Version of 12/3/10

REVIEW OF RADIOACTIVE TRACER SURVEYS FOR CEMENT INTEGRITY

Facility Name			Operator		
Romulus Facility			Environmental GeoTechnologies		
Well Name			USEPA Permit Number	Witness	Analyst
Well 1-12			MI-163-1W-C010	Vugrinovich	Greenhagen
State	Test Date	Test Number	Logging Company		Analysis Date
Michigan	December 5, 2012	2013-011	Baker Hughes		March 13, 2013

Well and Operational Information

LS Csg Material	LS Casing OD, in	Casing weight, #/ft	Casing ID, in	Long String Casing Length, ft	
Steel and Hastelloy	7	26	6.28	4080	
Tubing Material	Tubing OD, in		Tubing ID, in	Tubing Length, ft	
Fiberglass	4.5		3.980		
Tail Pipe Material	Tail Pipe OD, in	Tail Pipe, weight#/ft.	Tail Pipe ID, in	Tail Pipe Length, ft	Tail Pipe Depth, ft
	OpenHole diameter, in	TD, ft	PBTD, ft	Top of Open Interval, ft	
	8.75	4645	N/A	4080	
Packer Model		Packer Type		Top of Packer, ft	Bottom of Packer, ft
GPS					

Geological Information

Name of Lowermost USDW	Formations in Arrestment Interval	Formations in Injection Interval
Dundee Limestone	Black River Glenwood, Trempealeau	Franconia, Eau Claire, Mt. Simon
Base of Lowermost USDW, ft	Depth to top of Arrestment Interval, ft	Injection Interval Top, ft
387	3457	4035

TOOL INFORMATION

Tool Zero	BDET, ft below tool ze	Ejector, ft below tool z	TDET, ft below tool zero	MDET, ft below tool zero	
0.0	0.0	-4.0	-8.50	N/A	

CALIBRATION INFORMATION

Depth BDET, ft	Depth TDET, ft	BDET CPSPI	Lithology	Maximum Reading, LD	Minimum Reading, LD
3955	3947	40	"Shale"	1.6	0.3
Depth BDET, ft	Depth TDET, ft	BDET CPSPI	Lithology	Maximum Reading, LD	Minimum Reading, LD
3802	3794	40	"Sand"	0.4	0

BACKGROUND LOG (BDET) BEFORE TESTS

Appearance of Log, lithology discernible, extremely suppressed, noisy, etc. Is calibration the same as for statistical checks?

Lithology is discernable on the log.

REVIEW OF RADIOACTIVE TRACER SURVEYS FOR CEMENT INTEGRITY

Facility Name			Operator		
Romulus Facility			Environmental GeoTechnologies		
Well Name			USEPA Permit Number	Witness	Analyst
Well 1-12			MI-163-1W-C010	Vugrinovich	Greenhagen
State	Test Date	Test Number	Logging Company		Analysis Date
Michigan	December 5, 2012	2013-011	Baker Hughes		March 13, 2013

FIRST SLUG TRACKING SEQUENCE

Flow Rate, gpm	Velocity in tubing, fpm	Depth of deflection on 1st pass	Deflection on 1st pass, u	Deflection/Background	Passes Through Slug
5	8	3142	63.6	39	10
Slug Split? yes or no	Depth of Split, ft	Moved up, yes or no	Minimum Slug Depth, ft	Distance above shoe,	Maximum Slug Depth, ft
No	N/A	N/A	N/A	N/A	4170

Comments

An anomaly occurred when the slug was at about 4050 ft; it does not appear to be of concern but the area should be monitored on future surveys.

FIRST STATIONARY TEST

Tool Setting Depth, ft	Depth of BDET, ft	BDET to open interval, ft	Time at station, min	Injection Rate, gpm	Log Divisions per Minute
4080	4080.0	0.0	77.0	5	12
Ejector Depth, ft	Depth of TDET, ft	BDET above deeper of tbg or casing, ft	Pass BDET up, LD	Pass UDET up, LD	Velocity Up, ft/min
4076.0	4071.5	zero	795	N/A	N/A

Comments:

An increase in detected activity begins at about 66 minutes and continues through the end of the test at the bottom detector. The top detector does not show any noticeable increase. Given the exceptionally slow rate of slug movement, it is not clear if a longer test would have shown increased activity passing the top detector.

FINAL LOG

Is the appearance much the same as the first log?

Yes

Do the traces overlay well above the casing shoe?

Yes

At what depths above the casing shoe does the final log show higher gamma ray activity?

N/A

COMMENTS

The approved procedures for this test state that the rate of injection should be between 20 and 50 gallons per minute; however, this test had an injection rate of five gallons per minute. The injection well schematic in the test report has incorrect depths listed for the top of injection zone, top of injection interval, and is still labeled for EDS. Also, see comments above relative to the specific test types.

REGULATORY AND ENFORCEMENT REQUIREMENTS

Is there movement above the casing shoe?	Is there movement above the top of the injection interva	Is there cause for concern?
Potentially	**Unlikely**	**Unknown**

HAVE REGULATORY OR ENFORCEMENT REQUIREMENTS BEEN MET?

No

What follow-up actions have been taken?

What follow-up actions are needed?

The UIC Technical Review Workgroup (TRW) cannot make a conclusive determination based on the submitted test. TRW recommends that the injection rate for the tests follow the approved test procedure of 20-50 gallons per minute. Region 5 UIC Branch Guidance #5 recommends that the injection rate for the stationary test be as close to the rate of proposed operation as is possible; therefore, it is recommended that the stationary test be run as close to 50 gpm as possible. An updated well schematic should be submitted containing the correct depths to the top of the injection zone and top of the injection interval, verify that the depth to the top of the confining zone is correct, and add values for the depths to the top and bottom of the packer and the depth to the bottom of the tailpipe, if any.

Date follow-up action completed

Version of 12/3/10

REVIEW OF RADIOACTIVE TRACER SURVEYS FOR CEMENT INTEGRITY

Facility Name			Operator		
Romulus Facility			Environmental GeoTechnologies		
Well Name			USEPA Permit Number	Witness	Analyst
Well #2-12			MI-163-1W-C011	Lanigan	Greenhagen
State	Test Date	Test Number	Logging Company		Analysis Date
Michigan	January 16, 2013	2013-012	Baker Hughes		March 18, 2013

Well and Operational Information

LS Csg Material	LS Casing OD, in	Casing weight, #/ft	Casing ID, in	Long String Casing Length, ft	
Steel and Hastelloy	7	26		3983	
Tubing Material	Tubing OD, in		Tubing ID, in	Tubing Length, ft	
Fiberglass	4.5		3.980		
Tail Pipe Material	Tail Pipe OD, in	Tail Pipe, weight#/ft.	Tail Pipe ID, in	Tail Pipe Length, ft	Tail Pipe Depth, ft
	OpenHole diameter, in	TD, ft	PBTD, ft	Top of Open Interval, ft	
	8.75	4550	4025	3983	
Packer Model		Packer Type		Top of Packer, ft	Bottom of Packer, ft
		GPS			

Geological Information

Name of Lowermost USDW	Formations in Arrestment Interval	Formations in Injection Interval
Dundee Limestone	Black River Glenwood, Trempealeau	Franconia, Eau Claire, Mt. Simon
Base of Lowermost USDW, ft	Depth to top of Arrestment Interval, ft	Injection Interval Top, ft
387	3369	3937

TOOL INFORMATION

Tool Zero	BDET, ft below tool zer	Ejector, ft below tool ze	TDET, ft below tool zero	MDET, ft below tool zero	
0.0	0.0	-4.0	-8.50	N/A	

CALIBRATION INFORMATION

Depth BDET, ft	Depth TDET, ft	BDET CPSPI	Lithology	Maximum Reading, LD	Minimum Reading, LD
3800	3792	40	"Sand"	0.4	0.0
Depth BDET, ft	Depth TDET, ft	BDET CPSPI	Lithology	Maximum Reading, LD	Minimum Reading, LD
3855	3847	40	"Shale"	1.8	0.2

BACKGROUND LOG (BDET) BEFORE TESTS

Appearance of Log, lithology discernible, extremely suppressed, noisy, etc. Is calibration the same as for statistical checks?

Lithology is discernable on the log.

REVIEW OF RADIOACTIVE TRACER SURVEYS FOR CEMENT INTEGRITY

Facility Name			Operator		
Romulus Facility			Environmental GeoTechnologies		
Well Name			USEPA Permit Number	Witness	Analyst
Well #2-12			MI-163-1W-C011	Lanigan	Greenhagen
State	Test Date	Test Number	Logging Company		Analysis Date
Michigan	January 16, 2013	2013-012	Baker Hughes		March 18, 2013

FIRST SLUG TRACKING SEQUENCE

Flow Rate, gpm	Velocity in tubing, fpm	Depth of deflection on 1st pass	Deflection on 1st pass, ft	Deflection/Background	Passes Through Slug
34	53	3814	12.6	7	8
Slug Split? yes or no	Depth of Split, ft	Moved up, yes or no	Minimum Slug Depth, ft	Distance above shoe,	Maximum Slug Depth, ft
No	N/A	N/A	N/A	N/A	4118

Comments

The radioactive material peak in the slug chase test is only 7 times greater than the lithological variation - EPA Region 5 UIC Guidance #5 recommends that this ratio be at least 50 times greater.

FIRST STATIONARY TEST

Tool Setting Depth, ft	Depth of BDET, ft	BDET to open interval, ft	Time at station, min	Injection Rate, gpm	Log Divisions per Minute
3977	3977.0	6.0	30.0	34	12
Ejector Depth, ft	Depth of TDET, ft	BDET above deeper of tbg or casing, ft	Pass BDET up, LD	Pass UDET up, LD	Velocity Up, ft/min
3973.0	3968.5	6	N/A	N/A	N/A

Comments:

The consultant's explanation of a earlier surface iodine leak causing an incidental anomaly is plausible since the radioactive material is detected first at the top detector and then the bottom detector indicating downward movement. However, this occurrence could have completely masked any upward moving material from the intentional slug.

FINAL LOG

Is the appearance much the same as the first log?

The final gamma ray log appears to show residual iodine along the entire length that was compared.

Do the traces overlay well above the casing shoe?

The traces overlay fairly well, but are elevated in the final run.

At what depths above the casing shoe does the final log show higher gamma ray activity?

Over the entire length of the final base log.

COMMENTS

The well schematic provided in the test report lists an incorrect depth to the top of the injection interval, and the depth to the packer given on the schematic conflicts with the depth to the packer denoted on the log chart. Also, see comments above relative to the specific test types. The elevated radioactive activity in the final log compared to that in the initial log should be explained.

REGULATORY AND ENFORCEMENT REQUIREMENTS

Is there movement above the casing shoe?	Is there movement above the top of the injection interva	Is there cause for concern?
Indeterminate	**Indeterminate**	**Unknown**

HAVE REGULATORY OR ENFORCEMENT REQUIREMENTS BEEN MET?

No

What follow-up actions have been taken?

What follow-up actions are needed?

The UIC Technical Review Workgroup (TRW) cannot make a conclusive determination based on the submitted test. TRW recommends that the injection rate for the tests follow the approved test procedure of 20-50 gallons per minute. Region 5 UIC Branch Guidance #5 recommends that the injection rate for the stationary test be as close to the rate of proposed operation as is possible; therefore, it is recommended that the stationary test be run as close to 50 gpm as possible. An updated well schematic should be submitted containing the correct depths to the top of the injection zone, top of the injection interval, and top of the confining zone, and add values for the depths to the top and bottom of the packer and the depth to the bottom of the tailpipe, if any. The elevated radioactive activity in the final log compared to that in the initial log should be explained.

Date follow-up action completed

Version: Temperature log 2009-11-16

REVIEW OF TEMPERATURE LOGS FOR PART (2) OF MI

Facility Name Romulus Facility		Operator Enviromental GeoTechnologies	
Well Name Well #1-12	Test ID Number 2013-009	US EPA Permit Number MI-163-1W-C010	Analyst J. Wawczak
County Wayne	State Michigan	Test Date December 4, 2012	Analysis Date March 12, 2013

Well and Operational Information

Long String Casing Length, ft 4080	Tubing Depth, ft 4066	Tailpipe Depth, ft 4070	Does Injectate Temperature vary? No
Depth to Base of USDW, ft. 136	Name of Lowermost USDW Dundee Limestone	Date of Last Injection Unknown	Is this a Multi-zone Facility? No
Depth to Top of Injection Interval, ft 4035	Name of Injection Zone Black River Glenwood, Trempealeau	Hour of Last Injection N/A	Other Zones Used at Facility No
Top of Fill/Plugged Back Depth, ft. 4247	Total Depth, ft 4645	Volume Injected in PastYear, gal Zero	Depth to Other Injection Zone, ft No

Calibration Information		Logging Information	
Low Gauge Temp, deg F 36.5	High Gauge Temperature, deg. F N/A	Time of start of Logging 08:00	For Data Plot, Data Interval, ft 5
Low Thermometer Temp, deg. F 36	High Thermometer Temp, deg. F N/A	Hours since injection Unknown	Max Log Depth, ft. 4250
Were Log Readings Adjusted? No	Overall Appearance Good? Yes	Decay Series? No	Maximum Logging Speed, ft/min 33

Observations

Depth to Liquid Level, ft Surface	Top of Receptive Strata, ft. Can't be determined	Depth of Most Extreme temp above IZ, ft N/A	Depth of Most Extreme temp in IZ, ft N/A
Temperature at Total Depth, deg F 85.78	Bottom of Receptive Strata, ft. Can't be determined	Most Extreme Temp above IZ, deg F N/A	Most Extreme Temp in IZ, deg F N/A
Top of Receptive Strata to top of IZ, ft N/A	Thickness of Receptive Interval, ft N/A		

Analysis

Is a Log Available for Comparison? Yes	Are traces Essentially Congruent? Yes	Intervals with Constant Temp over more than 50 ft. present in cased hole? No	
What Well Log Used? EGT #1-12	Is there a Pivot Point No	Top of Interval #1, ft N/A	Top of Interval #2, ft N/A
What Year? 2007	If yes, What depth? ft 0	Bottom of Interval #1, ft N/A	Bottom of Interval #2, ft N/A
	If Yes, What Temp? deg F 0	Is Constant Temp More or Less than Temp Above? N/A	N/A
		Does this Suggest Flow? N/A	Does this Suggest Flow? N/A

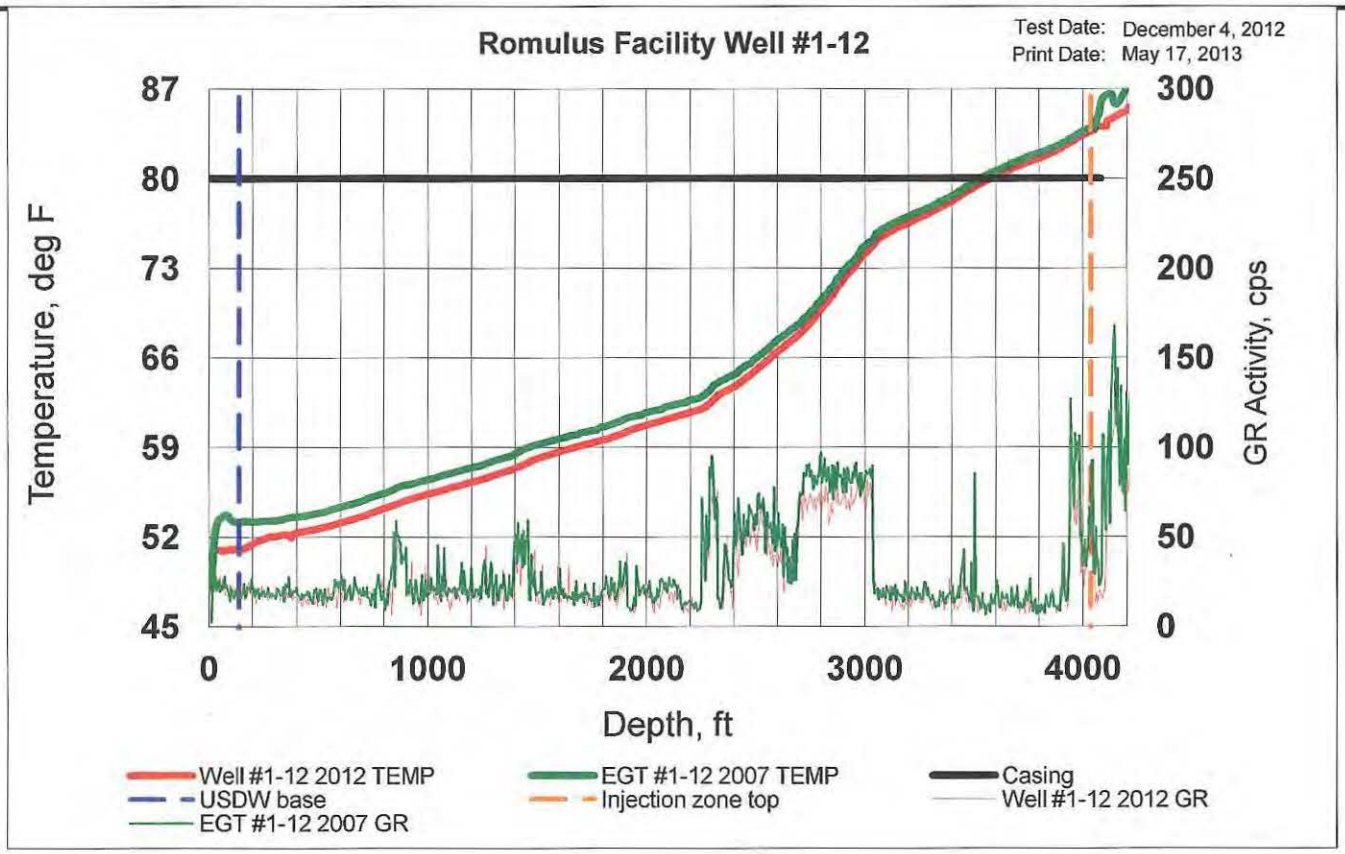
Comments

It should be noted that in the procedures it states that prior to running the temperature log, the tool must be compared with a calibrated thermometer in ice water and water of ambient temperature. The tool appears to only have been calibrated with the ice water.

Does the Well Have External Mechanical Integrity?

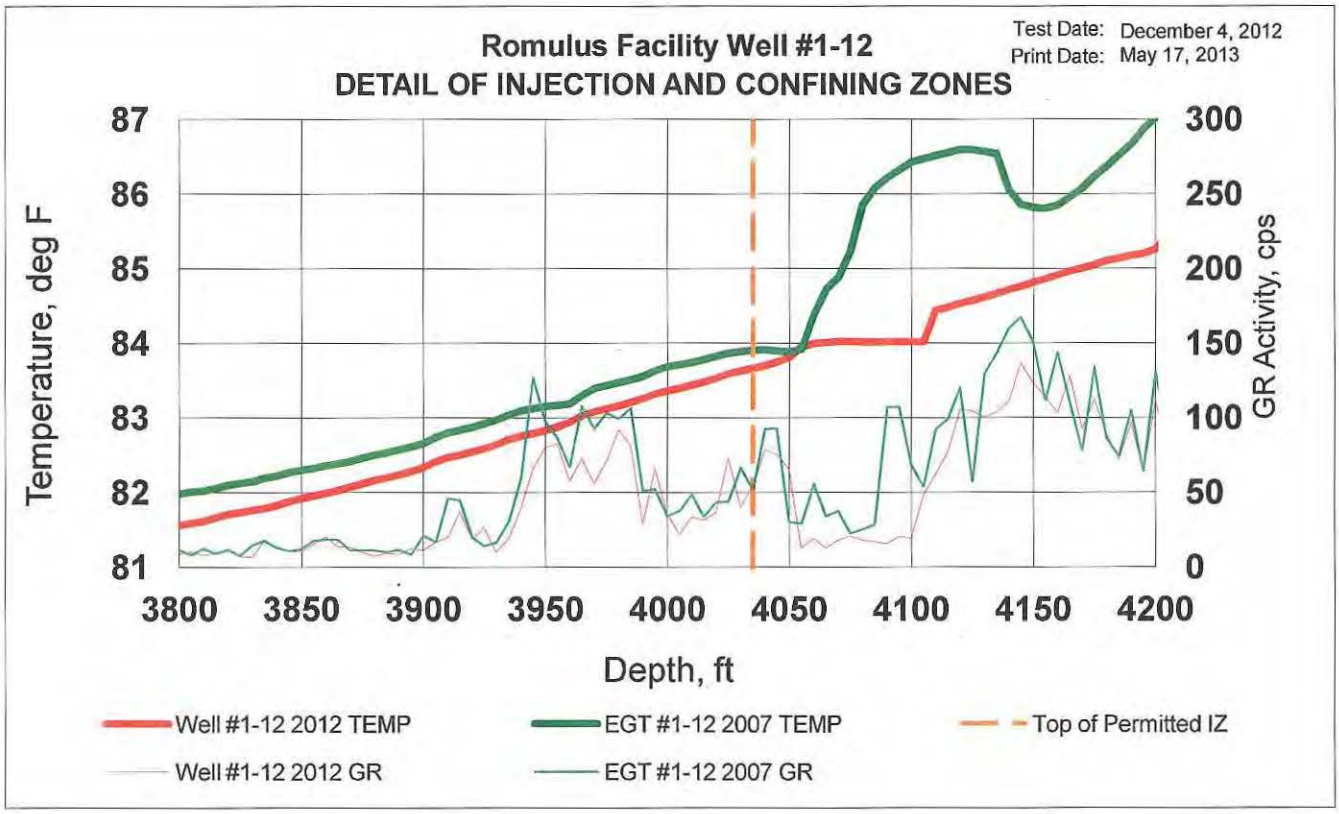
Unsatisfactory - Approved Procedures Were Not Followed

Version: Temperature log 2009-11-16



Comments:

The 2012 test mirrors the 2007 test very well. The only major difference is in the injection zone. In the 2012 test at a depth of about 4050 feet the curve stops climbing and stays steady for about 60 feet, then the temperature jumps up almost half a degree and continues to rise.



Version: Temperature log 2009-11-16

REVIEW OF TEMPERATURE LOGS FOR PART (2) OF MI

Facility Name Romulus Facility		Operator Enviromental GeoTechnologies	
Well Name Well #1-12		USEPA Permit Number MI-163-1W-C010	Analyst J. Wawczak
County Wayne	State Michigan	Test Date December 4, 2012	Analysis Date March 12, 2013

COMMENTS

The 2012 test mirrors the 2007 test very well. The only major difference is in the injection zone. In the 2012 test at a depth of about 4050 feet the curve stops climbing and stays steady for about 60 feet, then the temperature jumps up almost half a degree and continues to rise. The lack of apparent injection zone in the 2012 is possibly due to the lack of injection over the past few years causing a return to geothermal temperatures.

Version: Temperature log 2009-11-16

REVIEW OF TEMPERATURE LOGS FOR PART (2) OF MI

Facility Name Romulus Facility		Operator Environmental GeoTechnologies	
Well Name Well #2-12	Test ID Number 2013-010	US EPA Permit Number MI-163-1W-C011	Analyst J. Wawczak
County Wayne	State Michigan	Test Date January 16, 2013	Analysis Date March 8, 2013

Well and Operational Information

Long String Casing Length, ft 3983	Tubing Depth, ft 3965	Tailpipe Depth, ft 3969	Does Injectate Temperature vary? No
Depth to Base of USDW, ft. 136	Name of Lowermost USDW Dundee Limestone	Date of Last Injection June 29, 2007	Is this a Multi-zone Facility? No
Depth to Top of Injection Interval, ft 3940	Name of Injection Zone Black River, Glenwood, Trempealeau	Hour of Last Injection N/A	Other Zones Used at Facility No
Top of Fill/Plugged Back Depth, ft. 4025	Total Depth, ft 4550	Volume Injected in PastYear, gal Zero	Depth to Other Injection Zone, ft No

Calibration Information		Logging Information	
Low Gauge Temp, deg F 32	High Gauge Temperature, deg. F N/A	Time of start of Logging N/A	For Data Plot, Data Interval, ft 5
Low Thermometer Temp, deg. F 32	High Thermometer Temp, deg. F N/A	Hours since injection N/A	Max Log Depth, ft. 4195
Were Log Readings Adjusted? No.	Overall Appearance Good? Yes	Decay Series? No	Maximum Logging Speed, ft/min 30

Observations

Depth to Liquid Level, ft 235	Top of Receptive Strata, ft. Can not be determined	Depth of Most Extreme temp above IZ, ft N/A	Depth of Most Extreme temp in IZ, ft N/A
Temperature at Total Depth, deg F 86.94	Bottom of Receptive Strata, ft. Can not be determined	Most Extreme Temp above IZ, deg F N/A	Most Extreme Temp in IZ, deg F N/A
Top of Receptive Strata to top of IZ, ft N/A	Thickness of Receptive Interval, ft N/A		

Analysis

Is a Log Available for Comparison? Yes	Are traces Essentially Congruent? Yes	Intervals with Constant Temp over more than 50 ft. present in cased hole? N/A	N/A
What Well Log Used? Well #2-12	Is there a Pivot Point N/A	Top of Interval #1, ft N/A	Top of Interval #2, ft N/A
What Year? 2007	If yes, What depth? ft N/A	Bottom of Interval #1, ft N/A	Bottom of Interval #2, ft N/A
	If Yes, What Temp? deg F N/A	Is Constant Temp More or Less than Temp Above? N/A	N/A
		Does this Suggest Flow? N/A	Does this Suggest Flow? N/A

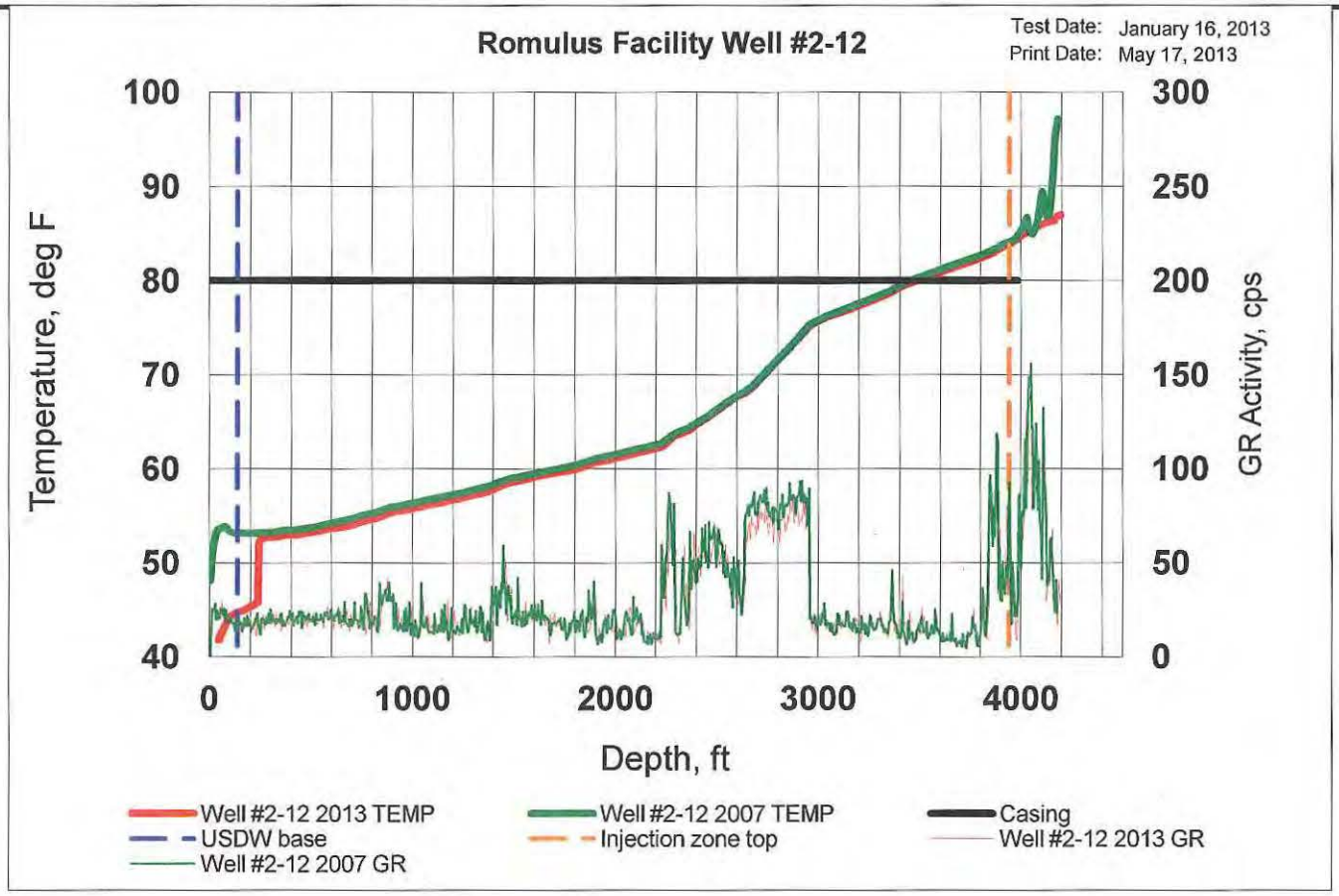
Comments

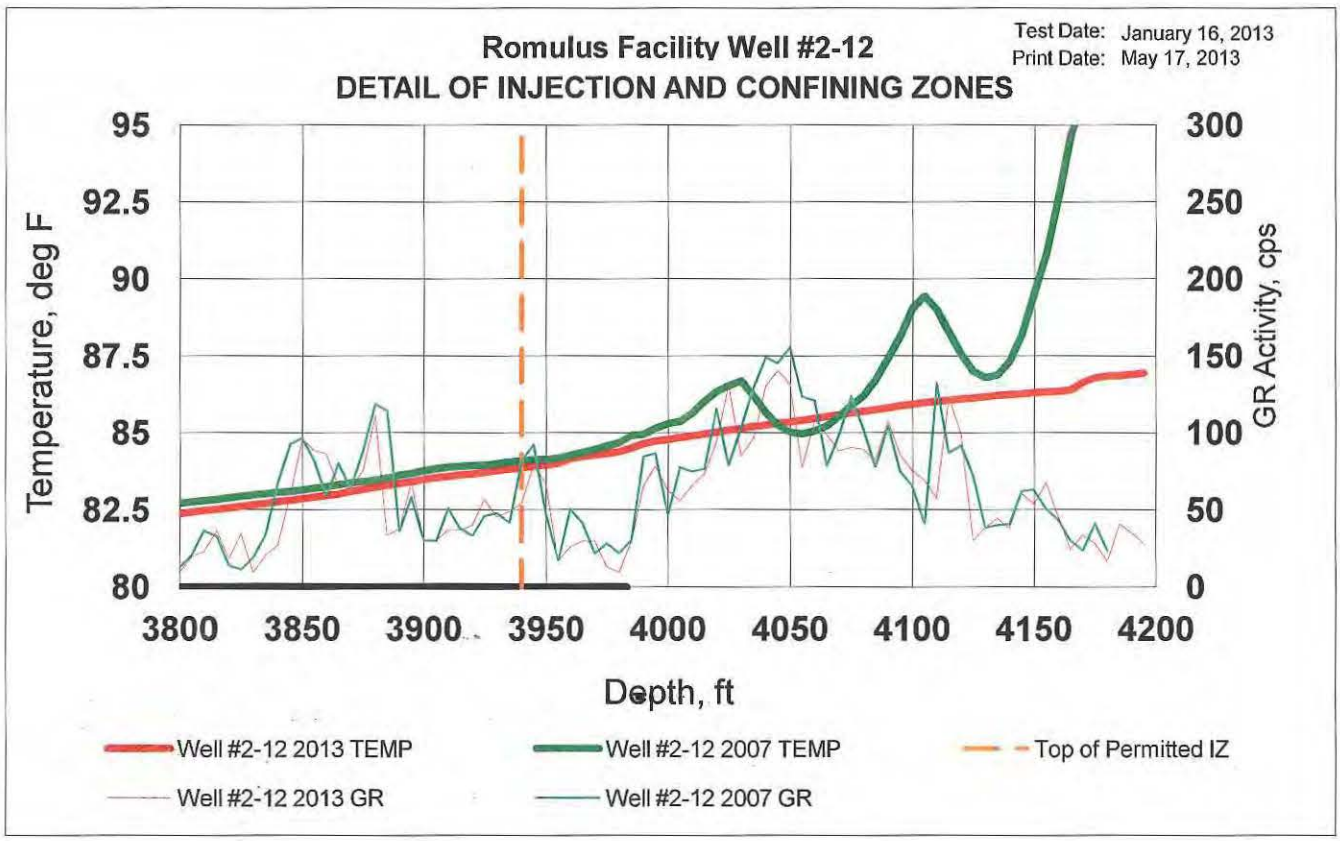
It should be noted that in the procedures it states that prior to running the temperature log, the tool must be compared with a calibrated thermometer in ice water and water of ambient temperature. The tool appears to only have been calibrated with the ice water.

Does the Well Have External Mechanical Integrity?

Unsatisfactory - Approved Procedures Were Not Followed

Version: Temperature log 2009-11-16





Version: Temperature log 2009-11-16

REVIEW OF TEMPERATURE LOGS FOR PART (2) OF MI

Facility Name Romulus Facility		Operator Environmental GeoTechnologies	
Well Name Well #2-12		USEPA Permit Number MI-163-1W-C011	Analyst J. Wawczak
County Wayne	State Michigan	Test Date January 16, 2013	Analysis Date March 8, 2013

COMMENTS

The 2013 test mirrors the 2007 test very well. There is a small difference at the beginning of the test. Around 210 feet the temperature jumps around 8 degrees. After this point the graphs are almost perfectly in line, all the way to the injection zone. Once in the injection zone the 2007 graph has two small bumps then the temperature rapidly increases, for the 2013 test it stays at a steady rising slope and at around 4200 feet the temperature reading is almost 10 degrees less than in 2007. The lack of apparent injection zone in the 2013 is possibly due to the lack of injection over the past few years causing a return to geothermal temperatures.