

UIC - 1 - 8-0

**MECHANICAL
INTEGRITY TEST
(MITs)**

DATE: _____

Submit 1 Copy To Appropriate District Office

District I - (575) 393-6161
1625 N. French Dr., Hobbs, NM 88240
District II - (575) 748-1283
811 S. First St., Artesia, NM 88210
District III - (505) 334-6178
1000 Rio Brazos Rd., Aztec, NM 87410
District IV - (505) 476-3460
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy, Minerals and Natural Resources

OIL CONSERVATION DIVISION
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-103
Revised July 18, 2013

WELL API NO. 30 - 015 - 26575
5. Indicate Type of Lease STATE <input checked="" type="checkbox"/> <input type="checkbox"/> FEE <input type="checkbox"/>
6. State Oil & Gas Lease No. NM - 0557371

SUNDRY NOTICES AND REPORTS ON WELLS (DO NOT USE THIS FORM FOR PROPOSALS TO DRILL OR TO DEEPEN OR PLUG BACK TO A DIFFERENT RESERVOIR. USE "APPLICATION FOR PERMIT" (FORM C-101) FOR SUCH PROPOSALS.)		7. Lease Name or Unit Agreement Name Gaines - WDW - 3
1. Type of Well: Oil Well <input type="checkbox"/> Gas Well <input type="checkbox"/> Other: Injection Well		8. Well Number WDW - 3
2. Name of Operator HollyFrontier Navaio Refining llc.		9. OGRID Number: 15694
3. Address of Operator P.O. Box 159, Artesia, NM. 88211 ; 501 E. Main, Artesia, NM. 88210		10. Pool name or Wildcat: Navajo Permo-Penn
4. Well Location Unit Letter <u>N</u> : <u>790</u> feet from the <u>SOUTH</u> line and <u>2250</u> feet from the <u>WEST</u> line Section <u>1</u> Township <u>18S</u> Range <u>27E</u> NMPM County: <u>EDDY</u>		
11. Elevation (Show whether DR, RKB, RT, GR, etc.) 3609' GL, RKB		

12. Check Appropriate Box to Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:		SUBSEQUENT REPORT OF:	
PERFORM REMEDIAL WORK <input type="checkbox"/>	PLUG AND ABANDON <input type="checkbox"/>	REMEDIAL WORK <input type="checkbox"/>	ALTERING CASING <input type="checkbox"/>
TEMPORARILY ABANDON <input type="checkbox"/>	CHANGE PLANS <input type="checkbox"/>	COMMENCE DRILLING OPNS. <input type="checkbox"/>	P AND A <input type="checkbox"/>
PULL OR ALTER CASING <input type="checkbox"/>	MULTIPLE COMPL <input type="checkbox"/>	CASING/CEMENT JOB <input type="checkbox"/>	
DOWNHOLE COMMINGLE <input type="checkbox"/>			
CLOSED-LOOP SYSTEM <input type="checkbox"/>			
OTHER: <input type="checkbox"/>		OTHER: <input checked="" type="checkbox"/>	

13. Describe proposed or completed operations. (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). SEE RULE 19.15.7.14 NMAC. For Multiple Completions: Attach wellbore diagram of proposed completion or recompletion.

Aug. 24, 2016; Wednesday, Subsurface personnel travel to Artesia.

Thursday, August 25, 2016

1. Install bottom hole memory gauges in all three wells and continue normal injection for 48 hours. Gauges need to be in wells by 12:00 pm. Install surface pressure recorder on Gaines Well No. 3. Gauges to be set at the top of the perforations in all three wells as follows;
Mewbourne Well No. 1 7924 feet
Chukka Well No. 2 7570 feet
Gaines Well No. 3 7660 feet
Subsurface personnel will return to Houston.

Friday, August 26, 2016

Continue normal injection into the wells.

Saturday, August 27, 2016

1. At 12:00 pm, Navajo personnel will shut-in offset wells, Chukka Well No. 2 and Mewbourne Well No. 1, start the 30-hour injection period for Gaines Well No. 3. The Chukka Well No. 2 and Mewbourne Well No. 1 will have to be isolated at the wing valve, MOV, and at the main pipeline valve.

2. Navajo Refining is to maintain a constant injection rate at approximately 160 GPM into the Gaines Well No. 3 for a minimum of 30 hours prior to shutting in the well. The 30 hours was the agreed upon time interval by the OCD and Navajo in the approved test plan.

3. The rate should be constant at 160 GPM during the 30-hour injection period. This might be best accomplished by opening the pipe line and wellhead valves wide open allowing full flow to the well. Record the rate and wellhead pressure in the control room on a minimum of 15 second intervals during the injection period. Do not exceed 1200 psig wellhead pressure.

4. Plant personnel will record rate, volume, and pressure during the injection period for all wells to confirm that a constant pre-falloff injection rate is maintained.

5. Collect a grab sample of the injection fluid every 10 hours; analyze the fluid for pH and Specific Gravity.

Sunday, August 28, 2016

6. Continue constant injection into Gaines Well No. 3. The offset wells Mewbourne and Chukka will remain shut-in.

7. At 6:00 pm, Navajo personnel will shut in Gaines Well No. 3 for the 30-hour falloff period. Chukka Well No. 2 and Mewbourne Well No. 1 will remain shut-in during the 30-hour falloff period. The Gaines No. 3 will need to be isolated at the wing valve, MOV, and at the main pipeline valve.

Monday, August 29, 2016

8. Continue to monitor pressure falloff in Gaines Well No. 3.

Tuesday, August 30, 2016

9. At 7:00 am, acquire downhole pressure memory gauges from all three wells.

10. Tag bottom of fill and come out of hole very slowly (no faster than 30 feet per minute), making 7-minute gradient stops while coming out of Gaines Well No. 3 every 1000 feet (7000 feet, 6000 feet, 5000 feet, 4000 feet, 3000 feet, 2000 feet, 1000 feet, Surface).

11. Turn well over to Navajo personnel. Subsurface personnel to return to Houston, TX.

This procedure date is subject to change due to weather conditions or Refinery needs.

Spud Date:

Rig Release Date:

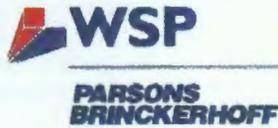
I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNATURE *L R Dade* TITLE: Env. Spec. DATE: 08/23/2016

Type or print name: Lewis R. Dade E-mail address: Lewis.Dade@hollyfrontier.com
PHONE: 575-746-5281

For State Use Only

APPROVED BY: *Core J. Chaves* TITLE Environmental Engineer DATE 8/25/16
Conditions of Approval (if any):



PRESSURE FALLOFF TESTING WORK PLAN

Project No. 50904A

**HOLLY FRONTIER NAVAJO REFINING (NAVAJO)
WDW-3 GAINES
ARTESIA, NEW MEXICO**

Date: 08/23/16

Page: 2 of 2

3. The rate should be constant at 160 GPM during the 30-hour injection period. This might be best accomplished by opening the pipe line and wellhead valves wide open allowing full flow to the well. Record the rate and wellhead pressure in the control room on a minimum of 15 second intervals during the injection period. Do not exceed 1200 psig wellhead pressure.
4. Plant personnel will record rate, volume, and pressure during the injection period for all wells to confirm that a constant pre-falloff injection rate is maintained.
5. Collect a grab sample of the injection fluid every 10 hours; analyze the fluid for pH and Specific Gravity.

Sunday, August 28, 2016

6. Continue constant injection into Gaines Well No. 3. The offset wells Mewbourne and Chukka will remain shut-in.
7. At 6:00 pm, Navajo personnel will shut in Gaines Well No. 3 for the 30-hour falloff period. Chukka Well No. 2 and Mewbourne Well No. 1 will remain shut-in during the 30-hour falloff period. The Gaines No. 3 will need to be isolated at the wing valve, MOV, and at the main pipeline valve.

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11. Turn well over to Navajo personnel. Subsurface personnel to return to Houston, TX.

PREPARED BY
Ted Jose

DATE
8/23/16

REVIEWED BY
Tim Jones

DATE
8/23/16



PRESSURE FALLOFF TESTING WORK PLAN

Project No. 50904A

**HOLLY FRONTIER NAVAJO REFINING (NAVAJO)
WDW-3 GAINES
ARTESIA, NEW MEXICO**

Date: 08/23/16

Page: 1 of 2

INTRODUCTION

The following work plan has been developed to conduct the annual pressure falloff testing on WDW-3 Gaines. The results of the falloff testing will confirm the validity of the reservoir model in the well permit with respect to permeability-thickness.

Note: This procedure follows the guidance in the approved 2012 Falloff Test Plan.

WORK PROGRAM

Wednesday, August 24, 2016

Subsurface personnel to travel to Artesia, NM

Thursday, August 25, 2016

1. Install bottom hole memory gauges in all three wells and continue normal injection for 48 hours. Gauges need to be in wells by 12:00 pm. Install surface pressure recorder on Gaines Well No. 3. Gauges to be set at the top of the perforations in all three wells as follows;

Mewbourne Well No. 1	7924 feet
Chukka Well No. 2	7570 feet
Gaines Well No. 3	7660 feet

Subsurface personnel will return to Houston.

Friday, August 26, 2016

Continue normal injection into the wells.

Saturday, August 27, 2016

1. At 12:00 pm, Navajo personnel will shut-in offset wells, Chukka Well No. 2 and Mewbourne Well No. 1, start the 30-hour injection period for Gaines Well No. 3. The Chukka Well No. 2 and Mewbourne Well No. 1 will have to be isolated at the wing valve, MOV, and at the main pipeline valve.
2. Navajo Refining is to maintain a constant injection rate at approximately 160 GPM into the Gaines Well No. 3 for a minimum of 30 hours prior to shutting in the well. The 30 hours was the agreed upon time interval by the OCD and Navajo in the approved test plan.

PREPARED BY
Ted Jose

DATE
8/23/16

REVIEWED BY
Tim Jones

DATE
8/23/16

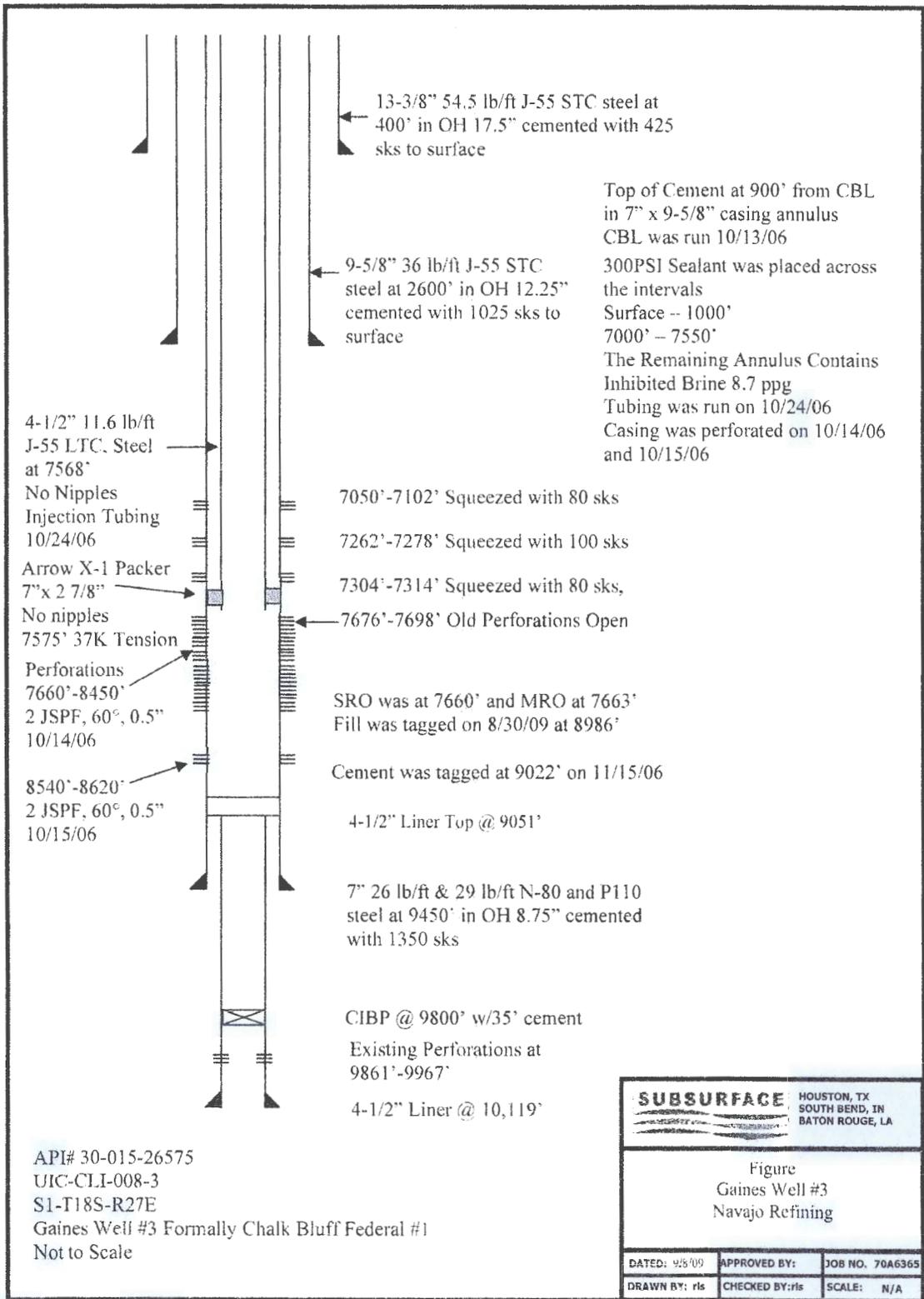


FIGURE 3

Oil Conservation Division, Environmental Bureau
 C/O: Carl Chavez
 1220 South St. Francis Drive
 Santa Fe, New Mexico 87505

BRADENHEAD TEST REPORT
 (Submit 2 copies to above address)

Date of Test 10/15/14 Operator Navajo Refining Co., L.L.C. API #30-0 15-26575

Property Name WDW Well #3 Well No. 3 Location: Unit 0 Section 1 Township 18S Range 27E

Well Status (Shut-In or Producing) Tubing Intermediate Casing Bradenhead

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

TIME	PRESSURES:				BRADENHEAD	INTERMEDIATE
	BRADENHEAD	INTERMEDIATE	CASING		FLOWED	FLOWED
5 minutes	<u>0</u>	<u>0</u>	<u>0</u>	Steady Flow	<u>N/A</u>	<u>NA</u>
10 minutes	<u>N/A</u>		<u>N/A</u>	Surges	<u>N/A</u>	<u>N/A</u>
15 minutes	<u>N/A</u>		<u>N/A</u>	Down to Nothing	<u>Immediately</u>	<u>20 sec gas</u>
20 minutes	<u>N/A</u>		<u>N/A</u>	Nothing	<u>X</u>	<u>N/A</u>
25 minutes	<u>N/A</u>		<u>N/A</u>	Gas	<u>N/A</u>	<u>X</u>
30 minutes	<u>N/A</u>		<u>N/A</u>	Gas & Water	<u>N/A</u>	<u>N/A</u>
				Water	<u>N/A</u>	<u>N/A</u>

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR FRESH SALTY SULFUR BLACK

5 MINUTE SHUT-IN BRADENHEAD 0 INTERMEDIATE 0

REMARKS:

The surface and intermediate Bradenhead valves on WDW-3 were opened one at a time. After an initial discharge of air, the intermediate Bradenhead valve quickly bled to zero pounds of pressure. The surface Bradenhead valve had no release at all.

By *Micki Schultz*
 Environmental Specialist
 (Position)

Witness *Ben Jerry*

E-mail address micki.schultz@hollyfrontier.com

Oil Conservation Division, Environmental Bureau
 C/O: Carl Chavez
 1220 South St. Francis Drive
 Santa Fe, New Mexico 87505

BRADENHEAD TEST REPORT

(Submit 2 copies to above address)

Date of Test 11/12/13 Operator Navajo Refining Co., L.L.C. API #30-0 15-26575

Property Name WDW Well #3 Well No. 3 Location: Unit 0 Section 1 Township 18S Range 27E

Well Status (Shut-In or Producing) Tubing Intermediate Casing Bradenhead

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

TIME	PRESSURES:			BRADENHEAD FLOWED	INTERMEDIATE FLOWED
	BRADENHEAD	INTERMEDIATE	CASING		
5 minutes	0	0	0	Steady Flow	N/A
NA					
10 minutes	N/A		N/A	Surges	N/A
15 minutes	N/A		N/A	Down to Nothing	Immediately
20 minutes	N/A		N/A	Nothing	N/A
25 minutes	N/A		N/A	Gas	X
30 minutes	N/A		N/A	Gas & Water	N/A
				Water	N/A

Handwritten notes in table:
 - Next to 15 minutes: 60 sec gas @ 1/4 open
 - Next to 20 minutes: 20 sec gas

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR FRESH SALTY SULFUR BLACK

5 MINUTE SHUT-IN BRADENHEAD 0 INTERMEDIATE 0

REMARKS:

The surface and intermediate bradenheads on WDW-3 were opened one at a time. After an initial discharge of air, both bradenheads bled to zero pounds of pressure. The intermediate released gas tapering off to nothing within ⁶⁰20 seconds and there was only a "puff" from the surface bradenhead.

By Micki Schultz
 Environmental Specialist
 (Position)

Witness Dyan Dwyer

E-mail address micki.schultz@hollyfrontier.com

Chavez, Carl J, EMNRD

From: Schultz, Michele <Michele.Schultz@hollyfrontier.com>
Sent: Monday, September 17, 2012 2:54 PM
To: Chavez, Carl J, EMNRD
Cc: Holder, Mike; Combs, Robert; Strange, Aaron
Subject: Navajo Q3 Bradenhead test
Attachments: 4752_001.pdf

Carl,

Please see the attached Bradenhead test form dated 9/17/12, for the third quarter of 2012. The test was performed on the Gaines well (WDW-3 UICCL1-008-3 (I-008), API No. 30-015-26575). The current test had similar results to previous tests, as demonstrated in the form.

Please let me know if you have any questions or comments

Micki Schultz, P.E., CHMM
Environmental Specialist, Water and Waste Programs
Navajo Refining Company
575-746-5281 (office)
575-308-2141 (cell)
micki.schultz@hollyfrontier.com

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Oil Conservation Division, Environmental Bureau
 C/O: Carl Chavez
 1220 South St. Francis Drive
 Santa Fe, New Mexico 87505

BRADENHEAD TEST REPORT
 (Submit 2 copies to above address)

Date of Test 9/17/12 Operator Navajo Refining Co., L.L.C. API #30-0 15-26575
 Property Name WDW Well #3 Well No. 3 Location: Unit 0 Section 1 Township 18S Range 27E
 Well Status (Shut-In or Producing) Tubing Intermediate Casing Bradenhead

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

TIME	PRESSURES:			BRADENHEAD FLOWED	INTERMEDIATE FLOWED
	BRADENHEAD	INTERMEDIATE	CASING		
5 minutes	0	0	0	Steady Flow	N/A
<u>NA</u>					
10 minutes	N/A		N/A	Surges	N/A
15 minutes	N/A		N/A	Down to Nothing	Immediately
20 minutes	N/A		N/A	Nothing	N/A
25 minutes	N/A		N/A	Gas	X
30 minutes	N/A		N/A	Gas & Water	N/A
				Water	N/A

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR FRESH SALTY SULFUR BLACK

5 MINUTE SHUT-IN BRADENHEAD 0 INTERMEDIATE 0

REMARKS:

The surface and intermediate bradenheads on WDW-3 were opened one at a time. After an initial discharge of air, both bradenheads bled to zero pounds of pressure. The intermediate released gas tapering off to nothing within 20 seconds and there was only a "puff" from the surface bradenhead.

By Micki Schultz
 Environmental Specialist
 (Position)

Witness Byron Inez

E-mail address micki.schultz@hollyfrontier.com

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Thursday, August 02, 2012 8:06 AM
To: pthompson@merrion.bz; Holder, Mike (Mike.Holder@hollyfrontier.com); Combs, Robert (Robert.Combs@hollyfrontier.com); Schmaltz, Randy (Randy.Schmaltz@wnr.com); Cheryl.Johnson@wnr.com
Cc: Sanchez, Daniel J., EMNRD; VonGonten, Glenn, EMNRD
Subject: UIC Class I (NH) Injection Well Operators (Annual MIT Reminder) Due on/or before September 30, 2012

Dear Sir or Madam:

It is that time of year again to remind operators that their annual MIT for this season must be completed by 9/30/2012. The list of operator names with associated UIC Class I (non-hazardous) Injection Wells are provided above.

Operators are aware of the MIT (30 min @ 300 psig or more MIT with Bradenhead) requirement(s) that are typically run with the Fall-Off Test (FOT). The OCD is currently evaluating the FOT frequency requirement at OCD UIC Class I Facilities in New Mexico and until further notice either specified in a discharge permit renewal and/or via communication, you will know when a FOT is required for your well soon.

Please contact me at (505) 476-3490 on or before June 30, 2012 to schedule your MIT date and time. I will coordinate with the District Staff to finalize the MIT date and time so that an OCD District Office inspector may be present to witness the MIT. Thank you for your cooperation in this matter.

File: UICI- 5, 8, 8-0, 8-1 & 9

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Department
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Drive, Santa Fe, New Mexico 87505
Office: (505) 476-3490
E-mail: CarlJ.Chavez@State.NM.US
Website: <http://www.emnrd.state.nm.us/ocd/>

“Why Not Prevent Pollution; Minimize Waste; Reduce the Cost of Operations; & Move Forward With the Rest of the Nation?” To see how, please go to: “Pollution Prevention & Waste Minimization” at <http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Friday, June 29, 2012 2:07 PM
To: Schultz, Michele (Michele.Schultz@hollyfrontier.com)
Cc: VonGonten, Glenn, EMNRD; Dade, Randy, EMNRD
Subject: FW: Bradenhead test second quarter 2012 (UICI-8-0) UIC Class I (NH) Disposal Well
Quarterly Bradenhead Well Test
Attachments: bradenhead tst 062912.pdf

Michele:

Good afternoon. The New Mexico Oil Conservation Division regards the well test results as a "Pass" from the test performed on the above subject well.

Please contact me if you have questions.

Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Department
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Drive, Santa Fe, New Mexico 87505
Office: (505) 476-3490
E-mail: CarlJ.Chavez@State.NM.US

Website: <http://www.emnrd.state.nm.us/ocd/>

"Why Not Prevent Pollution; Minimize Waste; Reduce the Cost of Operations; & Move Forward With the Rest of the Nation?" To see how, please go to: "Pollution Prevention & Waste Minimization" at <http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>

From: Schultz, Michele [<mailto:Michele.Schultz@hollyfrontier.com>]
Sent: Friday, June 29, 2012 10:13 AM
To: Chavez, Carl J, EMNRD
Subject: Bradenhead test second quarter 2012

Carl,

Please see the attached Bradenhead test form dated 6/29/12, for the second quarter of 2012. The test was performed on the Gaines well (WDW-3 UICCL1-008-3 (I-008), API No. 30-015-26575). The current test had similar results to previous tests, as demonstrated in the form.

Please let me know if you have any questions or comments.

Micki Schultz, P.E., CHMM
Environmental Specialist, Water and Waste Programs
Navajo Refining Company
575-746-5281 (office)
575-308-2141 (cell)
micki.schultz@hollyfrontier.com

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Chavez, Carl J, EMNRD

From: Schultz, Michele <Michele.Schultz@hollyfrontier.com>
Sent: Friday, June 29, 2012 10:13 AM
To: Chavez, Carl J, EMNRD
Subject: Bradenhead test second quarter 2012
Attachments: bradenhead tst 062912.pdf

Carl,

Please see the attached Bradenhead test form dated 6/29/12, for the second quarter of 2012. The test was performed on the Gaines well (WDW-3 UICCL1-008-3 (I-008), API No. 30-015-26575). The current test had similar results to previous tests, as demonstrated in the form.

Please let me know if you have any questions or comments.

Micki Schultz, P.E., CHMM
Environmental Specialist, Water and Waste Programs
Navajo Refining Company
575-746-5281 (office)
575-308-2141 (cell)
micki.schultz@hollyfrontier.com

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Oil Conservation Division, Environmental Bureau
 C/O: Carl Chavez
 1220 South St. Francis Drive
 Santa Fe, New Mexico 87505

BRADENHEAD TEST REPORT
 (Submit 2 copies to above address)

Date of Test 6/29/12 Operator Navajo Refining Co., L.L.C. API #30-0 15-26575

Property Name WDW Well #3 Well No. 3 Location: Unit 0 Section 1 Township 18S Range 27E

Well Status (Shut-In or Producing) Tubing Intermediate Casing Bradenhead

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

TIME	PRESSURES:				BRADENHEAD	INTERMEDIATE
	BRADENHEAD	INTERMEDIATE	CASING		FLOWED	FLOWED
5 minutes	<u>0</u>		<u>0</u>	Steady Flow	<u>N/A</u>	<u>NA</u>
10 minutes	<u>N/A</u>		<u>N/A</u>	Surges	<u>N/A</u>	<u>N/A</u>
15 minutes	<u>N/A</u>		<u>N/A</u>	Down to Nothing	<u>Immediately</u>	<u>20 sec</u>
20 minutes	<u>N/A</u>		<u>N/A</u>	Nothing	<u>N/A</u>	<u>N/A</u>
25 minutes	<u>N/A</u>		<u>N/A</u>	Gas	<u>X</u>	<u>X</u>
30 minutes	<u>N/A</u>		<u>N/A</u>	Gas & Water	<u>N/A</u>	<u>N/A</u>
				Water	<u>N/A</u>	<u>N/A</u>

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR FRESH SALTY SULFUR BLACK

5 MINUTE SHUT-IN BRADENHEAD 0 INTERMEDIATE 0

REMARKS:

The surface and intermediate bradenheads on WDW-3 were opened one at a time. After an initial discharge of air, both bradenheads bled to zero pounds of pressure. The intermediate released gas tapering off to nothing within 20 seconds and there was only a "puff" from the surface bradenhead.

By Micki Schultz
 Environmental Specialist
 (Position)

Witness Robert R. Valverde

E-mail address micki.schultz@hollyfrontier.com

Chavez, Carl J, EMNRD

From: Combs, Robert [Robert.Combs@hollyfrontier.com]
Sent: Thursday, March 29, 2012 4:47 PM
To: Chavez, Carl J, EMNRD
Cc: Schultz, Michele; Lackey, Johnny
Subject: Bradenhead test First quarter 2012
Attachments: OCD Bradenhead Test 032812.pdf

Carl,

Please see the attached Bradenhead test form performed 3/28/12, for the quarter of 2012. The test was performed on the Gaines well (WDW-3 UICCL1-008-3 (I-008), API No. 30-015-26575). The current test had similar results to previous tests, as demonstrated in the form.

Please let me know if you have any questions or comments.

Thanks,
Robert

Robert Combs

Environmental Specialist
The HollyFrontier Companies
P.O. Box 159
Artesia, NM 88211-0159
office: 575-746-5382
cell: 575-308-2718
fax: 575-746-5451
Robert.Combs@hollyfrontier.com

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Oil Conservation Division, Environmental Bureau
 C/O: Carl Chavez
 1220 South St. Francis Drive
 Santa Fe, New Mexico 87505

BRADENHEAD TEST REPORT
 (Submit 2 copies to above address)

Date of Test 3/27/12 Operator Navajo Refining Co., L.L.C. API #30-0 15-26575

Property Name WDW Well #3 Well No. 3 Location: Unit 0 Section 1 Township 185 Range 27E

Well Status (Shut-In or Producing) Tubing Intermediate Casing Bradenhead

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

TIME	PRESSURES:				BRADENHEAD	INTERMEDIATE
	BRADENHEAD	INTERMEDIATE	CASING		FLOWED	FLOWED
5 minutes	0		0	Steady Flow	N/A	40 sec
10 minutes	N/A		N/A	Surges	N/A	N/A
15 minutes	N/A		N/A	Down to Nothing	Immediately	50 sec
20 minutes	N/A		N/A	Nothing	N/A	N/A
25 minutes	N/A		N/A	Gas	X	X
30 minutes	N/A		N/A	Gas & Water	N/A	N/A
				Water	N/A	N/A

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR FRESH SALTY SULFUR BLACK

5 MINUTE SHUT-IN BRADENHEAD 0 INTERMEDIATE 0

REMARKS:

The surface and intermediate bradenheads on WDW-3 were opened one at a time. After an initial discharge of air, both bradenheads bled to zero pounds of pressure. The intermediate released gas steadily for ~40 seconds and stopped within 50 seconds; there was only a "puff" from the surface bradenhead.

By *Robert Combs*
 Environmental Specialist
 (Position)

Witness *Micki Schuelz, P.E.*

E-mail address robert.combs@hollyfrontier.com

Chavez, Carl J, EMNRD

From: Moore, Darrell [Darrell.Moore@hollyfrontier.com]
Sent: Thursday, December 29, 2011 9:58 AM
To: Chavez, Carl J, EMNRD
Subject: Qrtly Bradenhead
Attachments: December Bradenhead

Carl

Attached, please find the qrtly bradenhead for the Gaines Injection Well.

Darrell Moore
Environmental Manager for Water and Waste
The Holly Frontier Companies
Navajo Refining Company, LLC
501 E Main
PO Box 159
Artesia NM 88211-0159
Phone: 575-746-5281
Cell: 575-703-5058

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Chavez, Carl J, EMNRD

From: Moore, Darrell [Darrell.Moore@hollyfrontier.com]
Sent: Friday, October 21, 2011 9:06 AM
To: Chavez, Carl J, EMNRD
Subject: Qtrly Bradenhead
Attachments: 2603_001.pdf

Carl

Attached is the Qtrly bradenhead on the Gaines Well.

Darrell Moore
Environmental Manager for Water and Waste
The Holly Frontier Companies
Navajo Refining Company, LLC
501 E Main
PO Box 159
Artesia NM 88211-0159
Phone: 575-746-5281
Cell: 575-703-5058

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Chavez, Carl J, EMNRD

From: Moore, Darrell [Darrell.Moore@hollycorp.com]
Sent: Wednesday, June 29, 2011 2:51 PM
To: Chavez, Carl J, EMNRD
Subject: June Bradenhead
Attachments: Bradenhead.pdf

Carl

Attached, please find the quarterly bradenhead report for our WDW-3

Darrell Moore
Environmental Manager for Water and Waste
Navajo Refining Company, LLC
Phone Number 575-746-5281
Cell Number 575-703-5058
Fax Number 575-746-5451

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Oil Conservation Division, Environmental Bureau
 C/O: Carl Chavez
 1220 South St. Francis Drive
 Santa Fe, New Mexico 87505

BRADENHEAD TEST REPORT

Date of Test June 29, 2011 Operator Navajo Refining API #30-015-26575
 Property Name WDW Well No 3 Location: Unit O Section 1 Township 18S Range 27E
 Well Status (Shut-In or Producing) Tubing___ Intermediate___ Casing___ Bradenhead___

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

TIME	PRESSURES:				BRADENHEAD FLOWED	INTERMEDIATE FLOWED
	BRADENHEAD	INTERMEDIATE	CASING			
5 minutes	0	0		Steady Flow	NA	NA
10 minutes	NA	NA		Surges	NA	NA
15 minutes	NA	NA		Down to Nothing	Immediately	Immediately
20 minutes	NA	NA		Nothing	X	X
25 minutes	NA	NA		Gas	NA	NA
30 minutes	NA	NA		Gas & Water	NA	NA
				Water	NA	NA

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR___ FRESH___ SALTY___ SULFUR___ BLACK___

5 MINUTE SHUT-IN: BRADENHEAD 0 INTERMEDIATE 0

REMARKS:

The surface and intermediate bradenheads on the well were opened one at a time. After an initial puff of air, both bradenheads bled down to zero pressure immediately.

By Darrell Moore  Witness

Env. Mgr. for Water and Waste Navajo Refining
 (Position)

E-mail address Darrell.moore@hollycorp.com

Chavez, Carl J, EMNRD

From: Moore, Darrell [Darrell.Moore@hollycorp.com]
Sent: Wednesday, April 20, 2011 3:55 PM
To: Chavez, Carl J, EMNRD; Dade, Randy, EMNRD
Subject: 1st Quarter Bradenhead Test
Attachments: OCD BRADENHEADTEST Form (9).doc

Gentlemen

Attached, please find the Bradenhead form for our WDW-3 (Gaines Well). This well is tested quarterly due to a small leak in antifreeze from the Well Annulus Measurement System (WAMS) tanks.

Darrell Moore
Environmental Manager for Water and Waste
Navajo Refining Company, LLC
Phone Number 575-746-5281
Cell Number 575-703-5058
Fax Number 575-746-5451

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Oil Conservation Division, Environmental Bureau
 C/O: Carl Chavez
 1220 South St. Francis Drive
 Santa Fe, New Mexico 87505

BRADENHEAD TEST REPORT

Date of Test March 18, 2011 Operator Navajo Refining API #30-015-26575
 Property Name WDW Well No 3 Location: Unit O Section 1 Township 18S Range 27E
 Well Status (Shut-In or Producing) Tubing____ Intermediate____ Casing____ Bradenhead____

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

TIME	PRESSURES:				BRADENHEAD	INTERMEDIATE
	BRADENHEAD	INTERMEDIATE	CASING		FLOWED	FLOWED
5 minutes	0	0		Steady Flow	NA	NA
10 minutes	NA	NA		Surges	NA	NA
15 minutes	NA	NA		Down to Nothing	Immediately	Immediately
20 minutes	NA	NA		Nothing	X	X
25 minutes	NA	NA		Gas	NA	NA
30 minutes	NA	NA		Gas & Water	NA	NA
				Water	NA	NA

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR____ FRESH____ SALTY____ SULFUR____ BLACK____

5 MINUTE SHUT-IN BRADENHEAD 0 INTERMEDIATE 0

REMARKS:

The surface and intermediate bradenheads were opened one at a time. There was a puff of air out of each but no sustained pressure. There was no flow.

By Darrell Moore

Witness

Env. Mgr. for Water and Waste Navajo Refining
 (Position)

E-mail address Darrell.moore@hollycorp.com

Oil Conservation Division, Environmental Bureau
 C/O: Carl Chavez
 1220 South St. Francis Drive
 Santa Fe, New Mexico 87505

BRADENHEAD TEST REPORT
 (Submit 2 copies to above address)

Date of Test December 16, 2010 Operator Navajo Refining API #30-015-26575
 Property Name WDW Well No 3 Location: Unit O Section 1 Township 18S Range 27E
 Well Status (Shut-In or Producing) Tubing____ Intermediate____ Casing____ Bradenhead____

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

TIME	PRESSURES:				BRADENHEAD	INTERMEDIATE
	BRADENHEAD	INTERMEDIATE	CASING		FLOWED	FLOWED
5 minutes	0	0		Steady Flow	NA	NA
10 minutes	NA	NA		Surges	NA	NA
15 minutes	NA	NA		Down to Nothing	Immediately	Immediately
20 minutes	NA	NA		Nothing	X	X
25 minutes	NA	NA		Gas	NA	NA
30 minutes	NA	NA		Gas & Water	NA	NA
				Water	NA	NA

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR____ FRESH____ SALTY____ SULFUR____ BLACK____

5 MINUTE SHUT-IN BRADENHEAD 0 INTERMEDIATE 0

REMARKS:

We opened the surface and intermediate bradenheads one at a time. There was a puff of air out of each but that quickly went to nothing. There was no flow. No sustained pressure.

By Darrell Moore  Witness

Env. Mgr. for Water and Waste Navajo Refining
 (Position)

E-mail address Darrell.moore@hollycorp.com

Oil Conservation Division, Environmental Bureau
 C/O: Carl Chavez
 1220 South St. Francis Drive
 Santa Fe, New Mexico 87505

BRADENHEAD TEST REPORT
 (Submit 2 copies to above address)

Date of Test September 14, 2010 Operator Navajo Refining API #30-015-26575

Property Name WDW Well No 3 Location: Unit O Section 1 Township 18S Range 27E

Well Status (Shut-In or Producing) Tubing____ Intermediate____ Casing____ Bradenhead____

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

TIME	PRESSURES:				BRADENHEAD FLOWED	INTERMEDIATE FLOWED
	BRADENHEAD	INTERMEDIATE	CASING			
5 minutes	0	0		Steady Flow	NA	NA
10 minutes	NA	NA		Surges	NA	NA
15 minutes	NA	NA		Down to Nothing	Immediately	Immediately
20 minutes	NA	NA		Nothing	X	X
25 minutes	NA	NA		Gas	NA	NA
30 minutes	NA	NA		Gas & Water	NA	NA
				Water	NA	NA

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR____ FRESH____ SALTY____ SULFUR____ BLACK____

5 MINUTE SHUT-IN BRADENHEAD 0 INTERMEDIATE 0

REMARKS:

Both the surface and intermediate bradenheads were opened. Each had a puff of air and then nothing.No flow. No Pressure.

By Darrell Moore  Witness

Env. Mgr. for Water and Waste Navajo Refining
 (Position)

E-mail address Darrell.moore@hollycorp.com

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Tuesday, July 06, 2010 9:04 AM
To: 'Moore, Darrell'
Subject: RE: Sewer Testing

Darrell:

Thanks for the notification.

Also, the OCD needs Navajo to complete the quarterly Bradenhead information on the form provided to you last week for our records. Let me know if you have any questions. Staff in Artesia questioned the 30 minutes in the form, and I determine that Navajo just needs to use the form to document compliance with our quarterly Bradenhead testing requirement for WDW-3. The MITs for Class I Wells need to be completed by 9/30/2010 along with Annual Fall-Off Test. OCD can use the MIT pressure chart for WDW-3 to satisfy the MIT requirement this season.

Please contact me if you have questions. Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>
(Pollution Prevention Guidance is under "Publications")

From: Moore, Darrell [<mailto:Darrell.Moore@hollycorp.com>]
Sent: Tuesday, July 06, 2010 7:24 AM
To: Chavez, Carl J, EMNRD
Subject: Sewer Testing

Carl

We will be testing sewers in the Vacuum Unit at the Artesia Refinery on Friday July 9, 2010 starting at 8 am. If OCD would like to witness let me know.

Darrell Moore
Environmental Manager for Water and Waste
Navajo Refining Company, LLC
Phone Number 575-746-5281
Cell Number 575-703-5058
Fax Number 575-746-5451

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Oil Conservation Division, Environmental Bureau
 C/O: Carl Chavez
 1220 South St. Francis Drive
 Santa Fe, New Mexico 87505

BRADENHEAD TEST REPORT
 (Submit 2 copies to above address)

Date of Test June 30, 2010 Operator Navajo Refining API #30-015-26575

Property Name WDW Well No. 3 Location: Unit 0 Section 1 Township 185 Range 27e
Injecting

Well Status (Shut-In or Producing) Tubing Intermediate Casing Bradenhead

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

TIME	PRESSURES:			BRADENHEAD FLOWED	INTERMEDIATE FLOWED
	BRADENHEAD	INTERMEDIATE	CASING		
5 minutes	<u>0</u>	<u>0</u>		Steady Flow <u>N/A</u>	<u>N/A</u>
10 minutes	<u>N/A</u>	<u>N/A</u>		Surges <u>N/A</u>	<u>N/A</u>
15 minutes	<u>N/A</u>	<u>N/A</u>		Down to Nothing <u>immediately</u>	<u>immediately</u>
20 minutes	<u>N/A</u>	<u>N/A</u>		Nothing <u>X</u>	<u>X</u>
25 minutes	<u>N/A</u>	<u>N/A</u>		Gas <u>N/A</u>	<u>N/A</u>
30 minutes	<u>N/A</u>	<u>N/A</u>		Gas & Water <u>N/A</u>	<u>N/A</u>
				Water <u>N/A</u>	<u>N/A</u>

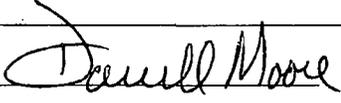
If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR FRESH SALTY SULFUR BLACK

5 MINUTE SHUT-IN BRADENHEAD 0 INTERMEDIATE 0

REMARKS:

Both the surface and intermediate bradenheads were opened one at a time. Both
had a puff of air upon opening the valve (from heat build-up) and then nothing.
No flow. No pressure.

By Darrell Moore  Witness

Env. Mgr. for Water & Waste Navajo Refining
 (Position)

E-mail address darrell.moore@hollycorp.com

Chavez, Carl J, EMNRD

From: Moore, Darrell [Darrell.Moore@hollycorp.com]
Sent: Wednesday, June 30, 2010 1:47 PM
To: Chavez, Carl J, EMNRD; Dade, Randy, EMNRD
Subject: FW:
Attachments: WDW-3.pdf

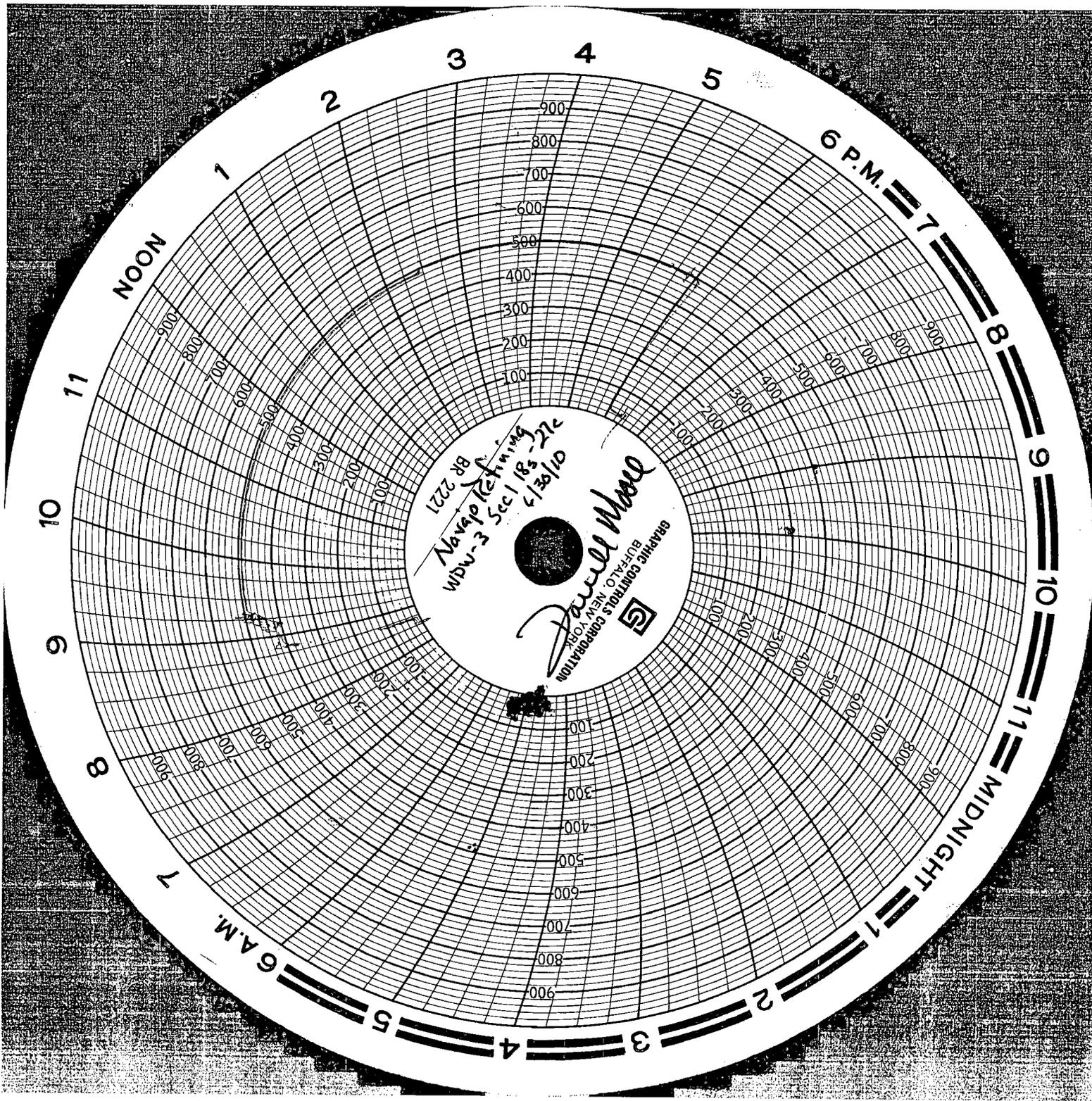
Gentlemen,

Attached, please find the quarterly MIT for Navajo's WDW-3 Injection well located in Sec 1, 18 south 27 east. If there are any questions concerning this submission, please call me at 575-746-5281.

From: Hernandez, Carrie
Sent: Wednesday, June 30, 2010 1:44 PM
To: Moore, Darrell
Subject:

Carrie Hernandez
Environmental Administrative Assistant
Navajo Refining Co. LLC
Direct Line 575-748-6733
Direct Fax 575-746-5451
Life is a Journey. Roll down the Windows and Enjoy the Breeze

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01/18/51
5818-27c
Navigation
BR 2221
WDW-3

Dawell Wood
GRAPHIC CONTROLS CORPORATION
BUFFALO, NEW YORK



Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Friday, July 02, 2010 2:00 PM
To: 'Moore, Darrell'
Cc: Gray, Darold, EMNRD
Subject: FW: UICI-8-0 Gaines Well (WDW-3) Quarterly Bradenhead MITs CLASS I (NH) Disposal Well
Attachments: OCD BRADENHEADTEST Form.doc

Darrell:

Please find attached a Bradenhead form to complete the Quarterly. Bradenhead Inspection.

Please contact me if you have questions. Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/oed/index.htm>
(Pollution Prevention Guidance is under "Publications")

CC: OCD Online UIC-8-0 WDW-3 "MITs" Thumbnail

From: Chavez, Carl J, EMNRD
Sent: Thursday, July 01, 2010 4:43 PM
To: 'Moore, Darrell'
Cc: Gray, Darold, EMNRD
Subject: FW: UICI-8-0 Gaines Well (WDW-3) Quarterly Bradenhead MITs CLASS I (NH) Disposal Well

Darrell:

Please provide OCD with documentation from the recent Bradenhead for the OCD Admin. File. Thank you sir.
☺

Please contact me if you think we still need to discuss.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/oed/index.htm>
(Pollution Prevention Guidance is under "Publications")

From: Gray, Darold, EMNRD
Sent: Thursday, July 01, 2010 3:03 PM
To: Chavez, Carl J, EMNRD
Subject: RE: UICI-8-0 Gaines Well (WDW-3) Quarterly Bradenhead MITs CLASS I (NH) Disposal Well

Richard is in communication with Darrell Moore concerning this situation. He will provide him with all of the information that is needed.

From: Chavez, Carl J, EMNRD
Sent: Thursday, July 01, 2010 2:56 PM
To: Gray, Darold, EMNRD
Subject: RE: UICI-8-0 Gaines Well (WDW-3) Quarterly Bradenhead MITs CLASS I (NH) Disposal Well

Darold:

Hi. Well, we have this operator performing quarterly Bradenhead testing due to a small leak in their annulus fluid monitoring vessel at surface. OCD required quarterly bradenheads. So now, they went out and did a bradenhead and a annulus test, but give not details on the field data from a bradenhead test.

Could you or Richard Inge provide me with anything that would help this operator document a Bradenhead Test? I think I may have something on it in the OCD Training Folder, but doubt it.

Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/oed/index.htm>
(Pollution Prevention Guidance is under "Publications")

From: Gray, Darold, EMNRD
Sent: Thursday, July 01, 2010 2:24 PM
To: Chavez, Carl J, EMNRD
Subject: RE: UICI-8-0 Gaines Well (WDW-3) Quarterly Bradenhead MITs

Carl,

We don't use a form other than what is in RBDMS to report bradenhead tests. For MIT tests, the clock on the chart should be set for 1 hr. The pressure will actually be held for 30 minutes. If they will give a 24 hr. notice, we will have someone there to witness the tests.

The bradenhead, and MIT's are actually 2 separate tests. A truck IS needed to perform MIT. NO truck is needed for bradenhead tests, and you don't run a chart on these. As far as an operator reporting the test, that is usually done on a form C-103, and OCD usually retains the original chart if the test passed.

From: Chavez, Carl J, EMNRD
Sent: Thursday, July 01, 2010 2:09 PM
To: Moore, Darrell
Cc: Dade, Randy, EMNRD; Gray, Darold, EMNRD; Inge, Richard, EMNRD
Subject: RE: UICI-8-0 Gaines Well (WDW-3) Quarterly Bradenhead MITs

Darrell:

I'm tied up this afternoon. How about tomorrow morning. In OCD's RDMS System we have basic info. that must be entered for the Bradenhead MIT. I'm copying OCD Field Staff in the event they can provide a basic form they use to capture this test and for compliance with the recent WDW-3 Quarterly Bradenhead MIT requirement on the well.

I'm available from 10:30 to Noon, and 1 to 5 p.m. Let me know.... Thanks.

Carl J. Chavez, CHMM

New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>
(Pollution Prevention Guidance is under "Publications")

From: Moore, Darrell [<mailto:Darrell.Moore@hollycorp.com>]
Sent: Thursday, July 01, 2010 9:57 AM
To: Chavez, Carl J, EMNRD
Cc: Dade, Randy, EMNRD
Subject: RE: UICI-8-0 Gaines Well (WDW-3) Quarterly Bradenhead MITs

Carl

The annulus test was run over about 45 minutes...not hours. The chart clock can be set on hours or minutes. For a 30 minute test we set it on minutes...therefore, each division is 5 minutes. Both bradenheads were then opened to check for leaks. They both had small amounts of pressure on them (probably from heat) then bled off to nothing in a matter of seconds. So there are obviously no leaks in the bradenheads. The annulus test (chart) also shows no leaks.

I can call you to discuss. Are you free at 2 oclock today?

From: Chavez, Carl J, EMNRD [<mailto:CarlJ.Chavez@state.nm.us>]
Sent: Thursday, July 01, 2010 9:35 AM
To: Moore, Darrell
Cc: Dade, Randy, EMNRD
Subject: RE: UICI-8-0 Gaines Well (WDW-3) Quarterly Bradenhead MITs

Darrell:

Navajo Refining Company is supposed to be performing quarterly Bradenhead MITs on the above subject well. The chart reflects an annulus test over several hours...

Please call to discuss. Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>
(Pollution Prevention Guidance is under "Publications")

From: Moore, Darrell [<mailto:Darrell.Moore@hollycorp.com>]
Sent: Wednesday, June 30, 2010 1:47 PM
To: Chavez, Carl J, EMNRD; Dade, Randy, EMNRD
Subject: FW:

Gentlemen,

Attached, please find the quarterly MIT for Navajo's WDW-3 Injection well located in Sec 1, 18 south 27 east. If there are any questions concerning this submission, please call me at 575-746-5281.

From: Hernandez, Carrie
Sent: Wednesday, June 30, 2010 1:44 PM
To: Moore, Darrell
Subject:

Carrie Hernandez
Environmental Administrative Assistant
Navajo Refining Co. LLC
Direct Line 575-748-6733
Direct Fax 575-746-5451
Life is a Journey. Roll down the Windows and Enjoy the Breeze

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Oil Conservation Division, Environmental Bureau
 C/O: Carl Chavez
 1220 South St. Francis Drive
 Santa Fe, New Mexico 87505

BRADENHEAD TEST REPORT

(Submit 2 copies to above address)

Date of Test _____ Operator _____ API #30-0 _____

Property Name _____ Well No. _____ Location: Unit _____ Section _____ Township _____ Range _____

Well Status (Shut-In or Producing) Tubing _____ Intermediate _____ Casing _____ Bradenhead _____

OPEN BRADENHEAD AND INTERMEDIATE TO ATMOSPHERE INDIVIDUALLY FOR 15 MINUTES EACH

TIME	PRESSURES:			BRADENHEAD FLOWED	INTERMEDIATE FLOWED
	BRADENHEAD	INTERMEDIATE	CASING		
5 minutes				Steady Flow	
10 minutes				Surges	
15 minutes				Down to Nothing	
20 minutes				Nothing	
25 minutes				Gas	
30 minutes				Gas & Water	
				Water	

If bradenhead flowed water, check all of the descriptions that apply below:

CLEAR _____ FRESH _____ SALTY _____ SULFUR _____ BLACK _____

5 MINUTE SHUT-IN BRADENHEAD _____ INTERMEDIATE _____

REMARKS:

By _____ Witness _____

(Position)

E-mail address _____

Chavez, Carl J, EMNRD

From: Moore, Darrell [Darrell.Moore@hollycorp.com]
Sent: Wednesday, June 30, 2010 1:47 PM
To: Chavez, Carl J, EMNRD; Dade, Randy, EMNRD
Subject: FW:
Attachments: WDW-3.pdf

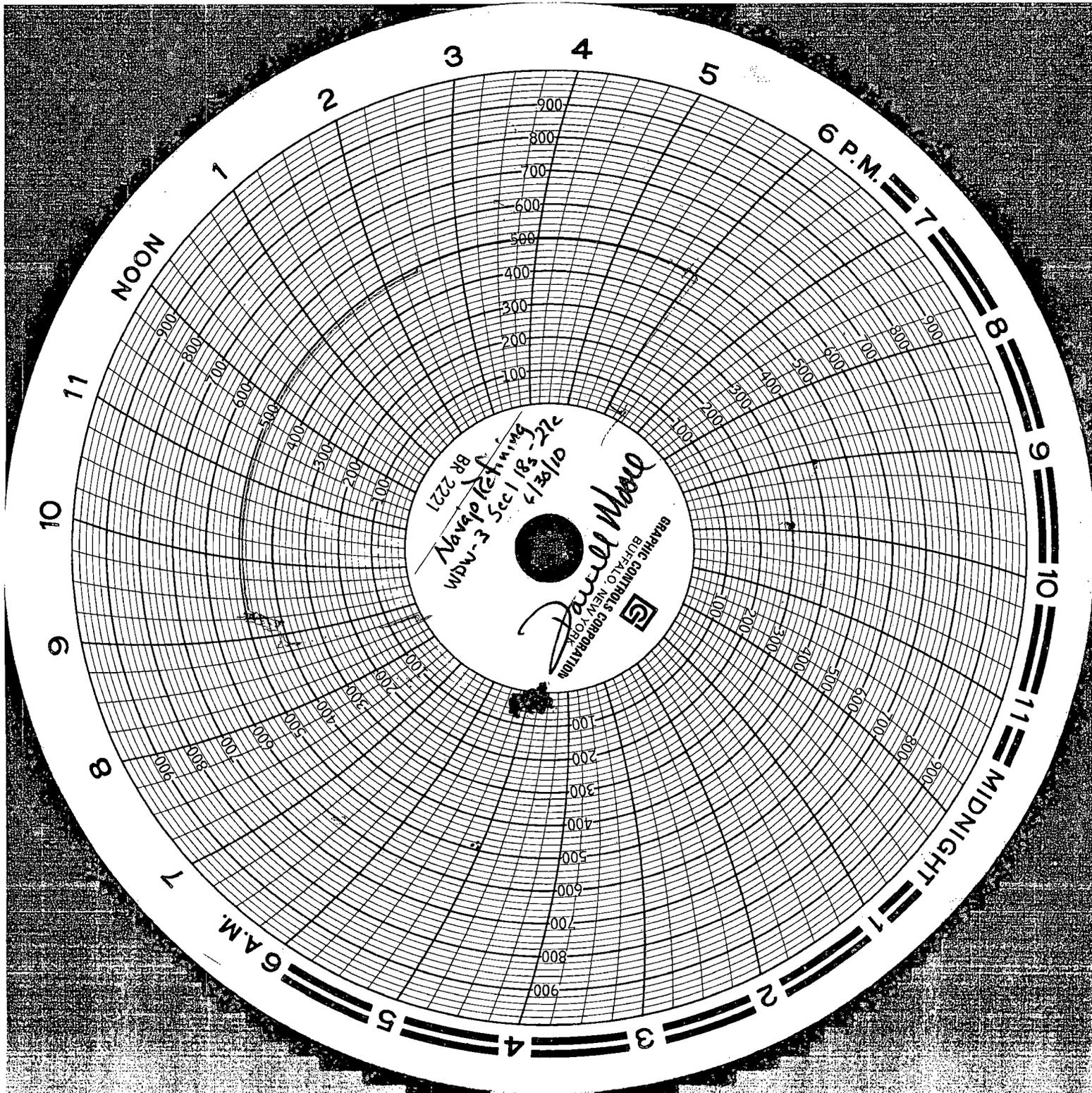
Gentlemen,

Attached, please find the quarterly MIT for Navajo's WDW-3 Injection well located in Sec 1, 18 south 27 east. If there are any questions concerning this submission, please call me at 575-746-5281.

From: Hernandez, Carrie
Sent: Wednesday, June 30, 2010 1:44 PM
To: Moore, Darrell
Subject:

Carrie Hernandez
Environmental Administrative Assistant
Navajo Refining Co. LLC
Direct Line 575-748-6733
Direct Fax 575-746-5451
Life is a Journey. Roll down the Windows and Enjoy the Breeze

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Chavez, Carl J, EMNRD

From: Moore, Darrell [Darrell.Moore@hollycorp.com]
Sent: Tuesday, March 09, 2010 8:57 AM
To: Chavez, Carl J, EMNRD
Cc: Dade, Randy, EMNRD
Attachments: WDW-3 MIT.pdf

Carl,

Sorry...here it is.

Darrell Moore
Environmental Manager for Water and Waste
Navajo Refining Company, LLC
Phone Number 575-746-5281
Cell Number 575-703-5058
Fax Number 575-746-5451

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Chavez, Carl J, EMNRD

From: Moore, Darrell [Darrell.Moore@hollycorp.com]
Sent: Friday, March 05, 2010 8:51 AM
To: Chavez, Carl J, EMNRD
Subject: WDW-3 Qtrl MIT

Carl

Attached, please find the chart for the MIT we did on our WDW-3 on February 24, 2010. We also opened the did a bradenhead test and there was no sustained pressure. There was a slight puff but it dissipated quickly and can be attributed to temperature changes.

If there are any questions concerning this submission, please call me at 575-746-5281.

Darrell Moore

Environmental Manager for Water and Waste

Navajo Refining Company, LLC

Phone Number 575-746-5281

Cell Number 575-703-5058

Fax Number 575-746-5451

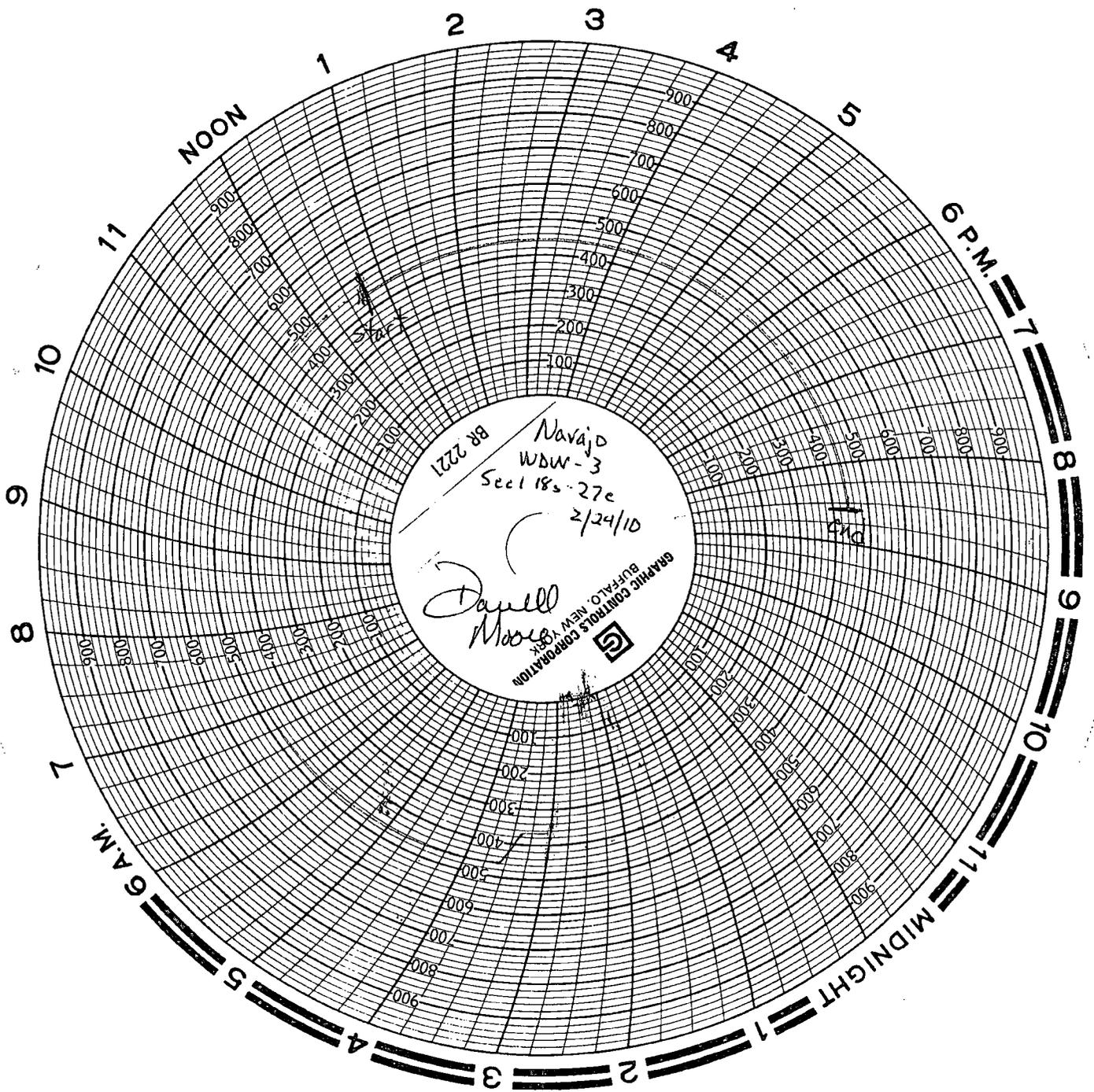
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Chavez, Carl J, EMNRD

From: Moore, Darrell [Darrell.Moore@hollycorp.com]
Sent: Wednesday, December 09, 2009 11:41 AM
To: Chavez, Carl J, EMNRD; Lackey, Johnny
Cc: Jones, William V., EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD; Sanchez, Daniel J., EMNRD
Subject: RE: NAVAJO WDW-3 UIC (UICI-8-0) Violation Leaky Ethylene Glycol Problem MIT Failure Declaration & Resolution

Carl

Navajo concurs with OCD's recommendation. Navajo will implement quarterly bradenhead monitoring to coincide with the annual MIT. We will notify OCD of the dates of these quarterly events so that OCD will have the opportunity to witness. Also, as suggested, Navajo will continue to monitor the WAMS fluid level and report that data on the quarterly injection report.

A "Minor Modification" to our discharge permit from OCD would be welcomed.

Thank you for your attention to this matter and a mutually beneficial path forward.

From: Chavez, Carl J, EMNRD [mailto:CarlJ.Chavez@state.nm.us]
Sent: Friday, December 04, 2009 7:47 AM
To: Moore, Darrell; Lackey, Johnny
Cc: Jones, William V., EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD; Sanchez, Daniel J., EMNRD
Subject: RE: NAVAJO WDW-3 UIC (UICI-8-0) Violation Leaky Ethylene Glycol Problem MIT Failure Declaration & Resolution

Darrell and Johnny:

Re: Resolution of August 2009 MIT and WAMs Unit Ethylene Glycol Loss Problem

Good morning. The OCD has completed its review of Navajo Refining Company's (NRC) responses to Oil Conservation Division (OCD) concerns about leakage of Ethylene Glycol from the WAMs Unit. While this year's MIT appears to have passed OCD's "Pass/Fail" pressure loss criteria, the OCD did notice an increase in pressure loss from last year's MIT.

The OCD proposes the following path forward with your consent: quarterly bradenhead monitoring to coincide with the annual MIT along with continued WAMs fluid level monitoring. If NRC agrees, OCD will send out a "Minor Modification" to the discharge permit that requires quarterly bradenhead monitoring. The NRC and OCD will continue to monitor the situation going forward.

Please contact me if you have questions. Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>
(Pollution Prevention Guidance is under "Publications")

From: Moore, Darrell [mailto:Darrell.Moore@hollycorp.com]
Sent: Thursday, November 19, 2009 2:39 PM
To: Chavez, Carl J, EMNRD; Lackey, Johnny
Cc: Jones, William V., EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD; Sanchez, Daniel J., EMNRD
Subject: RE: NAVAJO WDW-3 UIC (UICI-8-0) Violation Leaky Ethylene Glycol Problem MIT Failure Declaration & Resolution

Carl

Attached is the requested updated well bore diagram with detailed evaluation of the cement tops and annular fluids. As you will see, the top of cement is at 900' BGL on the 7.0" casing leaving a mud filled annulus between the 9 5/8 X 7.0" casing from 900' BGL to the surface. This space is adequately protecting the USDW since it is inside the cemented 9 5/8".

We suggest monitoring the 7" – 9 5/8" annulus. Absent any evidence that there are any leaks in this annulus, it would tend to support the absence of any pathway for the Ethylene Glycol to migrate into the USDW.

If there are any questions concerning this submission, please call me at 575-746-5281.

From: Chavez, Carl J, EMNRD [mailto:CarlJ.Chavez@state.nm.us]
Sent: Tuesday, November 03, 2009 9:56 AM
To: Lackey, Johnny; Moore, Darrell
Cc: Jones, William V., EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD; Sanchez, Daniel J., EMNRD
Subject: FW: NAVAJO WDW-3 UIC (UICI-8-0) Violation Leaky Ethylene Glycol Problem MIT Failure Declaration & Resolution

Johnny:

The New Mexico Oil Conservation Division (OCD) has reviewed your October 27, 2009 e-mail message on the above subject at your UIC Class I Disposal Well.

The OCD requests more information before deciding on the addition of a monitor well near the disposal well. Please provide and consider the following information:

- 1) An updated well-bore diagram with detailed evaluation of the cement top information to assess the potential for impacts to fresh water.
- 2) If Navajo Refining Company can demonstrate that the wells are cemented adequately to protect fresh water, the OCD may be able to forego the addition of a monitor well and require quarterly Bradenhead MIT testing with notifications of date and time of testing to the OCD in addition to the annual MIT schedule to demonstrate that well loss is not impacting fresh water? In addition, if OCD observes through MITs that there is a well problem, and/or the problem is getting progressively worse, and/or failing MITs, then the guidance that OCD originally sent (System Failure dated 8/19/2009 w/ CAs by 11/19/2009- September 3, 2009) to Navajo Refining Company will need to be implemented (find the leak, physically fix the problem, etc.).
- 3) Note that monitor well (MW) installation may require as many as 4 MWs with static water level monitoring; three wells at a minimum to triangulate GW flow direction over time; and then another monitor well may need to be placed downgradient from the disposal well in order to detect contamination.

Please respond to this communiqué before November 19, 2009 in order to meet the UIC 90-day corrective action period requirement. Please contact me if you have questions. Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>
(Pollution Prevention Guidance is under "Publications")

From: Chavez, Carl J, EMNRD
Sent: Thursday, October 29, 2009 9:05 AM
To: Jones, William V., EMNRD; Sanchez, Daniel J., EMNRD
Subject: NAVAJO WDW-3 UIC Violation Leaky Ethylene Glycol Problem MIT Failure Declaration & Resolution

Hey guys. I would like to meet with you about Navajo Refinery's proposed solution (see Johnny's text msg. below) to leaky ethylene glycol (~ 10 gal./mo) in the well. I'll try to catch you guys this p.m. Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>
(Pollution Prevention Guidance is under "Publications")

From: Lackey, Johnny [mailto:Johnny.Lackey@hollycorp.com]
Sent: Tuesday, October 27, 2009 1:50 PM
To: Chavez, Carl J, EMNRD
Cc: Moore, Darrell; Whatley, Michael
Subject: NAVAJO WDW-3

Carl:

As we discussed on 10/22/09, Navajo's consultant, Sub Surface, contacted each of the EPA Region VI member states of AR, LA, TX, NM & OK as well as the EPA Region VI office in Dallas, TX asking for each of their written Guidelines for Annulus Pressure Testing (APT) on UIC Class I nonhazardous Waste Disposal Wells (WDW). The purpose of this survey is to try and establish what is considered a significant leak as well as the specific maximum allowable test pressure deviation.

The actual conditions of the 2009 Navajo Annulus Pressure Test (APT) run on WDW-3 were both a Static (No Injection) and Dynamic (Injection) test. The starting pressure for the Static test was 560 psi and the ending pressure, taken 30 minutes later, was 540 psi. This is a static pressure loss total of 20 psi (3.6%). This loss is well within the historical allowable regulatory pressure deviation limits. The starting pressure for the Dynamic test was 580 psi and the ending pressure was 570 psi. This is a dynamic test pressure loss total of 10 psi (1.7 %). This loss is also well within the historical allowable regulatory deviation limits.

Considering these test results, there is no significant leak in WDW-3. What makes it significant to the OCD is the Ethylene Glycol Anti-Freeze that was added to the WAMS unit and possibly a portion of the casing-tubing annulus. In the MSDS (Ethylene Glycol CAS No. 107-21-13 5000 (2270 kg)) you referred to, it states in Section 12 Ecological Information under Environmental Fate: "When released to the soil, this material is expected to readily biodegrade..." additionally, "this material is expected to have a half life between 1 and 10 days and it is not expected to significantly bioaccumulate." Considering the biodegradability of this material, Ethylene Glycol will biodegrade and no longer is a threat to human health or the environment within about three months. Based on the records and previous e-mail correspondence, September 2007 is probably the earliest the WDW-3 casing-tubing annulus and/or Well Annulus Monitoring System (WAMS) could have come in contact with Ethylene Glycol Anti-Freeze. Therefore, any Ethylene Glycol that was added to the system has had over two years to degrade if in fact it was ever released to the environment. **Also, in order to have a reportable spill or release, 5000 pounds would have had to leak into the environment. WDW-3 has not even been exposed to that volume of Ethylene Glycol in either the casing, tubing annulus or the WAMS unit.**

Attached is a MSDS of the ethylene Glycol that is used at WDW-3. Note that this is a 50/50 mixture (50% water and 50% glycol) and not 100% ethylene glycol.

Navajo would like to propose an alternate to changing out the annulus fluid and/or locating and repairing the leak by first drilling a shallow monitor well to monitor the uppermost USDW at around 80 feet. This would allow us to rate the significance of the leak and therefore the need for repair. It appears that what is probably happening is salt water leaking through the squeezed perforations above the packer. **If the shallow monitor well sampling shows that there is no potential for harm to human health or the environment, the fluid loss can be monitored quarterly as you suggested, until the well needs maintenance for other reasons or WDW-3 fails the annulus pressure test (APT) or standard annulus pressure test (SAPT).**

The written EPA Guidelines are from Region V which appears to be the most recent EPA version outlining APT requirements.

EPA

DETERMINATION OF THE MECHANICAL INTEGRITY OF INJECTION WELLS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 5 -- UNDERGROUND INJECTION CONTROL (UIC) BRANCH REGIONAL GUIDANCE #5

Revised February, 2008

ATTACHMENT 1 STANDARD ANNULUS PRESSURE TEST (SAPT)

4. Procedures for the SAPT:

To properly conduct the SAPT:

1. The tubing/casing annulus (annulus) must be completely filled with liquid (variations must be approved by Region 5). Temperature stabilization of the well and annulus liquid is necessary prior to conducting the test. This may be achieved by filling the annulus with liquid and either ceasing injection or maintaining stabilized injection (i.e., continuous injection at a constant rate and constant injection fluid temperature) before and through the test;

No unapproved substances may be added to the annulus liquid. Use of any substance which might affect the outcome of testing may constitute falsification of the test procedure, invalidate the test, and may subject the owner/operator to civil or criminal prosecution;

2. After stabilization, the annuluses of Class II wells should be pressurized to a surface pressure of no less than 300 psig. The annuluses of Class I wells should be pressurized to the greater of 300 psig or a pressure which exceeds the maximum allowable injection pressure by 100 psi, unless an alternate pressure is approved by Region 5. A positive pressure differential between the pressure in the annular space and the injection tubing pressure of at least 100 psi should be maintained throughout the entire annulus (from the top of the packer to the surface) of all Class I and II wells. Specific gravity differences between liquids in the annulus and the tubing should be accounted for when determining the appropriate test pressure. Following pressurization, the annular system must be isolated from the source of pressure and the seal-pot (if present) by a closed valve. If not inconvenient, the connection to the pressure source should be disconnected entirely;
3. The annulus system must remain isolated for a period of no less than 30 minutes for Class II, III, and V wells. The *isolation must be maintained for one hour for Class I wells*. During the period of isolation measurements of pressure should be made at ten-minute intervals; and

4. After the SAPT test period has been completed, the valve to the annulus should be opened and liquid returns from the annulus observed and measured. This may be done by allowing liquid to flow into a seal-pot assembly and measuring the volume of the returns or by opening a valve and catching the liquid flow-back in a container. The volume of annulus liquid returns recovered is proportional to the volume of the annulus and the amount of pressurization. The liquid return test can serve as an indication as to whether the full length of the annulus has been tested. As an alternative, the amount of liquid needed to increase the pressure can be measured. If the entire length of the annulus, from the wellhead to the packer, set at the approved depth, is not tested, then the test is void.

New Mexico

The written requirements in New Mexico are specified in Title 19 Chapter 15 Part 26 Injection. The issuing agency is the Energy, Minerals and Natural Resources Department, Oil Conservation Division. Specifically, 19.15.26.11 Testing, Monitoring, Step-Rate Tests, Notice to the Division, Requests For Pressure Increases:

A. Testing

- (1) "Prior to commencement of Injection and any time the operator pulls the tubing or reseats the packer, if used, including pressure testing of the casing-tubing annulus to a minimum of 300 psi for 30-minutes or such other pressure or time as the appropriate district supervisor may approve. The Operator shall use a pressure recorder and submit copies of the chart to the appropriate division office within 30 days following the test date..." The percentage allowable deviation is not specifically stated in the New Mexico regulations, however, the previous APT allowable deviations has been 10%.

Thanks,

Johnny Lackey
Environmental Manager
Navajo Refining Company, L.L.C.
Office - 575-746-5490
Cell - 972-261-8075
Fax - 575-746-5451
Johnny.Lackey@hollycorp.com

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Chavez, Carl J, EMNRD

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Sent: Friday, December 04, 2009 7:47 AM
To: 'Moore, Darrell'; Lackey, Johnny
Cc: Jones, William V., EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD; Sanchez, Daniel J., EMNRD
Subject: RE: NAVAJO WDW-3 UIC (UICI-8-0) Violation Leaky Ethylene Glycol Problem MIT Failure Declaration & Resolution

Darrell and Johnny:

Re: Resolution of August 2009 MIT and WAMs Unit Ethylene Glycol Loss Problem

Good morning. The OCD has completed its review of Navajo Refining Company's (NRC) responses to Oil Conservation Division (OCD) concerns about leakage of Ethylene Glycol from the WAMs Unit. While this year's MIT appears to have passed OCD's "Pass/Fail" pressure loss criteria, the OCD did notice an increase in pressure loss from last year's MIT.

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To: Lackey, Johnny; Moore, Darrell

Cc: Jones, William V., EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD; Sanchez, Daniel J., EMNRD
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Sent: Tuesday, October 27, 2009 1:50 PM
To: Chavez, Carl J, EMNRD

Cc: Moore, Darrell; Whatley, Michael
Subject: NAVAJO WDW-3

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Considering these test results, there is no significant leak in WDW-3. What makes it significant to the OCD is the Ethylene Glycol Anti-Freeze that was added to the WAMS unit and possibly a portion of the casing-tubing annulus. In the MSDS (Ethylene Glycol CAS No. 107-21-13 5000 (2270 kg)) you referred to, it states in Section 12 Ecological Information under Environmental Fate: "When released to the soil, this material is expected to readily biodegrade..." additionally, "this material is expected to have a half life between 1 and 10 days and it is not expected to significantly bioaccumulate." Considering the biodegradability of this material, Ethylene Glycol will biodegrade and no longer is a threat to human health or the environment within about three months. Based on the records and previous e-mail correspondence, September 2007 is probably the earliest the WDW-3 casing-tubing annulus and/or Well Annulus Monitoring System (WAMS) could have come in contact with Ethylene Glycol Anti-Freeze. Therefore, any Ethylene Glycol that was added to the system has had over two years to degrade if in fact it was ever released to the environment. **Also, in order to have a reportable spill or release, 5000 pounds would have had to leak into the environment. WDW-3 has not even been exposed to that volume of Ethylene Glycol in either the casing, tubing annulus or the WAMS unit.**

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Navajo would like to propose an alternate to changing out the annulus fluid and/or locating and repairing the leak by first drilling a shallow monitor well to monitor the uppermost USDW at around 80 feet. This would allow us to rate the significance of the leak and therefore the need for repair. It appears that what is probably happening is salt water leaking through the squeezed perforations above the packer. **If the shallow monitor well sampling shows that there is no potential for harm to human health or the environment, the fluid loss can be monitored quarterly as you suggested, until the well needs maintenance for other reasons or WDW-3 fails the annulus pressure test (APT) or standard annulus pressure test (SAPT).**

The written EPA Guidelines are from Region V which appears to be the most recent EPA version outlining APT requirements.

EPA

DETERMINATION OF THE MECHANICAL INTEGRITY OF INJECTION WELLS

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5 -- UNDERGROUND INJECTION CONTROL (UIC) BRANCH
REGIONAL GUIDANCE #5**

Revised February, 2008

**ATTACHMENT 1
STANDARD ANNULUS PRESSURE TEST (SAPT)**

4. Procedures for the SAPT:

To properly conduct the SAPT:

1. The tubing/casing annulus (annulus) must be completely filled with liquid (variations must be approved by Region 5). Temperature stabilization of the well and annulus liquid is necessary prior to conducting the test. This may be achieved by filling the annulus with liquid and either ceasing injection or maintaining stabilized injection (i.e., continuous injection at a constant rate and constant injection fluid temperature) before and through the test;

No unapproved substances may be added to the annulus liquid. Use of any substance which might affect the outcome of testing may constitute falsification of the test procedure, invalidate the test, and may subject the owner/operator to civil or criminal prosecution;

2. After stabilization, the annuluses of Class II wells should be pressurized to a surface pressure of no less than 300 psig. The annuluses of Class I wells should be pressurized to the greater of 300 psig or a pressure which exceeds the maximum allowable injection pressure by 100 psi, unless an alternate pressure is approved by Region 5. A positive pressure differential between the pressure in the annular space and the injection tubing pressure of at least 100 psi should be maintained throughout the entire annulus (from the top of the packer to the surface) of all Class I and II wells. Specific gravity differences between liquids in the annulus and the tubing should be accounted for when determining the appropriate test pressure. Following pressurization, the annular system must be isolated from the source of pressure and the seal-pot (if present) by a closed valve. If not inconvenient, the connection to the pressure source should be disconnected entirely;
3. The annulus system must remain isolated for a period of no less than 30 minutes for Class II, III, and V wells. The isolation must be maintained for one hour for Class I wells. During the period of isolation measurements of pressure should be made at ten-minute intervals; and
4. After the SAPT test period has been completed, the valve to the annulus should be opened and liquid returns from the annulus observed and measured. This may be done by allowing liquid to flow into a seal-pot assembly and measuring the volume of the returns or by opening a valve and catching the liquid flow-back in a container. The volume of annulus liquid returns recovered is proportional to the volume of the annulus and the amount of pressurization. The liquid return test can serve as an indication as to whether the full length of the annulus has been tested. As an alternative, the amount of liquid needed to increase the pressure can be measured. If the entire length of the annulus, from the wellhead to the packer, set at the approved depth, is not tested, then the test is void.

New Mexico

The written requirements in New Mexico are specified in Title 19 Chapter 15 Part 26 Injection. The issuing agency is the Energy, Minerals and Natural Resources Department, Oil Conservation Division. Specifically, 19.15.26.11 Testing, Monitoring, Step-Rate Tests, Notice to the Division, Requests For Pressure Increases:

A. Testing

- (1) "Prior to commencement of Injection and any time the operator pulls the tubing or reseats the packer, if used, including pressure testing of the casing-tubing annulus to a minimum of 300 psi for 30 minutes or such other

pressure or time as the appropriate district supervisor may approve. The Operator shall use a pressure recorder and submit copies of the chart to the appropriate division office within 30 days following the test date..." The percentage allowable deviation is not specifically stated in the New Mexico regulations, however, the previous APT allowable deviations has been 10%.

Thanks,

Johnny Lackey
Environmental Manager
Navajo Refining Company, L.L.C.
Office - 575-746-5490
Cell - 972-261-8075
Fax - 575-746-5451
Johnny.Lackey@hollycorp.com

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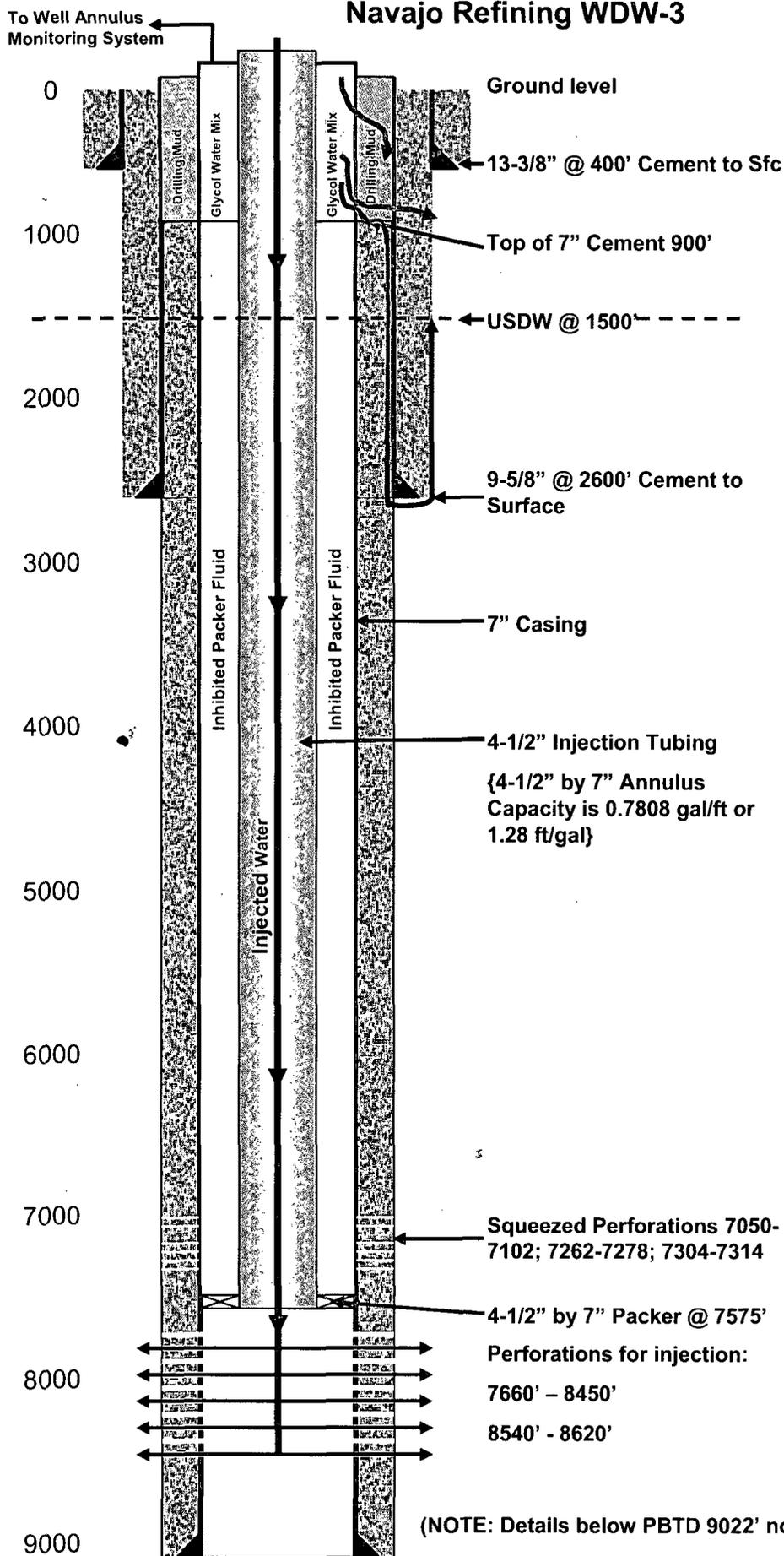
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Navajo Refining WDW-3



Case 1: A Casing Leak Exists Above 900'

Assume Total Antifreeze Volume 220 gal

Assume 100% Mixing by Convection, Dispersion, and Diffusion (worst case scenario for concentration at 900')

Assume Antifreeze is 60% Glycol

Capacity of annulus is $900' \times .78 \text{ g/ft}$ or 702 gallons from surface to 900'

Glycol Concentration = $60\% \times 220/702 = 18.8\%$ from surface to 900 ft. (light blue)

Inhibited Packer Fluid (yellow)

1-A LEAK PATH DEFINED BY BLUE ARROW

Glycol Water Mix Exits a Small Leak in the 7" Casing and Enters the Drilling Mud above the Cement in the 7" by 9-5/8" Annulus and Remains Trapped in the Annulus Between the 7" and 9-5/8"

Annulus Operating Pressure of 150 psi would increase the pressure on the 7" by 9-5/8" annulus.

Monitoring the pressure on that annulus would provide an indication of a casing leak in the 7" above 900'

1-B LEAK PATH DEFINED BY RED ARROW

Pressure in the 7" by 9-5/8" annulus elevated sufficiently to force fluid to travel downward through the annular cement and enter the formation at 2600'. Then travel upward 1100' to the base of the USDW.

1-C LEAK PATH DEFINED BY GREEN ARROW

Pressure in the 7" by 9-5/8" annulus elevated sufficiently to force fluid through the 9-5/8" casing, the annular cement between the 9-5/8" casing and the open hole, and into the USDW

Elevated Annulus Pressure is Required in Each Scenario 1-A, 1-B, or 1-C

Monitoring the 7" by 9-5/8" Annulus Pressure Would Detect an Elevated Pressure

(NOTE: Details below PBDT 9022' not shown)

Chavez, Carl J, EMNRD

From: Moore, Darrell [Darrell.Moore@hollycorp.com]
Sent: Thursday, November 19, 2009 2:39 PM
To: Chavez, Carl J, EMNRD; Lackey, Johnny
Cc: Jones, William V., EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD; Sanchez, Daniel J., EMNRD
Subject: RE: NAVAJO WDW-3 UIC (UICI-8-0) Violation Leaky Ethylene Glycol Problem MIT Failure Declaration & Resolution
Attachments: WDW-3.pdf

Carl

Attached is the requested updated well bore diagram with detailed evaluation of the cement tops and annular fluids. As you will see, the top of cement is at 900' BGL on the 7.0" casing leaving a mud filled annulus between the 9 5/8 X 7.0" casing from 900' BGL to the surface. This space is adequately protecting the USDW since it is inside the cemented 9 5/8".

We suggest monitoring the 7" – 9 5/8" annulus. Absent any evidence that there are any leaks in this annulus, it would tend to support the absence of any pathway for the Ethylene Glycol to migrate into the USDW.

If there are any questions concerning this submission, please call me at 575-746-5281.

From: Chavez, Carl J, EMNRD [mailto:CarlJ.Chavez@state.nm.us]
Sent: Tuesday, November 03, 2009 9:56 AM
To: Lackey, Johnny; Moore, Darrell
Cc: Jones, William V., EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD; Sanchez, Daniel J., EMNRD
Subject: FW: NAVAJO WDW-3 UIC (UICI-8-0) Violation Leaky Ethylene Glycol Problem MIT Failure Declaration & Resolution

Johnny:

The New Mexico Oil Conservation Division (OCD) has reviewed your October 27, 2009 e-mail message on the above subject at your UIC Class I Disposal Well.

The OCD requests more information before deciding on the addition of a monitor well near the disposal well. Please provide and consider the following information:

- 1) An updated well-bore diagram with detailed evaluation of the cement top information to assess the potential for impacts to fresh water.
- 2) If Navajo Refining Company can demonstrate that the wells are cemented adequately to protect fresh water, the OCD may be able to forego the addition of a monitor well and require quarterly Bradenhead MIT testing with notifications of date and time of testing to the OCD in addition to the annual MIT schedule to demonstrate that well loss is not impacting fresh water? In addition, if OCD observes through MITs that there is a well problem, and/or the problem is getting progressively worse, and/or failing MITs, then the guidance that OCD originally sent (System Failure dated 8/19/2009 w/ CAs by 11/19/2009- September 3, 2009) to Navajo Refining Company will need to be implemented (find the leak, physically fix the problem, etc.).
- 3) Note that monitor well (MW) installation may require as many as 4 MWs with static water level monitoring; three wells at a minimum to triangulate GW flow direction over time; and then another monitor well may need to be placed downgradient from the disposal well in order to detect contamination.

Please respond to this communiqué before November 19, 2009 in order to meet the UIC 90-day corrective action period requirement. Please contact me if you have questions. Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505

Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>
(Pollution Prevention Guidance is under "Publications")

From: Chavez, Carl J, EMNRD
Sent: Thursday, October 29, 2009 9:05 AM
To: Jones, William V., EMNRD; Sanchez, Daniel J., EMNRD
Subject: NAVAJO WDW-3 UIC Violation Leaky Ethylene Glycol Problem MIT Failure Declaration & Resolution

Hey guys. I would like to meet with you about Navajo Refinery's proposed solution (see Johnny's text msg. below) to leaky ethylene glycol (~ 10 gal./mo) in the well. I'll try to catch you guys this p.m. Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>
(Pollution Prevention Guidance is under "Publications")

From: Lackey, Johnny [<mailto:Johnny.Lackey@hollycorp.com>]
Sent: Tuesday, October 27, 2009 1:50 PM
To: Chavez, Carl J, EMNRD
Cc: Moore, Darrell; Whatley, Michael
Subject: NAVAJO WDW-3

Carl:

As we discussed on 10/22/09, Navajo's consultant, Sub Surface, contacted each of the EPA Region VI member states of AR, LA, TX, NM & OK as well as the EPA Region VI office in Dallas, TX asking for each of their written Guidelines for Annulus Pressure Testing (APT) on UIC Class I nonhazardous Waste Disposal Wells (WDW). The purpose of this survey is to try and establish what is considered a significant leak as well as the specific maximum allowable test pressure deviation.

The actual conditions of the 2009 Navajo Annulus Pressure Test (APT) run on WDW-3 were both a Static (No Injection) and Dynamic (Injection) test. The starting pressure for the Static test was 560 psi and the ending pressure, taken 30 minutes later, was 540 psi. This is a static pressure loss total of 20 psi (3.6%). This loss is well within the historical allowable regulatory pressure deviation limits. The starting pressure for the Dynamic test was 580 psi and the ending pressure was 570 psi. This is a dynamic test pressure loss total of 10 psi (1.7 %). This loss is also well within the historical allowable regulatory deviation limits.

Considering these test results, there is no significant leak in WDW-3. What makes it significant to the OCD is the Ethylene Glycol Anti-Freeze that was added to the WAMS unit and possibly a portion of the casing-tubing annulus. In the MSDS (Ethylene Glycol CAS No. 107-21-13 5000 (2270 kg)) you referred to, it states in Section 12 Ecological Information under Environmental Fate: "When released to the soil, this material is expected to readily biodegrade..." additionally, "this material is expected to have a half life between 1 and 10 days and it is not expected to significantly bioaccumulate." Considering the biodegradability of this material, Ethylene Glycol will biodegrade and no longer is a threat to human health or the environment within about three months. Based on the records and previous e-mail correspondence, September 2007 is probably the earliest the WDW-3 casing-tubing annulus and/or Well Annulus Monitoring System

(WAMS) could have come in contact with Ethylene Glycol Anti-Freeze. Therefore, any Ethylene Glycol that was added to the system has had over two years to degrade if in fact it was ever released to the environment. **Also, in order to have a reportable spill or release, 5000 pounds would have had to leak into the environment. WDW-3 has not even been exposed to that volume of Ethylene Glycol in either the casing, tubing annulus or the WAMS unit.**

Attached is a MSDS of the ethylene Glycol that is used at WDW-3. Note that this is a 50/50 mixture (50% water and 50% glycol) and not 100% ethylene glycol.

Navajo would like to propose an alternate to changing out the annulus fluid and/or locating and repairing the leak by first drilling a shallow monitor well to monitor the uppermost USDW at around 80 feet. This would allow us to rate the significance of the leak and therefore the need for repair. It appears that what is probably happening is salt water leaking through the squeezed perforations above the packer. **If the shallow monitor well sampling shows that there is no potential for harm to human health or the environment, the fluid loss can be monitored quarterly as you suggested, until the well needs maintenance for other reasons or WDW-3 fails the annulus pressure test (APT) or standard annulus pressure test (SAPT).**

The written EPA Guidelines are from Region V which appears to be the most recent EPA version outlining APT requirements.

EPA

DETERMINATION OF THE MECHANICAL INTEGRITY OF INJECTION WELLS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION 5 -- UNDERGROUND INJECTION CONTROL (UIC) BRANCH REGIONAL GUIDANCE #5

Revised February, 2008

ATTACHMENT 1 STANDARD ANNULUS PRESSURE TEST (SAPT)

4. Procedures for the SAPT:

To properly conduct the SAPT:

1. The tubing/casing annulus (annulus) must be completely filled with liquid (variations must be approved by Region 5). Temperature stabilization of the well and annulus liquid is necessary prior to conducting the test. This may be achieved by filling the annulus with liquid and either ceasing injection or maintaining stabilized injection (i.e., continuous injection at a constant rate and constant injection fluid temperature) before and through the test;

No unapproved substances may be added to the annulus liquid. Use of any substance which might affect the outcome of testing may constitute falsification of the test procedure, invalidate the test, and may subject the owner/operator to civil or criminal prosecution;

2. After stabilization, the annuluses of Class II wells should be pressurized to a surface pressure of no less than 300 psig. The annuluses of Class I wells should be pressurized to the greater of 300 psig or a pressure which exceeds the maximum allowable injection pressure by 100 psi, unless an alternate pressure is approved by Region 5. A positive pressure differential between the pressure in the annular space and the injection tubing pressure of at least 100 psi should be maintained throughout the entire annulus (from the top of the packer to the surface) of all Class I and II wells. Specific gravity differences between liquids in the annulus and the tubing should be accounted for when determining the appropriate test pressure. Following pressurization, the annular system must

- be isolated from the source of pressure and the seal-pot (if present) by a closed valve. If not inconvenient, the connection to the pressure source should be disconnected entirely;
3. The annulus system must remain isolated for a period of no less than 30 minutes for Class II, III, and V wells. The isolation must be maintained for one hour for Class I wells. During the period of isolation measurements of pressure should be made at ten-minute intervals; and
 4. After the SAPT test period has been completed, the valve to the annulus should be opened and liquid returns from the annulus observed and measured. This may be done by allowing liquid to flow into a seal-pot assembly and measuring the volume of the returns or by opening a valve and catching the liquid flow-back in a container. The volume of annulus liquid returns recovered is proportional to the volume of the annulus and the amount of pressurization. The liquid return test can serve as an indication as to whether the full length of the annulus has been tested. As an alternative, the amount of liquid needed to increase the pressure can be measured. If the entire length of the annulus, from the wellhead to the packer, set at the approved depth, is not tested, then the test is void.

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The written requirements in New Mexico are specified in Title 19 Chapter 15 Part 26 Injection. The issuing agency is the Energy, Minerals and Natural Resources Department, Oil Conservation Division. Specifically, 19.15.26.11 Testing, Monitoring, Step-Rate Tests, Notice to the Division, Requests For Pressure Increases:

A. Testing

- (1) "Prior to commencement of Injection and any time the operator pulls the tubing or reseats the packer, if used, including pressure testing of the casing-tubing annulus to a minimum of 300 psi for 30 minutes or such other pressure or time as the appropriate district supervisor may approve. The Operator shall use a pressure recorder and submit copies of the chart to the appropriate division office within 30 days following the test date..." The percentage allowable deviation is not specifically stated in the New Mexico regulations, however, the previous APT allowable deviations has been 10%.

Thanks,

Johnny Lackey
Environmental Manager
Navajo Refining Company, L.L.C.
Office - 575-746-5490
Cell - 972-261-8075
Fax - 575-746-5451
Johnny.Lackey@hollycorp.com

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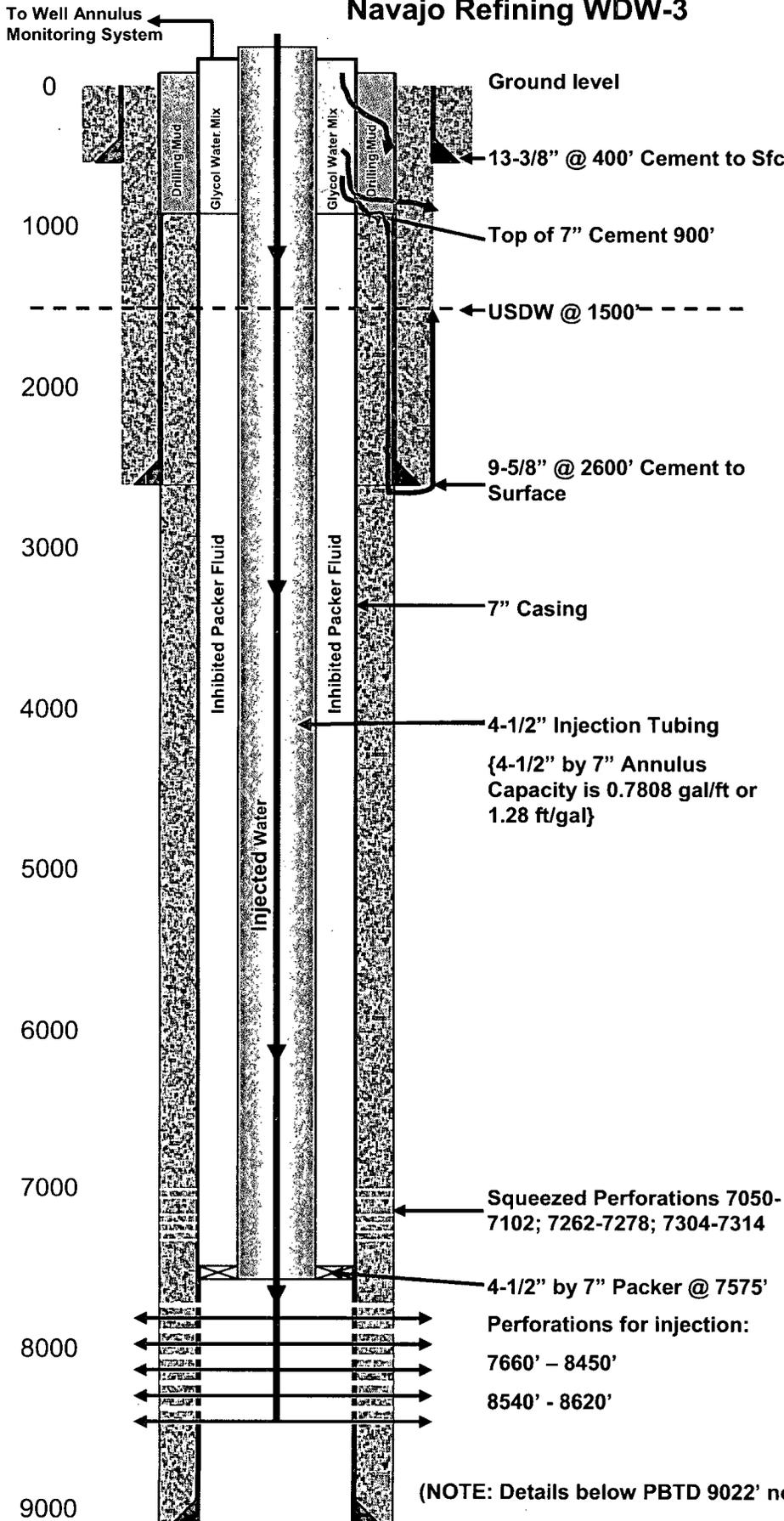
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Navajo Refining WDW-3



Case 1: A Casing Leak Exists Above 900'

Assume Total Antifreeze Volume 220 gal

Assume 100% Mixing by Convection, Dispersion, and Diffusion (worst case scenario for concentration at 900')

Assume Antifreeze is 60% Glycol

Capacity of annulus is 900' x .78 g/ft or 702 gallons from surface to 900'

Glycol Concentration = 60% x 220/702 = 18.8% from surface to 900 ft. (light blue)

Inhibited Packer Fluid (yellow)

1-A LEAK PATH DEFINED BY BLUE ARROW

Glycol Water Mix Exits a Small Leak in the 7" Casing and Enters the Drilling Mud above the Cement in the 7" by 9-5/8" Annulus and Remains Trapped in the Annulus Between the 7" and 9-5/8"

Annulus Operating Pressure of 150 psi would increase the pressure on the 7" by 9-5/8" annulus.

Monitoring the pressure on that annulus would provide an indication of a casing leak in the 7" above 900'

1-B LEAK PATH DEFINED BY RED ARROW

Pressure in the 7" by 9-5/8" annulus elevated sufficiently to force fluid to travel downward through the annular cement and enter the formation at 2600'. Then travel upward 1100' to the base of the USDW.

1-C LEAK PATH DEFINED BY GREEN ARROW

Pressure in the 7" by 9-5/8" annulus elevated sufficiently to force fluid through the 9-5/8" casing, the annular cement between the 9-5/8" casing and the open hole, and into the USDW

Elevated Annulus Pressure is Required in Each Scenario 1-A, 1-B, or 1-C

Monitoring the 7" by 9-5/8" Annulus Pressure Would Detect an Elevated Pressure

(NOTE: Details below PBDT 9022' not shown)

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Tuesday, November 03, 2009 9:56 AM
To: 'Lackey, Johnny'; Moore, Darrell
Cc: Jones, William V., EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD; Sanchez, Daniel J., EMNRD
Subject: FW: NAVAJO WDW-3 UIC (UICI-8-0) Violation Leaky Ethylene Glycol Problem MIT Failure Declaration & Resolution
Attachments: Service Pro Anti Freeze.pdf

Johnny:

The New Mexico Oil Conservation Division (OCD) has reviewed your October 27, 2009 e-mail message on the above subject at your UIC Class I Disposal Well.

The OCD requests more information before deciding on the addition of a monitor well near the disposal well. Please provide and consider the following information:

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- 2) If Navajo Refining Company can demonstrate that the wells are cemented adequately to protect fresh water, the OCD may be able to forego the addition of a monitor well and require quarterly Bradenhead MIT testing with notifications of date and time of testing to the OCD in addition to the annual MIT schedule to demonstrate that well loss is not impacting fresh water? In addition, if OCD observes through MITs that there is a well problem, and/or the problem is getting progressively worse, and/or failing MITs, then the guidance that OCD originally sent (System Failure dated 8/19/2009 w/ CAs by 11/19/2009- September 3, 2009) to Navajo Refining Company will need to be implemented (find the leak, physically fix the problem, etc.).
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Please respond to this communiqué before November 19, 2009 in order to meet the UIC 90-day corrective action period requirement. Please contact me if you have questions. Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>
(Pollution Prevention Guidance is under "Publications")

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Sent: Thursday, October 29, 2009 9:05 AM
To: Jones, William V., EMNRD; Sanchez, Daniel J., EMNRD
Subject: NAVAJO WDW-3 UIC Violation Leaky Ethylene Glycol Problem MIT Failure Declaration & Resolution

Hey guys. I would like to meet with you about Navajo Refinery's proposed solution (see Johnny's text msg. below) to leaky ethylene glycol (~ 10 gal./mo) in the well. I'll try to catch you guys this p.m. Thanks.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
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Sent: Tuesday, October 27, 2009 1:50 PM
To: Chavez, Carl J, EMNRD
Cc: Moore, Darrell; Whatley, Michael
Subject: NAVAJO WDW-3

Carl:

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Considering these test results, there is no significant leak in WDW-3. What makes it significant to the OCD is the Ethylene Glycol Anti-Freeze that was added to the WAMS unit and possibly a portion of the casing-tubing annulus. In the MSDS (Ethylene Glycol CAS No. 107-21-13 5000 (2270 kg)) you referred to, it states in Section 12 Ecological Information under Environmental Fate: "When released to the soil, this material is expected to readily biodegrade..." additionally, "this material is expected to have a half life between 1 and 10 days and it is not expected to significantly bioaccumulate." Considering the biodegradability of this material, Ethylene Glycol will biodegrade and no longer is a threat to human health or the environment within about three months. Based on the records and previous e-mail correspondence, September 2007 is probably the earliest the WDW-3 casing-tubing annulus and/or Well Annulus Monitoring System (WAMS) could have come in contact with Ethylene Glycol Anti-Freeze. Therefore, any Ethylene Glycol that was added to the system has had over two years to degrade if in fact it was ever released to the environment. **Also, in order to have a reportable spill or release, 5000 pounds would have had to leak into the environment. WDW-3 has not even been exposed to that volume of Ethylene Glycol in either the casing, tubing annulus or the WAMS unit.**

Attached is a MSDS of the ethylene Glycol that is used at WDW-3. Note that this is a 50/50 mixture (50% water and 50% glycol) and not 100% ethylene glycol.

Navajo would like to propose an alternate to changing out the annulus fluid and/or locating and repairing the leak by first drilling a shallow monitor well to monitor the uppermost USDW at around 80 feet. This would allow us to rate the significance of the leak and therefore the need for repair. It appears that what is probably happening is salt water leaking through the squeezed perforations above the packer. **If the shallow monitor well sampling shows that there is no potential for harm to human health or the environment, the fluid loss can be monitored quarterly as you suggested, until the well needs maintenance for other reasons or WDW-3 fails the annulus pressure test (APT) or standard annulus pressure test (SAPT).**

The written EPA Guidelines are from Region V which appears to be the most recent EPA version outlining APT requirements.

EPA

DETERMINATION OF THE MECHANICAL INTEGRITY OF INJECTION WELLS

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5 -- UNDERGROUND INJECTION CONTROL (UIC) BRANCH
REGIONAL GUIDANCE #5**

Revised February, 2008

**ATTACHMENT 1
STANDARD ANNULUS PRESSURE TEST (SAPT)**

4. Procedures for the SAPT:

To properly conduct the SAPT:

1. The tubing/casing annulus (annulus) must be completely filled with liquid (variations must be approved by Region 5). Temperature stabilization of the well and annulus liquid is necessary prior to conducting the test. This may be achieved by filling the annulus with liquid and either ceasing injection or maintaining stabilized injection (i.e., continuous injection at a constant rate and constant injection fluid temperature) before and through the test;

No unapproved substances may be added to the annulus liquid. Use of any substance which might affect the outcome of testing may constitute falsification of the test procedure, invalidate the test, and may subject the owner/operator to civil or criminal prosecution;

2. After stabilization, the annuluses of Class II wells should be pressurized to a surface pressure of no less than 300 psig. The annuluses of Class I wells should be pressurized to the greater of 300 psig or a pressure which exceeds the maximum allowable injection pressure by 100 psi, unless an alternate pressure is approved by Region 5. A positive pressure differential between the pressure in the annular space and the injection tubing pressure of at least 100 psi should be maintained throughout the entire annulus (from the top of the packer to the surface) of all Class I and II wells. Specific gravity differences between liquids in the annulus and the tubing should be accounted for when determining the appropriate test pressure. Following pressurization, the annular system must be isolated from the source of pressure and the seal-pot (if present) by a closed valve. If not inconvenient, the connection to the pressure source should be disconnected entirely;
3. The annulus system must remain isolated for a period of no less than 30 minutes for Class II, III, and V wells. The isolation must be maintained for one hour for Class I wells. During the period of isolation measurements of pressure should be made at ten-minute intervals; and
4. After the SAPT test period has been completed, the valve to the annulus should be opened and liquid returns from the annulus observed and measured. This may be done by allowing liquid to flow into a seal-pot assembly and measuring the volume of the returns or by opening a valve and catching the liquid flow-back in a container. The volume of annulus liquid returns recovered is proportional to the volume of the annulus and the amount of pressurization. The liquid return test can serve as an indication as to whether the full length of the annulus has been tested. As an alternative, the amount of liquid needed to increase the pressure can be measured. If the entire length of the annulus, from the wellhead to the packer, set at the approved depth, is not tested, then the test is void.

New Mexico

The written requirements in New Mexico are specified in Title 19 Chapter 15 Part 26 Injection. The issuing agency is the Energy, Minerals and Natural Resources Department, Oil Conservation Division. Specifically, 19.15.26.11 Testing, Monitoring, Step-Rate Tests, Notice to the Division, Requests For Pressure Increases:

A. Testing

- (1) "Prior to commencement of Injection and any time the operator pulls the tubing or reseats the packer, if used, including pressure testing of the casing-tubing annulus to a minimum of 300 psi for 30 minutes or such other pressure or time as the appropriate district supervisor may approve. The Operator shall use a pressure recorder and submit copies of the chart to the appropriate division office within 30 days following the test date..." The percentage allowable deviation is not specifically stated in the New Mexico regulations, however, the previous APT allowable deviations has been 10%.

Thanks,

Johnny Lackey
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Initial Preparation Date: 8/24/2004
Last Revision Date: None
Effective Date: 10/4/2004

MATERIAL SAFETY DATA SHEET

PRODUCT IDENTITY: SERVICE PRO 50/50 PREDILUTED ANTIFREEZE & COOLANT

1. CHEMICAL PRODUCT & COMPANY INFORMATION

**OLD WORLD INDUSTRIES, INC.
4065 COMMERCIAL AVENUE
NORTHBROOK, ILLINOIS 60062
PHONE: 847-559-2000
EMERGENCY PHONE: 1-800-424-9300 (CHEMTREC)**

2. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Material</u>	<u>CAS#</u>	<u>% by Wt</u>	<u>PEL (OSHA)</u>	<u>TLV (ACGIH)</u>
Water	7732-18-5	49 - 50	None	None
Ethylene Glycol	107-21-1	45 - 48	50 ppm	50 ppm
Diethylene Glycol	111-46-6	0 - 2	None	None
Dipotassium Phosphate	7758-11-4	< 2	None	None

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

<i>Slight odor.</i>	<i>May be fatal if swallowed.</i>	<i>Vapors can cause eye irritation.</i>
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Lowest Known LD50 (Oral)	107-21-1	11,680 mg/kg (Rats)
Lowest Known LD50 (Skin)	107-21-1	19,060 mg/kg (Rabbits)

HAZARD RATING SYSTEM

NFPA: HEALTH: 1 FLAMMABILITY: 1 REACTIVITY: 0
HMIS: HEALTH: 2 FLAMMABILITY: 1 REACTIVITY: 0

KEY: 0 - Minimal 1 - Slight 2 - Moderate 3 - Serious 4 - Severe

POTENTIAL HEALTH EFFECTS

Routes of Exposure: Inhalation, Ingestion, Skin Contact/Absorption, Eye Contact

Eye: May cause slight transient (temporary) eye irritation. Corneal injury is unlikely. Vapors or mists may cause eye irritation.

Skin: Prolonged or repeated exposure not likely to cause significant skin irritation. A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. Repeated skin exposure may result in absorption of harmful amounts. Massive contact with damaged skin or of material sufficiently hot to burn skin may result in absorption of potential lethal amounts.

Ingestion: Single dose oral toxicity is considered to be moderate. Excessive exposure may cause central nervous system effects, cardiopulmonary effects (metabolic acidosis), and kidney failure. Small amounts swallowed incidental to normal handling operations are not likely to cause injury; however, swallowing amounts larger than that may cause serious injury, even death.

Inhalation: At room temperature, exposures to vapors are minimal due to physical properties; higher temperatures may generate vapor levels sufficient to cause adverse effects.

Systemic (Other Target Organ) Effects: Repeated excessive exposures may cause severe kidney and also liver and gastrointestinal effects. Signs and symptoms of excessive exposure may be central nervous system effects. Signs and symptoms of excessive exposure may be nausea and/or vomiting. Signs and symptoms of excessive exposure may be anesthetic or narcotic effects. Observations in animals include formation of bladder stones after repeated oral doses of ethylene glycol. Reports of kidney failure and death in burn patients suggest the ethylene glycol may have been a factor. The use of topical applications containing this material may not be appropriate in severely burned patients or individuals with impaired renal function.

Cancer Information: Based on data from long-term animal studies, ethylene glycol is not believed to pose a carcinogenic risk to man.

Teratology (Birth Defects): Exposure to ethylene glycol has caused birth defects in laboratory animals only at doses toxic to the mother.

Reproductive Effects: Ethylene glycol has not interfered with reproduction in animal studies except at very high doses.

CHRONIC, PROLONGED OR REPEATED OVEREXPOSURE

Effects of Repeated Overexposure: Repeated inhalation of ethylene glycol mist may produce signs of central nervous system involvement, particularly dizziness and nystagmus.

Other Effects of Overexposure: repeated skin contact with ethylene glycol may, in a very small proportion of cases, cause sensitization with the development of allergic contact dermatitis. The incidence is significantly less than 1% with the undiluted material.

4. **FIRST AID MEASURES**

Ensure physician has access to this MSDS.

TREATMENT

Eyes: Immediately flush eyes with large amounts of water for 15 minutes, lifting lower and upper lids. Get medical attention as soon as possible. Contact lenses should never be worn when working with this chemical.

Skin: Flush area of skin contact immediately with large amounts of water for at least 15 minutes while removing contaminated clothing. If irritation persists after flushing, get medical attention promptly. Wash clothing before re-use.

Inhalation: If inhaled, immediately remove victim to fresh air and call *emergency medical care*. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Ingestion: Obtain medical attention immediately. If patient is fully conscious, give two glasses of water. Do not induce vomiting. If medical advice is delayed, and if the person has swallowed a moderate volume of material (a few ounces), then give three to four ounces of hard liquor, such as whisky. For children, give proportionally less liquor, according to weight.

Notes to Physician:

It is estimated that the lethal oral dose to adults is of the order of 1.0 ml/kg. Ethylene glycol is metabolized by alcohol dehydrogenase to various metabolites including glyceraldehydes, glycolic acid and oxalic acid which cause an elevated anion-gap metabolic acidosis and renal tubular injury. The signs and symptoms in ethylene glycol poisoning are those of metabolic acidosis, CNS depression, and kidney injury. Urinalysis may show albuminuria, hematuria and oxaluria. Clinical chemistry may reveal anion-gap metabolic acidosis and uremia. The currently recommended medical management of ethylene glycol poisoning includes elimination of ethylene glycol and metabolites, correction of metabolic acidosis and prevention of kidney injury. It is essential to have immediate and follow up urinalysis and clinical chemistry. There should be particular emphasis on acid-base balance and renal function tests. A continuous infusion of 5% sodium bicarbonate with frequent monitoring of electrolytes and fluid balance is used to achieve correction of metabolic acidosis and forced diuresis. As a competitive substrate for alcohol dehydrogenase, ethanol is antidotal. Given in the early stages of intoxication, it blocks the formulation of nephrotoxic metabolites. A therapeutically effective blood concentration of ethanol is in the range 100-150 mg/dl, and should be achieved by a rapid loading dose and maintained by intravenous infusion. For severe and/or deteriorating cases, hemodialysis may be required. Dialysis should be considered for patients who are symptomatic, have severe metabolic acidosis, a blood ethylene glycol concentration greater than 25 md/dl, or compromise of renal functions.

A more effective intravenous antidote for physician use is 4-methylpyrazole, a potent inhibitor of alcohol dehydrogenases, which effectively blocks the formation of toxic metabolites of ethylene glycol. It has been used to decrease the metabolic consequences of ethylene glycol poisoning before metabolic acidosis coma, seizures, and renal failure have occurred. A generally recommended protocol is a loading dose of 15 mg/kg followed by 10 mg/kg every 12 hours for 4 doses and then 15 mg/kg every 12 hours until ethylene glycol concentrations are below 20 mg/100 ml. Slow intravenous infusion is required. Since 4-methylpyrazole is dialyzable, increased dosage may be necessary during hemodialysis. Additional therapeutic measures may include the administration of cofactors involved in the metabolism of ethylene glycol. Thiamine (100 mg) and pyridoxine (50 mg) should be given every six hours.

Pulmonary edema with hypoxemia has been described in a number of patients following poisoning with ethylene glycol. The mechanism of production has not been elucidated, but it appears to be non-cardiogenic in origin in several cases. Respiratory support with mechanical ventilation and positive end expiratory pressure may be required. There may be cranial nerve involvement in the late stages of toxicity from swallowed ethylene glycol. In particular, effects have been reported involving the seventh, eighth and ninth cranial nerves, presenting with bilateral facial paralysis, diminished hearing and dysphasia.

5. FIRE FIGHTING MEASURES

Flammable Properties

Flash Point: None, since % of water is over 20.

Autoignition Temperature: Autoignition temperature for 100% ethylene glycol is 398°C (748°F).

Flammability Limits - % of vapor concentration at which product can ignite in presence of spark.

Lower Flammability Limit: Not determined

Upper Flammability Limit: Not determined

Flammability limits are not determined on this product because the solution consists of 50% water. If and when the water evaporates and 100% glycol is left, the upper and lower flammability limits would be 3.2% and 15.3% (the same as concentrated Ethylene glycol).

Hazardous Combustion Products: Hazardous combustion products may include and are not limited to carbon monoxide, carbon dioxide and trace amounts of aldehydes and organic acids. When available oxygen is limited, as in a fire or when heated to very high temperatures by a hot wire or plate, carbon monoxide and other hazardous compounds such as aldehydes might be generated.

Extinguishing Media: Water fog or fine spray. Alcohol resistant foams (ATC type) are preferred if available. General purpose synthetic foams (including AFFF) or protein foams may function, but much less effectively. Carbon dioxide. Dry chemical. Do not use direct water stream. May spread fire.

Fire Fighting Instructions: No fire and explosion hazards expected under normal storage and handling conditions (i.e. ambient temperatures). However, ethylene glycol or solutions of ethylene glycol and water can form flammable vapors with air if heated sufficiently. Keep people away. Isolate fire area and deny unnecessary entry.

Protective Equipment for Fire Fighters: Wear positive-pressure, self-contained breathing apparatus (SCBA) and protective fire fighting clothing (includes fire-fighting helmet, coat, pants, boots and gloves).

6. ACCIDENTAL RELEASE MEASURES

Protect People: Material is moderately toxic when ingested. Take adequate precautions to keep people, especially children away from spill site. PVC-coated rubber gloves and monogoggles or face shield can be used during cleanup of spill site. Product on surfaces can cause slippery conditions. Practice reasonable care and cleanliness. Avoid breathing spray mists if generated. Keep out of reach of children. Product may become a solid at temperatures below -18°C (0°F). Do not store near food, foodstuffs, drugs or potable water supplies.

Protect the Environment: Do not dump used product or diluted material into sewers, on the ground, or into any body of water.

Cleanup: Small spills: Soak up with absorbent material. Large spills: Dike and pump into suitable containers for disposal. Ensure compliance with all applicable statues that require notification of appropriate government officials.
Service Pro 50/50 Antifreeze

7. HANDLING AND STORAGE

Steps to be Taken in Case Material is Released or Spilled: Eliminate all sources of ignition in vicinity of the spilled or released fluid.

Other Precautions: Use normal precautions in handling any combustible liquid. Keep container closed when not in use. Store away from heat or open flame. Product on surfaces can cause slippery conditions. Practice reasonable care and cleanliness. Avoid breathing spray mists if generated. Keep out of reach of children. Product may become a solid at temperatures below -37°C (-34°F). Do not store near food, foodstuffs, drugs or potable water supplies.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Respiratory Protection: Respiratory protection is required if airborne concentration exceeds TLV. At any detectable concentration any self-contained breathing apparatus with a full face piece and operated in a pressure-demand or other positive pressure mode or any supplied-air respirator with a full face piece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.

Escape: Any air-purifying full face piece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister or any appropriate escape-type self-contained breathing apparatus.

Skin Protection: Protective gloves recommended when prolonged skin contact cannot be avoided. Polyethylene; Neoprene; Nitrile; Polyvinyl alcohol; Natural Rubber, Butyl Rubber. Safety shower should be available.

Eye Protection: Safety goggles and face shield. Emergency eyewash should be available. Contact lenses should not be worn when working with this chemical.

Engineering Controls: Use general or local exhaust ventilation to meet TLV requirements.

EXPOSURE LIMITS

<u>Component</u>	<u>Exposure Limits</u>	<u>Skin Form</u>
Ethylene glycol	100 mg/m3 CEILING ACGIH	Aerosol
Ethylene glycol	125 mg/m3 CEILING OSHA-vacated	
	50 ppm CEILING OSHA - vacated	
	100 mg/m3 CEILING UCC	Aerosol and Vapor
Diethylene glycol	50 ppm TWA8 AIHA WEEL	Aerosol and Vapor
Diethylene glycol	10 mg/m3 TWA8 AIHA WEEL	Aerosol

In the Exposure Limits Chart above, if there is no specific qualifier (i.e., Aerosol) listed in the Form Column for a particular limit, the listed limit includes all airborne forms of the substance that can be inhaled.

A "blank" in the Skin column indicates that exposure by the cutaneous (skin) route is not a potential significant contributor to overall exposure.

9. PHYSICAL / CHEMICAL PROPERTIES

Boiling Range:	106 - 108°C (224 - 227°F)
Freeze Point:	-37°C (-34°F)
Specific Gravity (Water =1):	1.07
Pounds/Gallons:	8.9
Vapor Pressure (mm of Hg) @ 20C:	<0.1
Vapor Density (air=1):	2.1
Water Solubility:	Complete
Evaporation Rate (BuAc = 1):	Nil
% Volatile By Volume:	50
Appearance:	Green
Odor:	Mild
pH:	10.5-11.0

10. STABILITY & REACTIVITY DATA

Stability:	Stable
Conditions to Avoid:	Keep away from flame
Incompatibility (Materials to Avoid):	Strong acid or oxidizing agents
Hazardous Decomposition Products:	Incomplete combustion may produce CO gas
Hazardous Polymerization:	Will not occur

11. TOXICOLOGICAL INFORMATION **(Concentrated Ethylene Glycol)**

Skin: The dermal LD50 has not been determined.

Ingestion: The lethal dose in humans is estimated to be 100 ml (3 ozs.). The oral LD50 for rats is in the 6000-13,000-mg/kg range.

Mutagenicity (The Effects on Genetic Material): In vitro mutagenicity studies were negative. Animal mutagenicity studies were negative.

Significant Data with Possible Relevance to Humans: Ethylene glycol has been shown to produce dose-related teratogenic effects in rats and mice when given by gavage or in drinking water at high concentrations or doses. The no-effect doses for developmental toxicity for ethylene glycol given by gavage over the period of organogenesis has been shown to be 150 mg/kg/day for the mouse and 500 mg/kg/day for the rat. Also, in a preliminary study to assess the effects of exposure of pregnant rats and made to aerosol at concentrations of 150, 1000 and 25000 mg/m³ for 6 hours a day throughout the period of organogenesis, teratogenic effects were produced at the highest concentration, but only in mice. The conditions of these latter experiments did not allow a conclusion as to whether the developmental toxicity was mediated by inhalation of aerosol percutaneous absorption of ethylene glycol from contaminated skin, or swallowing ethylene glycol as a result of grooming the wetted coat. In a further study, comparing effects from high aerosol concentration by whole-body or nose-only exposure, it was shown that nose-only exposure resulted in maternal toxicity (1000 and 25000 mg/m³) and developmental toxicity with minimal evidence of teratogenicity (2500 mg/m³). The no-effects concentration (based on maternal toxicity) was 500 mg/m³. In a further study in mice, no teratogenic effects could be produced when ethylene glycol was applied to skin of pregnant mice over the period of organogenesis. The above observations suggest that ethylene glycol is to be regarded as an animal teratogen. There is currently no available information to suggest that ethylene glycol has caused birth defects in humans. Cutaneous application of ethylene glycol is ineffective in producing developmental

toxicity. Exposure to high aerosol concentrations is only minimally effective in producing developmental toxicity. The major route for producing developmental toxicity is perorally. Two chronic feeding studies, using rats and mice, have not produced any evidence that ethylene glycol causes dose-related increases in tumor incidence or a different pattern of tumors compared with untreated controls. The absence of carcinogenic potential for ethylene glycol has been supported by numerous in vitro genotoxicity studies showing that it does not produce mutagenic or clastogenic effects.

A chronic dietary feeding study of diethylene glycol with rats showed mild kidney injury at 1%, while concentrations of 2% and 4% caused more marked kidney injury. In addition, at 2% and 4% of diethylene glycol in the diet, some rats developed benign papillary tumors in the urinary bladder. These have been attributed to the presence of urinary bladder calcium oxalate stones. No evidence for carcinogenicity was found with a chronic skin-painting study with diethylene glycol in mice. The absence of a direct chemical carcinogenic effect addords with the results in vitro genotoxicity studies that show that it does not produce mutagenic or clastogenic effects. A feeding study employing up to 5.0% diethylene glycol in the diet failed to produce any teratogenic effects. In a mouse continuous breeding study with large doses of diethylene glycol in drinking water, there was evidence for reproductive toxicity at 3.5% (equivalent to 6.1 g/kg/day) as reduced number of litter, live pups per litter and live pup weight. No such effects were seen at 1.75% (approximately 3.05 g/kg/day). The relevance of these very high dosages to human health is uncertain. Pregnant rats receiving undiluted diethylene glycol by gavage over the period of organogenesis had toxic effects at 4.0 and 8.0 ml/kg/day as mortality, decreased body weight, decreased food consumption increased water consumption and increased liver and kidney weights. Fetotoxicity was seen only at these maternally toxic dosages. Decreased fetal body weight occurred at 8.0 ml/kg/day, and increased skeletal variants at 4.0 and 8.0 ml/kg/day. No embryotoxic or teratogenic effects were seen. Neither maternal toxicity nor fetotoxicity occurred at 1.0 ml/kg/day. In a study with mice also receiving undiluted diethylene glycol over the period of organogenesis, maternal toxicity occurred at 2.5 and 10.0 ml/kg/day, but not at 0.5 ml/kg/day. Definitive developmental toxicity was not seen in this species.

ACUTE TOXICITY

Peroral: The lethal dose in humans is estimated to be 3 oz. or 100 ml.

Rat: LD50 (6000 – 13000) mg/kg

Percutaneous:

Rabbit: LD50 = >22270 mg/kg; 24 h occluded

Inhalation:

Rat: 8-hour exposure, substantially saturated vapor studies, dynamic generation method

Mortality: 0/6

Inhalation: Mist/vapor study, rat, at 170°C, 8-hour exposure = 2.2 mg/l

Mortality: 0/6

Inhalation:

Rat: 8-hour exposure, fog = 10000 ppm; 65° - 70°C

Mortality: 0/6

IRRITATION

Skin:

Rabbit: 24-hour occluded contact, 0.5 ml
Results: Minor erythema and edema

Skin:

Human: Primary irritation patch test, 48-hour occluded, 0.2 ml
Results: Evidence of irritation

Eye:

Rabbit: 0.1 ml
Results: Minor transient iritis, conjunctival irritation with discharge

REPEATED EXPOSURE

In a 7-day dietary study with rats, a significant increase in kidney weights in females was observed at 5.0 gm/kg. The NOEL was 2.5 gm/kg.

In a 24-month dietary study with rats, increased mortality in males was observed at the highest dose, 1.0 gm/kg/day. There were multiple signs: mineralization of several organs, including the cardiac vessels, cardiac muscle, vas deferens, stomach and pulmonary vessels; cellular hyperplasia of the parathyroids, hemosiderosis of the spleen, myocardial fibrosis, portal fibrosis of the liver, bile duct hyperplasia and hydronephrosis and oxylate nephrosis of the kidneys. Ethylene glycol was not oncogenic.

In a 90-day dietary study with dogs, repeated exposures to 2.5 gm/kg resulted in acute renal failure and deaths. The NOAEL was 1.0 gm/kg.

SENSITIZATION (ANIMAL AND HUMAN STUDIES)

Repeated skin contact with ethylene glycol may, in a very small proportion of cases, cause sensitization with the development of allergic contact dermatitis. The incidence is significantly less than 1% with the undiluted material.

REPRODUCTIVE TOXICITY

A three-generation study indicated that ethylene glycol did not affect reproductive parameters at dietary concentrations up to 1.0 gm/kg/day in any generation.

CHRONIC TOXICITY AND CARCINOGENICITY

Two chronic feeding studies, using rats and mice, have not produced any evidence that ethylene glycol causes dose-related increases in tumor incidence or a different pattern of tumors compared with untreated controls. The absence of a carcinogenic potential for ethylene glycol has been supported by numerous in vitro genotoxicity studies showing that it does not produce mutagenic or clastogenic effects.

GENETIC TOXICOLOGY

In Vitro: Ethylene glycol was devoid of genotoxic activity in an Ames test, forward gene mutation and sister chromatid exchange (SCE) studies in Chinese Hamster Ovary (CHO) cells and an in vitro cytogenetics study.

In Vivo: Ethylene glycol by three different routes (intravenous, peroral and percutaneous) demonstrates apparent first-order pharmacokinetic behavior for the disposition in and the elimination from the plasma. Dose-dependent changes occur for the elimination of metabolites in the urine and as $^{14}\text{CO}_2$ after single doses for the intravenous and peroral, but not the percutaneous route. The hypothesis from literature sources exists that developmental toxicity is caused by a metabolite of ethylene glycol, called glycolic acid, and not parent ethylene glycol. Under most

conditions of ethylene glycol exposure, the glycolic acid metabolite is present in the blood in very low levels. However, it can become the major metabolite following large doses of ethylene glycol due to saturation of glycolic acid oxidation and/or elimination. When levels of this acidic metabolite exceed the capacity of maternal blood buffers to neutralize it, a maternal metabolic acidosis ensues, which has been hypothesized to be the true agent responsible for ethylene glycol induced developmental toxicity. Research suggests that ethylene glycol developmental toxicity is due to a dose-rate dependent toxicokinetic shift leading to glycolate accumulation and metabolic acidosis.

ADDITIONAL STUDIES

Ethylene glycol has been shown to produce dose-related teratogenic effects in rats and mice when given by gavage or in drinking water at high concentrations or doses. The no-effect doses for developmental toxicity for ethylene glycol given by gavage over the period of organogenesis has been shown to be 150 mg/kg/day for the mouse and 500 mg/kg/day for the rat. Also, in a preliminary study to assess the effects of exposure of pregnant rats and mice to aerosols at concentrations of 150, 1000 and 2500 mg/m³ for 6 hours a day throughout the period of organogenesis, teratogenic effects were produced at the highest concentration, but only in mice. The conditions of these latter experiments did not allow a conclusion as to whether the developmental toxicity was mediated by inhalation of aerosol, percutaneous absorption of ethylene glycol from contaminated skin, or swallowing of ethylene glycol as a result of grooming the wetted coat. In a further study, comparing effects from high aerosol concentration by whole-body or nose-only exposure, it was shown that nose-only exposure resulted in maternal toxicity (1000 and 2500 mg/m³) and developmental toxicity with minimal evidence of teratogenicity (2500 mg/m³). The no-effects concentration (based on maternal toxicity) was 500 mg/m³. In a further study in mice, no teratogenic effects could be produced when ethylene glycol was applied to the skin of pregnant mice over the period of organogenesis. The above observations suggest that ethylene glycol is to be regarded as an animal teratogen. There is currently no available information to suggest that ethylene glycol has caused birth defects in humans. Cutaneous application of ethylene glycol is ineffective in producing developmental toxicity. Exposure to high aerosol concentrations is only minimally effective in producing developmental toxicity.

12. ECOLOGICAL INFORMATION

(Concentrated Ethylene Glycol)

ENVIRONMENTAL FATE

Movement & Partitioning: Bioconcentration potential is low (BCF less than 100 or Log Kow less than 3). Log octanol/water partition coefficient (log Kow) is -1.36. Henry's Law Constant (H) is 6.0E-08 atm-m³/mol. Bioconcentration factor (BCF) is 10 in golden orfe.

Degradation & Transformation: Biodegradation under aerobic static laboratory conditions is high (BOD20 or BOD28/ThOD greater than 40%). 5-Day biochemical oxygen demand (BOD5) is 0.78 p/p. 10-Day biochemical oxygen demand (BOD10) is 1.06 p/p. 20-Day biochemical oxygen demand (BOD20) is 1.15 p/p. Theoretical oxygen demand (THOD) is calculated to be 1.29 p/p. Biodegradation may occur under both aerobic and anaerobic conditions (in either the presence or absence of oxygen). Inhibitory concentration (IC50) in OECD "Activated Sludge, Respiration Inhibition Test" (Guideline # 209) is < 1000 mg/L. Degradation is expected in the atmospheric environment within days to weeks.

Ecotoxicology: Material is practically non-toxic to aquatic organisms on an acute basis (LC50 greater than 100 mg/L in most sensitive species). Acute LC50 for fathead minnow (*Pimephales promelas*) is 51000 mg/L. Acute LC50 for bluegill (*Lepomis macrochirus*) is 27549 mg/L. Acute LC50 for rainbow trout (*Oncorhynchus mykiss*) is about 18000-46000 mg/L. Acute LC50 for guppy (*Poecilia reticulata*) is 49300 mg/L. Acute LC50 for water flea (*Daphnia magna*) is 46300-51100 mg/L. Acute LC50 for the cladoceran *Ceriodaphnia dubia* is 10000-25800 mg/L. Acute LC50 for crayfish is 91430 mg/L. Acute LC50 for brine shrimp (*Artemia salina*) is 20000 mg/L. Acute

LC50 for golden orfe (*Leuciscus idus*) is greater than 10000 mg/L. Acute LC50 for goldfish (*Carassius auratus*) is greater than 5000 mg/L. Growth inhibition EC50 for green alga *Selenastrum capricornutum* is 9500-13000 mg/L.

BOD (% Oxygen Consumption):

Day 5	Day 10	Day 15	Day 20	Day 30
51%	80%		97%	

ECOTOXICITY

Toxicity to Micro-organisms:

Bacterial / NA: 16 h; IC50
Result Value: >10000 mg/l

Toxicity to Aquatic Invertebrates:

Daphnia: 48 h; LC50
Result Value: >100000 mg/l

Toxicity to Fish

Fathead Minnow: 94 h; LC50
Result Value: 70000 mg/l

FURTHER INFORMATION

Chemical Oxygen Demand (COD) – Measured: 1.29 mg/mg
Theoretical Oxygen Demand (THOD) – Calculated: 1.30 mg/mg

Octanol/Water Partition Coefficient – Measured: -1.36

13. DISPOSAL CONSIDERATIONS

DO NOT discharge to sewer. Wear appropriate personal protection. Take up with sand, vermiculite, or similar inert material. Dispose in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION

Non-Bulk

Not regulated by the US D.O.T. (in quantities under 5,000 lbs in any one inner package)

Bulk

Proper Shipping Name: Environmentally Hazardous Substance, LIQUID N.O.S. (ETHYLENE GLYCOL)
Technical Name: ETHYLENE GLYCOL
ID Number: UN 3082
Hazard Class: 9
Packing Group: PG III
Reportable Quantity: 5,000 lb.

IATA

Non-Bulk

Not Regulated by IATA
Service Pro 50/50 Antifreeze

IMDG

Non-Bulk

Not regulated by IMDG (in quantities under 5,000 lbs in any one inner package)

15. REGULATORY INFORMATION

THIS PRODUCT CONTAINS COMPONENT(S) CITED ON THE FOLLOWING REGULATIONS.

<u>Chemical Name</u>	<u>Cas Number</u>
Ethylene Glycol	107-21-1

United States - TSCA

Inventory: Listed

Water Standards: No data available

Atmospheric Standards: Clean Air Act (1990) - List of Hazardous Air Contaminants: listed

CERCLA: Reportable Quantity (RQ): 5,000 pounds (532 gallons)

OSHA Hazard Communication Standard:

This product is a "hazardous chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SARA Title III:

Section 311/312 - Categories: Acute hazard; chronic hazard

Section 312 - Inventory Reporting: Ethylene glycol is subject to Tier I and/or Tier II annual inventory reporting.

Section 313 - Emission Reporting: Ethylene glycol is subject to Form R reporting requirements.

Section 302 - Extremely Hazardous Substances: Ethylene glycol is not listed.

State Right-To-Know:

California - Exposure Limits - Ceilings:	vapor-50 ppm ceiling; 125 mg/m3 ceiling
Director's List of Hazardous Substances:	listed
Florida - Hazardous Substances List:	listed
Massachusetts - Right-to-Know List:	listed
Minnesota - Haz. Subs. List:	listed (particulate and vapor)
New Jersey - Right-to-Know List (Total):	Present greater than 1.0%
Pennsylvania Right-to-Know List:	environmental hazard

Canadian Regulations: This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required.

WHMIS Information: D2A - material has potential toxic effects. Refer elsewhere in the MSDS for specific warnings and safe handling information. Refer to the employer's workplace education program.

California Proposition 65 (Safe Drinking Water and Toxic Enforcement Act of 1986): The normal consumer use of this product does not result in exposure to chemicals known to the state of California to cause Cancer and/or reproductive harm above the significant risk level for carcinogens or the maximum allowable dose levels for reproductive toxins. Warnings are not required for consumer packaging. However, industrial or other occupational use of this product at higher frequency and using larger quantities of this product may result in exposures exceeding these levels and are labeled accordingly.

California SCAQMD Rule 443.1 (South Coast Air Quality Management District Rule 443.1, Labeling of Materials Containing Organic Solvents):

VOC: Vapor pressure 0.06 mmHg at 20°C
1113.38 g/l

16. OTHER INFORMATION

Contact: Thomas Cholke

Phone: (847) 559-2225

Old World Industries, Inc. makes no warranty, representation or guarantee as to the accuracy, sufficiency or completeness of the material set forth herein. It is the user's responsibility to determine the safety, toxicity and suitability of his own use, handling and disposal of this product. Since actual use by others is beyond our control, no warranty, expressed or implied, is made by Old World Industries, Inc. as to the effects of such use, the results to be obtained or the safety and toxicity of this product, nor does Old World Industries, Inc. assume liability arising out of the use by others of this product referred to herein. The data in this MSDS relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Chavez, Carl J, EMNRD

From: Lackey, Johnny [Johnny.Lackey@hollycorp.com]
Sent: Tuesday, October 27, 2009 1:50 PM
To: Chavez, Carl J, EMNRD
Cc: Moore, Darrell; Whatley, Michael
Subject: NAVAJO WDW-3
Attachments: Service Pro Anti Freeze.pdf

Carl:

As we discussed on 10/22/09, Navajo's consultant, Sub Surface, contacted each of the EPA Region VI member states of AR, LA, TX, NM & OK as well as the EPA Region VI office in Dallas, TX asking for each of their written Guidelines for Annulus Pressure Testing (APT) on UIC Class I nonhazardous Waste Disposal Wells (WDW). The purpose of this survey is to try and establish what is considered a significant leak as well as the specific maximum allowable test pressure deviation.

The actual conditions of the 2009 Navajo Annulus Pressure Test (APT) run on WDW-3 were both a Static (No Injection) and Dynamic (Injection) test. The starting pressure for the Static test was 560 psi and the ending pressure, taken 30 minutes later, was 540 psi. This is a static pressure loss total of 20 psi (3.6%). This loss is well within the historical allowable regulatory pressure deviation limits. The starting pressure for the Dynamic test was 580 psi and the ending pressure was 570 psi. This is a dynamic test pressure loss total of 10 psi (1.7 %). This loss is also well within the historical allowable regulatory deviation limits.

Considering these test results, there is no significant leak in WDW-3. What makes it significant to the OCD is the Ethylene Glycol Anti-Freeze that was added to the WAMS unit and possibly a portion of the casing-tubing annulus. In the MSDS (Ethylene Glycol CAS No. 107-21-13 5000 (2270 kg)) you referred to, it states in Section 12 Ecological Information under Environmental Fate: "When released to the soil, this material is expected to readily biodegrade..." additionally, "this material is expected to have a half life between 1 and 10 days and it is not expected to significantly bioaccumulate." Considering the biodegradability of this material, Ethylene Glycol will biodegrade and no longer is a threat to human health or the environment within about three months. Based on the records and previous e-mail correspondence, September 2007 is probably the earliest the WDW-3 casing-tubing annulus and/or Well Annulus Monitoring System (WAMS) could have come in contact with Ethylene Glycol Anti-Freeze. Therefore, any Ethylene Glycol that was added to the system has had over two years to degrade if in fact it was ever released to the environment. **Also, in order to have a reportable spill or release, 5000 pounds would have had to leak into the environment. WDW-3 has not even been exposed to that volume of Ethylene Glycol in either the casing, tubing annulus or the WAMS unit.**

Attached is a MSDS of the ethylene Glycol that is used at WDW-3. Note that this is a 50/50 mixture (50% water and 50% glycol) and not 100% ethylene glycol.

Navajo would like to propose an alternate to changing out the annulus fluid and/or locating and repairing the leak by first drilling a shallow monitor well to monitor the uppermost USDW at around 80 feet. This would allow us to rate the significance of the leak and therefore the need for repair. It appears that what is probably happening is salt water leaking through the squeezed perforations above the packer. **If the shallow monitor well sampling shows that there is no potential for harm to human health or the environment, the fluid loss can be monitored quarterly as you suggested, until the well needs maintenance for other reasons or WDW-3 fails the annulus pressure test (APT) or standard annulus pressure test (SAPT).**

The written EPA Guidelines are from Region V which appears to be the most recent EPA version outlining APT requirements.

EPA

DETERMINATION OF THE MECHANICAL INTEGRITY OF INJECTION WELLS

**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5 -- UNDERGROUND INJECTION CONTROL (UIC) BRANCH
REGIONAL GUIDANCE #5**

Revised February, 2008

**ATTACHMENT 1
STANDARD ANNULUS PRESSURE TEST (SAPT)**

4. Procedures for the SAPT:

To properly conduct the SAPT:

1. The tubing/casing annulus (annulus) must be completely filled with liquid (variations must be approved by Region 5). Temperature stabilization of the well and annulus liquid is necessary prior to conducting the test. This may be achieved by filling the annulus with liquid and either ceasing injection or maintaining stabilized injection (i.e., continuous injection at a constant rate and constant injection fluid temperature) before and through the test;

No unapproved substances may be added to the annulus liquid. Use of any substance which might affect the outcome of testing may constitute falsification of the test procedure, invalidate the test, and may subject the owner/operator to civil or criminal prosecution;

2. After stabilization, the annuluses of Class II wells should be pressurized to a surface pressure of no less than 300 psig. The annuluses of Class I wells should be pressurized to the greater of 300 psig or a pressure which exceeds the maximum allowable injection pressure by 100 psi, unless an alternate pressure is approved by Region 5. A positive pressure differential between the pressure in the annular space and the injection tubing pressure of at least 100 psi should be maintained throughout the entire annulus (from the top of the packer to the surface) of all Class I and II wells. Specific gravity differences between liquids in the annulus and the tubing should be accounted for when determining the appropriate test pressure. Following pressurization, the annular system must be isolated from the source of pressure and the seal-pot (if present) by a closed valve. If not inconvenient, the connection to the pressure source should be disconnected entirely;
3. The annulus system must remain isolated for a period of no less than 30 minutes for Class II, III, and V wells. The isolation must be maintained for one hour for Class I wells. During the period of isolation measurements of pressure should be made at ten-minute intervals; and
4. After the SAPT test period has been completed, the valve to the annulus should be opened and liquid returns from the annulus observed and measured. This may be done by allowing liquid to flow into a seal-pot assembly and measuring the volume of the returns or by opening a valve and catching the liquid flow-back in a container. The volume of annulus liquid returns recovered is proportional to the volume of the annulus and the amount of pressurization. The liquid return test can serve as an indication as to whether the full length of the annulus has been tested. As an alternative, the amount of liquid needed to increase the pressure can be measured. If the entire length of the annulus, from the wellhead to the packer, set at the approved depth, is not tested, then the test is void.

New Mexico

The written requirements in New Mexico are specified in Title 19 Chapter 15 Part 26 Injection. The issuing agency is the Energy, Minerals and Natural Resources Department, Oil Conservation Division. Specifically, 19.15.26.11 Testing, Monitoring, Step-Rate Tests, Notice to the Division, Requests For Pressure Increases:

A. Testing

- (1) "Prior to commencement of Injection and any time the operator pulls the tubing or reseats the packer, if used, including pressure testing of the casing-tubing annulus to a minimum of 300 psi for 30 minutes or such other pressure or time as the appropriate district supervisor may approve. The Operator shall use a pressure recorder and submit copies of the chart to the appropriate division office within 30 days following the test date..." The percentage allowable deviation is not specifically stated in the New Mexico regulations, however, the previous APT allowable deviations has been 10%.

Thanks,

Johnny Lackey
Environmental Manager
Navajo Refining Company, L.L.C.
Office - 575-746-5490
Cell - 972-261-8075
Fax - 575-746-5451
Johnny.Lackey@hollycorp.com

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This inbound email has been scanned for malicious software and transmitted safely to you using Webroot Email Security.

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Thursday, September 03, 2009 9:41 AM
To: 'Moore, Darrell'; Lackey, Johnny
Cc: Sanchez, Daniel J., EMNRD; VonGonten, Glenn, EMNRD; Dade, Randy, EMNRD
Subject: FW: WDW-3 Class I Disposal Well Annulus Leak in Disposal Well & OCD Notice of Well System Failure dated 8/19/2009 w/ CAs by 11/19/2009

Darrell:

The official date of notification of failure was 8/19/2009 with a 90 day period for corrective action to find the leak and fix it by November, 19, 2009.

Please find below the OCD's path forward (emphasis added w/ yellow highlighted text) based from our meeting on September 1, 2009 and from a review of EPA literature related to NRC's well problem.

- 1) Until the nature of the leak is known, replace the annulus fluid with an environmentally preferred fluid approved by OCD that will not cause down hole problems to the well system;
- 2) Increase standard annulus pressure and bradenhead testing to quarterly (from 8/14/2009 MIT) until the leak is repaired;
- 3) Increase monitoring of fluid loss at the Well Annulus Monitoring System (WAMS) Unit;
- 4) Identify the leaking component and verify that the leak is not occurring within any USDW zones, which will require a detailed evaluation of well construction for basis for USDW protection;
- 5) If a sealant is used to prevent or decrease the leak as required and the well cannot demonstrate MI, the Director will request the operator to discontinue the use of the additive and repair the well mechanically, such that MI is achieved, or plug and abandon the well in accordance with prescribed plugging and abandonment practices.
- 6) NRC could opt to conduct physical options for finding and repairing the leak in lieu of Item 5 above?

Subsequent to the notification, OCD met with Navajo Refining Company (NRC) on September 1, 2009 in Santa Fe to discuss the implications of the notification and confirm that the leak is considered an MIT System Failure. In the meeting we discuss steps that may help NRC with its corrective actions. OCD agreed to follow-up with a path forward based on concerns about the USDWs, well construction, hazardous nature of annulus fluid and its replacement, etc.

On September 2, 2009, the OCD after reviewing an MSDS informed NRC that the proposed use of propylene glycol was also of concern and the OCD recommended that NRC seek professional assistance from vendors who sell annulus fluids and are knowledgeable in with environmental issues that annulus fluids pose in the down hole environment. In addition, the OCD provided a website link to EPA procedures for dealing with an annulus pressure leak, which is provided below and forms the basis for OCD's path forward.

Physical Options for Finding & Fixing Leak

Leaks in injection well components can be eliminated through a number of procedures including:

- 1.
2. Resetting the packer;
3. Replacing the tubing;
4. Squeezing - cement may be forced through a casing leak;
5. Recasing - all or part of the well;
6. Cementing the tubing into the well
7. Setting mechanical casing patches of various kinds; or
8. Adding materials to the liquid in the annulus to change the properties of the liquid to prevent or diminish flow through the leak or to mechanically plug the leak.

Considerations

The critical issues in formulating a program policy regarding the use of chemical or mechanical sealants in well annuli which have lost MI are:

- 1.

2. Does the sealant allow transmission of pressure throughout the annulus so that new and continuing leaks can be detected?
3. Does the additive offer a long-term solution to the problem?
4. If the sealant fails, is there an annulus monitoring system in place capable of timely detection of the loss of MI?
5. Will USDWs be protected from contamination in the event that there is failure to totally eliminate leaking or a failure of the sealant at a later time?
6. In the event the additive does not work and migrates out of the annulus, are its properties such that it cannot contaminate a USDW?
7. Will the additive remain suspended within the annulus fluid and not settle on the packer and inhibit its removal?

Positive answers to these questions assure that there will be no environmental impact resulting from the use of repair which may prove to be temporary.

Recommended Approach

A. Conditions Under which Additives to the Annulus Liquid may be Used

We recommend that injection well operators be permitted to attempt the elimination of leaks, at the UIC Program Director's discretion, by means of either:

1. Chemical additives which increase the viscosity of the annulus fluid; or Materials which can mechanically plug small leaks when added to the annulus fluid under the following conditions:
 2. The leaking well component must be known (i.e., tubing and packer or casing) and, in the case of a casing leak, located;
 3. Any leak in the outermost casing must be below the base of the lowermost USDW if leakage of injectate or annulus fluid may cause a violation of any national primary drinking water standard or may otherwise adversely affect the health of persons;
 4. If the leak is in the outermost casing, the well must have part 2 of MI and it must be demonstrated periodically (e.g., that is, cementing records cannot be accepted as a demonstration of MI);
 5. The additive will allow transmission of pressure throughout the entire tubing- casing annulus from the wellhead to the packer;
 6. The annulus pressure and/or liquid level are frequently monitored and reported along with additions of liquid to the annulus system so that any increase in leak rate will be identified in a timely manner;
 7. The potential for contamination of USDWs must not be increased as a result of any means used to restore MI.
 8. If the additive should fail to prevent or decrease the leak as required and the well cannot demonstrate MI, the Director will request the operator to discontinue the use of the additive and repair the well mechanically, such that MI is achieved, or plug and abandon the well in accordance with prescribed plugging and abandonment practices.

Please contact me if you have questions. Thank you in advance for cooperation in this matter.

Carl J. Chavez, CHMM
 New Mexico Energy, Minerals & Natural Resources Dept.
 Oil Conservation Division, Environmental Bureau
 1220 South St. Francis Dr., Santa Fe, New Mexico 87505
 Office: (505) 476-3490
 Fax: (505) 476-3462
 E-mail: CarlJ.Chavez@state.nm.us
 Website: <http://www.emnrd.state.nm.us/ocd/index.htm>
 (Pollution Prevention Guidance is under "Publications")

From: Chavez, Carl J, EMNRD
Sent: Wednesday, September 02, 2009 6:10 PM
To: 'Moore, Darrell'; Lackey, Johnny
Cc: Sanchez, Daniel J., EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD
Subject: WDW-3 Annulus Leak (Propylene Glycol (PG) MSDS & Annulus Fluid Replacement for Ethylene Glycol)

Darrell:

I'll focus on this tomorrow morning as OCD promised a path forward on the WDW-3 disposal well leak issue.

FYI, I looked over the MSDS (see link below) for PG and it is hazardous. I recommend you contact your business contacts for more assistance with the selection of an annulus fluid.

Propylene Glycol MSDS

<http://www.itbaker.com/msds/englishhtml/p6928.htm>

Relevant EPA Webpage (NATIONAL UIC TECHNICAL WORKGROUP

FINAL WORK PRODUCT #5 Use of Annulus Additives to Address Leaks in Deep Injection Wells)

<http://www.epa.gov/r5water/uic/ntwg/issue5.htm>

Thanks.

Carl J. Chavez, CHMM

New Mexico Energy, Minerals & Natural Resources Dept.

Oil Conservation Division, Environmental Bureau

1220 South St. Francis Dr., Santa Fe, New Mexico 87505

Office: (505) 476-3490

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E-mail: CarlJ.Chavez@state.nm.us

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Chavez, Carl J, EMNRD

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Sent: Thursday, September 03, 2009 9:41 AM
To: 'Moore, Darrell'; Lackey, Johnny
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Carl J. Chavez, CHMM
 New Mexico Energy, Minerals & Natural Resources Dept.
 Oil Conservation Division, Environmental Bureau
 1220 South St. Francis Dr., Santa Fe, New Mexico 87505
 Office: (505) 476-3490
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From: Chavez, Carl J, EMNRD
Sent: Wednesday, September 02, 2009 6:10 PM
To: 'Moore, Darrell'; Lackey, Johnny
Cc: Sanchez, Daniel J., EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD
Subject: WDW-3 Annulus Leak (Propylene Glycol (PG) MSDS & Annulus Fluid Replacement for Ethylene Glycol)

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<http://www.itbaker.com/msds/englishhtml/p6928.htm>

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FINAL WORK PRODUCT #5 Use of Annulus Additives to Address Leaks in Deep Injection Wells)

<http://www.epa.gov/r5water/uic/ntwg/issue5.htm>

Thanks.

Carl J. Chavez, CHMM

New Mexico Energy, Minerals & Natural Resources Dept.

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1220 South St. Francis Dr., Santa Fe, New Mexico 87505

Office: (505) 476-3490

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E-mail: CarlJ.Chavez@state.nm.us

Website: <http://www.emnrd.state.nm.us/ocd/index.htm>

(Pollution Prevention Guidance is under "Publications")

Chavez, Carl J, EMNRD

Subject: UICI-008 WDW-3 Well Leakage Problem Meeting
Location: OCD Conference Room 3rd Floor Wendell Chino Bldg. Santa Fe

Start: Tue 9/1/2009 1:15 PM
End: Tue 9/1/2009 2:15 PM

Recurrence: (none)

Meeting Status: Meeting organizer

Organizer: Chavez, Carl J, EMNRD
Required Attendees: Moore, Darrell; Lackey, Johnny; Sanchez, Daniel J., EMNRD; Jones, William V., EMNRD; Chavez, Carl J, EMNRD; Ezeanyim, Richard, EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD; VonGonten, Glenn, EMNRD

OCD Santa Fe will call Randy Dade's (Artesia District Office) office phone number OFFICE: (575) 748-1283 Ext. 102 to include Artesia in the meeting.

We have a meeting in Santa Fe with NMED on September 1, 2009 at 9 am. We were wondering if you would be available to meet with us at 1pm that same day to discuss our MIT on the Injection Well and our issue with the WAMS unit? Daniel Sanchez would also be a good party to have that meeting. Does that work for you guys?

Darrell Moore
Environmental Manager for Water and Waste
Navajo Refining Company, LLC
Phone Number 575-746-5281
Cell Number 575-703-5058
Fax Number 575-746-5451

From: Chavez, Carl J, EMNRD
Sent: Wednesday, August 19, 2009 5:15 PM
To: Moore, Darrell; Lackey, Johnny
Cc: Sanchez, Daniel J., EMNRD; Jones, William V., EMNRD; VonGonten, Glenn, EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD
Subject: Navajo Refining Company WDW-3 (UICI-008-0) UIC Class I Well API# 30-015-26575 Annulus Fluid in WAMS Unit Loosing 10 gal/mo Ethylene Glycol

Darrell, et al.:

I have discussed the WAMS Unit loss of ethylene glycol somewhere within the well system with various OCD UIC Inspectors and Mr. Daniel Sanchez (OCD UIC Director). The OCD has determined based on the well system and recent MIT conducted on Friday, August 14, 2009 that the pinhole leak (10 gal/mo.) situation of ethylene glycol constitutes an MIT failure determination. Consequently, by receipt of this e-mail communiqué, the OCD hereby requires Navajo Refining Company to undertake corrective action(s) within 90 days from the today's date to fix the leakage problem. In addition, the OCD requires that the hazardous ethylene glycol fluid be immediately replaced with an "inert" or non-hazardous fluid that does not have the potential to adversely impact the USDW.

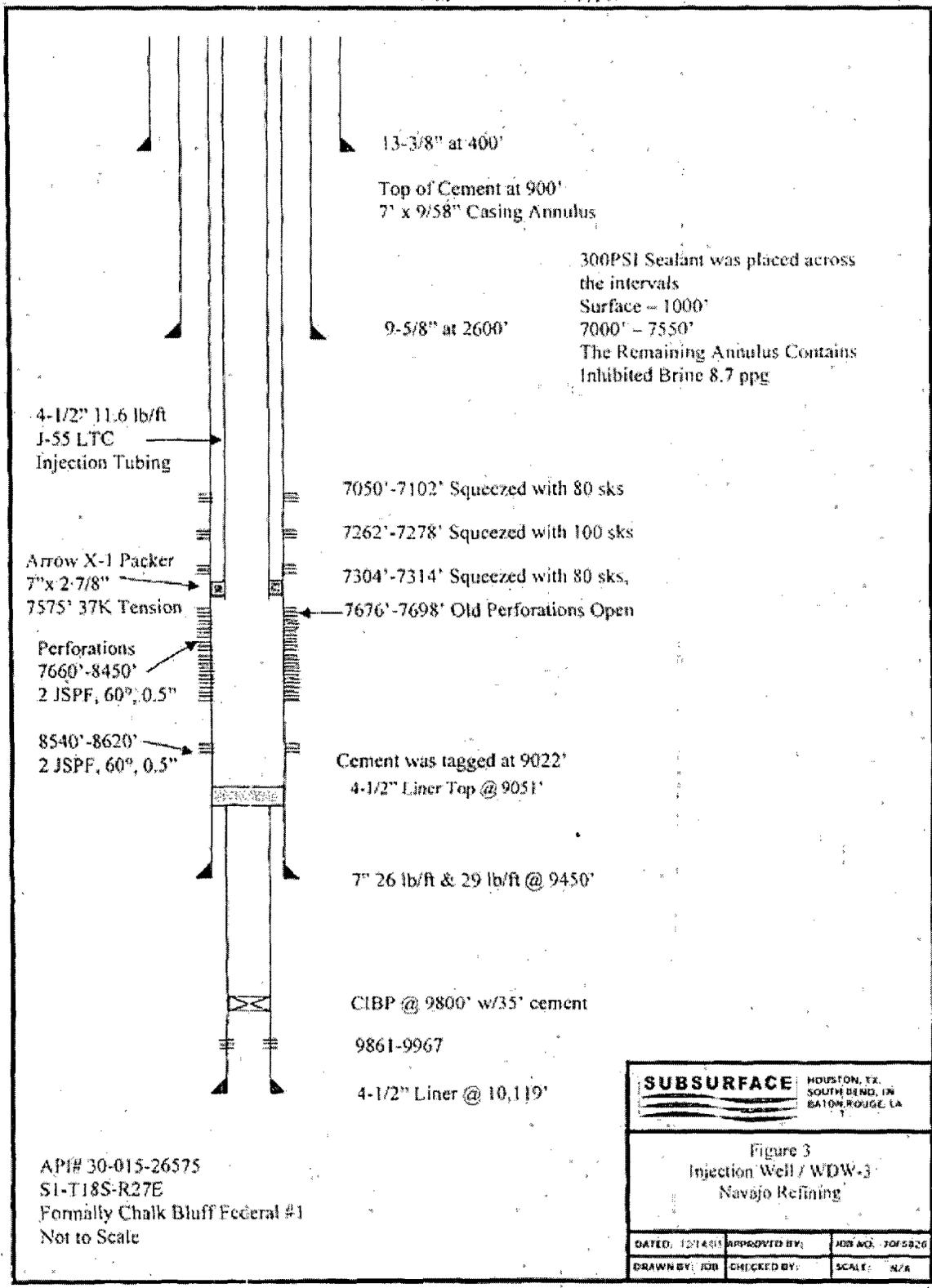
The OCD is aware of the most recent attempt by a company called "300 PSI" (see Well Diagram below with depths of sealant placement within the well) to isolate and repair leakage in the well system using a proprietary sealant. However, it appears that there is still a leak and the OCD notices an increasing pressure loss over the past 2 years of standard annulus pressure tests or MITs of the well, which may indicate the leak size may be increasing? Regardless of the pressure loss, leak rate, and passing of a standard OCD MIT, the leak indicates that there is a well system failure.

In addition, the OCD considered your proposal in the field during the most recent MIT Inspection on Friday, August 14, 2009, which was to replace the fluid and/or augment the existing ethylene glycol with a leak additive standard to ethylene

glycol refrigerants to fix the problem. Ethylene Glycol is a listed contaminant under 40 CFR 302.4 with a Reportable Quantity for Releases to the NRC (Ethylene Glycol CAS No. 107-21-1 3 5000 lbs. (2270 kg)). Consequently, the OCD cannot condone the continued use of a hazardous compound under its Underground Injection Control Program in a disposal well that is known to be leaking and in an area underlain by an USDW(s). According to the most recent public notice for this well, fresh ground water (~1500 ppm TDS) is present at about 80 ft. below ground level.

Please contact me to discuss a schedule for corrective action(s) within the next 14 calendar days. Thank you.

WDW-3 Well Diagram

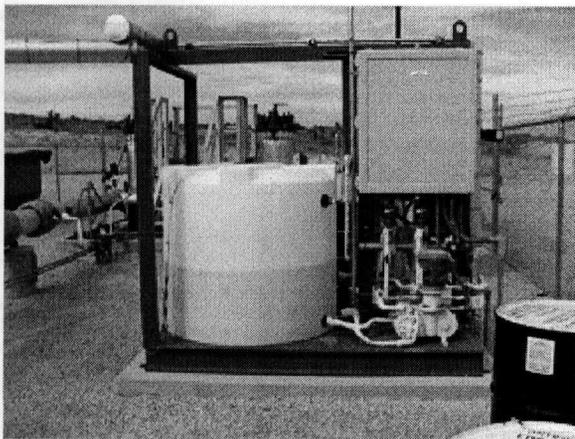


Darrell called at ?

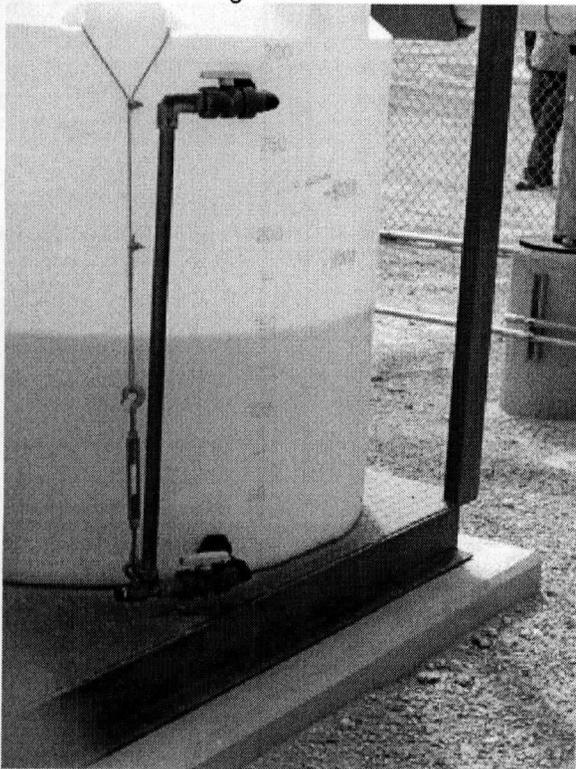
Discussion:

It is the Artesia Office that we need to include in the meeting as the well is in Eddy County.

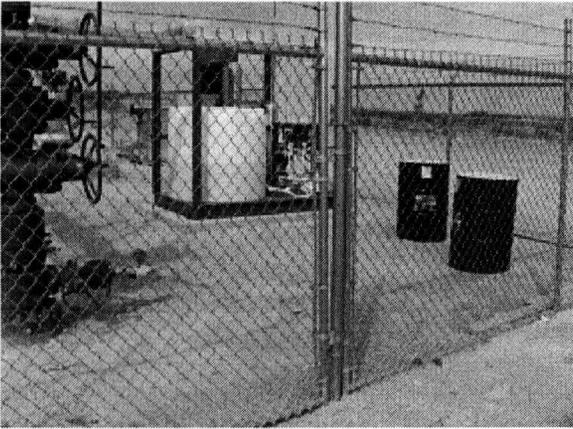
On MITs, OCD arrives, to witness chart placement onto a calibrated recorder with appropriate clock setting and give it 30 minutes +/- 10% on these type of wells to pass. There is a provision highlighted below that indicates a pass designation as determined by the inspector where there is pressure bleed-off +/- 10%. I passed the MIT w/ start pressure of 560 psig and end pressure at 540 psig on 8/14/2009; however, the discharge permit has the provision 22(G) (see yellow highlighted text below) for the WAMs unit (term used by Navajo Refining Company), which is connected to annulus for daily fluid level monitoring. Based on this provision of the permit, they have a system problem either downhole or somewhere in the system on or near the surface as they are losing fluid at a rate of about 10 gal/mo. The OCD permit states a significant gain or loss of fluid from the system. I am looking through out P2 section to find environmentally friendly packer fluids that may be preferred to ethylene glycol. According to the operator, the systems at their other 2 Class I Disposal Wells show no loss of fluids.



WAMs Unit in Foreground



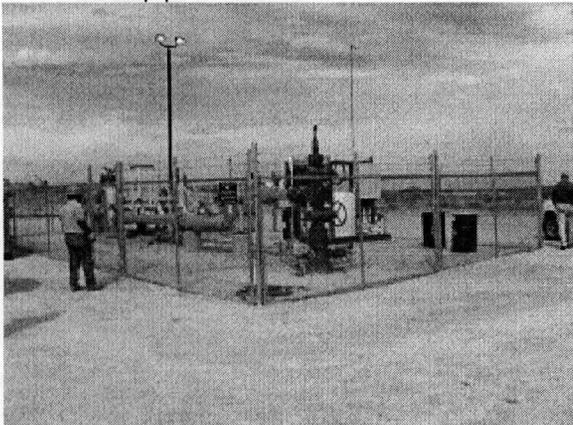
WAMs Unit Ethylene Glycol Fluid Monitoring
(10 gal/mo) addition of fluid needed to maintain level.



WAMs Unit relative to disposal wellhead



WAMs Unit piped into wellhead Annulus



Fenced wellhead w/ lighting 24/7

DP Section 22. Class I Injection Well(s) Identification, Operation, Monitoring, Bonding and Reporting.

C. Injection Formation. Interval & Waste: Injected refinery exempt/non-exempt non-hazardous wastes will be injected into the Lower-Wolfeamp Formation at the interval 7650 ft to 8450 ft and 8450 ft to 8620 ft. Tubing shall be surrounded by surface casing set to a depth protective of fresh ground water (< 10,000 ppm TDS). The owner/operator shall take all steps necessary to ensure that the injected waste enters only the above specified injection interval and is not permitted to escape to other formations or onto the surface. The operator shall provide written notice of the date of commencement of injection to the Santa Fe Office of the Division.

D. Well Injection Pressure Limits: The wellhead injection pressure on the well shall be limited to no more than 1530 psig. In addition, the injection well or system shall be equipped with a pressure limiting device in workable condition, which shall, at all times, limit surface injection pressure to the maximum allowable pressure for this well. The maximum operating surface injection and/or test pressure measured at the wellhead shall not exceed 1530 psig unless otherwise approved by the

OCD. The pressure-limiting device shall monthly be demonstrated and reported quarterly to the OCD. Navajo Refining Company shall take all steps necessary to ensure that the injected water enters only the proposed injection interval and is not permitted to escape to other formations or onto the ground surface. Any pressure that causes new fractures or propagation in existing fractures or causes damage to the system shall be reported to OCD within 24 hours of discovery.

The Director of the OCD may authorize an increase in injection pressure upon demonstration by the operator of said well that such higher pressure will not result in migration of the injected fluid from the injection formation. Such demonstration shall consist of a valid step-rate test run in accordance with and acceptable to the OCD.

B. Mechanical Integrity Testing (MIT):

The owner/operator shall complete an annual casing-tubing annulus pressure test from the surface to the approved injection depth and below the depth of fresh ground water (< 10,000 ppm TDS) to assess casing and tubing integrity. The MIT shall consist of a 30-minute test at a minimum pressure from 300 to 500 psig measured at the surface. A Bradenhead test(s) shall also be performed annually along with the casing-tubing annulus test. A Bradenhead test(s) shall be performed in all annular spaces including surface casing if not cemented.

The owner/operator shall complete an annual pressure fall-off test to monitor the pressure buildup in the injection zone. The well shall be shut down for a period sufficient to conduct the test and shall be submitted to the OCD in the annual report (see Section 22K (11)).

All well testing shall be performed annually or shall also be performed whenever the tubing is pulled or the packer reseated or when the injection formation will be isolated from the casing/tubing annuals.

The operator shall notify the supervisor of the Santa Fe Office of the Division of the date, time and time of the installation of disposal equipment and of any MIT so that it may be inspected and witnessed.

1. General Requirements:

- a. If the testing requires a packer then casing-tubing annulus must be loaded with inert fluid 24 hours prior to testing.
- b. Have manpower and equipment available for pressure test. Wellhead shall be prepared for test and all valves and gauges should be in good working order.
- c. Pumps, tanks, external lines etc. must be isolated from the wellhead during test.
- d. A continuous recording pressure device with a maximum 4-hour clock shall be installed on the casing-tubing annulus. The pressure range shall not be greater than 500 psig. The operator must provide proof that the pressure-recording device has been calibrated within the past 6 months.
- e. A minimum of one pressure gauge shall be installed on the casing/tubing annulus.
- f. OCD must witness the beginning of test (putting chart on) and ending of test (removing chart). At the end of test, the operator may be required to bleed-off well pressure to demonstrate recorder and gauge response.
- g. The Operator shall supply the following information on the pressure chart that the inspector will file in the well records:
 1. Company Name, Well Name, API #, Legal Location.
 2. Test Procedure with "Pass/Fail" designation.
 3. Testing Media: Water, Gas, Oil, Etc.
 4. Date, time started and ending.
 5. Name (printed) and signature of company representative and OCD Inspector

2. Test Acceptance:

The OCD will use the following criteria in determining if a well has passed the Mechanical Integrity Test:

- a. Passes if Zero Bleed-Off during the test.

b. Passes if Final Test Pressure is within $\pm 10\%$ of Starting Pressure, if approved by the OCD inspector.

c. Fails if any Final Test Pressure is greater than $\pm 10\%$ of Starting Pressure. Operators must investigate for leaks and demonstrate that mechanical integrity of the well(s) by ensuring there are no leaks in the tubing, casing, or packer, and injected/produced fluids are confined within the piping and/or injection zones. Wells shall not resume operations until approved by OCD.

Note: OCD recognizes that different operations, well designs, formation characteristics and field conditions may cause variations in the above procedures. If the operator wishes to make or discuss anticipate changes, please notify the OCD for approval. All operators are responsible to notify OCD of any procedure that may cause harm to the well system or formation. Please be advised that OCD approval does not relieve any operator of liability should operations result in pollution of surface water, groundwater, or the environment.

d. When the MIT is not witnessed by an OCD Representative and fails, the owner/operator shall notify the OCD within 24 hours after having knowledge of well MIT failure.

F. Loss of Mechanical Integrity: The operator shall report within 24 hours of discovery any failure of the casing, tubing or packer, or movement of fluids outside of the injection zone. The operator shall cease operations until proper repairs are made and receive OCD approval to re-start injection operations. In addition, any associated fresh ground water monitor wells, which exhibit anomalous static water levels, detection of elevated general chemistry constituents, public health issues, etc. shall be immediately reported to the OCD.

G. Injection Record Volumes and Pressures: The owner/operator shall submit quarterly reports of its disposal, operation and well workovers provided herein. The minimum, maximum, average flow waste injection volumes (including total volumes) and annular pressures of waste (oil field exempt/non-exempt non-hazardous waste) injected will be recorded monthly and submitted to the OCD Santa Fe Office on a quarterly basis.

The casing-tubing annulus shall contain fluid and be equipped with a pressure gauge or an approved leak detection device in order to determine leakage in the casing, tubing, or packer. Due to pressure fluctuations observed at Navajo's other two nearby Class I Injection Wells, WDW-3 shall be equipped with an expansion tank under constant 100 psig pressure connected to the casing-annulus and maintained under constant pressure. The expansion tank shall initially be filled half-full (250 gallon expansion tank) with an approved fluid to establish an equilibrium volume and fluid level. Weekly monitoring of fluid levels in the expansion tank coupled with documented additions/removals of fluids into or out of the expansion tank is required to maintain the equilibrium volume. Any loss or gain of fluids in the expansion tank shall be recorded, and if significant, reported to the OCD within 24 hours of discovery. The owner/operator shall provide the following information on a quarterly basis: weekly expansion tank volume readings shall be provided in a table in the cover letter of each quarterly report. Navajo shall monitor, record and note any fluid volume additions or removals from the expansion tank on a quarterly basis. In addition, any well activity (i.e., plugging, changing injection intervals, etc.) shall be conducted in accordance with all applicable New Mexico Oil Conservation Division regulations.

2009 FIRST QUARTER WEEKLY WAMS LEVEL TABLE

	1/2/09	1/8/09	1/15/09	1/22/09	1/29/09	2/5/09	2/12/09	2/17/09	2/23/09	3/4/09	3/13/09	3/20/09	3/27/09
WDW-1 ¹	150	150	150	150	150	150	145	140	135	135	135	135	135
WDW-2 ¹	175	175	175	175	175	175	165	155	150	150	150	150	150
WDW-3 ²	58%	58%	58%	58%	58%	58%	56%	56%	56%	56%	56%	56%	56%

¹ Graduated tank gauged weekly in the field.

² Reading measured directly, and reported as percentage capacity.

Navajo Refining Company, L.L.C.

2009 SECOND QUARTER WEEKLY WAMS LEVEL TABLE

	4/3/09	4/9/09	4/16/09	4/23/09	4/30/09	5/6/09	5/13/09	5/20/09	5/29/09	6/4/09	6/11/09	6/18/09	6/25/09
WDW-1 ¹	135	135	135	135	135	135	135	135	135	130	130	130	130
WDW-2 ¹	150	150	150	150	150	150	150	150	150	150	150	150	150
WDW-3 ²	56%	56%	56%	56%	56%	56%	56%	56%	56%	53%	39%	30%	64%

Comments: Added 110 gallons of antifreeze to WDW-3 on 6/25/09.

¹ Graduated tank gauged weekly in the field.

² Reading measured directly, and reported as percentage capacity.

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Thursday, August 27, 2009 11:37 AM
To: 'Moore, Darrell'
Cc: Lackey, Johnny; Sanchez, Daniel J., EMNRD; Inge, Richard, EMNRD
Subject: Navajo Refining Company WDW-3 (UICI-008-0) MIT Inspection Friday, August 14, 2009
Attachments: WDW-3 8-14-09.pdf

Darrell:

Please find attached the OCD's inspection notes from Friday, August 14, 2009.

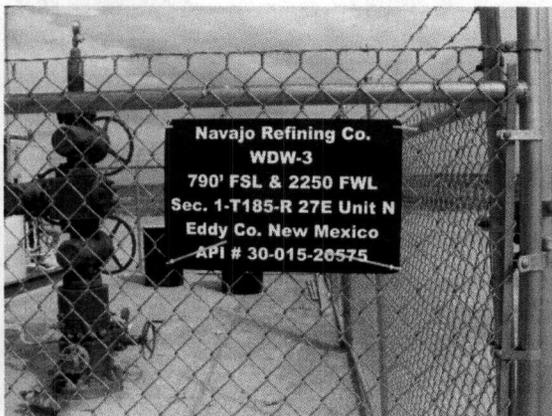
As you indicated in the field, you have placed any drums in the fenced security area into the impermeable pad area. In addition, to indicated that an RFE would be submitted to replace the ½ inch diameter with 1 inch diameter piping due to concerns about high-pressure on a small line and over concerns of breakage of the small line during future MITs, etc.

Also, Navajo Refining Company will be in Santa Fe on Tuesday, September 1, 2009 to discuss the leakage issue from the inspection. The OCD recommends that Navajo investigate other environmentally preferred chemicals for the WAMs unit due to the USDW beneath the well site.

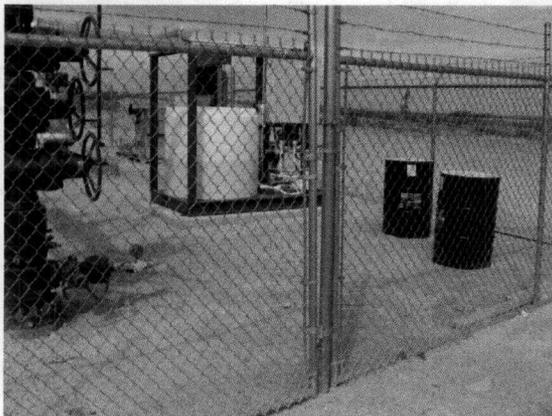
Please contact me if you have questions. Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
Oil Conservation Division, Environmental Bureau
1220 South St. Francis Dr., Santa Fe, New Mexico 87505
Office: (505) 476-3490
Fax: (505) 476-3462
E-mail: CarlJ.Chavez@state.nm.us
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>
(Pollution Prevention Guidance is under "Publications")

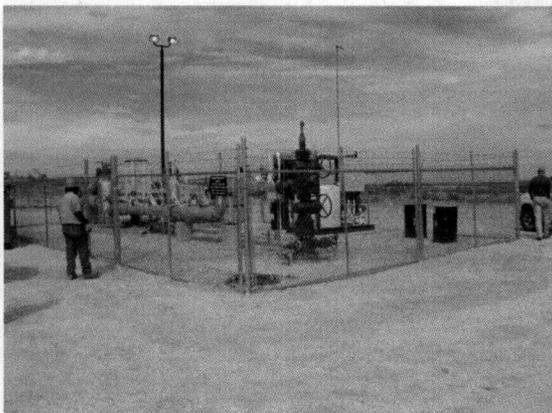
WDW-3 Inspection & MIT (8/14/2009)



UIC Class I Well WDW-3 sign w/ security fence and lighting 24/7.



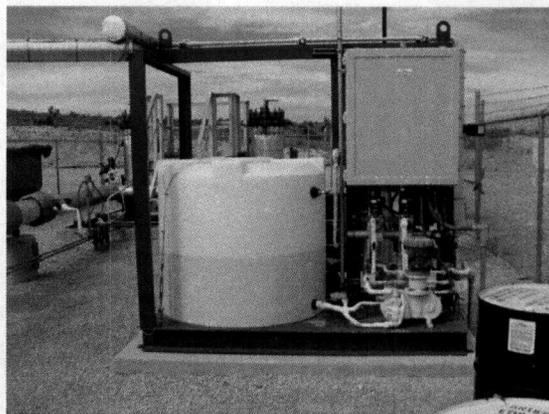
WAMs Unit near wellhead w/ drums of ethylene glycol not stored in impermeable area



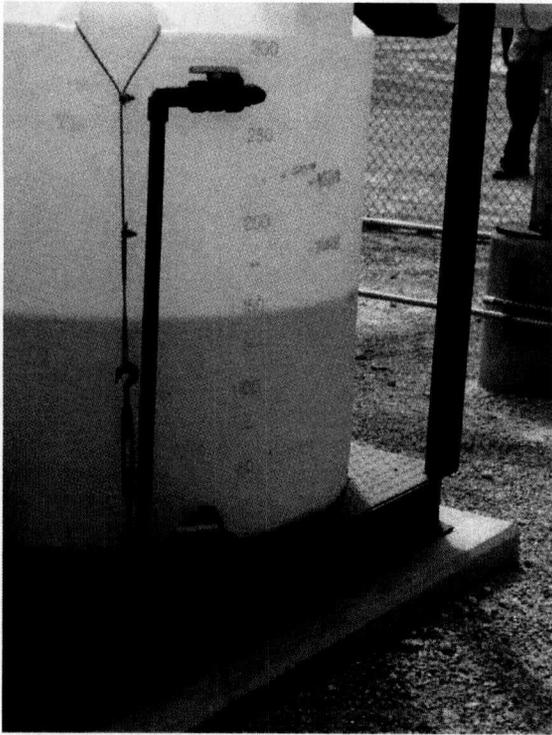
Wellhead from a distance looking SE



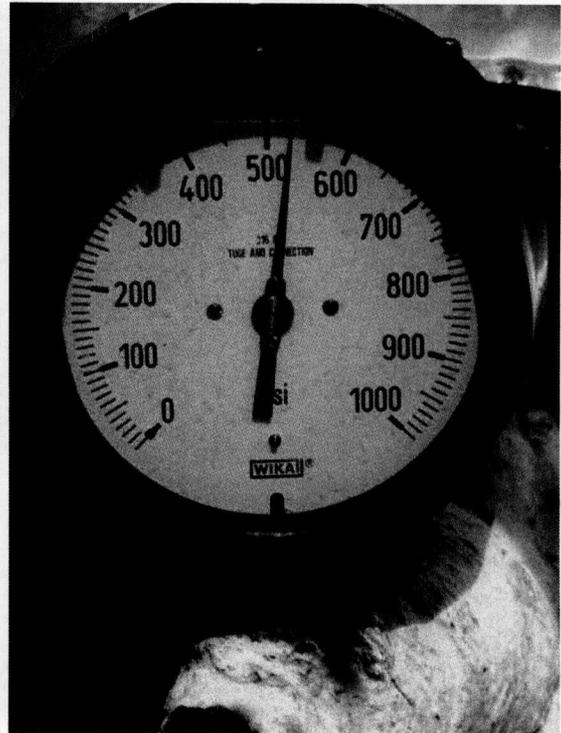
Annulus pressure gauge at top of well casing reading ~ 500 psig during pressure up on annulus



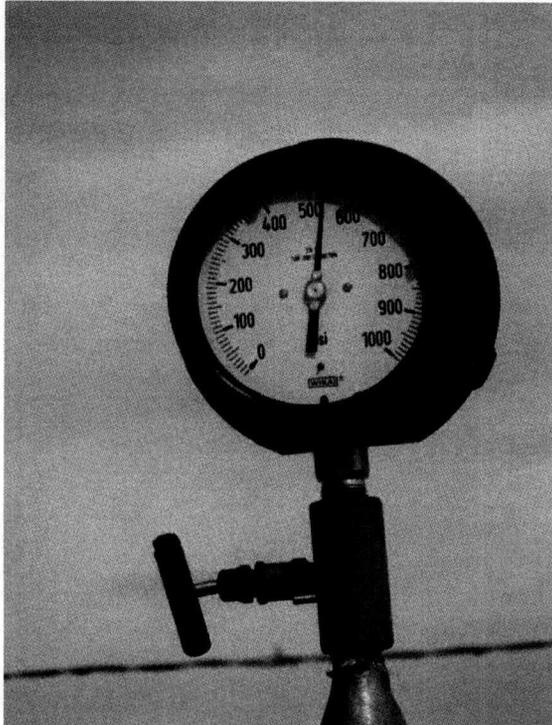
WAMs unit w/ overhead piping to wellhead looking E



WAMs Unit fluid loss ~ 10gal/mo.



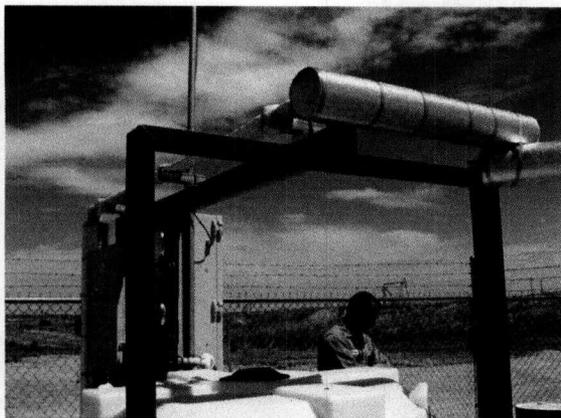
Another pressure gauge during MIT at ~ 530 psig



Annulus pressure gauge during MIT at ~530 psig



Rusty fittings near wellhead pinhole leak(s)?



WAMs Unit overhead piping into wellhead annulus w/ no apparent leakage observed



Hot Oil fluid pressure up on annulus w/ valve configuration during MIT



Operator wants to replace $\frac{1}{2}$ inch nipple w/ at least 1 inch over breakage concerns and high pressure on small diameter pipe during the MITs, etc.

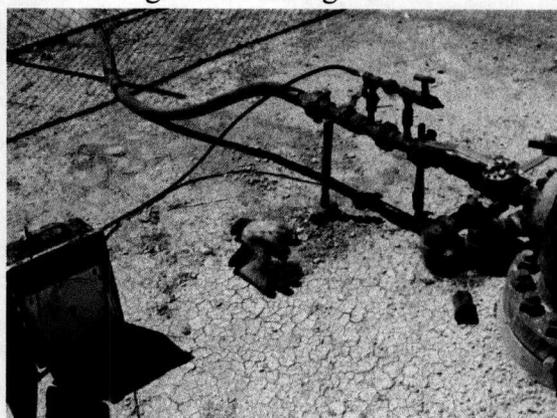
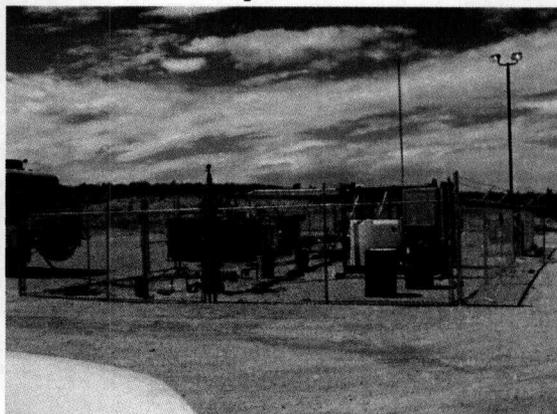
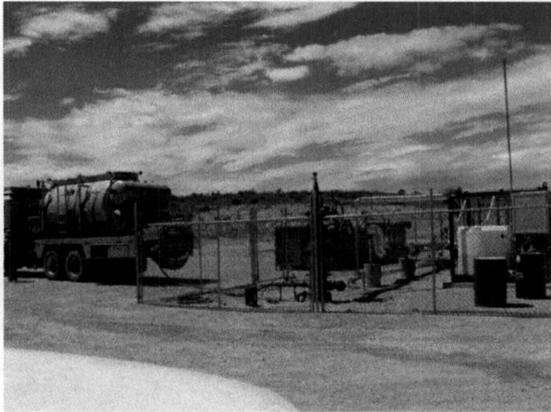


Chart recorder setup for test



Looking E across fenced and lighted facility w/ ethylene glycol drums stored on ground.



Hot Oil truck setup for MIT

Notes:

- 1) MIT passed (Start @ 560 psig w/
End @ 540 psig) on 8/14/2009.
- 2) MIT system integrity concerns about
WAMs Unit & ethylene glycol
leakage somewhere in the system.
No discernable stains, leaks have
been observed at surface. Company
called "300 PSI" performed (~ 2006)
a proprietary sealant leak application
from surface to 1000 ft. and from ~
7000 ft. to near top of perforated
interval.
- 3) Need to test all surface lines, valves,
etc. for pinhole leakage and proceed
into well if leak not found in surface
piping.
- 4) Drums need to be stored in the
impermeable pad area.

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Wednesday, August 19, 2009 5:15 PM
To: 'Moore, Darrell'; Lackey, Johnny
Cc: Sanchez, Daniel J., EMNRD; Jones, William V., EMNRD; VonGonten, Glenn, EMNRD; Dade, Randy, EMNRD; Inge, Richard, EMNRD
Subject: Navajo Refining Company WDW-3 (UICI-008-0) UIC Class I Well API# 30-015-26575
Annulus Fluid in WAMs Unit Loosing 10 gal/mo Ethylene Glycol

Darrell, et al.:

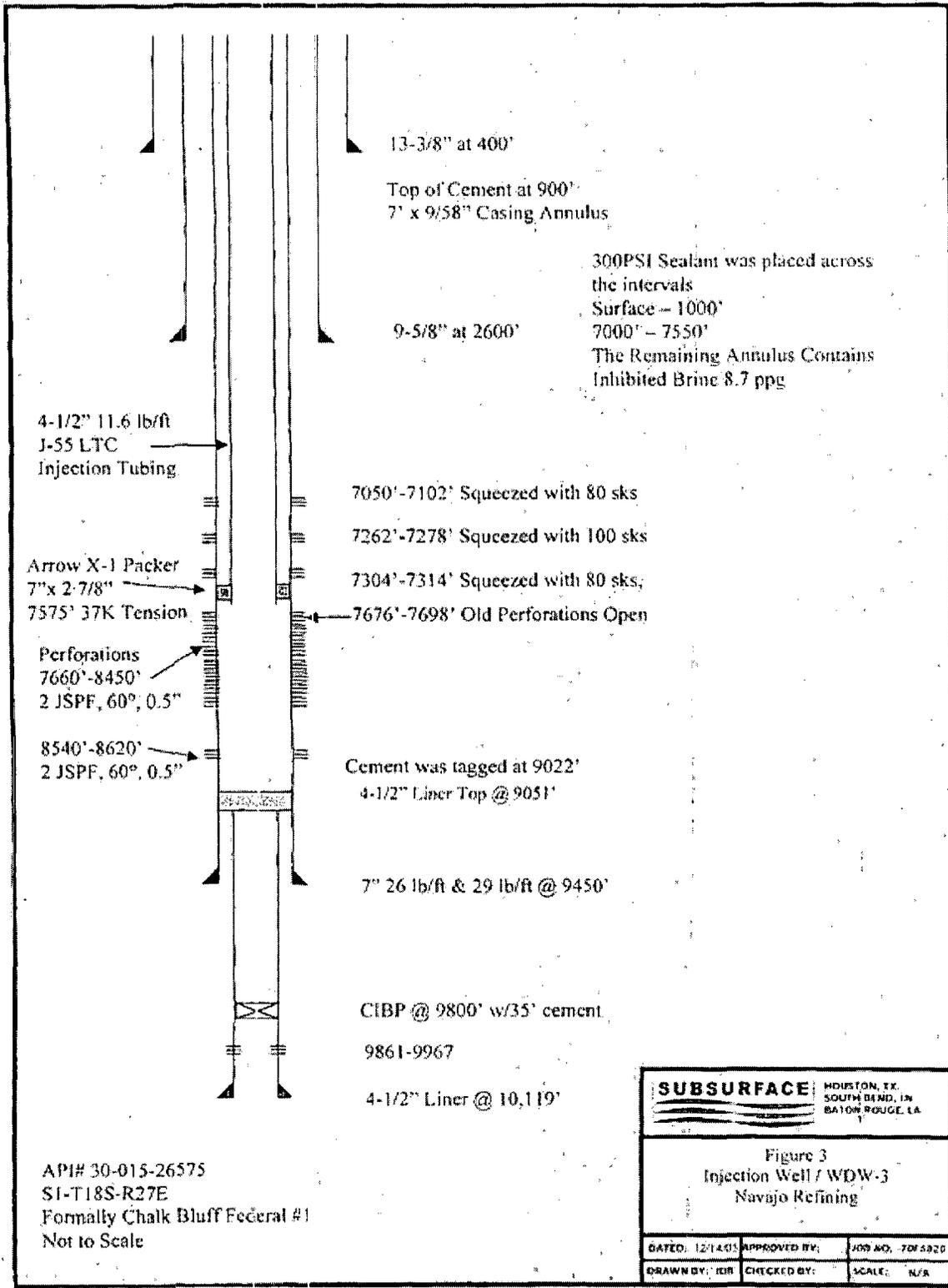
I have discussed the WAMs Unit loss of ethylene glycol somewhere within the well system with various OCD UIC Inspectors and Mr. Daniel Sanchez (OCD UIC Director). The OCD has determined based on the well system and recent MIT conducted on Friday, August 14, 2009 that the pinhole leak (10 gal/mo.) situation of ethylene glycol constitutes an MIT failure determination. Consequently, by receipt of this e-mail communiqué, the OCD hereby requires Navajo Refining Company to undertake corrective action(s) within 90 days from the today's date to fix the leakage problem. In addition, the OCD requires that the hazardous ethylene glycol fluid be immediately replaced with an "inert" or non-hazardous fluid that does not have the potential to adversely impact the USDW.

The OCD is aware of the most recent attempt by a company called "300 PSI" (see Well Diagram below with depths of sealant placement within the well) to isolate and repair leakage in the well system using a proprietary sealant. However, it appears that there is still a leak and the OCD notices an increasing pressure loss over the past 2 years of standard annulus pressure tests or MITs of the well, which may indicate the leak size may be increasing? Regardless of the pressure loss, leak rate, and passing of a standard OCD MIT, the leak indicates that there is a well system failure.

In addition, the OCD considered your proposal in the field during the most recent MIT Inspection on Friday, August 14, 2009, which was to replace the fluid and/or augment the existing ethylene glycol with a leak additive standard to ethylene glycol refrigerants to fix the problem. Ethylene Glycol is a listed contaminant under 40 CFR 302.4 with a Reportable Quantity for Releases to the NRC (Ethylene Glycol CAS No. 107-21-1 3 5000 lbs. (2270 kg)). Consequently, the OCD cannot condone the continued use of a hazardous compound under its Underground Injection Control Program in a disposal well that is known to be leaking and in an area underlain by an USDW(s). According to the most recent public notice for this well, fresh ground water (~1500 ppm TDS) is present at about 80 ft. below ground level.

Please contact me to discuss a schedule for corrective action(s) within the next 14 calendar days. Thank you.

WDW-3 Well Diagram



Carl J. Chavez, CHMM
 New Mexico Energy, Minerals & Natural Resources Dept.
 Oil Conservation Division, Environmental Bureau
 1220 South St. Francis Dr., Santa Fe, New Mexico 87505
 Office: (505) 476-3490

Fax: (505) 476-3462

E-mail: CarlJ.Chavez@state.nm.us

Website: <http://www.emnrd.state.nm.us/ocd/index.htm>
(Pollution Prevention Guidance is under "Publications")

Chavez, Carl J, EMNRD

From: Chavez, Carl J, EMNRD
Sent: Wednesday, August 06, 2008 12:10 PM
To: Moore, Darrell
Cc: Price, Wayne, EMNRD; 'Lackey, Johnny'; Sanchez, Daniel J., EMNRD
Subject: Navajo UICL-8 UIC Class I Wells MIT Charts from 8-5-2008
Attachments: WDW-1 MIT UICL-8 8-5-2008.tif; WDW-2 MIT UICL-8 8-5-2008.tif; WDW-3 MIT UICL-8 8-5-2008.tif

Darrell:

Please find attached the charts from yesterday's MITs (dynamic). The injection wells were in operation during the annulus pressure MITs and the information is as follows:

WDW# 1: 500 psi to 498.psi (Pass).

- 1) Request DP renewal application as permit expired on 7/14/2008.
- 2) WAMs Mo. Monitor Log for pressure limiting device installed at well.

WDW# 2: 580 to 578 psi (Pass)

- 1) DP expires on 10/5/2009.
- 2) WAMs Mo. Monitor Log for pressure limiting device installed at well.

WDW# 3: 580 – 570 psi (Pass)

- 1) Well recently permitted by OCD in 2007.
- 2) Need sign placed near well with well name, location & API#.
- 3) WAMs Mo. Monitor Log for pressure limiting device installed at well. OCD observed that 10 gallons of fluid has been lost, since 7/15/2008. You indicated that Subsurface (company) has been retained to determine the nature of the loss. There was speculation of air pockets due to foaming of the fluid, since the pressure limiting device or system was placed on-line.

Please contact me if you have questions. Thank you.

Carl J. Chavez, CHMM
New Mexico Energy, Minerals & Natural Resources Dept.
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8/6/2008

