564-3100
303-882-7715 – David Richardson
320-

Richardson Operating
Navajo Tribal H -13

San Juan, New Mexico
Sec.13,T29N,R14W
Mesaverde

Step Rate Test

~~February~~ May **22, 2002**

Prepared for: Mr. David Richardson
Owner
Richardson Operating
(303) 830-8000-Denver Office

Prepared by: Mike McNeese
AMERICAN ENERGY SERVICES

Service Point: Farmington
Sales Contact: Mike McNeese

AMERICAN ENERGY SERVICES

GENERAL INFORMATION

Customer :	**Richardson Operating**
Well Name :	**Navajo Tribal H -13**
County, State :	**San Juan, New Mexico**
Note :	**Step Rate Test**
Prepared for :	**Mr. David Richardson**
Customer Title:	**Owner**
Phone No. :	(303) 830-8000-Denver Office
Prepared by :	**Mike McNeese**
Title:	**Technical Sales**
Phone No. :	**(505) 325-4192**
Service point :	Farmington
State :	**New Mexico**
Sales Contact:	**Mike McNeese**
Sales Title:	**Account Manager**
Phone No. :	**(505) 325-4192**
Sec.,T,R	**Sec.13,T29N,R14W**
Field	**Blanco Mesaverde**
Formation:	**Mesaverde**
Date:	**February 22, 2002**
Miles To Loc.:	**10**
No. Units:	**7**

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JOB DATA

Job Type:	**Step Rate Test**		
Treating Conductor:	Tubing		
Est. Pump Rate (bpm):	12.250		
Est. Pressure (psi):	**2,200**	**3,000**	**(max psi)**
Fluid Requirements:			
	Produced Water	**98,438**	**gallons**
	Total Water Required:	**98,438**	**gallons**
Proppant/Diverter Requirements:			
	Total Sand Volume:	**0**	
	(lbs sand/foot pay)	**0**	

WELL DATA

Formation:	**Mesaverde**	
Top Perforation (ft.):	2,490	
Bottom Perforation (ft):	2,520	
Mid Perforation (ft):	2,505	
No. of Perforations:	**60**	**2 jspf**
Perforation Diameter (inches):	0.41	
Frac Height (ft.):	n/a	
Net Pay (ft.):	30	
Fracture Gradient (psi/ft):	0.7500	
Bottomhole Pressure (psi):	n/a	
Bottom Hole Temp (deg. F):	120	
Porosity (%):	n/a	
Permeability (md):	n/a	
Tubing Size:	2 7/8", 6.5#, 0'-2390'	
Casing Size:	4 1/2", 10.5#, 0'-3220' (PBTD)	
Liner Size:	n/a	
Well/Production type:	Salt Water Disposal	

Additional Information: *Produced water will be supplied by the customer.*

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FLUID SPECIFICATIONS

Fluid 1: Produced Water

Fluid 7: Total Water Required:

Chem. Code	*CHEMICAL*	*UOM*	*LOADING PER 1000 GALS.*				
Fluid 1:							
98,438 gls.							98,438 gls.

--- Additional Information ---

Produced water will be furnished by the customer.

2347.84' - packer

Frac Calculations

Tool Set @ 2501'

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INPUT		
Top Perforation (ft.):	**2,490**	
Bottom Perforation (ft):	**2,520**	
Mid Perforation (ft):	**2,505**	
Fracture Gradient (psi/ft):	**0.75**	
Pipe Friction (psi/ft):	560	
No. of Perforations:	**60**	
Perforation Diameter (inches):	**0.41**	
Fluid S.G.	1.000	
Tubing Size:	**2 7/8", 6.5#, 0'-2390'**	
Casing Size:	**4 1/2", 10.5#, 0'-3220' (PBTD)**	
Liner Size:	**n/a**	
Est. Pump Rate (bpm):	**12.25**	
Csg./Tbg Capacity (bbl/ft):	0.00579	0.0238
Flush Volume (gal):	**1,561**	

Definitions:

BHFP = Bottomhole Frac Pressure (psi)

HH = Hydrostatic Head (psi)

PF = Friction Pressure Loss (psi)

PPF = Perforation Friction Pressure (psi)
= {2.93 * (rate/ #perfs)^2 / (perf diameter)^4}
*** specific gravity**

ISDP = Instantaneous Shut Down Pressure
= BHFP - HH

STP = Surface Treating Pressure (psi)
= BHFP - HH + PF + PPF

HHP = Hydraulic horsepower (hhp)
= STP * Rate / 40.8

Calculations:

BHFP =	**1,879**	**psi**
HH =	**1,086**	**psi**
PF =	**1,403**	**psi**
PFP =	**4**	**psi**
ISDP =	**792**	**psi**
STP =	**2,200**	**psi**
HHP =	**660**	

Procedure For Step Rate Test:

1. ***Pump produced water at 0.25 bpm for exactly 15 minutes and record all of the rates and pressure. Use a adjustable choke to pinch back the rate and adjust to the desired rate.***

2. ***Pump produced water at 0.75 bpm for exactly 15 minutes and record all of the rates and pressure. Use a adjustable choke to pinch back the rate and adjust to the desired rate.***

3. ***Pump produced water at 1.25 bpm for exactly 15 minutes and record all of the rates and pressure. Use a adjustable choke to pinch back the rate and adjust to the desired rate.***

4. ***Pump produced water at 1.75 bpm for exactly 15 minutes and record all of the rates and pressure. Use a adjustable choke to pinch back the rate and adjust to the desired rate.***

5. ***Pump produced water at 2.25 bpm for exactly 15 minutes and record all of the rates and pressure. Use a adjustable choke to pinch back the rate and adjust to the desired rate.***

6. ***Pump produced water at 2.75 bpm for exactly 15 minutes and record all of the rates and pressure. Use a adjustable choke to pinch back the rate and adjust to the desired rate.***

7. ***Pump produced water at 3.25 bpm for exactly 15 minutes and record all of the rates and pressure. Use a adjustable choke to pinch back the rate and adjust to the desired rate.***

8. ***Pump produced water at 3.75 bpm for exactly 15 minutes and record all of the rates and pressure. Use a adjustable choke to pinch back the rate and adjust to the desired rate.***

9. ***Pump produced water at 4.25 bpm for exactly 15 minutes and record all of the rates and pressure. Use a adjustable choke to pinch back the rate and adjust to the desired rate.***

10. ***Pump produced water at 4.75 bpm for exactly 15 minutes and record all of the rates and pressure. Use a adjustable choke to pinch back the rate and adjust to the desired rate.***

11. ***Pump produced water at 5.25 bpm for exactly 15 minutes and record all of the rates and pressure.***

12. Pump produced water at 5.75 bpm for exactly 15 minutes and record all of the rates and pressure.

13. Pump produced water at 6.25 bpm for exactly 15 minutes and record all of the rates and pressure.

14. Pump produced water at 6.75 bpm for exactly 15 minutes and record all of the rates and pressure.

15. Pump produced water at 7.25 bpm for exactly 15 minutes and record all of the rates and pressure.

16. Pump produced water at 7.75 bpm for exactly 15 minutes and record all of the rates and pressure.

17. Pump produced water at 8.25 bpm for exactly 15 minutes and record all of the rates and pressure.

18. Pump produced water at 8.75 bpm for exactly 15 minutes and record all of the rates and pressure.

19. Pump produced water at 9.25 bpm for exactly 15 minutes and record all of the rates and pressure.

20. Pump produced water at 9.75 bpm for exactly 15 minutes and record all of the rates and pressure.

21. Pump produced water at 10.25 bpm for exactly 15 minutes and record all of the rates and pressure.

22. Pump produced water at 10.75 bpm for exactly 15 minutes and record all of the rates and pressure.

23. Pump produced water at 11.25 bpm for exactly 15 minutes and record all of the rates and pressure.

24. Pump produced water at 11.75 bpm for exactly 15 minutes and record all of the rates and pressure.

25. Pump produced water at 12.25 bpm for exactly 15 minutes and record all of the rates and pressure.

STP required to fracture the formation =		*1,879*	*psi*	
(based on ISIP from pump-in)	*ISDP =*	*909*	*psi*	
Frac Gradient From ISDP =		0.7500	*psi/ft*	ESTIMATED FROM OFFSET

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Number of tanks Using 360 Usable BBL/Tank: **6.51**

Fluid & Proppant Pumping Schedule

Fluid Type	Fluid Volume (gals)	Conc. (lb/gal)	Totals (lbs)	Proppant Mesh Size	Clean Fluid (bbls)	Volume Cum Clean (bbls)	Slurry Fluid (bbls)	Cum Slurry (bbls)
Produced Water	**158**	0.00	0	Pad	4	4	**4**	4
Produced Water	**473**	0.00	0	0.00	11	15	**11**	15
Produced Water	**788**	0.00	0	0.00	19	34	**19**	34
Produced Water	**1103**	0.00	0	0.00	26	60	**26**	60
Produced Water	**1418**	0.00	0	0.00	34	94	**34**	94
Produced Water	**1733**	0.00	0	0.00	41	135	**41**	135
Produced Water	**2048**	0.00	0	0.00	49	184	**49**	184
Produced Water	**2363**	0.00	0	0.00	56	240	**56**	240
Produced Water	**2678**	0.00	0	0.00	64	304	**64**	304
Produced Water	**2993**	0.00	0	0.00	71	375	**71**	375
Produced Water	**3308**	0.00	0	0.00	79	454	**79**	454
Produced Water	**3623**	0.00	0	0.00	86	540	**86**	540
Produced Water	**3938**	0.00	0	0.00	94	634	**94**	634
Produced Water	**4253**	0.00	0	0.00	101	735	**101**	735
Produced Water	**4568**	0.00	0	0.00	109	844	**109**	844
Produced Water	**4883**	0.00	0	0.00	116	960	**116**	960
Produced Water	**5198**	0.00	0	0.00	124	1084	**124**	1084
Produced Water	**5513**	0.00	0	0.00	131	1215	**131**	1215
Produced Water	**5828**	0.00	0	0.00	139	1354	**139**	1354
Produced Water	**6143**	0.00	0	0.00	146	1500	**146**	1500
Produced Water	**6458**	0.00	0	0.00	154	1654	**154**	1654
Produced Water	**6773**	0.00	0	0.00	161	1815	**161**	1815
Produced Water	**7088**	0.00	0	0.00	169	1984	**169**	1984
Produced Water	**7403**	0.00	0	0.00	176	2160	**176**	2160
Produced Water	**7718**	0.00	0	0.00	184	2344	**184**	2344
Totals	**98438**		**0**		**2344**		**2344**	

Rate Schedule

Fluid Type	Fluid Volume (gals)	Proppant Conc. (lb/gal)	Slurry Rate (bpm)	Clean Fluid Rate (bpm)	Proppant Rate (lbs/min)	Slurry Volume (bbls)	Cum Slurry (bbls)	Pump Time (min)
Produced Water	158	0.00	0.25	0.3	0	4	4	15.00
Produced Water	473	0.00	0.75	0.8	0	11	15	15.00
Produced Water	788	0.00	1.25	1.3	0	19	34	15.00
Produced Water	1103	0.00	1.75	1.8	0	26	60	15.00
Produced Water	1418	0.00	2.25	2.3	0	34	94	15.00
Produced Water	1733	0.00	2.75	2.8	0	41	135	15.00
Produced Water	2048	0.00	3.25	3.3	0	49	184	15.00
Produced Water	2363	0.00	3.75	3.8	0	56	240	15.00
Produced Water	2678	0.00	4.25	4.3	0	64	304	15.00
Produced Water	2993	0.00	4.75	4.8	0	71	375	15.00
Produced Water	3308	0.00	5.25	5.3	0	79	454	15.00
Produced Water	3623	0.00	5.75	5.8	0	86	540	15.00
Produced Water	3938	0.00	6.25	6.3	0	94	634	15.00
Produced Water	4253	0.00	6.75	6.8	0	101	735	15.00
Produced Water	4568	0.00	7.25	7.3	0	109	844	15.00
Produced Water	4883	0.00	7.75	7.8	0	116	960	15.00
Produced Water	5198	0.00	8.25	8.3	0	124	1084	15.00
Produced Water	5513	0.00	8.75	8.8	0	131	1215	15.00
Produced Water	5828	0.00	9.25	9.3	0	139	1354	15.00
Produced Water	6143	0.00	9.75	9.8	0	146	1500	15.00
Produced Water	6458	0.00	10.25	10.3	0	154	1654	15.00
Produced Water	6773	0.00	10.75	10.8	0	161	1815	15.00
Produced Water	7088	0.00	11.25	11.3	0	169	1984	15.00
Produced Water	7403	0.00	11.75	11.8	0	176	2160	15.00
Produced Water	7718	0.00	12.25	12.3	0	184	2344	15.00
					Total Pump Time (min)			**375**
					Total Pump Time (hrs.)			**6.25**

Rex Danny

10.75 bbl/min - Ran out of H_2O @ 1:56pm 03/16

920 - ISIP
490 - 5 min
440 - 10 min
420 - 15 min