2007 BRADENHEAD TESTING

And

COMPARISON WITH PRIOR DATA

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I.EXECUTIVE SUMMARY

In year 2007 the Bureau of Land Management requested oil and gas operators in the Ignacio-Blanco Field to perform bradenhead testing of all jurisdictional active gas wells. *Bradenhead tests in 2007 numbered 1217 of approximately 1266 active jurisdictional gas wells*. Forty-nine active wells were not tested Due to weather conditions in January-mid-March during the time of "make-up testing. A few wells are devoid of bradenhead testing capability. Others are in the APD process or approved and not yet drilled. Water disposal wells are of dual jurisdiction. They are permitted by EPA. BLM performs a well bore review to assure that producing and known water horizons are protected. Numbers presented in the tables reflect the data received for actual tests conducted and the wells missed.

All active gas wells were to be tested in 2007. Conventional gas wells with greater than 25 psig have decreased from 84 wells in 1992 to 12 wells in 2007.

The total number of conventional gas wells with bradenhead pressure between **2 psig and 25 psig** declined from **272** wells in 1992, to **75** wells in 2007

Equally significant is the increase in the number of gas wells showing no significant bradenhead pressure (0-2 psig). Conventional gas wells in this category (numbering 326 in 1994) accounted for 443 of 529 wells tested in 2007.

The increased number of well-bores displaying lower bradenhead test pressure/flow may be ascribed to successful remediation and mitigation efforts. Six gas wells were approved for work-over in 2007. Five work-overs (including seal repairs, casing/cement repairs) were completed this year. Bradenhead venting was authorized at 6 conventional and 4 Fruitland coal gas wells in 2007 and 2 re-completed conventional (CBM wells). No wells were plugged and abandoned.

II. HISTORY OF SJRA BRADENHEAD TESTING AND RELATIONSHIP TO GROUNDWATER MONITORING

Glen T. Braden invented a gas well casing head in the 1920's that became so popular that before long all surface casing heads were commonly termed "bradenheads." Among other functions, the casing head seals the annular space between the production casing, intermediate casing (if present) and the surface casing.

Under the Notice to Lessees titled "NTL-MDO-91-1" (and subsequent revisions subtitled "Change 1", and "Change 2"), the San Juan Field Office of the Bureau of Land Management - has aggressively pursued bradenhead testing since 1991. Bradenhead testing has been instrumental in identification of defective gas well-bores. Gas wells have routinely been tested for aberrant quantities of gas/fluid flow. Gas/fluid compositions have been analyzed to aid in remedial action or mitigation plans.

Gas wells within designated "***critical***" groundwater areas (Areas constituting an approximate 1 mile buffer zone surrounding domestic wells where methane has been documented at concentrations higher than 1.0 mg/L in 1994 and 1995) are targeted by BLM for remediation when bradenhead pressures exceed five psig. In all other non-designated areas (termed “non-critical”) the bradenhead pressure *action threshold* is 25 psig. Wells with less than these threshold bradenhead pressures, but which exhibit sustained measurable flow throughout the 30-minute test period are targeted for remediation as well. Wells with bradenhead valves issuing a fluid flow are also subject to remediation.

The bradenhead testing program is loosely associated with groundwater quality monitoring of La Plata County domestic water wells. As a result of BLM and COGCC testing of domestic water wells in the San Juan Basin of Colorado, 17 areas of critical concern have been identified. The *Critical Areas* have exhibited anomalously **high concentrations of methane** entrained in groundwater **or** are of critical concern because of proximity to the **HD Mountain Area** or the Tiffany Enhanced Coal Bed Methane Recovery area. (Nitrogen injection has ceased in the Tiffany ECBM Recovery area as of several years ago.) The gas signature (gas constituent relationships which may include an analysis of stable Carbon /Carbon 13 isotope ratios) can indicate whether the gas is of shallow biologic generation, alteration of existing soil gas, or a possible gas well leak. The HD Mountain and Bondad/Sunnyside areas were specifically targeted in 1996 for domestic water well testing to determine the effectiveness of gas well remediation. Locations of continuing concern were identified where measurable bradenhead pressures and entrained methane in groundwater persisted. In 1998 the BLM and the COGCC combined efforts to retest areas not addressed in 1996. Water wells tested in 1998 were selected particularly in the proximity of remediated gas wells. Water wells with elevated baseline concentrations of methane and having methane stable carbon isotope ratios greater than -55 per mil (thereby indicating possible thermogenic signatures and potential association with natural gas producing horizons) were targeted. Water wells

with lower baseline methane concentrations, but in proximity to remediated gas wells, were also tested. The results of monitoring in calendar year 2000 indicated that methane contamination of water wells was decreasing, presumably in response to remedial actions of potentially defective well-bores. The findings continue to direct remediation efforts toward identifying potentially defective gas well-bores. Ongoing monitoring of groundwater is also being conducted.

III. YEAR 2007 IGNACIO-BLANCO FIELD TEST RESULTS

During calendar year 2007, San Juan Field Office personnel witnessed 150 bradenhead tests. This represented roughly 12% of all active BLM jurisdictional gas wells and 12% of the tested gas wells. Of 1404 jurisdictional gas wells on the BLM data base, approximately 1266 are currently active. Bradenhead tests were conducted at 1217 wells. Plugged and abandoned wells have lost their capacity for tubular testing, but many are regularly monitored by soil vapor tubes. Active conventional wells number 549. Approximately 81 have been re-completed to Fruitland CBM production. Of the latter, many wells produce Fruitland gas while retaining production capability in a conventional horizon. Most CBM gas wells were initially drilled to the Fruitland Formation, including two monitoring wells, four "slant" wells, and a dozen wells drilled solely for mitigation of outcrop seepage.

The BLM focused primarily on witnessing bradenhead tests in 2007 at well-bores neglected in years past. A summary of bradenhead test pressure results at *conventional* wells in 2007 is shown in **Table # 1.** CBM well counts are shown in Table #2 with re-completed wells in table #3. Actual documented bradenhead **tests** in 2007 include 1217 of 1266 *active* BLM jurisdictional gas wells in the Ignacio-Blanco Field data base.

Approximately 84% (443 of 529 tested) *conventional* gas wells showed insignificant (2 psig or less) bradenhead pressure. (See Table #1.) Those with measured pressure between two and 25 psig numbered 75, or approximately 18% of the **tested** conventional wells. *Conventional gas wells with initial test pressure greater than 25 psig numbered 12, or roughly 2%* of the total number of **tested** active conventional wells in the Ignacio-Blanco Field.

TABLE 1: CONVENTIONAL GAS WELLS: Critical/Non Critical Statistics

BRADENHEAD PSIG	INITIAL TEST	INITIAL TEST	% OF CONV (523)	%OF TOTAL ACTIVE WELLS (1259)
	Non-Critical Areas	Critical Areas		
BRADENHEAD N/T 21	incl.P&A, undrilled, and no bradenhead		4	0.8
0 - 2.0 PSIG	377	66	84	35
>2.0 & 25 PSIG	56	19	14	7
> 25 PSIG	12	0	2	1
578 ACTIVE WELLS	(445-active tested)	(85-active tested)		

Table 2 shows data regarding conventional wells recompleted as CBM wells. Of *Conventional-wells-recompleted-as-CBM-producers* within *Critical areas***,** those with bradenhead pressures greater than 25# number merely 0. There were no *Conventional-wells-recompleted-as-CBM producers* having bradenhead pressures greater than 25 psig and located within *Non-critical designated areas*. *Conventional-wells-recompleted-as-CBM-producers* in critical areas tested with bradenhead pressure exceeding 2 psig but less than or equal to 25 psig account for 2 wells and in non critical areas numbered thirteen. Note that high bradenhead pressure in re-completed gas wells may represent an artifact of the original well bore condition prior to the recompletion process in the Fruitland coal zones. Therefore, aberrant bradenhead pressure may reflect pre-existing conditions, such as incomplete primary cement isolation. Lack of zonal isolation may provide a limited source of concern for the CBM recompletion process in old wells. No significant pressure (<2psig) was documented at 6 of the *re-completed conventional wells tested in critical area and 54 in non critical areas (61 of 75 tested).* Low pressure (<25 psig) was shown at all of the 75 tested *conventional-wells-recompleted-as-CBM-producers*. This amounted to a similar proportion of re-completed as non-re-completed *conventiona*l well-bores.

TABLE 2: CONVENTIONAL WELLS RECOMPLETED AS CBM WELLS:

BRADENHEAD PRESSURE	INITIAL TEST	# CBM WELLS RECOMPLETED		TESTED 42 Of 79	% TOTAL OF ACTIVE WELLS
NOT TESTED #	6	Non-Critical 3	Critical 3	Total 7%	1266
0.0 - 2.0 PSIG		54	6	74%	5%
>2 & 25 PSIG		13	2	19%	1%
> 25 PSIG		0	0	0 %	0.00%
CONV RECL. CBM	75 tested	70	11		

Table 3 shows data regarding CBM wells. Of *CBM-producers* within *Critical areas***,** those with bradenhead pressures greater than 25# number merely 13. There were 10 *CBM producers* having bradenhead pressures greater than 25 psig and located within *Non-critical designated areas*. *CBM-producers* in critical areas tested with bradenhead pressure exceeding 2 psig but less than or equal to 25 psig account for 20 wells and in non critical areas numbered 55**.** No significant pressure (<2psig) was documented at 124 of the *CBM wells tested* in critical area and 401 in non critical areas. Low pressure (<25 psig) was shown at 600 of 613 tested *CBM-producers*.

TABLE 3: CBM WELLS:

BRADENHEAD PSIG	INITIAL TEST	INITIAL TEST	% OF CBM (638)	%OF TOTAL ACTIVE WELLS (1266)
510	Non-Critical Areas	Critical Areas	635	
BRADENHEAD N/T 22	incl.P&A, undrilled, and no bradenhead		3%	2%
0 - 2.0 PSIG	401	124	83	41%
>2.0 & 25 PSIG	55	20	12%	6%
> 25 PSIG	10	3	2%	1%
613Tested ACTIVE WELLS	(466-active tested)	(147-active tested)		

In overall summary, of 1217 wells tested in 2007, 1028 or 81% showed insignificant pressure of less than or equal to 2 psig. Those wells with low pressure (documented between two psig and 25 psig) numbered 165 (i.e. 13%) of all wells tested. Gas wells with greater than 25 psig initial bradenhead pressure numbered 25 of the wells tested (approximately 2% of all BLM jurisdictional gas wells tested).

It is important to observe that bradenhead test pressures documented in this report reflect initial pressure after a minimum of 14 day's closure of the bradenhead valve. Most of the wells with recorded pressure are being actively mitigated the other 50 weeks of the year. When anticipated gas flows are insignificant mitigation may take the form of venting bradenhead gas to the atmosphere to prevent pressure accumulation in the aquifers. Other surface casings with significant flow are approved for connection to on-site equipment enabling a beneficial use application. A few wells with bradenhead gas character indicative of production gas have been connected to production lines.

Appendix XI (p.47) includes a map showing BLM Jurisdictional gas wells encountered in 2007 which had initial bradenhead pressures exceeding the 25 psig threshold. These well locations are shown in spatial representation within the Colorado portion of the Northern San Juan Basin Ignacio Blanco Gas Field. Gas well locations are represented by dots sized relative to initial bradenhead pressure. Some aberrant pressures were addressed and remediated/mitigated by 2007 year end. (It should be noted that the program has been plagued with recordation errors documenting the bradenhead valves as the intermediate valve and vice versa. Most errors were corrected, but may on occasion have implicated high initial pressures that were erroneous.)

IV. YEAR 2007 BRADENHEAD TEST RESULTS COMPARED TO RESULTS FROM 1992-2006

A comparison of previous annual bradenhead findings (reports 1991-2006) with the current Year 2007 data reveals a reduction in well-bores exhibiting pressure greater than 25 psig within the surface

casing. The overall number of gas wells exhibiting high bradenhead pressure has declined from 97 wells in 1992 to 25 wells in 2007(Table 4). On occasion individual wells do show signs of increasing pressure. Gas analyses may indicate a possible source, whether a lack of internal well-bore integrity or incomplete annular isolation. Those gas wells showing surface casing pressure anomalies are tested and inspected for possible failure of well bore integrity. Persistent testing and monitoring will continue to be critical in managing the production of this natural gas resource

Table 4 (following) gives a tabular comparison of prior test results with Year 2006 bradenhead testing. Chart “A” offers a graphic comparison of data between years 1992 and 2006. Conventional gas wells with bradenhead pressure in excess of 25 psig decreased from 84 wells in 1992, to 25 wells in 2006. The aggregate number of gas wells, conventional (including conventional wells recompleted as CBM producers) and CBM well with bradenhead pressures greater than 25 psig declined from 138 wells in 1992, to 15 wells in 2007. See Chart “B”.

TABLE 4 COMPARISON OF 1992-2007 BRADENHEAD TEST STATISTICS

YEAR OF TEST	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07
WELL CATEGORY																
CONV WELLS 0 TO 2#	338	343	326	405	406	413	381	354	414	395	384	422	441	423	452	443
CONV WELLS 0 TO 25 #	556	490	497	503	513	526	479	430	499	483	475	464	475	514	512	12
CONV WELLS >2 & 25 #	218	147	171	95	107	113	98	83	85	88	91	88	39	91	60	87
CONV WELLS > 25 PSIG	84	80	59	60	47	43	32	27	28	31	18	18	15	25	13	12
TL CONV WELL TESTS	640	570	556	563	562	569	511	465	527	541	493	557	517	540	523	529
CBM WELLS >0 & 2 #	293	382	373	394	408	385	266	377	190	491	65	508	x	514	101	525
CBM WELLS 0 TO 25 #	347	440	448	440	442	430	310	412	217	543	74	96	x	564	115	600
CBM WELLS >2 & 25#	54	58	75	46	34	45	44	32	27	52	9	73	x	50	14	75
CBM WELLS WITH > 25#	13	15	11	17	13	10	13	11	10	17	7	17	x	17	3	13
TOTAL CBM TESTS	360	455	459	457	455	440	323	420	227	560	81	622	615	581	118	613
6NT																
Conv Recompl to FC 0-2									48	61	27	60	34	52	35	60
Conv Recom to FC 0-25									60	70	29	73	40	67	54	75
Conv Recom to FC 2-25#									12	7	2	13	6	15	7	15
Conv Recom to FC >25#									6	3	2	3	1	4	2	0
TL Conv Recom to FC 77									66	73 tested	31	76	77	77	79	81
TOTAL 0 # TO 2 #	631	725	699	799	814	798	647	731	652	886	449	990	475	937	553	928
TOTAL 0 # TO 25 #	903	930	945	943	955	956	789	842	776	1026	424	633	520	1078	627	1193
TOTAL >2 #& 25 #	272	205	246	144	141	158	142	115	124	93	100	174	45	141	74	165
TOTAL WELLS > 25#	97	95	70	77	60	53	45	38	44	48	25	38	16	63	18	25

TL WELLS TESTED	1000	1025	1015	1027	1009	1054	834	884	820	1074	574	1126	536	1121	643	1217

The numbers of gas wells with insignificant bradenhead pressure (0-2 psig) was 928 in 2007. Slight number discrepancies may be attributable to query inconsistencies. TO HERE

Reviewing gas wells in designated critical areas, where significant entrained methane in groundwater was documented by earlier studies, **Table 5** gives an insight into past conditions and current comparisons. Statistics can be misleading, though, as critical areas have increased in number and gas well numbers are in a state of flux. Nevertheless, in designated critical areas overall 3 critical area gas wells indicated pressures above 25 psig in 2007, as opposed to 19 gas wells in 1995. Approximately 20% percent (12) of the conventional gas wells in critical areas had in excess of 25 psig initial bradenhead pressures in 1994. The expanded designated critical areas has increased, nevertheless, (0.2%) of the conventional gas wells tested in critical areas exceeded 25 psig in 2007.

TABLE 5: 1994-2007 CRITICAL AREA BRADENHEAD PSIG at BLM JURISDICTIONAL WELLS

WELL TYPE / CATEGORY	1994	1995	1996	1997	1998	1999	2000	2001	2003	2004	2005	2006	2007	2008
CONVENTIONAL wells with 0>BHP 2	22	52	57	65	56	47	67	71	64	68	63	66	66	
CONVENTIONAL wells with 2>BHP< 25	26	16	31	17	16	14	17	10	13	16	21	14	19	
CONVENTIONAL wells with BHP>25	12	14	13	11	10	10	10	7	6	2	1	3	0	
CONVENTIONAL not tested				2	7	23	0	9	8	22	2	4	6	
Total conventional wells - critical areas	60	82	101	95	89	94	94	97	83	86	86	87	91	
CBM wells with 0> BHP 2 psig	53	83	112	101	93	98	33	118	25	x	118	17	124	
CBM wells with 2>BHP 25 psig		17	7	15	19	7	7	8	2	x	17	3	20	
CBM wells with BHP>25 psig	1	5	2	3	5	4	1	6	2	x	2	0	3	
CBM wells no test (56 tested)				3	0	25	93	5	108	568	49	48	1	
Total CBM wells - critical areas	54	105	121	122	117	134	134	137	137	145	150	146	148	
RECOMPL wells 0> BHP 2 #				(11)	1	4	3	6	3	2	4	4	6	
RECOMPL wells 2>BHP 25#				(7)	4	4	4	2	2	2	3	1	2	
RECOMPLETED >25 psig				(3)	1	0	1	1	1	1	1	0	0	
Tl RECOMPLETED wells in critical areas not tested				(2)	1	0	0	0	3	5	1	6	3	
TL RECOMPL wells in crit areas				(23)	7	8	8	9	9	5	10	11	11	
TL wells, critical. areas >0 <2#	75	135	169	177	150	149	103	189	89	70	181	87	196	
Tl wells,crit areas >2 # & < 25#	26	33	38	39	39	25	28	18	15	18	38	18	41	
Tl wells in crit areas >25 #	13	19	15	17	16	14	12	13	8	3	3	3	6	
Total gas wells not tested				7	7	48	93	(45)	118	626	158	58	10	
Tl Jurisd. wells in critical areas	114	187	222	240	212	236	236	220	230	236	252	260	249	

NOTE: The Tiffany area was added to the 17 designated critical areas in 1996 totaling 18 Designated Critical Areas. (Thirteen areas had been designated in 1993. A total of Seventeen areas were defined in 1994-95.)

By comparison, 41 gas wells outside of the designated critical areas **(Table 7)** showed pressures in excess of 25 psig in 2006, as opposed to 61 wells in 1994.

TABLE 6: BRADENHEAD PSIG in AREAS OUTSIDE of DESIGNATED CRITICAL AREAS.

WELL TYPE/CATEGORY	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Conv wells with bhd pressure <2 #	281	317	345	338	333	260	347	342	355	320	373	360	386	377	
Conv wells with bhd pressure 2- 25#	147	83	74	88	83	53	68	78	69	78	23	70	44	56	
Conv wells with bhd pressure > 25#	49	38	34	28	22	15	18	24	13	12	13	24	10	12	
Conventional gas wells not tested			8	14	31	127	29	9	-	33	22	2	15	14	
TL Conventional wells non critical areas	477	438	453	468	469	461	462	453	437	443	463	454	455	459	
CBM wells with bhd pressure <2 psig	316	320	296	284	172	279	157	373	392	40	x	396	84	401	
CBM wells with bhd pressure 2- 25 psig	77	32	27	30	26	25	20	44	54	7	x	33	11	55	
CBM wells with bhd pressure >25 psig	12	13	11	7	7	7	9	11	10	5	x	15	3	10	
CBM wells not tested			5	16	3	133	258	36	9	413	x	49	398	21	
TOTAL CBM wells-non critical areas	405	365	339	337	208	444	444	464	465	465	479	498	492	487	
Rec conv wells with bhd press <2 #			4	7	24	37	45	55	54	24	2	48	31	54	
Rec conv wells with bhd press 2-25#			2	2	4	12	8	2	11	0	2	12	4	13	
Tl Jurisl Recom conv NC bhd >25 psig			2	1	1	2	5	6	2	1	1	2	2	0	
Tl Juris Recomp conv wells NC areas no test			0	0	8	0	2	0	0	42	36	6	31	5	
Tl juris Recomp conv wells NC areas			8	10	37	51	60	63	67	67	67	67	68	72	
Tl Juris wells in NC areas bhd press <2 #	597	637	645	629	529	582	549	715	801	360	405	756	501	832	
Juris wells in NC areas, bhd press 2-25 #	224	115	103	120	113	90	96	119	134	85	27	115	59	124	
Tl Juris wells, NC areas, bhd press >25#	61	51	47	36	30	24	32	35	25	17	13	41	15	22	
Tl Juris wells in NC areas not tested	0	0	13	30	42	260	289	(45)	9	488	18	?	462	40	
Tl Juris wells in NC- areas	882	803	808	815	714	956	966	914	969	908	942	972	1015	1018	

V. BEYOND BRADENHEAD TESTING - REMEDIAL ACTION

A BLM representative is generally on-site when casing integrity testing, wellhead seal testing/repairs, or remedial cementing is accomplished to insure compliance with prescribed Conditions of Approval. Mitigation efforts have often incorporated bradenhead venting. If venting actions prove ineffective, more aggressive remedial efforts may be required. Decreases observed in bradenhead pressure and flow character appear attributable to successful remediation. Mechanical remedial action was **approved** at 6

wells with work-over action **completed** at 5 gas well under BLM jurisdiction in 2007. Where workovers are authorized, wells are remedially cemented and/or wellhead seal repairs made. No wells were plugged in 2007. Bradenhead venting to the atmosphere was authorized at 10 wells in 2007. **Appendix B** lists remediation efforts approved in 2007; efforts completed, and action implemented in prior years. **Appendix C** lists gas-well mitigation efforts approved during 20076.

Appendix D lists BLM jurisdictional gas wells in alphabetical order of well name showing historical initial bradenhead test pressure at individual gas wells since 1992. At wellheads authorized for bradenhead venting, test results were documented following a minimum 14-day pressure stabilization period during which the bradenhead valve was closed. Therefore, measured pressures/flows at the surface casing reflect a shut-in maximum. Such pressures and flows at vented wells reduce to negligible amounts during the remainder of the year when the bradenhead valve is left open.

2008 PROPOSED BRADENHEAD TESTING

Ignacio-Blanco Field BLM jurisdictional conventional gas wells and conventional gas wells re-completed to the Fruitland Formation are to be tested in 2008 (active, temporarily abandoned and shut-in wells). The BLM expects to witness 145 bradenhead tests basin-wide in 2008.

REFERENCES

1. The Bureau of Land Management, "1993 Bradenhead Testing Program Overview and Test Results," 1994, BLM-SJRA.

2. The Bureau of Land Management, "Dissolved Methane Concentrations in Groundwater, La Plata and Archuleta Counties, Colorado," March 1994, BLM-SJRA

3. The Bureau of Land Management, "Final Report - 1994 Groundwater Monitoring, San Juan Basin, La Plata County, Colorado Comprehensive Infill Testing," March 20, 1995, BLM-SJRA.

4. The Bureau of Land Management, "1994 Bradenhead Testing Program, Overview and Test Results", March 20, 1995, BLM-SJRA

5. The Bureau of Land Management, "1995 Bradenhead Testing with Prior Years Test Results", March 15, 1996, BLM-SJRA

6. The Bureau of Land Management, "1996 Bradenhead Testing with Review of Prior Years Test Results," March 15, 1997, Revised October 30, 1997; BLM-SJRA

7. The Bureau of Land Management, "1997 Bradenhead Testing and Comparison with Prior Data," June 15, 1998, BLM-SJRA

8. The Bureau of Land Management, "1998 Bradenhead Testing and Comparison with Prior Data," March 15, 2000, BLM-SJRA

9. The Bureau of Land Management, "1999 Bradenhead Testing and Comparison with Prior Data," August, 2001, BLM-SJRA

10. The Bureau of Land Management, "2000 Bradenhead Testing and Comparison with Prior Data," August, 2001, BLM-SJRA

11. The Bureau of Land Management, "2001 Bradenhead Testing and Comparison with Prior Data," March 2003, BLM-SJRA

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13. The Bureau of Land Management, "2003 Bradenhead Testing and Comparison with Prior Data," January 2005, BLM-SJRA

14. The Bureau of Land Management, "2004 Bradenhead Testing and Comparison with Prior Data," March 2005, BLM-SJRA

15. The Bureau of Land Management, "2005 Bradenhead Testing and Comparison with Prior Data," Mayl 2007, BLM-SJRA

16. The Bureau of Land Management, "2006 Bradenhead Testing and Comparison with Prior Data," May 2007, BLM-SJRA

17. The Bureau of Land Management, "2007 Bradenhead Testing and Comparison with Prior Data," May 2007, BLM-SJRA

BRIEF of BLM BRADENHEAD and GROUNDWATER REPORTS

The "Notice to Lessees (NTL) MDO-91-1" issued by the Bureau of Land Management (BLM) in July 1991, requires annual bradenhead testing of all BLM jurisdictional gas wells located within the Colorado portion of the Ignacio-Blanco Field. NTL MDO-91-1 Changes 1 & 2 have altered the frequency of testing to annual for conventional wells and semiannual for CBM wells. Pressure thresholds requiring gas analyses have been raised to five psig in designated critical areas and 25 psig in non-designated areas. The Colorado Oil and Gas Conservation Commission issued "Rule 10 of Order 112-85" also requiring annual bradenhead testing of all gas wells under State of Colorado Jurisdiction in the Ignacio-Blanco Field of Colorado. Since 1991, bradenhead testing has been an integral part of BLM and COGCC efforts to remediate gas wells which have exhibited excessive pressures indicating potential for ground water contamination and/or natural gas resource loss.

Earlier BLM reports have presented the following results:

Bradenhead Testing and Groundwater Protection Program Overview and 1992 Results
This report discussed groundwater protection and the results of 1992 testing. In summary, 37 percent of jurisdictional gas wells tested showed bradenhead pressures exceeding 0 psig, and 10 percent had pressures greater than 25 psig.

Dissolved Methane Concentrations in Groundwater, La Plata and Archuleta Counties, Colorado
More than 200 domestic water wells within the Ignacio-Blanco Field were tested by the BLM during 1993. Relatively high concentrations of methane gas were discovered in 13 geographic areas of La Plata County. Within these 13 areas, gas wells with measurable bradenhead pressure received high priority as remediation candidates.

1993 Bradenhead Testing Program Overview and Test Results
Bradenhead test results for calendar year 1993 were presented. Gas production related potentials for shallow aquifer contamination were discussed. In summary, 29 percent of jurisdictional gas wells had pressures exceeding 0 psig, and 9 percent exhibited pressures greater than 25 psig.

Final Report - 1994 Groundwater Monitoring, San Juan Basin, La Plata County, Colorado Comprehensive Infill Testing
This cooperative report released by the BLM and the COGCC, produced water quality measurements from 383 domestic water well sites in La Plata County, supplementing the 1993 BLM water study of 200 wells. A groundwater quality baseline was established. Redefining and expanding the 13 areas depicted in the 1993 study, a total of 17 areas with relatively high concentrations of entrained methane-in-water were delineated by diminishing methane concentrations and apparent isotopic transitional zones. Data regarding wells coincident with those tested in the 1994 BLM/COGCC testing was incorporated from the 1990 USGS study of water wells in the Animas River Valley, and from data listed in the Ignacio-Blanco Groundwater Task Force study of 1991. The 17 areas were further defined by carbon isotopic analyses that suggested biogenic or thermogenic origins of the entrained methane.

1994 Bradenhead Testing Program Overview and Testing Results
This report noted results of the 1994 bradenhead testing program, including statistics for the Ignacio-Blanco Field and the 17 Critical Areas. A discussion presented results of remedial actions. In summary, 31 percent of the gas wells tested had greater than 0 psig bradenhead pressure, while those with greater than 25 psig bradenhead pressure accounted for 7 percent of jurisdictional gas wells.

1995 Bradenhead Testing and Prior Testing Review
This report summarized the test results of the 1995 bradenhead testing program and discussed areas targeted for remediation, and the success of remediation to date. In summary, 21 percent (219) of the gas wells tested had greater than 2.0 psig bradenhead pressure, while those with greater than 25 psig bradenhead pressure accounted for 6.8 percent of Jurisdictional gas wells.

1996 Bradenhead Testing and Prior Testing Review
This report summarized the test results of the 1996 bradenhead testing program and discussed remediation methods employed. Gas wells with bradenhead pressure in excess of 2 psig accounted for 140 gas wells (13.8 percent) of all BLM jurisdictional wells in the Ignacio-Blanco Field. Coal-bed methane (CBM) and conventional gas wells with bradenhead pressure of greater than 25 psig numbered 58 (5.5 percent) of the BLM jurisdictional Ignacio-Blanco wells.

1997 Bradenhead Testing and Comparison with Prior Data
This report summarized the test results of 1997 bradenhead monitoring at jurisdictional gas wells in the Ignacio-Blanco (I-B) field. Gas wells with measured bradenhead pressures between two and twenty-five psig initial pressure numbered 159 wells or 15.1 percent of all BLM jurisdictional gas wells. Coal Bed Methane and conventional gas wells with greater than twenty-five psig initial bradenhead test pressure numbered 53 and accounted for 5.0 percent of all BLM jurisdictional I-B gas wells. Eight hundred and four gas wells, or 76.3% exhibited bradenhead pressure of two psig or less.

1998 Bradenhead Testing and Comparison with Prior Data
This report summarized the test results of 1998 jurisdictional gas well monitoring in the Ignacio-Blanco (I-B) field. Coal bed methane and conventional gas wells with greater than twenty-five psig initial bradenhead test pressure numbered 45 (5.2 percent) of all tested BLM jurisdictional I-B gas wells. Gas wells with measured bradenhead pressures between two and twenty-five psig initial pressure numbered 150 wells, or 17.3 percent of tested BLM jurisdictional gas wells. Gas wells under BLM jurisdiction that exhibited bradenhead pressure of two psig or less numbered 672, or 77.5 percent of all wells tested in 1998.

1999 Bradenhead Testing and Comparison with Prior Data
This report summarizes the test results of 1999 bradenhead monitoring at jurisdictional gas wells in the Ignacio-Blanco (I-B) field. Coal bed methane and conventional gas wells with >25psig initial bradenhead test pressure numbered 38, accounting for 4 percent of all tested BLM jurisdictional I-B gas wells. Gas wells with measured bradenhead pressures between 2-25psig initial pressure numbered 115 wells, or 13 percent of tested BLM jurisdictional gas wells. Gas wells under BLM jurisdiction that exhibited bradenhead pressure of two psig or less numbered 731, or 83 percent of all wells tested in 1999.

2000 Bradenhead Testing and Comparison with Prior Data
This report summarizes the test results of 2000 bradenhead monitoring at jurisdictional gas wells in the Ignacio-Blanco (I-B) field. Coal bed methane and conventional gas wells with >25psig bradenhead test pressure numbered 44, accounting for 5 percent of all tested BLM jurisdictional I-B gas wells. Gas wells with measured bradenhead pressures between 2-25psig initial pressure numbered 124 wells, or 15 percent of tested BLM jurisdictional gas wells. Gas wells under BLM jurisdiction that exhibited bradenhead pressure of two psig or less numbered 652, or 80 percent of all wells tested in 2000.

2001 Bradenhead Testing and Comparison with Prior Data. This report summarizes the test results of 2001 bradenhead monitoring at jurisdictional gas wells in the Ignacio-Blanco (I-B) field. Coal bed methane and conventional gas wells with >25psig initial bradenhead test pressure numbered 48, accounting for 4 percent of all tested BLM jurisdictional I-B gas wells. Gas wells with bradenhead pressures between 2-25psig initial pressure numbered 140 wells, or 13 percent

of tested BLM jurisdictional gas wells. Gas wells under BLM jurisdiction that exhibited bradenhead pressure of two psig or less numbered 886, or 79 percent of all wells tested in 2001.

2002 Bradenhead Testing and Comparison with Prior Data. This report summarizes the test results of 2002 bradenhead monitoring at jurisdictional gas wells in the Ignacio-Blanco (I-B) field. Coal bed methane and conventional gas wells with >25psig initial bradenhead test pressure numbered 27, accounting for 5 percent of all tested BLM jurisdictional I-B gas wells. Gas wells with bradenhead pressures between 2-25psig initial pressure numbered 102 wells, or 18 percent of tested BLM jurisdictional gas wells. Gas wells under BLM jurisdiction that exhibited bradenhead pressure of two psig or less numbered 476, or 83 percent of all wells tested in 2002.

2003 Bradenhead Testing and Comparison with Prior Data. This report summarizes the test results of 2003 bradenhead monitoring at jurisdictional gas wells in the Ignacio-Blanco (I-B) field. Coal bed methane and conventional gas wells with >25psig initial bradenhead test pressure numbered 16, accounting for 2.5 percent of all tested BLM jurisdictional I-B gas wells. Gas wells with bradenhead pressures between 2-25# initial pressure consisted of 88 wells, or 15 percent of tested BLM jurisdictional gas wells. Gas wells under BLM jurisdiction that exhibited bradenhead pressure of two psig or less numbered 475, or 78 percent of all wells tested in 2003.

2004 Bradenhead Testing and Comparison with Prior Data. This report summarizes the test results of 2004 bradenhead monitoring at jurisdictional gas wells in the Ignacio-Blanco (I-B) field. Coal bed methane and conventional gas wells with >25psig initial bradenhead test pressure numbered 16, accounting for 3 percent of all tested BLM jurisdictional I-B gas wells. Gas wells with bradenhead pressures between 2-25psig initial pressure numbered 45 wells, or 8 percent of tested BLM jurisdictional gas wells. Gas wells under BLM jurisdiction that exhibited bradenhead pressure of two psig or less numbered 475, or 89 percent of all wells tested in 2004.

2005 Bradenhead Testing and Comparison with Prior Data. This report summarizes the test results of 2005 bradenhead monitoring at jurisdictional gas wells in the Ignacio-Blanco (I-B) field. Coal bed methane and conventional gas wells with >25psig initial bradenhead test pressure numbered 41, accounting for 4 percent of all tested BLM jurisdictional I-B gas wells. Gas wells with bradenhead pressures between 2-25psig initial pressure numbered 156 wells, or 12 percent of tested BLM jurisdictional gas wells. Gas wells under BLM jurisdiction that exhibited bradenhead pressure of two psig or less numbered 989 or 77percent of all wells tested in 2005.

2006 Bradenhead Testing and Comparison with Prior Data. This report summarizes the test results of 2006 bradenhead monitoring at jurisdictional gas wells in the Ignacio-Blanco (I-B) field. Coal bed methane and conventional gas wells with >25psig initial bradenhead test pressure numbered 18, accounting for 3 percent of all tested BLM jurisdictional I-B gas wells. Gas wells with bradenhead pressures between 2-25psig initial pressure numbered 79 wells, or 12 percent of tested BLM jurisdictional gas wells. Gas wells under BLM jurisdiction that exhibited bradenhead pressure of two psig or less numbered 588 or 92 percent of all wells tested in 2006.

2007 Bradenhead Testing and Comparison with Prior Data. This report summarizes the test results of 2007 bradenhead monitoring at jurisdictional gas wells in the Ignacio-Blanco (I-B) field. Coal bed methane and conventional gas wells with >25psig initial bradenhead test pressure numbered 25, accounting for 3 percent of all tested BLM jurisdictional I-B gas wells. Gas wells with bradenhead pressures between 2-25psig initial pressure numbered 165 wells, or 14 percent of tested BLM jurisdictional gas wells. Gas wells under BLM jurisdiction that exhibited bradenhead pressure of two psig or less numbered 1027 or 85 percent of all wells tested in 2007.

IX. APPENDIX: A1

Gas Wells Approved for Workover Action in 2007

APPENDIX: A2

Gas Wells with Workover Action Completed During 2007

APPENDIX: A3

Gas Wells Plugged and Abandoned in 2007

(None)

APPENDIX: B1

Conventional Gas Well Venting Mitigation Approved during 2007

APPENDIX: B2

Fruitland CBM Gas Well Venting Approved during 2007

APPENDIX: B3

Conventional-Recompleted to Fruitland CBM Gas Well Venting Approved during 2007

APPENDIX: C1
Conventional Gas Wells Not Tested This Year

APPENDIX: C2
CBM Gas Wells Not Tested This Year

APPENDIX: C3

Conventional Wells Re-completed to CBM Not Tested This Year

APPENDIX: D

HISTORIC BRADENHEAD PRESSURES
1992-2007

Note: 9999.9 indicates that no bradenhead exists.
9090.9 indicates that a bradenhead exists, but was not tested

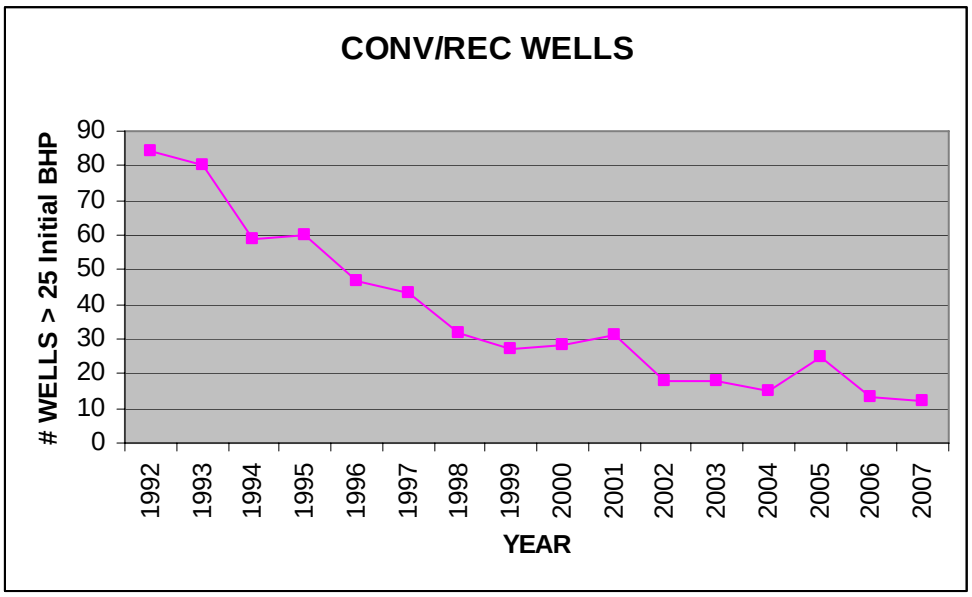
APPENDIX: E1
List of Conventional Wells Re-completed as CBM
with other Horizons.

APPENDIX X: AREA MAP

JURISDICTIONAL GAS WELLS:
BRADENHEAD PRESSURE
GREATER THAN 25 PSIG

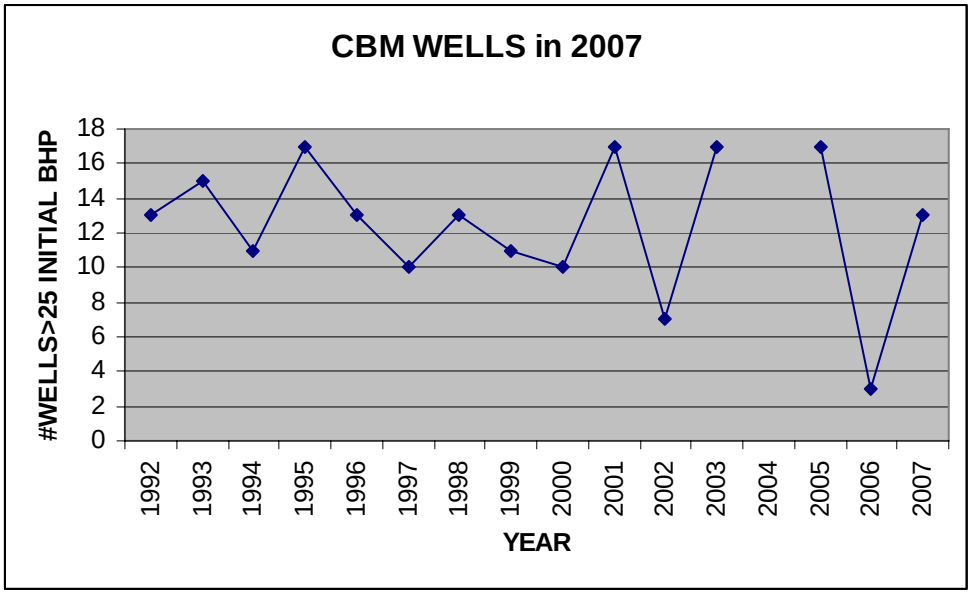
APPENDIX XI: CHART A

CONVENTIONALGAS WELLS
GREATER THAN 25 PSIG
BRADENHEAD PRESSURE
1992-2007



APPENDIX XII: CHART B

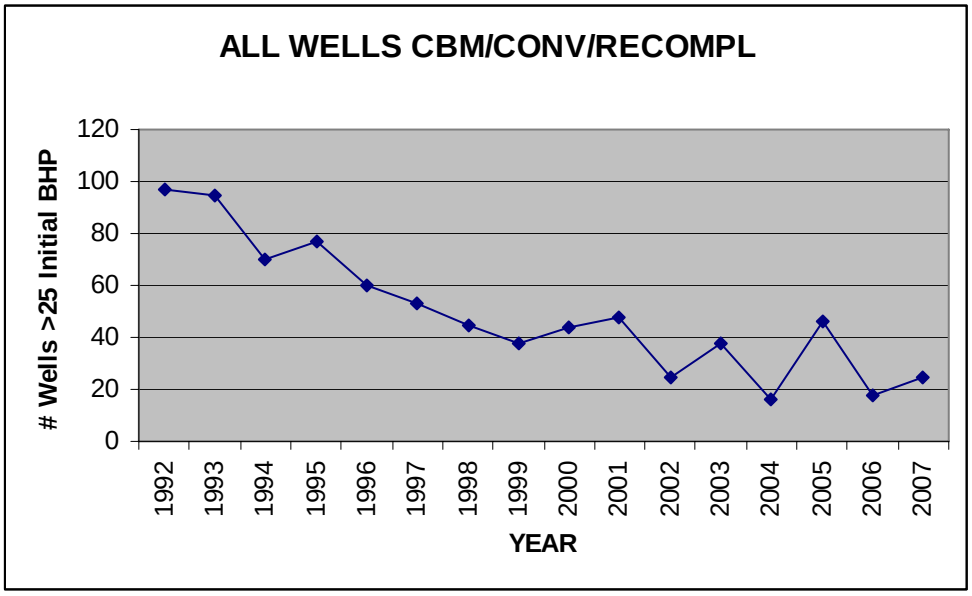
CBM GAS WELLS
GREATER THAN 25 PSIG
BRADENHEAD PRESSURE
1992-2007



(CBM wells tested every other year)

APPENDIX XI: CHART C

ALL IGNACIO-BLANCO FIELD GAS WELLS
GREATER THAN 25 PSIG
BRADENHEAD PRESSURE
1992-2007



2007 Bradenhead Pressure >25 psig by location

2007 -- Bradenhead Initial Pressuure > 25 psig

BHIP_Wells_2007

BHIP

(25 - 85

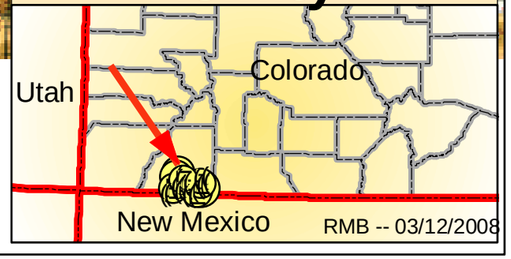
Ⓔ 86 - 188

○ 188 - 380

380 - 999.9

0 4 8 16 Miles

Vicinity



RMB -- 03/12/2008