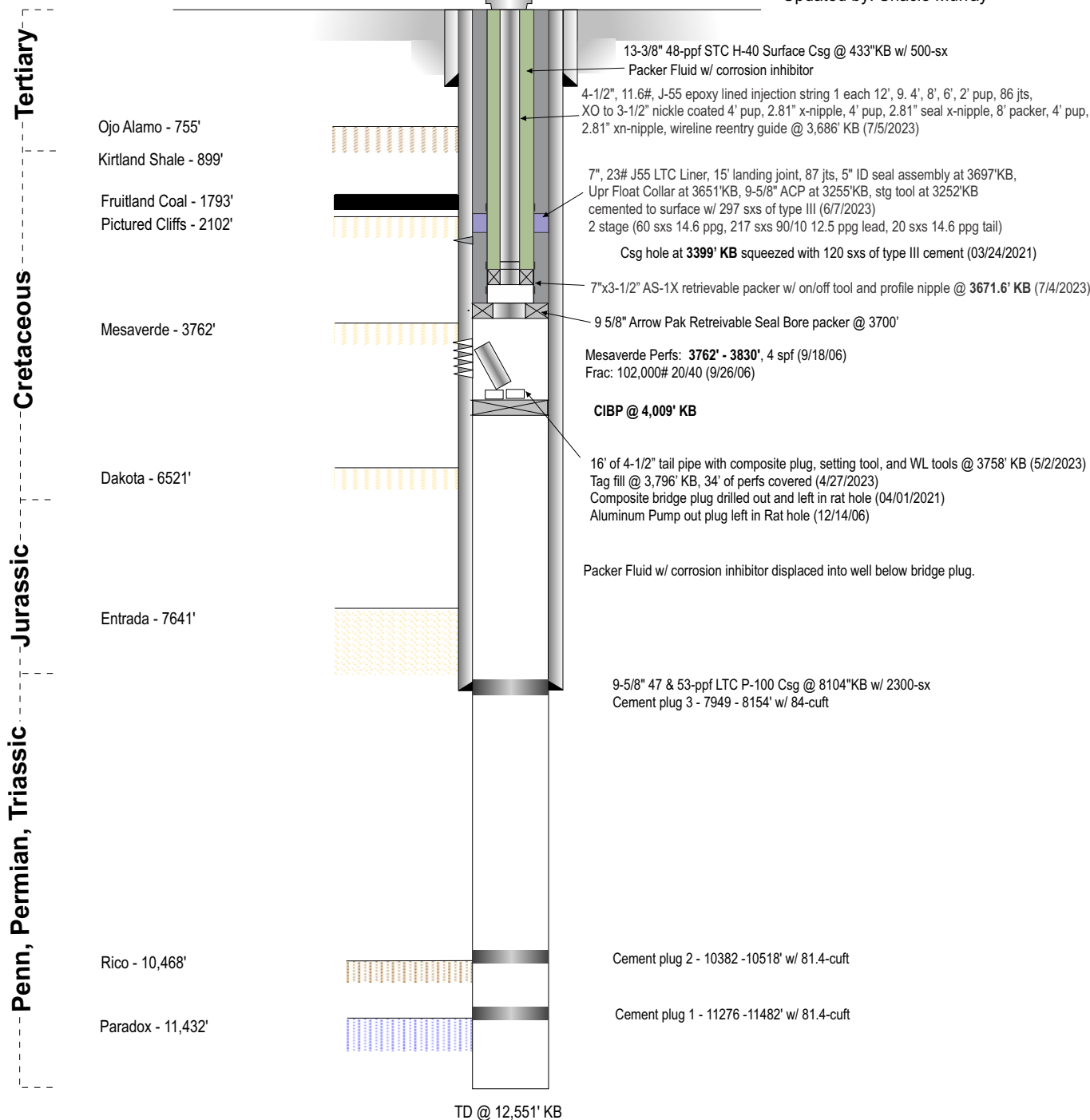
Agua Moss LLC Wellbore Schematic Pretty Lady 30-11-34 Current Wellbore Configuration

Location: 1760' fsl & 1475' fel (nw se)
 Sec 34, T30N, R11W, NMPM
 San Juan Co, New Mexico

Date: July 6th, 2023

Elevation: 5789' GL
 5802' RKB

Injection Zone: Mesaverde
 Prepared by: Connie Dinning
 Updated by: Shacie Murray



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1625 N. French Dr., Hobbs, NM 88240
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State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

CONDITIONS

Action 274664

CONDITIONS

Operator: NEW MEXICO ENERGY MINERALS & NATURAL RESOURCE 1220 S St Francis Dr Santa Fe , NM 87504	OGRID: 264235
	Action Number: 274664
	Action Type: [IM-SD] Admin Order Support Doc (ENG) (IM-AAO)

CONDITIONS

Created By	Condition	Condition Date
pgoetze	None	10/11/2023