

**2R - 56**

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# **Annual GW Mon. Report**

**Year:**

**2012**

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March 26, 2013

Mr. Ed Hansen  
NM Oil Conservation Division  
1220 S. Saint Francis  
Santa Fe, NM 87505

Reference: Devon Energy Fed. Com 2RP-056  
Avalon Hills 7 Fed Com #3 Release Site (2R-56)  
Section 7, T21S, R27E, NMPM, Eddy County, New Mexico

Subject: Annual Report

Dear Mr. Hansen,

Enclosed is an "Annual Report" required pursuant to your December 20, 2011 4:08:27 PM MST E-mail and work plan approval. The approved work plan consisted of installing a Micro-Vapor Extraction System to extract hydrocarbon vapors out of the last remaining on-site monitoring well MW-1, and collect a base line sample for general chemistry, PAH's, and routine water and air samples.

Please find in Appendix "A", a spreadsheet that reflects all data collected to-date from MW-1, including more recent air samples. Appendix "B" contains all of the field and laboratory analytical sheets.

Brief History:

As you know, this site had experienced a high-pressure down-hole gas well blowout (2005-2006). After the gas well was brought under control, it was plugged and abandoned. Devon Energy installed a series of monitoring boreholes, and wells to determine if local ground water had been impacted.

All of these wells have since been properly plugged and abandoned, as approved by the OCD March 23, 2011 (E-mail), except MW-1, which lied within a few feet of the actual gas well-bore blow-out area and was directly impacted by the down-hole liquids.

When OCD approved the closure of the non-impacted monitoring wells, they conditioned the approval with a required clean-up plan for the MW-1 well.

Devon had bailed hydrocarbon/water emulsions, monitored and tested the MW-1 well from October of 2006 until August 2010. During the August 2010 sampling event, it was noted the water level in MW-1 had dropped down to the point that proper sampling protocol was impeded and pumping made impractical.

Devon submitted a work plan and was approved by OCD on April 18, 2011 to use oil absorbent pigs to assist in removing any free phase hydrocarbons in the well. This process worked, but was quite time and labor intensive. The absorbent pigs removed an estimated three pints of oily liquid in a three-month period.

Due to the inefficiency of this process, and the fact that the water level in the well had dropped to a point where the pigs were not saturated, was reason for Devon to recommend the micro vapor extraction system.

The vapor system was started up in early May of 2012 and has been monitored on several occasions.

#### Findings:

The vapor extraction system has been in operation almost a year now and the system reliability has been excellent, as the system has not experienced any major downtimes.

Appendix "A" (Excel Spreadsheet) first sheet labeled (Water), shows the entire analytical history of MW-1. The second sheet labeled (Air) reflects the Air samples collected from the discharge of the vapor pump. A third sheet, labeled (Graphs) show the plotted data over time. Each sheet contains pertinent field notes during sampling events.

It appears that both the benzene and toluene water and air fractions were somewhat recalcitrant during the year, however large decreases have been noted during the total duration of the project. The last recorded water analytical results for benzene was (455 ug/l), while toluene was noted at (1420 ug/l). Both of these values exceed the WQCC groundwater standard for benzene (10 ug/l) and toluene (750 ug/l) respectfully.

Xylenes did make a notable decrease during the year, ranging from a high of 5150 ug/l, down to 1680 ug/l, but still exceeded the WQCC groundwater standard for Xylene of (620 ug/l). Ethylbenzene was 61 ug/l, recorded during the last reading, and has consistently been below the WQCC groundwater standard of (750 ug/L) for the entire year.

Chlorides have ranged from about 34,984 mg/l initially in 2006, went up to 65,900 mg/l in 2007, and have progressively been going down, with the last sample noted at 7,660 mg/l.

OCD had requested we run PAH's on the first baseline water samples. The February 24, 2012 sample analytical results reflected the following PAH's;

Naphthalene at 13.1 ug/l; 2-Methylnaphtalene at 37.7 ug/l; 1-Methylnaphtalene at 19.4 ug/l; and Phenanthrene at 2.83 ug/l. The above Naphthalene totals appear to exceed the WQCC standard of 30 ug/l. The second round of sampling on August 03, 2012 were all non-detect. (This sample was diluted in order to obtain enough sample)

While the OCD does not have Air standards, the total BTEX and Hydrocarbon air factions also appear to be very recalcitrant. It appears from the collected air samples that the vapor extraction system is in deed removing a fair amount of product, and over time should impact the water readings.

Referring to the air sample data, see Appendix "A" sheet labeled (Air), the Total Volatile Hydrocarbons (TVHC) discharge readings averaged about 76,100 mg/m3. Using the average pump-rate data of 5 liters of air removed per minute, this calculates a product removal of about .07 gallons/day, which if annualized provides a product removal of about 25 gallons/year. (Calculation show in Appendix C).

#### Conclusions:

MW-1 did not communicate with any other monitor well on-site, as was verified by Devon and OCD. The original drilling log for MW-1 indicated this well was drilled into a cavern that appeared to have been in communication with the down-hole blow out casing area at about 80-90 feet BGL. Most importantly, no other monitor well or the local groundwater tables in this area appeared to have been impacted.

The MW-1 well water/air samples appear to be generated from the gas well blowout area. As pointed out in previous studies, the other monitor wells and associated groundwater was not hydraulically connected to this well. It is for this main reason, the OCD allowed all of the other monitoring wells to be properly plugged and abandoned.

The size and condition of the underground cavern (blow-out area) is unknown at this time. The blow out area was squeezed with several sacks of cement under pressure, and was successfully isolated by sealing off the casing above and below the shallow interval.

It does appear we are dealing with residual liquids and vadose zone contamination at about the 80-90 feet interval (BGL) that are contained in a small cavern, which MW-1 penetrated.

Continued air pumping over time will evaporate the liquids in the hole and remediate the vadoze. The uncertainty is the amount of time that will be involved in this process, and the environmental cost benefit in performing this remediation.

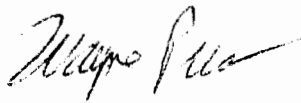
Recommendations:

Devon recommends that it be allowed to continue using the micro vapor extraction system and perform the existing monitoring and sampling protocol as approved by OCD, but reduce the sampling event to semi-annual, and provide a progress report in April of 2014.

Devon will also evaluate using additional water treatment chemicals, such as Hydrogen Peroxide (H2O2) or other approved methods to enhance the break down of the existing hydrocarbons to a more non-volatile and safer state.

On behalf of Devon Energy, Mr. Chris Biagi, Price LLC hereby submits this annual report for your evaluation and approval. If you should have any questions, or concerns, please do not hesitate to call or E-mail Wayne Price-Price LLC at 505-715-2809 or [wayneprice77@earthlink.net](mailto:wayneprice77@earthlink.net).

Sincerely,



Wayne Price-Price LLC  
312 Encantado Ridge Ct Ne  
Rio Rancho, NM 87124

CC: [chris.biagi@devon.com](mailto:chris.biagi@devon.com)

## APPENDIX “A”

- Water Analytical Summary
- Air Analytical Summary
- Water Graphs

Devon Energy Company  
Avalon Hills Fed 72R-0056  
Water Analytical Summary

Date	Lab Name	Lab No	MW-1					PAH's	Field Notes:
			Benzene (mg/L)	Toluene (mg/L)	Ethylbenzene (mg/L)	Xylene (mg/L)	BTEX (mg/L)		
10/29/06	Cardinal	1111728						WE	
11/19/06	Hill	0611272	6,880	22,000	770	5,400	34,750	WE	
11/26/06	Hill	0611317	4,000	26,000	570	6,500	37,070	WE	
01/07/07	Env. Lab of TX	7A15009						WE	
05/14/07	Xenoco	292577	2,210	6,000	475	4,800	13,485	WE	
11/02/07	Cardinal	H13647	3,370	4,450	490	4,800	13,070	WE	
03/02/08	Cardinal	H14366	2,370	2,450	493	3,300	8,613	WE	
03/06/08	Xenoco	299235						WE	
03/22/08	Xenoco	300277						WE	
04/04/08	Xenoco	300279						WE	
05/16/08	Cardinal	H14830						WE	
06/26/08	Cardinal	H16000	1,070	1,520	2,750	2,800	8,140	WE	
06/28/09	Cardinal	H16136	1,800	1,700	1,700	1,400	6,600	WE	
06/05/10			Sum volume for well to sample						
2/24/12	Trace Analysis	12022707	588	260		5,100	6,437	Price LLC	(No Purge)
8/2/12	Cardinal	H201817-01	2,000	142		2,200	7,153	Price LLC	(No Purge)
12/4/12	Trace Analysis	12121018	311	90		1,700	3,068	Price LLC	(No Purge)
3/5/13	Trace Analysis	13030702	61	61		1,700	3,616	Price LLC	(No Purge)

Incl's Gen Chem/PAH  
Sample Dilution Required  
HC order-strong  
HC order-strong  
HC order-strong  
HC order-med  
oil mist obser  
oil mist obser  
oil mist obser  
oil mist obser

Notes: 19-Dec-12 Treated well with approximately 10 quarts of 3% H2O2 and 2.5 gal DI water.  
26-Feb-13 Treated well with approximately 10 quarts of 3% H2O2 and 2.5 gal DI water.

Chemical Units	Benzene mg/m3	Benzene ppmv	Toluene mg/m3	Toluene ppmv	Ethylbenzene mg/m3	Ethylbenzene ppmv	Xylenes mg/m3	Xylenes ppmv	Total BTEX mg/m3	Total BTEX ppmv	TVHC mg/m3	TVHC ppmv
Date												
Method												
05/04/12												
Field PID		206.5										1479
08/08/12		340										1947
Field PID												
12/04/12	245	81.7	744	198	208	51.4	2070	476	3287	807.1	68,600	17,900
Lab												
03/05/13	315	105	1040	277	231	57	2230	513	3816	952	83,600	21,400
Lab												
											76,100 avg	

**Procedure:** Air samples were collected from the MW-1 air pump discharge using Tedlar bags. Samples stored on ice when sent to Lab.

**Note:** All Tuller bags were filled and purged three times before sample collection..

**Field PID Equipment:** 1. RAE Mini 3000 with benzene tubes. 2. Mini Ra6 for TPH



Devon 2RP-056 MW-1 &amp; P-A Marker



### Collecting Air Sample from MW-1 Vapor Extraction Pump



	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylene (ug/L)	BTEX (ug/L)	Chlorides (Mg/L)
11/19/05	6,100	12,100	770	9,400	38,270	51,000
11/26/06	1,000	10,000	570	6,000	31,870	45,000
01/07/07	2,760	1,950	475	2,900	13,085	65,000
05/14/07	3,577	5,085	480	8,500	34,822	65,700
11/02/07	2,170	2,570	403	4,570	19,253	55,000
09/25/08	1,520	1,350	2,320	26,900	30,440	55,000
08/28/09	475	1,210	1,540	15,800	18,955	54,000
2/24/12	439	588	260	5,150	6,437	1,590
8/23/12	1,690	2,210	142	3,111	7,153	1,800
12/4/12	837	311	90	1,830	3,068	14,800
3/5/13	455	1,420	61	3,680	3,616	7,660

**Benzene (ug/L)**



**Benzene (ug/L)**

**Toluene (ug/L)**



**Toluene (ug/L)**

**Ethylbenzene (ug/L)**



**Ethylbenzene (ug/L)**

**Xylene (ug/L)**



**Xylene (ug/L)**

**BTEX (ug/L)**



**BTEX (ug/L)**

**Chlorides (Mg/L)**



**Chlorides (Mg/L)**

# APPENDIX "C"

PUMP  
RAZING

$$5 \frac{\text{L}}{\text{MIN}} \times 60 \text{ MIN} = 300 \frac{\text{L}}{\text{HR}}$$

$$1 \text{ m}^3 = 1000 \text{ L}$$

AIR  
SAMPLE

$$12/12/12 \quad \text{TUHC} = 68,600 \frac{\text{mg}}{\text{m}^3}$$

$$\text{TUHC} = \frac{68,600}{1000 \frac{\text{L}}{\text{m}^3}} \frac{\text{mg}}{\text{m}^3} = 68.6 \frac{\text{mg}}{\text{L}}$$

$$\frac{300 \text{ L}}{\text{HR}} \times 68.6 \frac{\text{mg}}{\text{L}} = 20,580 \frac{\text{mg}}{\text{HR}}$$

$$1 \text{ LB} = 453.6 \text{ g} \quad 1000 \text{ mg} = 1 \text{ g} \quad 1 \text{ LB} = 453,600 \text{ mg}$$

$$\frac{20,580 \frac{\text{mg}}{\text{HR}}}{453,600 \frac{\text{mg}}{\text{LB}}} = .0454 \frac{\text{LB}}{\text{HR}} \text{ of TUHC}$$

$$.0454 \times 8 \frac{\text{HR}}{\text{DAY}} = \boxed{.363 \frac{\text{LB}}{\text{DAY}} \text{ TUHC}}$$

$$\approx 6.0 \frac{\text{g}}{\text{gal}} \quad \approx .363 \frac{\text{LB}}{\text{DAY}} = \boxed{.061 \frac{\text{GAL}}{\text{DAY}}}$$

$$.061 \times \frac{76,100}{68,600} = \boxed{.068 \frac{\text{GAL}}{\text{DAY}}} \text{ CORRECTED}$$