



## Radiation Safety Section Preliminary Brine Study Results



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 Date: July 2, 2018  
 RE: Preliminary Formation Brine Study Results

The Radiation Safety Section, at the request of Bob Worstall, is conducting a study to determine the amount of combined radium 226 and radium 228 in Ohio formation brine.

This is the second update to the study is ongoing and began in June of 2017. To date, with the help of UIC inspectors, a total of 107 samples from 10 different formations in 26 different counties have been collected. The table below is a summary of what has been seen in the results we have received one year into this study. The attached table shows a more detailed breakdown.

Formation	Number of Samples	Lowest Activity	Highest Activity	Average Activity
Berea	9	202 pCi/l	2419 pCi/l	930 pCi/l
Clinton	28	350 pCi/l	2017 pCi/l	1251 pCi/l
Marcellus	3	2120 pCi/l	2634 pCi/l	2316 pCi/l
Ohio Shale	2	452 pCi/l	663 pCi/l	557 pCi/l
Point Pleasant	20	172 pCi/l	3264 pCi/l	2096 pCi/l
Queenston	1	1157 pCi/l	1157 pCi/l	1157 pCi/l
Rose Run	7	232 pCi/l	1101 pCi/l	748 pCi/l
Trempealeau	27	203 pCi/l	2977 pCi/l	1403 pCi/l
Trenton	7	168 pCi/l	1166 pCi/l	405 pCi/l
Utica	1	539 pCi/l	539 pCi/l	539 pCi/l

Date Collected	Collector	FROM: Production Formation	FROM: Production County	FROM: Production Formation	FROM: Production FROM: Production Well(s) Name	FROM: Production Well(s)	Ra-226 pCi/L	Ra-228 pCi/L	Combined pCi/L
4/26/2017	Carder	Berea	Meigs	tbd	WHITE WC	34105209500000	103	99.8	202.8
8/7/2017	Carder	Berea	Ashland	726	L & S GILBERT(ERP #2	34005241480000	814	1047	1861
8/7/2017	Carder	Berea	Ashland	615	HASTINGS	34005238400000	378	381	759
2/7/2018	Thompson	Berea	Athens		AKERS EARL	34009234940000	1154	1265	2419
3/9/2018	Benko	Berea	Ashland	382	Wells	34005208240000	364	247	611
4/12/2018	Benko	Berea	Ashland	616	WRIGHT	34005235910000	169	216	385
4/18/2018	Benko	Berea	Licking	618	RUPPERSBURG	34089260620000	392	265	657
4/18/2018	Benko	Berea	Licking	591	SHOEMAKER	34089259990000	287	289	576
4/26/2018	Benko	Berea	Licking	392	Wilson B-1	34089241180000	477	426	903
4/18/2018	Benko	Berea	Licking	unk	HOOVER	34089628470000	392	336	728
2/7/2018	Benko	Big Lime	Huron	619	Chapin Chapin	34077201120000	278	45	323
3/7/2018	Benko	Black River Group	Morrow	2705	Staiger #3	34117241710000	270	123	393
3/7/2018	Benko	Black River Group	Morrow	2802	Strict Dorn Unit#1	34117241950000	527	122	649
3/14/2018	Benko	Black River Group	Morrow	3300	Owen #2	34117224920000	231	69	300
3/14/2018	Benko	Black River Group	Morrow	3317	Higgins #1	34117234010000	891	108	999
6/12/2017	Carder	Clinton	Knox	2830	CHAPIN D & M	34083238710000	224	583	807
10/31/2017	Thompson	Clinton	Perry	2863	Rayburn	34127273420000	2.5	662	664.5
11/8/2017	Benko	Clinton	Knox	2773	Treap #1	34083230120000	374	771	1145
12/12/2017	Benko	Clinton	Knox	2485	Wagner #5	34083244080000	305	667	972
1/23/2018	Benko	Clinton	Knox	2900	HAMMOND LUCY	34083218180000	470	558	1028
1/23/2018	Benko	Clinton	Licking	2654	MCCLAIN	34089253330000	490	987	1477
1/23/2018	Benko	Clinton	Knox	2877	MICKLEY PAUL	34083226790000	320	1002	1322
1/23/2018	Benko	Clinton	Knox	3044	Flack Paul	34083232990000	538	1280	1818
1/31/2018	Benko	Clinton	Knox	2992	HJT COMPANY	34083238480000	606	872	1478
1/31/2018	Benko	Clinton	Knox	2887	Cavallo	34083226790000	375	1349	1724
1/31/2018	Benko	Clinton	Coshocton	3215	Rogers	34031248900000	350	649	999
1/31/2018	Benko	Clinton	Knox	2989	HERSHBERGER PETEF	34083239450000	463	1080	1543
1/31/2018	Benko	Clinton	Coshocton	2890	MOHICAN MEADOW	34031243120000	230	673	903
2/7/2018	Thompson	Clinton	Hocking	2426	RISCH C & M	34073229080000	251	662	913
2/7/2018	Thompson	Clinton	Perry	3228	GORDON D & K	34127273270000	322	750	1072

2/22/2018	Benko	Clinton	Knox	3100 Swick	34083208330000	586	1338	1924
2/22/2018	Benko	Clinton	Knox	2885 LANDIS	34083222170000	388	843	1231
3/1/2018	Benko	Clinton	Knox	3146 Kaelbling	34083222980000	527	1490	2017
3/1/2018	Benko	Clinton	Knox	2706 Carrol Mercury Sales	34083225330000	380	1005	1385
3/13/2018	Benko	Clinton	Licking	2900 Albright	34089228190000	474	659	1133
3/27/2018	Benko	Clinton	Licking	2105 Teeters	34089259950000	337	709	1047
4/5/2018	Skidmore	Clinton	Mahoning	5064 Rt46	34099230760000	177	173	350
4/6/2018	Benko	Clinton	Knox	2840 Chapin #5	34083238450000	193	385	578
4/17/2018	Ball	Clinton	Guernsey	5540 S.O.S #2	34059243320000	940	512	1452
4/18/2018	Benko	Clinton	Licking	2107 WILSON	34089239870000	543	176	719
4/26/2018	Benko	Clinton	Licking	2938 WOLFORD	34089228910000	662	1308	1970
4/26/2018	Benko	Clinton	Licking	2906 Wheeler	34089231850000	721	931	1652
2/20/2018	Benko	Clinton	Licking	3006 Palerswini #7	34089253720000	553	1166	1719
5/4/2018	Scott	Marcellus	WV	unk Balli	47017067130000	2467	381	2848
5/4/2018	Scott	Marcellus	WV	unk Coal Quest	47910013460000	9236	562	9798
10/30/2017	Carder	Marcellus	Belmont	8499 Nick Knack	34013211850000	1543	1091	2634
10/30/2017	Carder	Marcellus	Monroe	8958 Starr	34111246950000	1102	1093	2195
11/2/2017	Thompson	Ohio Shale	Meigs	3612 GORDON PROFITT	34105215580000	306	357	663
11/2/2017	Thompson	Ohio Shale	Meigs	3512 HOFFMAN GLENNIS	34105230570000	145	307	452
8/18/2017	Leidy	Point Pleasant	Columbiana	7780 MILLTREE	34029217530000	1029	1072	2101
1/18/2018	Ball	Point Pleasant	Belmont	9245 Bigfoot	34013211050000	1730	1514	3244
1/18/2018	Ball	Point Pleasant	Belmont	9534 GOLD DIGGER	34013210760000	897	1114	2011
1/18/2018	Ball	Point Pleasant	Monroe	10604 MOSER A	34111246310000	1378	1348	2726
1/18/2018	Ball	Point Pleasant	Belmont	8504 SHUGERT	34013206910000	1480	1700	3180
1/18/2018	Ball	Point Pleasant	Belmont	9363 THUNDERSTRUCK	34013208270000	1579	1685	3264
2/5/2018	Ball	Point Pleasant	Monroe	11030 HERRICK EAST A	34111247040000	944	881	1825
2/5/2018	Ball	Point Pleasant	Monroe	9127 Streamer	34111246920000	1135	1230	2365
2/5/2018	Ball	Point Pleasant	Guernsey	7603 HAYES UNIT	34059243250000	103	69.9	172.9
2/5/2018	Ball	Point Pleasant	Monroe	10123 FOLLOWAY BRIAN SC	34111247210000	1163	1174	2337
2/21/2018	Ball	Point Pleasant	Guernsey	7636 Purple Hayes	34059244880000	178	101	279
2/21/2018	Ball	Point Pleasant	Belmont	7635 Norma Pad	34013211130000	1384	1670	3054
2/21/2018	Ball	Point Pleasant	Belmont	8959 Strong pad	34013207920000	1480	1459	2939
2/21/2018	Ball	Point Pleasant	Monroe	10239 ROBERTS VICTOR L &	34111247470000	2376	550	2926
2/21/2018	Ball	Point Pleasant	Guernsey	8198 BORTON A UNIT	34059243800000	162	166	328

4/17/2018	Ball	Point Pleasant	Monroe	CLAUGUS	34111246700000	1078	1042	2120
4/17/2018	Ball	Point Pleasant	Washington	7850 Farley	34167297230000	817	842	1659
4/17/2018	Ball	Point Pleasant	Monroe	10367 Holliday	34111245920000	549	718	1267
4/17/2018	Ball	Point Pleasant	Monroe	9332 Roger	34111246510000	1223	1814	3037
4/17/2018	Ball	Point Pleasant	Guernsey	8653 S.O.S/SWIW	34059242020000	521	601	1123
3/1/2018	Benko	Queenston	Wayne	3871 MILLER FLOYD	34169230770000	494	663	1157
3/9/2018	Benko	QUEENSTON	Wayne	3871 Miller Floyd	34169230770000	494	663	1157
11/20/2017	Thompson	Rose Run	Pickaway	2500 STEVENSON JOHN	34129200830000	963	138	1101
11/20/2017	Thompson	Rose Run	Pickaway	2454 HOFFMAN-STEVENSON	34129200980000	442	194	636
11/20/2017	Thompson	Rose Run	Fairfield	4166 SCHOLL-LAMB	34045212120000	187	83.2	270.2
11/20/2017	Thompson	Rose Run	Fairfield	4163 HOUSEHOLDER	34045211890000	154	78.5	232.5
2/7/2018	Thompson	Rose Run	Fairfield	4323 ROWLES R	34045213150000	654	162	816
3/15/2018	Benko	Rose Run	Muskingum	5324 J Priest	34119278280000	623	75	698
4/5/2018	Skidmore	Rose Run	Portage	4270 4K	34133244640000	527	213	740
2/7/2018	Benko	Treampleau	Huron	3800 HAMER UNIT	34077202530000	865	614	1479
2/22/2018	Benko	Treampleau	Licking	3913 Pickrell	34089256410000	961	233	1194
3/27/2018	Benko	Treampleau	Licking	4222 H & D BREYMAIER	34089260540000	1277	289	1566
3/27/2018	Benko	Treampleau	Licking	4106 BRUCE FARMS-SMITH	34089260730000	1442	236	1678
5/4/2018	Benko	Treampleau	Licking	4218 Breymaier	34089259960000	1567	239	1806
5/4/2018	Benko	Treampleau	Licking	4182 UHDE	34089253950000	2178	548	2736
5/9/2018	Benko	Treampleau	Delaware	3244 Crist #1	34041203770000	1355	357	1712
4/12/2018	Benko	Treampleau	Ottawa	Yeasting	34123602160000	1602	156	1758
6/26/2017	Carder	TREMPEALEAU	Morrow	3820 HOHL JOHN J	34117223400000	2106	217	2323
7/24/2017	Carder	TREMPEALEAU	Morrow	3833 SEI-SMITH-MORRISON	34117242100000	768	70.2	838.2
10/31/2017	Thompson	TREMPEALEAU	Pickaway	2357 Davis-Holbrook	34129202610000	523	203	726
11/1/2017	Thompson	TREMPEALEAU	Hocking	4456 HANBY GLORIA	34073234350000	152	51.7	203.7
11/8/2017	Benko	TREMPEALEAU	Butler	4647 Magers #1	34083242780000	2156	502	2658
11/8/2017	Benko	TREMPEALEAU	Coshocton	6567 Stricker-123	34031225160000	584	1202	1786
11/20/2017	Benko	TREMPEALEAU	Morrow	3576 Cramer #1	34117234490000	802	123	925
11/20/2017	Benko	TREMPEALEAU	Morrow	3576 Cox#1	34117236330000	592	76.9	668.9
11/20/2017	Benko	TREMPEALEAU	Morrow	3075 Fischer #1	34117220280000	442	103	545
11/27/2017	Benko	TREMPEALEAU	Huron	3790 Yaworsuy	34077202420000	1754	609	2363
11/27/2017	Benko	TREMPEALEAU	Huron	3751 Gray #1	34077202780000	1104	1356	2460
11/27/2017	Benko	TREMPEALEAU	Huron	3822 Green #2	34077202510000	1087	483	1570

12/6/2017	Benko	TREMPEALEAU	Morrow	2958 Barton	34117233840000	473	118	591
12/6/2017	Benko	TREMPEALEAU	Morrow	2950 Gillsom	34117220580000	330	99	429
12/12/2017	Benko	TREMPEALEAU	Morrow	3362 Fuller #1	34117239720000	976	186	1162
12/12/2017	Benko	TREMPEALEAU	Morrow	2991 Schillinger #2	34117221670000	382	49	431
12/18/2017	Benko	TREMPEALEAU	Morrow	3059 Clinger	34117229240000	486	89.8	575.8
12/18/2017	Benko	TREMPEALEAU	Morrow	2910 Murphy #2	34117228280000	257	65.9	322.9
12/20/2017	Benko	TREMPEALEAU	Knox	4576 Minard #1	34083242490000	1991	986	2977
1/23/2018	Benko	TREMPEALEAU	Knox	4452 SCHILLINGER	34083245190000	1770	704	2474
4/4/2018	Benko	Trenton	Wood	1280 Woelke #1	34173205830000	1131	35	1166
4/12/2018	Benko	Trenton	Wood	1130 Dove 3A	34173205750000	136	36	172
4/12/2018	Benko	Trenton	Wood	1100 Dove #1	34173612530000	150	18	168
5/16/2018	Benko	Trenton	Logan	1383 Stocker #2	34091200790000	279	24	303
5/16/2018	Benko	Trenton	Logan	1434 Stocker #2	34091200350000	145	72	217
1/18/2018	Ball	Utica	Belmont	8450 BARTON	34013212290000	229	310	539
2/21/2018	Ball	Utica	Belmont	8450 BARTON	34013212290000	509	532	1041