

## **APPENDIX B—Water Sampling and Chemistry**

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 5/12/08  
 Well ID: TC-201 Site Name: Cerrito Negro well  
 Owner Name: BLM Time on site: 13:30  
 Weather: Clear, cool, windy Time off site: \_\_\_\_\_

Observations: \_\_\_\_\_  
 Total Depth: 354 ft Depth to Water: 340.73 ft Water Column: 13.27 ft  
 Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: 19.5 gal  
 Pump-on time: \_\_\_\_\_ Discharge Rate: \_\_\_\_\_ gpm Pump-off time: \_\_\_\_\_  
 Total Discharge: \_\_\_\_\_ gal Casing Volumes Pumped: \_\_\_\_\_  
 Describe sample method and plumbing: Sampling from line in transmission pipe with peristaltic pump on line to filter.

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
	7.7	13.6		7.2	Trouble with pump.
	7.8	13.9	225		"
	7.78	12.9	205	3.6	"

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
		500 mL	Gen Chem			
		125 mL	Trace Metals			
		25 mL	Stable Isotopes			
		1000 mL	Tritium			
		1000 mL	C14			
		(3) 250 mL	CFCs			
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: \_\_\_\_\_

Comments: Trouble with generator/pump. Do not use samples.

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 5/13/08  
 Well ID: TC-204 Site Name: Chiflo well / Ezequiel well  
 Owner Name: BLM / Elised Rael Time on site: \_\_\_\_\_  
 Weather: \_\_\_\_\_ Time off site: \_\_\_\_\_

Observations: \_\_\_\_\_  
 Total Depth: 500 ft Depth to Water: 436.85 ft Water Column: 63.15 ft  
 Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: 92.7 gal  
 Pump-on time: 12:10 pm Discharge Rate: 7.9 gpm Pump-off time: 12:41 pm  
 Total Discharge: 244.9 gal Casing Volumes Pumped: 2.6  
 Describe sample method and plumbing: \_\_\_\_\_

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
12:11 p	8.45	14.6	248	3.5	
12:15	8.44	16.1	236	3.1	
12:16	8.45	16.7	231	3.0	
12:19	8.47	16.8	229	3.06	
12:21	8.47	16.9	232	3.30	Use this reading
12:25	8.42	17.0	234	3.35	SAMPLED
12:28	8.42	17.0	236	3.4	

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	12:26 p	500 mL	Gen Chem	-	-	
	12:28	125 mL	Trace Metals	nitric	yes	
	12:26	25 mL	Stable Isotopes	-	-	
	12:25	1000 mL	Tritium	-	-	
	12:25	1000 mL	C14	-	-	
	12:32	(3) 250 mL	CFCs	-	-	through garden hose
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, T. Kludt, P. Bauer, B. Felix

Comments: \_\_\_\_\_

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 5/13/08  
 Well ID: TC-208 Site Name: Moeller/Rael well  
 Owner Name: BLM Time on site: 2:00 pm  
 Weather: Windy Time off site: \_\_\_\_\_

Observations: \_\_\_\_\_  
 Total Depth: 340 ft Depth to Water: 291.20 ft Water Column: 48.8 ft  
 Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: 71.6 gal  
 Pump-on time: 2:22 pm Discharge Rate: 8.1 gpm Pump-off time: 3:04 pm  
 Total Discharge: 340.2 gal Casing Volumes Pumped: 4.7  
 Describe sample method and plumbing: Sampled overhead pipe through garden hose and polyethylene hose (for CFCs).

## PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
2:30 pm	8.5	15	335	3.23	water is rusty
2:36	8.45	14.9	339.5	3.35	
2:42	8.45	14.7	339.8	3.43	SAMPLED
2:47	8.45	14.7	340.	3.47	
2:53	8.45	15.0	340	3.53	

## SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	2:46 pm	500 mL	Gen Chem	-	-	
	2:49	125 mL	Trace Metals	nitric	yes	
	2:47	25 mL	Stable Isotopes	-	-	
	2:45	1000 mL	Tritium	-	-	
	2:46	1000 mL	C14	-	-	
	2:57	(3) 250 mL	CFCs	-	-	polyethylene hose
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, T. Kludt, P. Bauer, B. Felix

Comments:

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 5/14/08  
 Well ID: TC-209 Site Name: Abeyta/Rael ("submarine")  
 Owner Name: BLM/Al Abeyta Time on site: \_\_\_\_\_  
 Weather: \_\_\_\_\_ Time off site: \_\_\_\_\_

Observations: \_\_\_\_\_  
 Total Depth: 400 ft Depth to Water: 347.13 ft Water Column: 52.87 ft  
 Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: 77.6 gal  
 Pump-on time: 2:59 pm Discharge Rate: 10 gpm Pump-off time: 3:32 pm  
 Total Discharge: 330 gal Casing Volumes Pumped: 4.2  
 Describe sample method and plumbing: \_\_\_\_\_

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
3:05 pm	8.65	17.8	313.9	2.02	
3:09	8.65	17.7	313.9	2.15	
3:15	8.62	17.8	314.7	2.37	
3:18	8.60	18.0	315.0	2.46	
3:21	8.60	18.0	315.0	2.52	SAMPLED
3:26	8.60	18.0	314.9	2.59	

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	3:25 pm	500 mL	Gen Chem	-	-	
	3:27	125 mL	Trace Metals	nitric	yes	
	3:24	25 mL	Stable Isotopes	-	-	
	3:24	1000 mL	Tritium	-	-	
	3:23	1000 mL	C14	-	-	
	3:28	(3) 250 mL	CFCs	-	-	
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, T. Kludt, P. Bawer, B. Felix

Comments: \_\_\_\_\_

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 5/14/08

Well ID: TC-212 Site Name: Middlemist well

Owner Name: BLM/Al Abeyta Time on site: \_\_\_\_\_

Weather: \_\_\_\_\_ Time off site: 2:20 pm

Observations: \_\_\_\_\_

Total Depth: 422 ft Depth to Water: 388.53 ft Water Column: 33.47 ft

Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: 49.1 gal

Pump-on time: 12:59 pm Discharge Rate: 10 gpm Pump-off time: 2:04 pm

Total Discharge: 320 gal Casing Volumes Pumped: 6.5

Describe sample method and plumbing: Tapped water from pipe to tank.

## PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
1:02 pm	8.54	15.3	~100	2.42	
1:13	8.51	15.2	179	2.86	
1:17	8.50	15.0	183.7	3.08	pumping air
1:20	8.48	15.1	184.2	2.86	
1:23	8.49	15.2	184.6	2.92	
1:52	8.49	15.2	184.0	2.87	SAMPLED
2:04	8.39	16.0	190.0	3.2	

## SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	1:55 pm	500 mL	Gen Chem			
	1:57	125 mL	Trace Metals	nitric	yes	
	1:54	25 mL	Stable Isotopes			
	1:53	1000 mL	Tritium			
	1:54	1000 mL	C14			
	2:00	(3) 250 mL	CFCs			
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, T. Kludt, P. Bauer, B. Felix

Comments: \_\_\_\_\_

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 6/3/08

Well ID: TC-213 Site Name: Maestas well

Owner Name: Al & Andrew Abeyta Time on site: 2:40 pm

Weather: \_\_\_\_\_ Time off site: 4:04 pm

Observations: \_\_\_\_\_

Total Depth: 280 ft Depth to Water: 246.02 ft Water Column: 34 ft

Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: 49.9 gal

Pump-on time: 2:42 pm Discharge Rate: 3.6 gpm Pump-off time: 3:50 pm

Total Discharge: 244.8 gal Casing Volumes Pumped: 4.9

Describe sample method and plumbing: Tap sample from top of transmission line.

## PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
2:57 pm	8.05	15.7	230	5.40	
3:05	8.03	15.1	226.5	5.40	
3:16	8.14	15.3	225.8	5.38	
3:24	8.196	15.2	225.7	5.38	
3:33	8.175	15.3	225.5	5.40	SAMPLED
3:50	8.19	14.8	223.5	5.48	

## SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	3:39 pm	500 mL	Gen Chem	-	-	
	3:41	125 mL	Trace Metals	nitric	yes	
	3:40	25 mL	Stable Isotopes	-	-	
	3:38	1000 mL	Tritium	-	-	
	3:38	1000 mL	C14	-	-	
	3:42	(3) 250 mL	CFCs	-	-	
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: \_\_\_\_\_

Comments:

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 5/14/08  
 Well ID: TC-216 Site Name: Moeller well  
 Owner Name: BLM Time on site: 4:20 pm  
 Weather: \_\_\_\_\_ Time off site: 5:50 pm

Observations: \_\_\_\_\_  
 Total Depth: 540 ft Depth to Water: 401.1 ft Water Column: 139 ft  
 Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: 204 gal  
 Pump-on time: 4:31 pm Discharge Rate: ~20 gpm Pump-off time: ~5:40 pm  
 Total Discharge: ~1400 gal Casing Volumes Pumped: 6.8  
 Describe sample method and plumbing: Tapped overhead pipe.

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
4:39 pm	8.25	17.7	186.3	-	bubbles; silty
4:49	8.26	18.0	186.6	3.07	cloudy
5:09	8.285	17.5	186.5	3.02	clear; few bubbles (CO <sub>2</sub> ?)
5:17	8.274	17.5	186.3	3.12	" "
5:28	8.264	17.9	186.5	3.20	" "
5:39	8.270	17.7	186.4	3.23	SAMPLED " "

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	5:38 pm	500 mL	Gen Chem	-	-	
	5:43	125 mL	Trace Metals	nitric	yes	
	5:37	25 mL	Stable Isotopes	-	-	
	5:36	1000 mL	Tritium	-	-	
	5:35	1000 mL	C14	-	-	
		(3) 250 mL	CFCs			not sampled due to bubbles
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, P. Bauer

Comments:



# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 6/3/08  
 Well ID: TC-218 Site Name: Aline well  
 Owner Name: Lee Bagwell Time on site: 11:05 am  
 Weather: \_\_\_\_\_ Time off site: 12:14 pm

Observations: \_\_\_\_\_  
 Total Depth: ~ 630 ft Depth to Water: ~ 600 ft Water Column: ~ 30 ft  
 Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: 44.1 gal  
 Pump-on time: 11:28 am Discharge Rate: ~ 15 gpm Pump-off time: ~ 12:10 pm  
 Total Discharge: ~ 630 gal Casing Volumes Pumped: 14  
 Describe sample method and plumbing: Tapped into top of transmission pipe.

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
11:32 am	8.19	16.9	211	4.94	
11:40	8.12	19.8	213.5	4.71	
11:46	8.125	19.8	212.7	4.71	SAMPLED
11:58	8.123	19.8	212.4	4.67	

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	11:50 am	500 mL	Gen Chem	-	-	
	11:52	125 mL	Trace Metals	nitric	yes	
	11:51	25 mL	Stable Isotopes	-	-	
	11:49	1000 mL	Tritium	-	-	
	11:50	1000 mL	C14	-	-	
	11:53	(3) 250 mL	CFCs	-	-	
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, P. Bauer

Comments:

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 6/3/09

Well ID: TC-219 Site Name: Sowards well

Owner Name: BLM / Mr. ~~Sowards~~ Bagwell Time on site: \_\_\_\_\_

Weather: \_\_\_\_\_ Time off site: \_\_\_\_\_

Observations: \_\_\_\_\_

Total Depth: 501 ft Depth to Water: 348.62 ft Water Column: 151.38 ft

Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: \_\_\_\_\_ gal

Pump-on time: 11:34 am Discharge Rate: ~ 20 gpm Pump-off time: 12:30 pm

Total Discharge: \_\_\_\_\_ gal Casing Volumes Pumped: \_\_\_\_\_

Describe sample method and plumbing: Attached valve to supply pipe to tank.

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
11:35 am	8.22	16.76	165	7.54	
11:40	8.15	17.96	169	7.44	
11:45	8.08	17.96	167	7.50	
11:50	8.06	18.04	167	7.52	
11:55	8.05	18.07	166	7.59	
12:00					SAMPLED
12:03 pm	8.05	17.91	166	7.54	
12:05	8.04	18.02	166	7.52	
12:15	7.98	17.86	165	7.78	

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	12:03 pm	500 mL	Gen Chem			
	12:03	125 mL	Trace Metals			
	12:04	25 mL	Stable Isotopes			
	12:00	1000 mL	Tritium			
	12:02 pm	1000 mL	C14			
	12:06	(3) 250 mL	CFCs			
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, P. Bauer, M. Rodriguez (BLM)

Comments:

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 5/15/08

Well ID: TC-220 Site Name: Llano well

Owner Name: BLM / Johnny Maestas Time on site: 10:56 am

Weather: \_\_\_\_\_ Time off site: 12:10 pm

Observations: \_\_\_\_\_

Total Depth: 430 ft Depth to Water: 389.94 ft Water Column: 40 ft

Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: 58.7 gal

Pump-on time: 11:21 am Discharge Rate: 8.6 gpm Pump-off time: 11:59 am

Total Discharge: 326.8 gal Casing Volumes Pumped: 5.6

Describe sample method and plumbing: \_\_\_\_\_

## PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
11:21 am	8.09	9.7	180.7	1.92	
11:28	8.53	15.0	158.5	3.28	
11:35	8.53	15.4	158.0	3.08	
11:42	8.52	15.5	157.9	3.06	
11:46	8.52	15.3	157.9	3.03	SAMPLED
11:52	8.50	15.1	158.1	-	
11:58	8.51	15.2	157.9	-	

## SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	11:47 am	500 mL	Gen Chem	-	-	
	11:51	125 mL	Trace Metals	nitaz	yes	
	11:46	25 mL	Stable Isotopes	-	-	
	11:49	1000 mL	Tritium	-	-	
	11:48	1000 mL	C14	-	-	
	11:53	(3) 250 mL	CFCs	-	-	
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, T. Kludt, P. Bauer, B. Felix

Comments: \_\_\_\_\_

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 5/15/08

Well ID: TC-221 Site Name: No Agua Perlite mine well

Owner Name: Harborlite Corp. Time on site: 2:45 pm

Weather: \_\_\_\_\_ Time off site: 3:55 pm

Observations: \_\_\_\_\_

Total Depth: 1160 ft Depth to Water: 727 ft Water Column: 433 ft

Casing Diameter: ~12 in. Casing Radius: ~6 in. Wellbore Volume: ~2540 gal

Pump-on time: 3:05 pm Discharge Rate: - gpm Pump-off time: 3:50 pm

Total Discharge: - gal Casing Volumes Pumped: -

Describe sample method and plumbing: Sampled from tap outside well house.  
Earlier in day, well had pumped 14,000 gall.

## PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
3:15 pm	7.50	30.4	228.3	2.63	clear
3:22	7.34	31.1	231.6	2.53	"
3:28	7.29	31.0	235	2.58	"
3:35	7.25	31.0	236.1	2.60	
3:42	7.22	30.6	236.8	2.65	

## SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	3:40 pm	500 mL	Gen Chem	-	-	
	3:41	125 mL	Trace Metals	nitric	yes	
	3:40	25 mL	Stable Isotopes	-	-	
	3:39	1000 mL	Tritium	-	-	
	3:38	1000 mL	C14	-	-	
		(3) 250 mL	CFCs	-	-	Not sampled
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, P. Bauer

Comments: Hot water.

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 6/3/08  
 Well ID: TC-222 Site Name: Bagwell N  
 Owner Name: Lee Bagwell Time on site: 7:30 am  
 Weather: \_\_\_\_\_ Time off site: 8:50 am

Observations: \_\_\_\_\_  
 Total Depth: 685 ft Depth to Water: ~599 ft Water Column: 86 ft  
 Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: 126.3 gal  
 Pump-on time: running Discharge Rate: ~2 gpm Pump-off time: running  
 Total Discharge: - gal Casing Volumes Pumped: -  
 Describe sample method and plumbing: Continuously pumping due to float valve in tank. Sampled via poly tube inserted into pipe.

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
7:45 am	8.2	18.2	240.4	5.52	water in bucket warmed up
8:05	8.07	19.5	240.4	5.32	large bucket
8:31	7.975	19.8	240.0	4.95	small bucket

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	~ 8:15 am	500 mL	Gen Chem	-	-	
	"	125 mL	Trace Metals	nitric	yes	
	"	25 mL	Stable Isotopes	-	-	
	"	1000 mL	Tritium	-	-	
	"	1000 mL	C14	-	-	
	"	(3) 250 mL	CFCs	-	-	
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, P. Bauer

Comments: \_\_\_\_\_

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 5/16/08

Well ID: TC - 223 Site Name: Stateline well

Owner Name: Kelly + Jack Sowards / BLM Time on site: 9:20 am

Weather: \_\_\_\_\_ Time off site: 10:35 am

Observations: \_\_\_\_\_

Total Depth: 490 ft Depth to Water: 436.30 ft Water Column: 53.7 ft

Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: 78.8 gal

Pump-on time: 9:26 am Discharge Rate: 7.5 gpm Pump-off time: 10:26 am

Total Discharge: 450 gal Casing Volumes Pumped: 5.7

Describe sample method and plumbing: \_\_\_\_\_

## PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
9:32 am	8.5	12.4	154.4	2.92	rusty
9:39	8.12	12.6	162.5	3.38	"
9:46	8.00	12.5	159.0	3.57	
9:52	7.99	12.6	163.0	3.55	clear
9:58	8.02	12.7	163.6	3.55	"
10:04	8.05	12.8	164.0	3.52	"
10:25	8.01	13.7	164.9	3.34	"

## SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	10:11 am	500 mL	Gen Chem	-	-	
	10:15	125 mL	Trace Metals	nitric	yes	
	10:12	25 mL	Stable Isotopes	-	-	
	10:15	1000 mL	Tritium	-	-	
	10:10	1000 mL	C14	-	-	
	10:17	(3) 250 mL	CFCs	-	-	
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: \_\_\_\_\_

Comments:

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 5/16/08

Well ID: TC-224 Site Name: Shawcroft West

Owner Name: Donald Shawcroft Time on site: 12:00

Weather: \_\_\_\_\_ Time off site: 1:50 pm

Observations: \_\_\_\_\_

Total Depth: ~900 ft Depth to Water: ? ft Water Column: ~30? ft

Casing Diameter: 6 in. Casing Radius: 3 in. Wellbore Volume: ~50 gal

Pump-on time: 12:56 pm Discharge Rate: 11.5 gpm Pump-off time: 1:38 pm

Total Discharge: 483 gal Casing Volumes Pumped: ~9.6

Describe sample method and plumbing: Tapped into end of supply line to tank.

## PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
12:56 pm	8.64	18.0	~192	1.64	erratic readings
1:06	8.44	17.3	~190	2.82	" "
1:11	8.43	18.5	196.4	3.00	
1:16	8.41	18.8	198.5	3.00	
1:22	8.40	19.0	199.6	3.06	SAMPLED
1:38	8.40	19.1	200.2	3.15	

## SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	1:27 pm	500 mL	Gen Chem	-	-	
	1:29	125 mL	Trace Metals	nitric	yes	
	1:28	25 mL	Stable Isotopes	-	-	
	1:26	1000 mL	Tritium	-	-	
	1:25	1000 mL	C14	-	-	
	1:31	(3) 250 mL	CFCs	-	-	
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, P. Bauer

Comments:

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 5/16/08

Well ID: TC-226 Site Name: Shawcroft East

Owner Name: Donald Shawcroft Time on site: 2:20 pm

Weather: \_\_\_\_\_ Time off site: 3:40 pm

Observations: \_\_\_\_\_

Total Depth: 420 ft Depth to Water: ~390 ft Water Column: ~30 ft

Casing Diameter: 4 in. Casing Radius: 2 in. Wellbore Volume: ~28 gal

Pump-on time: 2:28 pm Discharge Rate: ~5 gpm Pump-off time: 3:23 pm

Total Discharge: ~275 gal Casing Volumes Pumped: 9.8

Describe sample method and plumbing: Sampled from faucet near top of transmission pipe. Water first rusty.

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
2:48 pm	8.55	14.5	266.3	2.30	water clearing
2:58	8.55	14.5	263.0	2.44	clear
3:08	8.54	14.5	263.1	2.64	"
3:23	8.53	14.5	263.1	2.85	SAMPLED

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	3:13 pm	500 mL	Gen Chem	-	-	
	3:14	125 mL	Trace Metals	nitric	yes	
	3:13	25 mL	Stable Isotopes	-	-	
	3:12	1000 mL	Tritium	-	-	
	3:11	1000 mL	C14	-	-	
	3:16	(3) 250 mL	CFCs	-	-	
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, P. Bauer

Comments:



# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 6/3/08  
 Well ID: TC-227 Site Name: Perlite mine office in Antonito  
 Owner Name: Harborlite Corp. Time on site: 9:00 am  
 Weather: \_\_\_\_\_ Time off site: 10:15 am

Observations: \_\_\_\_\_  
 Total Depth: 237 ft Depth to Water: 211 ft Water Column: 26 ft  
 Casing Diameter: ~12 in. Casing Radius: ~6 in. Wellbore Volume: ~152 gal  
 Pump-on time: 9:20 am Discharge Rate: 10 gpm Pump-off time: 10:10 am  
 Total Discharge: 500 gal Casing Volumes Pumped: 3.2  
 Describe sample method and plumbing: Sampled at exterior frost-free faucet that is downstream of small pressure tank.

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
9:43 am	8.43	11.8	583	7.58	
9:50	8.44	11.3	588	7.73	
9:55	8.43	11.4	588	7.68	SAMPLED
10:09	8.43	11.8	587	7.61	

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	10:00 am	500 mL	Gen Chem	-	-	
	10:01	125 mL	Trace Metals	nitric	yes	
	10:00	25 mL	Stable Isotopes	-	-	
	9:59	1000 mL	Tritium	-	-	
	9:58	1000 mL	C14	-	-	
	10:02	(3) 250 mL	CFCs	-	-	
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, P. Bauer

Comments:

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 6/4/08

Well ID: TC-229 Site Name: Crow well

Owner Name: Johnny Maestas Time on site: 8:30 am

Weather: \_\_\_\_\_ Time off site: 10:15 am

Observations: \_\_\_\_\_

Total Depth: 365 ft Depth to Water: 315.40 ft Water Column: 49.6 ft

Casing Diameter: 5 in. Casing Radius: 2.5 in. Wellbore Volume: 50.6 gal

Pump-on time: 9:19 am Discharge Rate: 8.6 gpm Pump-off time: 10:08 am

Total Discharge: 421 gal Casing Volumes Pumped: 8.3

Describe sample method and plumbing: Polyethylene tube inserted into  
ABS pipe into metal pipe.

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
9:27 am	8.38	14.8	183.8	4.45	
9:37	8.25	14.8	183.7	5.15	
9:45	8.243	15.0	183.5	5.29	
10:08	8.195	15.1	183.3	5.36	

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	9:53 am	500 mL	Gen Chem	-	-	
	9:55	125 mL	Trace Metals	nitric	yes	
	9:52	25 mL	Stable Isotopes	-	-	
	9:51	1000 mL	Tritium	-	-	
	9:50	1000 mL	C14	-	-	
	10:00	(3) 250 mL	CFCs	-	-	
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: \_\_\_\_\_

Comments:

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 6/4/09

Well ID: TC-233 Site Name: San Antonio Mtn well

Owner Name: \_\_\_\_\_ Time on site: \_\_\_\_\_

Weather: \_\_\_\_\_ Time off site: \_\_\_\_\_

Observations: 3'-diameter, hand-dug well at top of subdivision on east side of mtn.

Total Depth: 50 ft Depth to Water: 19' 2.75" ft Water Column: ~30' ft

Casing Diameter: \_\_\_\_\_ in. Casing Radius: \_\_\_\_\_ in. Wellbore Volume: \_\_\_\_\_ gal

Pump-on time: \_\_\_\_\_ Discharge Rate: \_\_\_\_\_ gpm Pump-off time: \_\_\_\_\_

Total Discharge: \_\_\_\_\_ gal Casing Volumes Pumped: \_\_\_\_\_

Describe sample method and plumbing: Bail sample with weighted bucket and rope. Sample taken from ~38' to 40' depth.

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
	6.5	6.56	139	10.5	Measured from bucket sample.

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
		500 mL	Gen Chem		No	} Three bottles filled from bail bucket.
		125 mL	Trace Metals	no acid	No	
		25 mL	Stable Isotopes		No	
		1000 mL	Tritium			
		1000 mL	C14			
		(3) 250 mL	CFCs			
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, P. Bauer, Tom Caldwell (local resident)

Comments: Well is lined with mortared bricks, and unlined at bottom of well so ground water flows through well.

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 11/12/10  
 Well ID: TC-240 Site Name: Chiflo site at BLM Wild Rivers  
 Owner Name: BLM Time on site: 14:00  
 Weather: Clear, cool Time off site: 16:30

Observations: \_\_\_\_\_  
 Total Depth: 415 ft Depth to Water: 343.59 ft Water Column: 71 ft  
 Casing Diameter: ~~8 1/8~~ 6 in. Casing Radius: .34 in. Wellbore Volume: 193 gal  
 Pump-on time: 3:16 pm Discharge Rate: 7-16 gpm Pump-off time: 4:12 pm  
 Total Discharge: ~660 gal Casing Volumes Pumped: >3.4  
 Describe sample method and plumbing: Attach garden hose (off for CFCs) and nylon tube to existing valve upstream of chlorinator.

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
3:23	8.48	16.94	249	3.12	
3:29	8.40	17.23	256	6.01	
3:35	8.35	17.39	259	6.90	
3:43	8.35	17.41	259	6.94	
3:52	8.34	17.40	258	7.21	
4:19	8.33	17.23	259	7.31	

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
	4:03	500 mL	Gen Chem			
	3:55	125 mL	Trace Metals	nitric	yes	
	4:09	25 mL	Stable Isotopes			
	4:05	1000 mL	Tritium			
	4:07	1000 mL	C14			Gloves on
	4:15	(3) 250 mL	CFCs, SF6			Gloves off
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, P. Bauer, Joe Marcoline, Herb Chavez

Comments: \_\_\_\_\_

# Well Water Sample Collection Form

Project: Northern Taos Plateau wells Date: 11/12/10  
 Well ID: TC-249 Site Name: Headquarters/Visitors Center BLM  
 Owner Name: BLM Time on site: 12:20  
 Weather: Clear, cool Time off site: 13:45

Observations: \_\_\_\_\_  
 Total Depth: ~~550~~ 546 ft Depth to Water: 486.55 ft Water Column: 64 ft  
 Casing Diameter: 8 1/8 in. Casing Radius: .34 in. Wellbore Volume: 174 gal  
 Pump-on time: 12:52 Discharge Rate: ~100 gpm Pump-off time: 13:33  
 Total Discharge: ~522 gal Casing Volumes Pumped: 3  
 Describe sample method and plumbing: Attach nylon tube to existing valve that is upstream of chlorinator.

YSI 556 Multiprobe

### PURGE RECORD

Time	pH	Temp (°C)	Spec. Cond. (µs/cm)	Dissolved oxygen (ppm)	Remarks
12:55	8.44	13.71	250	6.40	
1:00	8.32	14.46	249	7.01	
1:03	8.32	17.60	248	7.14	
1:06	8.33	17.76	248	7.08	
1:11	8.32	17.74	248	7.16	
1:31	8.32	17.81	248	7.20	

### SAMPLE RECORD

Sample ID	Time Collected	Sample Volume	Analysis	Preserved with	Filtered?	Notes
TC-249	1:21	500 mL	Gen Chem			
"	1:15	125 mL	Trace Metals	nitric	yes	
"	1:17	25 mL	Stable Isotopes			
"	1:23	1000 mL	Tritium			
"	1:20	1000 mL	C14			Gloves on
"	1:30	(3) <del>250</del> <sup>500</sup> mL	CFCs, SF6			Gloves off
		500 mL	Strontium			
		(2) Cu tubes	Noble gases			

Field Staff: P. Johnson, P. Bauer

Comments:

## $^{14}\text{C}$ Laboratory Sheets



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**Darden Hood**  
President

**Ronald Hatfield**  
**Christopher Patrick**  
Deputy Directors

July 29, 2008

Dr. Stacy Timmons  
New Mexico Bureau of Geology  
NM Tech  
801 Leroy Place  
Socorro, NM 87801

RE: Radiocarbon Dating Results For Samples TC-226, TC-223, TC-209, TC-204, TC-208, TC-222, TC-220, TC-227, TC-213, TC-201, TC-229, TC-221, TC-224, TC-212, TC-216, TC-218

Dear Dr. Timmons:

Enclosed are the radiocarbon dating results for 16 samples recently sent to us. They each provided plenty of carbon for accurate measurements and all the analyses went normally. The analyses were performed on the DIC within the submitted waters. Results are reported both as fraction of modern (F<sub>mdn</sub>) and as the Apparent Radiocarbon Age. The report sheet also includes the method used, material type, and applied pretreatments.

The reported Apparent Radiocarbon Ages have not been corrected for any effects. They do not necessarily represent the residence time of the water within the aquifer. That would have to be derived by incorporating the radiocarbon dating result into models which take hydrologic conditions into account. The Apparent Radiocarbon Age is used as a relational tool, of understandable units to the layman, to interpret hydrologic differences between wells and to monitor temporal changes. For example, if semi-annual measurements on the same well provided consecutively decreasing apparent ages, it may indicate over-pumping or eminent surface water uptake.

We analyzed these samples on a sole priority basis. No students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analysis. We analyzed them with the combined attention of our entire professional staff.

Information pages are also enclosed with the mailed copy of this report. If you have any specific questions about the analysis, please do not hesitate to contact us. Someone is always available to answer your questions.

Our invoices are enclosed. Please, immediately give them to the appropriate officer for prompt payment or send VISA charge authorization. Thank you.

Sincerely,



# REPORT OF RADIOCARBON DATING ANALYSES

Dr. Stacy Timmons

Report Date: 7/29/2008

New Mexico Bureau of Geology

Material Received: 7/1/2008

Sample Data	Apparent C14 Age (fraction modern)	C13/C12 Ratio
Beta - 246139 SAMPLE : TC-226 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	5720 +/- 50 BP (Fmdn 0.4904 +/- 0.0031)	-11.1 o/oo
Beta - 246140 SAMPLE : TC-223 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	4370 +/- 40 BP (Fmdn 0.5802 +/- 0.0029)	-12.4 o/oo
Beta - 246141 SAMPLE : TC-209 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	5230 +/- 40 BP (Fmdn 0.5213 +/- 0.0026)	-10.0 o/oo
Beta - 246142 SAMPLE : TC-204 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	4900 +/- 40 BP (Fmdn 0.5431 +/- 0.0027)	-10.7 o/oo
Beta - 246143 SAMPLE : TC-208 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	4760 +/- 40 BP (Fmdn 0.5527 +/- 0.0028)	-9.8 o/oo

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "\*\*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.





# REPORT OF RADIOCARBON DATING ANALYSES

Dr. Stacy Timmons

Report Date: 7/29/2008

Sample Data	Apparent C14 Age (fraction modern)	C13/C12 Ratio
Beta - 246144 SAMPLE : TC-222 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	5490 +/- 40 BP (Fmdn 0.5047 +/- 0.0025)	-11.8 o/oo
Beta - 246145 SAMPLE : TC-220 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	4680 +/- 40 BP (Fmdn 0.5582 +/- 0.0028)	-12.3 o/oo
Beta - 246146 SAMPLE : TC-227 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	6760 +/- 40 BP (Fmdn 0.4309 +/- 0.0021)	-7.9 o/oo
Beta - 246147 SAMPLE : TC-213 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	5140 +/- 40 BP (Fmdn 0.5271 +/- 0.0026)	-10.2 o/oo
Beta - 246148 SAMPLE : TC-201 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	6070 +/- 40 BP (Fmdn 0.4695 +/- 0.0023)	-11.5 o/oo

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "\*\*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.



# REPORT OF RADIOCARBON DATING ANALYSES

Dr. Stacy Timmons

Report Date: 7/29/2008

Sample Data	Apparent C14 Age (fraction modern)	C13/C12 Ratio
Beta - 246149 SAMPLE : TC-229 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	3890 +/- 40 BP (Fmdn 0.6159 +/- 0.0031)	-11.7 o/oo
Beta - 246150 SAMPLE : TC-221 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	6520 +/- 40 BP (Fmdn 0.4439 +/- 0.0022)	-10.7 o/oo
Beta - 246151 SAMPLE : TC-224 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	5700 +/- 50 BP (Fmdn 0.4916 +/- 0.0031)	-11.5 o/oo
Beta - 246152 SAMPLE : TC-212 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	3580 +/- 40 BP (Fmdn 0.6401 +/- 0.0032)	-11.5 o/oo
Beta - 246153 SAMPLE : TC-216 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation	5680 +/- 40 BP (Fmdn 0.4929 +/- 0.0025)	-11.5 o/oo

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "\*\*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.



## REPORT OF RADIOCARBON DATING ANALYSES

Dr. Stacy Timmons

Report Date: 7/29/2008

Sample Data	Apparent C14 Age (fraction modern)	C13/C12 Ratio
Beta - 246154	8030 +/- 50 BP (Fmdn 0.3679 +/- 0.0023)	-11.3 o/oo
SAMPLE : TC-218 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation		

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "\*\*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.



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Deputy Directors

*The Radiocarbon Laboratory Accredited to ISO-17025 Testing Standards (PJLA Accreditation #59423)*

July 16, 2009

Dr. Stacy Timmons  
New Mexico Bureau of Geology  
NM Tech  
801 Leroy Place  
Socorro, NM 87801  
USA

RE: Radiocarbon Dating Results For Samples TS-54B, TC-219, TS-86, TC-234

Dear Dr. Timmons:

Enclosed are the radiocarbon dating results for four samples recently sent to us. They each provided plenty of carbon for accurate measurements and all the analyses went normally. The analyses was performed on the DIC within the submitted waters. Results are reported both as fraction of modern (Fmdn) and as the Apparent Radiocarbon Age. The report sheet also includes the method used, material type, and applied pretreatments.

The reported Apparent Radiocarbon Ages have not been corrected for any effects. They do not necessarily represent the residence time of the water within the aquifer. That would have to be derived by incorporating the radiocarbon dating result into models which take hydrologic conditions into account. The Apparent Radiocarbon Age is used as a relational tool, of understandable units to the layman, to interpret hydrologic differences between wells and to monitor temporal changes. For example, if semi-annual measurements on the same well provided consecutively decreasing apparent ages, it may indicate over-pumping or eminent surface water uptake.

We analyzed these samples on a sole priority basis. No students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analysis. We analyzed them with the combined attention of our entire professional staff.

Information pages are also enclosed with the mailed copy of this report. If you have any specific questions about the analysis, please do not hesitate to contact us. Someone is always available to answer your questions.

Thank you for prepaying the analyses. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,



## REPORT OF RADIOCARBON DATING ANALYSES

Dr. Stacy Timmons

Report Date: 7/16/2009

New Mexico Bureau of Geology

Material Received: 6/29/2009

Sample Data	Apparent C14 Age (fraction modern)	C13/C12 Ratio
Beta - 261393	17630 +/- 90 BP (Fmdn 0.1113 +/- 0.0012)	-8.2 o/oo
SAMPLE : TS-54B ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation		
Beta - 261394	5990 +/- 40 BP (Fmdn 0.4742 +/- 0.0024)	-10.2 o/oo
SAMPLE : TC-219 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation		
Beta - 261395	8910 +/- 50 BP (Fmdn 0.3297 +/- 0.0021)	-10.8 o/oo
SAMPLE : TS-86 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation		
Beta - 261396	8180 +/- 50 BP (Fmdn 0.3610 +/- 0.0022)	-5.2 o/oo
SAMPLE : TC-234 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (water DIC): carbonate precipitation		

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "\*\*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.



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*The Radiocarbon Laboratory Accredited to ISO-17025 Testing Standards (PJLA Accreditation #59423)*

## Final Report

The final report package includes the final date report, a statement outlining our analytical procedures, a glossary of pretreatment terms, calendar calibration information, billing documents (containing balance/credit information and the number of samples submitted within the yearly discount period), and peripheral items to use with future submittals. The final report includes the individual analysis method, the delivery basis, the material type and the individual pretreatments applied. The final report has been sent by mail and e-mail (where available).

## Pretreatment

Pretreatment methods are reported along with each result. All necessary chemical and mechanical pretreatments of the submitted material were applied at the laboratory to isolate the carbon, which may best represent the time event of interest. When interpreting the results, it is important to consider the pretreatments. Some samples cannot be fully pretreated, making their  $^{14}\text{C}$  ages more subjective than samples, which can be fully pretreated. Some materials receive no pretreatments. Please look at the pretreatment indicated for each sample and read the pretreatment glossary to understand the implications.

## Analysis

Materials measured by the radiometric technique were analyzed by synthesizing sample carbon to benzene (92% C), measuring for  $^{14}\text{C}$  content in one of 53 scintillation spectrometers, and then calculating for radiocarbon age. If the Extended Counting Service was used, the  $^{14}\text{C}$  content was measured for a greatly extended period of time. AMS results were derived from reduction of sample carbon to graphite (100 %C), along with standards and backgrounds. The graphite was then detected for  $^{14}\text{C}$  content in one of 9 accelerator-mass-spectrometers (AMS).

## The Radiocarbon Age and Calendar Calibration

The "Conventional  $^{14}\text{C}$  Age (\*)" is the result after applying  $^{13}\text{C}/^{12}\text{C}$  corrections to the measured age and is the most appropriate radiocarbon age. If an "\*" is attached to this date, it means the  $^{13}\text{C}/^{12}\text{C}$  was estimated rather than measured (The ratio is an option for radiometric analysis, but included on all AMS analyses.) Ages are reported with the units "BP" (Before Present). "Present" is defined as AD 1950 for the purposes of radiocarbon dating.

Results for samples containing more  $^{14}\text{C}$  than the modern reference standard are reported as "percent modern carbon" (pMC). These results indicate the material was respiring carbon after the advent of thermo-nuclear weapons testing and is less than ~ 50 years old.

Applicable calendar calibrations are included for materials between about 100 and 19,000 BP. If calibrations are not included with a report, those results were too young, too old, or inappropriate for calibration. Please read the enclosed page discussing calibration.

## PRETREATMENT GLOSSARY

### Standard Pretreatment Protocols at Beta Analytic

Unless otherwise requested by a submitter or discussed in a final date report, the following procedures apply to pretreatment of samples submitted for analysis. This glossary defines the pretreatment methods applied to each result listed on the date report form (e.g. you will see the designation "acid/alkali/acid" listed along with the result for a charcoal sample receiving such pretreatment).

Pretreatment of submitted materials is required to eliminate secondary carbon components. These components, if not eliminated, could result in a radiocarbon date, which is too young or too old. Pretreatment does not ensure that the radiocarbon date will represent the time event of interest. This is determined by the sample integrity. Effects such as the old wood effect, burned intrusive roots, bioturbation, secondary deposition, secondary biogenic activity incorporating recent carbon (bacteria) and the analysis of multiple components of differing age are just some examples of potential problems. The pretreatment philosophy is to reduce the sample to a single component, where possible, to minimize the added subjectivity associated with these types of problems. If you suspect your sample requires special pretreatment considerations be sure to tell the laboratory prior to analysis.

#### "acid/alkali/acid"

The sample was first gently crushed/dispersed in deionized water. It was then given hot HCl acid washes to eliminate carbonates and alkali washes (NaOH) to remove secondary organic acids. The alkali washes were followed by a final acid rinse to neutralize the solution prior to drying. Chemical concentrations, temperatures, exposure times, and number of repetitions, were applied accordingly with the uniqueness of the sample. Each chemical solution was neutralized prior to application of the next. During these serial rinses, mechanical contaminants such as associated sediments and rootlets were eliminated. This type of pretreatment is considered a "full pretreatment". On occasion the report will list the pretreatment as "acid/alkali/acid - insolubles" to specify which fraction of the sample was analyzed. This is done on occasion with sediments (See "acid/alkali/acid - solubles")

Typically applied to: charcoal, wood, some peats, some sediments, and textiles "acid/alkali/acid - solubles"

On occasion the alkali soluble fraction will be analyzed. This is a special case where soil conditions imply that the soluble fraction will provide a more accurate date. It is also used on some occasions to verify the present/absence or degree of contamination present from secondary organic acids. The sample was first pretreated with acid to remove any carbonates and to weaken organic bonds. After the alkali washes (as discussed above) are used, the solution containing the alkali soluble fraction is isolated/filtered and combined with acid. The soluble fraction, which precipitates, is rinsed and dried prior to combustion.

#### "acid/alkali/acid/cellulose extraction"

Following full acid/alkali/acid pretreatments, the sample is bathed in (sodium chlorite)  $\text{NaClO}_2$  under very controlled conditions (pH = 3, temperature = 70 degrees C). This eliminates all components except wood cellulose. It is useful for woods that are either very old or highly contaminated.

Applied to: wood

#### "acid washes"

Surface area was increased as much as possible. Solid chunks were crushed, fibrous materials were shredded, and sediments were dispersed. Acid (HCl) was applied repeatedly to ensure the absence of carbonates. Chemical concentrations, temperatures, exposure times, and number of repetitions, were applied accordingly with the uniqueness of each sample. The sample was not be subjected to alkali washes to ensure the absence of secondary organic acids for intentional reasons. The most common reason is that the primary carbon is soluble in the alkali. Dating results reflect the total organic content of the analyzed material. Their accuracy depends on the researcher's ability to subjectively eliminate potential contaminants based on contextual facts.

Typically applied to: organic sediments, some peats, small wood or charcoal, special cases



Consistent Accuracy  
Delivered On Time

**Beta Analytic Inc**  
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Fax: 305-663-0964  
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**Mr. Darden Hood**  
President

**Mr. Ronald Hatfield**  
**Mr. Christopher Patrick**  
Deputy Directors

*The Radiocarbon Laboratory Accredited to ISO-17025 Testing Standards (PJLA Accreditation #59423)*

## Calendar Calibration at Beta Analytic

Calibrations of radiocarbon age determinations are applied to convert BP results to calendar years. The short-term difference between the two is caused by fluctuations in the heliomagnetic modulation of the galactic cosmic radiation and, recently, large scale burning of fossil fuels and nuclear devices testing. Geomagnetic variations are the probable cause of longer-term differences.

The parameters used for the corrections have been obtained through precise analyses of hundreds of samples taken from known-age tree rings of oak, sequoia, and fir up to about 10,000 BP. Calibration using tree-rings to about 12,000 BP is still being researched and provides somewhat less precise correlation. Beyond that, up to about 20,000 BP, correlation using a modeled curve determined from U/Th measurements on corals is used. This data is still highly subjective. Calibrations are provided up to about 19,000 years BP using the most recent calibration data available.

The Pretoria Calibration Procedure (Radiocarbon, Vol 35, No.1, 1993, pg 317) program has been chosen for these calendar calibrations. It uses splines through the tree-ring data as calibration curves, which eliminates a large part of the statistical scatter of the actual data points. The spline calibration allows adjustment of the average curve by a quantified closeness-of-fit parameter to the measured data points. A single spline is used for the precise correlation data available back to 9900 BP for terrestrial samples and about 6900 BP for marine samples. Beyond that, splines are taken on the error limits of the correlation curve to account for the lack of precision in the data points.

In describing our calibration curves, the solid bars represent one sigma statistics (68% probability) and the hollow bars represent two sigma statistics (95% probability). Marine carbonate samples that have been corrected for  $^{13}\text{C}/^{12}\text{C}$ , have also been corrected for both global and local geographic reservoir effects (as published in Radiocarbon, Volume 35, Number 1, 1993) prior to the calibration. Marine carbonates that have not been corrected for  $^{13}\text{C}/^{12}\text{C}$  are adjusted by an assumed value of 0 ‰ in addition to the reservoir corrections. Reservoir corrections for fresh water carbonates are usually unknown and are generally not accounted for in those calibrations. In the absence of measured  $^{13}\text{C}/^{12}\text{C}$  ratios, a typical value of -5 ‰ is assumed for freshwater carbonates.

(Caveat: the correlation curve for organic materials assume that the material dated was living for exactly ten years (e.g. a collection of 10 individual tree rings taken from the outer portion of a tree that was cut down to produce the sample in the feature dated). For other materials, the maximum and minimum calibrated age ranges given by the computer program are uncertain. The possibility of an "old wood effect" must also be considered, as well as the potential inclusion of younger or older material in matrix samples. Since these factors are in determinant error in most cases, these calendar calibration results should be used only for illustrative purposes. In the case of carbonates, reservoir correction is theoretical and the local variations are real, highly variable and dependent on provenience. Since imprecision in the correlation data beyond 10,000 years is high, calibrations in this range are likely to change in the future with refinement in the correlation curve. The age ranges and especially the intercept ages generated by the program must be considered as approximations.)



# Tritium Laboratory Sheets



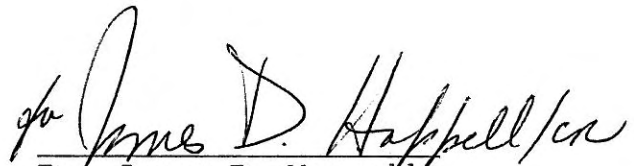
TC Wells

August 5, 2008

TRITIUM LABORATORY

Data Release #08-087  
Job # 2499

NEW MEXICO BUREAU OF GEOLOGY AND MINERAL RESOURCES  
TRITIUM SAMPLES

  
Dr. James D. Happell  
Associate Research Professor

Distribution:  
Stacy Timmons  
NM Bureau of Geology at NM Tech  
801 Leroy Place  
Socorro, NM 87801

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Tritium Laboratory  
4600 Rickenbacker Causeway • Miami, Florida 33149-1098  
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[www.rsmas.miami.edu/groups/tritium/](http://www.rsmas.miami.edu/groups/tritium/)

GENERAL COMMENTS ON TRITIUM RESULTSTritium Scale New Half-life

Tritium concentrations are expressed in TU, where 1 TU indicates a T/H abundance ratio of  $10^{-18}$ . The values refer to the tritium scale recommended by U.S. National Institute of Science and Technology (NIST, formerly NBS), and International Atomic Energy Agency (IAEA). The TU-numbers are based on the NIST tritium water standard #4926E. Age corrections and conversions are made using the recommended half-life of **12.32 years**, i.e., a decay rate of  $\lambda = 5.626\% \text{ year}^{-1}$ . In this scale, 1 TU is equivalent to 7.151 dpm/kg H<sub>2</sub>O, or 3.222 pCi/kg H<sub>2</sub>O, or 0.1192 Bq/kg H<sub>2</sub>O (Bq = disint/sec).

TU values are calculated for date of sample collection, REFDATE in the table, as provided by the submitter. If no such date is available, date of sample arrival at our laboratory is used.

The stated errors, eTU, are one standard deviation (1 sigma) including all conceivable contributions. In the table, QUANT is quantity of sample received, and ELYS is the amount of water taken for electrolytic enrichment. DIR means direct run (no enrichment).

Remark: From 1 Jan 1994 through 31 Dec 2001 we used the previously recommended value for the half-life, 12.43 years. The use of the new number, 12.32 years will in practice increase the reported TU-values by 0.9 %. This is insignificant since our reported values carry 1 sigma uncertainties of 3 % or more.

It is interesting to note that before 1994 we used the older, then recommended value of 12.26 years.

Very low tritium values

In some cases, negative TU values are listed. Such numbers can occur because the net tritium count rate is, in principle the difference between the count rate of the sample and that of a tritium-free sample (background count or blank sample). Given a set of "unknown" samples with no tritium, the distribution of net results should become symmetrical around 0 TU. The negative values are reported as such for the benefit of allowing the user unbiased statistical treatment of sets of the data. For other applications, 0 TU should be used.

Additional information

Refer to Services Rendered (Tritium), Section II.8, in the "Tritium Laboratory Price Schedule; Procedures and Standards; Advice on Sampling", and our Web-site [www.rsmas.edu/groups/tritium](http://www.rsmas.edu/groups/tritium).

Tritium efficiencies and background values are somewhat different in each of the nine counters and values are corrected for cosmic intensity, gas pressure and other parameters. For tritium, the efficiency is typically 1.00 cpm per 100 TU (direct counting). At 50x enrichment, the efficiency is equivalent to 1.00 cpm per 2.4 TU. The background is typically 0.3 cpm, known to about  $\pm 0.02$  cpm. Our reported results include not only the Poisson statistics, but also other experimental uncertainties such as enrichment error, etc.

End

Client: NM BUREAU GEOLOGY, NM TECH  
Recvd : 08/06/26  
Job# : 2499  
Final : 08/08/01

Purchase Order: various  
Contact: S. Timmons, 505/835-6951  
801 Leroy Place  
Socorro, NM 87801

Cust	LABEL INFO	JOB.SX	REFDATE	QUANT	ELYS	TU	eTU
<del>NM</del>	<del>CRYSTAL CREEK</del>	<del>2499.01</del>	<del>080426</del>	<del>1000</del>	<del>275</del>	<del>2.39</del>	<del>0.09</del>
NM	- RIO PUEBLO	2499.02	080125	1000	275	6.61	0.22
NM	- RIO LUCERO	2499.03	080125	1000	275	8.02	0.26
NM	- R FERNANDO	2499.04	080211	1000	275	6.15	0.20
NM	- RG DEL RANCHO	2499.05	080211	1000	275	8.37	0.28
NM	- TC213	2499.06	080603	1000	275	0.36	0.09
NM	- TC228	2499.07	080603	1000	275	6.69	0.22
NM	- TC229	2499.08	080604	1000	275	0.05	0.09
NM	- TC222	2499.09	080603	1000	275	0.02	0.09
NM	- TC227	2499.10	080603	1000	275	1.02*	0.09
NM	- TC223	2499.11	080515	1000	275	0.10	0.09
NM	- TC226	2499.12	080516	1000	275	0.03	0.09
NM	- TC218	2499.13	080603	1000	275	0.04	0.09
NM	- TC224	2499.14	080516	1000	275	-0.02	0.09
NM	- TC216	2499.15	080514	1000	275	0.19	0.09
NM	- TC220	2499.16	080515	1000	275	0.00	0.09
NM	- TC204	2499.17	080513	1000	275	0.22	0.09
NM	- TC209	2499.18	080514	1000	275	0.02	0.09
NM	- TC221	2499.19	080515	1000	275	0.02	0.09
NM	- TC212	2499.20	080514	1000	275	1.28	0.09
NM	- TC208	2499.21	080513	1000	275	0.03	0.09

\* Average of duplicate runs

Client: NM BUREAU GEOLOGY, NM TECH

Recvd : 09/06/26

Job# : 2636

Final : 09/09/04

Purchase Order: DP075159

Contact: S. Timmons, 505/835-6951

801 Leroy Place

Socorro, NM 87801

Prepaid under Inv 4596TRI

Cust	LABEL INFO	JOB.SX	REFDATE	QUANT	ELYS	TU	eTU
NM BUREAU GEOL	- TS-54B	2636.01	090611	1000	275	0.08	0.09
NM BUREAU GEOL	- TC-201	2636.02	080512	1000	275	0.04	0.09
NM BUREAU GEOL	- TS-86	2636.03	090611	1000	275	0.04	0.09
NM BUREAU GEOL	- TC-219	2636.04	090603	1000	275	50.8	1.7
NM BUREAU GEOL	- TC-234	2636.05	090605	1000	275	0.09*	0.09

\* Average of duplicate runs