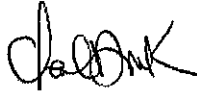




Division of Oil and Gas Resources Management
Radiation Safety Section



Interoffice Memorandum

TO: Richard J. Simmers, Chief
THROUGH: Scott Kell, Assistant Chief
FROM: Chuck McCracken, Manager, Radiation Safety Section 
DATE: July 26, 2017
RE: ASSESSMENT OF RA226 & RA228 RADIOACTIVITY IN AQUASALINA

As requested, an analytical assessment of the radioactive content of Nature's Own Source / AquaSalina and the vertical well brine associated with its production was initiated on May 24, 2017. During the month of June 2017, Radiation Safety Section (RSS) staff partnered with Environmental Safety Section staff to collect 14 samples from 6 locations in Ohio. All samples were sent to PACE Radiological Analytical Laboratory with the last of the analytical results being received back from PACE on July 5, 2017.

The attached radiological survey report no. 2017-044 details the RSS radiological assessment process and the results achieved. Based on the findings in this assessment, the following recommendations are being made for your consideration:

1. Advise Nature's Own Source/AquaSalina that our assessment finds that they are producing TENORM however, we require additional details about their production process to be absolutely certain. *(NOTE: We may need to collect additional pre and post samples)*
2. Advise Nature's Own Source/AquaSalina that the average radioactivity in AquaSalina exceeds the 40 CFR 141.66 Drinking Water limits for combined Ra-226 and Ra-228 by a factor of 300, thus human consumption of any amount of AquaSalina is highly discouraged.
3. Advise Nature's Own Source/AquaSalina that the radioactivity in AquaSalina exceeds State of Ohio discharge to the environment limits for Ra-226 and Ra-228 as delineated in Ohio Administrative Code 3701:1-38-12, Appendix C, Table II, Effluent Concentrations.
4. DOGRM should continue to analyze the radioactive concentrations in vertical formation brine to create an Ohio specific data set that can be used to further assess impacts to humans and the environment from the use of vertical brine from the oil and gas industry for dust suppression and road stability.

cf: Eric Vendel, Legal Counsel



**DIVISION OF OIL & GAS
RESOURCES MANAGEMENT,
RADIATION SAFETY SECTION**



**RADIOLOGICAL ASSESSMENT
SPECIAL REPORT**

Report No: 2017-044

Permit No(s): Chief's Order 2004-82

Location(s): Nature's Own Source/AquaSalina
246 North Cleveland Avenue Mogadore,
OH 44260

Nature's Own Source/AquaSalina
2850 W. 3rd Street
Cleveland, OH 44113

Counties: Guernsey, Summit, Tuscarawas, Cuyahoga

Date(s): June 2, 2017, June 5, 2017, June 12, 2017,
June 15, 2017 and June 21, 2017

Inspector: *Robert Leidy* Date: 07/20/2017

Robert Leidy
Senior Health Physicist

Inspector: *Paul Carder* Date: 07/26/2017

Paul Carder
Senior Health Physicist

Supervisor: *Chuck McCracken* Date: 07/26/2017

Chuck McCracken
Section Manager

1.0 Purpose

At the request of the Chief, Division of Oil & Gas, an analytical assessment of the radioactive content of Nature's Own Source / AquaSalina and the vertical well brine associated with its production was conducted.

2.0 Scope of Action / Sampling Methodology

May 24, 2017

Two Ohio Department of Natural Resources, Division of Oil & Gas Resources Management (DOGRM) staffs were assigned to go to Nature's Own Source /AquaSalina facility located at 246 North Cleveland Avenue, Mogadore, OH 44260 to collect pre and post-production samples of their liquid deicer, AquaSalina. Upon arrival staff was met by Stephanie Moore. The property owner, Jeff Moore, spoke to staff by phone and requested that they communicate directly with Mr. Dave Mansbery, the owner of Nature's Own Source/AquaSalina. Staff spoke with Mr. Mansbery, who was attending an Ohio DOT trade show. Mr. Mansbery said that AquaSalina is out of season and not currently in production but there is product on site. Mr. Mansbery offered to make arrangements for a qualified individual to be onsite to assist DOGRM staff by providing access and collecting split samples of AquaSalina. Staff suggested to Mr. Mansbery that he coordinate a return visit to the Mogadore facility with DOGRM Management. No samples were collected this day.

June 2, 2017

A DOGRM Columbus office staff member collected two 1-liter samples from a container of AquaSalina that was in storage at the DOGRM Environmental Analytical Laboratory located at 325 N. 7th St., Cambridge, Ohio 43725. Each sample was preserved with HNO₃. A chain of custody was created and the samples were delivered to the Pace Analytical Laboratories Service Center located at 4860 Blazer Pkwy, Dublin, OH 43017.

June 2, 2017

A DOGRM Uniontown office staff member was assigned to go to Hartville Hardware located at 1315 Edison St., NW, Hartville, OH 44632. Staff purchased a 1.74 gallon container of AquaSalina at this location. Staff then went to Lowe's Home Center located at 940 Interstate Parkway, Akron, OH 44312 and at 12:20 pm, purchased a 2.11 gallon container of AquaSalina. Two 1-liter samples were collected from each of the 2 containers of AquaSalina. Each sample was preserved with HNO₃. A chain of custody was created and the samples were delivered to the Pace Analytical Laboratories Service Center located at 4860 Blazer Pkwy, Dublin, OH 43017.

June 12, 2017

Two DOGRM staff members were assigned to go to the ODOT Tuscarawas County Garage located at 384 Stonecreek Road SE, New Philadelphia, 44663 to collect samples of brine that was made by adding halite salt to tap water. Two 1-liter samples were collected and each sample was preserved with HNO₃. A chain of custody was created and the samples were delivered to the Pace Analytical Laboratories Service Center located at 4860 Blazer Pkwy, Dublin, OH 43017.

June 12, 2017

Two DOGRM staff members were met in Mogadore by representatives for Nature's Own

Source/AquaSalina, Larry Gibler, Jim Hogue and Precision Analytical staffer, Jeremy Bratnick. Samples were collected by DOGRM and Precision Analytical of pre and post-production liquid. Each DOGRM sample was preserved with HNO₃ and tamperproof seals were placed on the sample containers. A chain of custody was created and the DOGRM samples were delivered to the Pace Analytical Laboratories Service Center located at 4860 Blazer Pkwy, Dublin, OH 43017.

DOGRM staffs were then directed to the Nature's Own Source/AquaSalina's Cuyahoga County facility located at 7033 Mill Road, Brecksville, OH 44141 to collect additional samples. Upon arrival staff was told that the location was a corporate office only and AquaSalina was not produced there. Staff was told that the Cuyahoga County production facility is located on the Arcelormittal Steel Mill property located at 2850 W. 3rd St., Cleveland OH. Staff was then informed that DOGRM's legal department needed to contact Nature's Own Source/AquaSalina's lawyer, Scott Doran, to discuss obtaining samples. No samples were collected.

June 15, 2017

Two DOGRM staff members were met at the Nature's Own Source/AquaSalina production facility on the Arcelormittal Steel Mill property by company representatives, Larry Gibler, Jim Hogue and Precision Analytical staffer, Jeremy Bratnick. Samples were collected by DOGRM and Precision Analytical of pre and post-production liquid. Each DOGRM sample was preserved with HNO₃ and tamperproof seals were placed on the sample containers. A chain of custody was created and the DOGRM samples were delivered to the Pace Analytical Laboratories Service Center located at 4860 Blazer Pkwy, Dublin, OH 43017.

June 21, 2017

DOGRM staff returned to the ODOT Tuscarawas County Garage to collect samples of the raw water used to create the brine mixture sampled on June 12, 2017. Each sample was preserved with HNO₃. A chain of custody was created and the samples were delivered to the Pace Analytical Laboratories Service Center located at 4860 Blazer Pkwy, Dublin, OH 43017.

3.0 Observations / Analytical Results

Sample Collection Location	Collection Date	Ra226 Results (pCi/l)*	Ra228 Results (pCi/l)*	Combined Results (pCi/l)*
Lowes – Canton [purchase]	6/2/17	1,059 ± 136	604 ± 111	1,663 ± 247
Hartville Hardware [purchase]	6/2/17	1,158 ± 144	1,333 ± 241	2,491 ± 384
ODNR Cambridge Lab	6/2/17	791 ± 41.8	604 ± 25.7	1,395 ± 67.5
AquaS Mogadore - PRE	6/12/17	925 ± 116	373 ± 69.8	1,298 ± 185.8
- POST	6/12/17	1,010 ± 126	432 ± 80.1	1,442 ± 206.1
AquaS Cleve - PRE (1)	6/15/17	595 ± 772	568 ± 127	1,163 ± 899
- POST (1)	6/15/17	949 ± 478	734 ± 129	1,683 ± 607
- PRE (2)	6/15/17	501 ± 462	387 ± 75	888 ± 537
- POST (2)	6/15/17	997 ± 545	713 ± 102	1,710 ± 647
ODOT tap water - PRE	6/21/17	1.90 ± 0.8	0.922 ± 0.4	2.8 ± 1.2
ODOT mixture - POST	6/12/17	2.77 ± 1.58	5.78 ± 7.67	8.55 ± 9.27

* Analytical laboratory results reports are attached.

4.1 Findings, Discussions & Conclusions

Findings

- All post-samples collected in this study were found to be increased in radioactivity activity from their respective pre-samples.
- There was an 11% increase in combined radium Ra226/Ra228 concentration between the pre and post-samples collected from the Nature's Own Source/AquaSalina Mogadore production facility.
- There was a 45% increase in combined radium Ra226/Ra228 concentration between the pre (1) and post (1) samples collected from the Nature's Own Source/AquaSalina Cleveland production facility.
- There was a 92% increase in combined radium Ra226/Ra228 concentration between the pre (2) and post (2) samples collected from the Nature's Own Source/AquaSalina Cleveland production facility.
- The combined radium Ra226/Ra228 concentration in the Nature's Own Source/AquaSalina container purchased from Hartville Hardware was the highest identified in this study at 2,491 pCi/l.
- The combined radium Ra226/Ra228 concentration in all samples of post-production AquaSalina (except the Hartville Hardware container sample) averaged within 10% of each other at 1,578.6 pCi/l.
- There are no production dates, lot numbers or other unique identifiers on the purchased containers of Nature's Own Source/AquaSalina.

Discussions

- Formation brine is Naturally Occurring Radioactive Material (NORM). Technologically Enhanced NORM (TENORM) is NORM that has been increased in radioactivity by or as a result of human activity¹. It would appear that Nature's Own Source/AquaSalina is producing TENORM however, without additional batch processing information from them, it cannot be determined with 100% certainty that the sampled pre-production brine has been increased in radioactivity due to the AquaSalina production processes.
- The USEPA National Primary Drinking Water Regulation, 40 CFR 141.66 limits combined Ra-226 and Ra-228 in drinking water to 5.0 pCi/l.
- The State of Ohio discharge to the environment limits for Ra-226 and Ra-228, as delineated in Ohio Administrative Code 3701:1-38-12, Appendix C, Table II, Effluent Concentrations, are 60 pCi/l for each (120 pCi/l for combined Ra226 & Ra228 and the unity rule applies).

1 Abbreviated TENORM definition. Full definition found in ORC 3748.01 as stated in ORC 1509.074 (C)(1)

- The Pennsylvania Department of Environmental Protection (PADEP) TENORM Study Report, Revision 1, dated May 2016 assessed radiation exposure to humans from road spreading of conventional (vertical) well brine.
 - The assessment was based on surface soil samples taken from roads where brine spreading is known to have occurred. The specific radioactive concentration of the brine that was spread on these roads was not considered in the assessment.
 - The estimated total dose to a recreationist was modeled to be 0.441 mrem/yr, which is well below PADEP's 100 mrem/yr public exposure regulatory limit.
 - The report concluded that while limited potential was found for radiation exposure to recreationist using roads treated with brine from conventional (*vertical*) gas wells, further study of radiological environmental impacts from the use of brine from the oil and gas industry for dust suppression and road stabilization should be conducted.
- Other states in our region of the U.S. that allow road spreading of vertical oil and gas well brine include Michigan, Illinois, Pennsylvania and West Virginia.

Conclusions

- Analytical results suggests that Nature's Own Source/AquaSalina is producing TENORM however, without additional batch processing information, it cannot be determined with 100% certainty that the sampled pre-production brine has been increased in radioactivity due to the AquaSalina production processes.
- All sample results (except the DOT tap water) **exceed** the USEPA 40 CFR 141.66 Drinking Water limits of combined Ra-226 and Ra-228 at less than or equal to 5.0 pCi/l.
- None of the sampled liquids (except DOT tap water) in this assessment are meant for human consumption.
- All sample results (except the DOT samples) **exceed** State of Ohio discharge to the environment limits for Ra-226 and Ra-228 as delineated in Ohio Administrative Code 3701:1-38-12, Appendix C, Table II, Effluent Concentrations.

These liquid effluent concentration limits were originally codified by the U.S. Nuclear Regulatory Commission to limit public radiation exposure to 50 millirem per year from ingestion of radioactive material discharged into rivers, streams and other bodies of water by companies and facilities licensed to possess and handle radioactive materials.

- None of the sampled liquids (except DOT tap water) in this assessment are meant for human consumption.
- Using the assumptions and findings in the PADEP study, RSS evaluated the post-processing sample results from this assessment and determined that it is unlikely that radiation exposure to Ohioans from road spreading of vertical brine would exceed the 100 mrem/yr public dose limit.

5.1 Recommendations

1. Advise Nature's Own Source/AquaSalina that our assessment finds that they are producing TENORM however, we require additional details about their production process to be absolutely certain. (NOTE: We may need to collect additional pre and post samples)
2. Advise Nature's Own Source/AquaSalina that the average radioactivity in AquaSalina exceeds the 40 CFR 141.66 Safe Drinking Water limits for combined Ra-226 and Ra-228 by a factor of 300, thus human consumption of any amount of AquaSalina is highly discouraged.
3. Advise Nature's Own Source/AquaSalina that the radioactivity in AquaSalina exceeds State of Ohio discharge to the environment limits for Ra-226 and Ra-228 as delineated in Ohio Administrative Code 3701:1-38-12, Appendix C, Table II, Effluent Concentrations.
4. DOGRM should continue to analyze the radioactive concentrations in vertical formation brine to create an Ohio specific data set that can be used to further assess impacts to humans and the environment from the use of brine from the oil and gas industry for dust suppression and road stabilization.

ATTACHMENT

1

Radiological Analytical Results for:

ODNR Cambridge Lab

June 19, 2017

Ms. Michelle Taylor
Microbac Laboratories, Inc.
158 Starlite Drive
Marietta, OH 45750

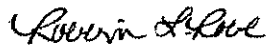
RE: Project: Aqua
Pace Project No.: 30220752

Dear Ms. Taylor:

Enclosed are the analytical results for sample(s) received by the laboratory on June 06, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Robbin Robl
robbin.robl@pacelabs.com
(724)850-5613
Project Manager

Enclosures



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: Aqua
Pace Project No.: 30220752

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601

L-A-B DOD-ELAP Accreditation #: L2417

Alabama Certification #: 41590

Arizona Certification #: AZ0734

Arkansas Certification

California Certification #: 04222CA

Colorado Certification

Connecticut Certification #: PH-0694

Delaware Certification

Florida/TNI Certification #: E87683

Georgia Certification #: C040

Guam Certification

Hawaii Certification

Idaho Certification

Illinois Certification

Indiana Certification

Iowa Certification #: 391

Kansas/TNI Certification #: E-10358

Kentucky Certification #: 90133

Louisiana DHH/TNI Certification #: LA140008

Louisiana DEQ/TNI Certification #: 4086

Maine Certification #: PA00091

Maryland Certification #: 308

Massachusetts Certification #: M-PA1457

Michigan/PADEP Certification

Missouri Certification #: 235

Montana Certification #: Cert 0082

Nebraska Certification #: NE-05-29-14

Nevada Certification #: PA014572015-1

New Hampshire/TNI Certification #: 2976

New Jersey/TNI Certification #: PA 051

New Mexico Certification #: PA01457

New York/TNI Certification #: 10888

North Carolina Certification #: 42706

North Dakota Certification #: R-190

Oregon/TNI Certification #: PA200002

Pennsylvania/TNI Certification #: 65-00282

Puerto Rico Certification #: PA01457

Rhode Island Certification #: 65-00282

South Dakota Certification

Tennessee Certification #: TN2867

Texas/TNI Certification #: T104704188-14-8

Utah/TNI Certification #: PA014572015-5

USDA Soil Permit #: P330-14-00213

Vermont Dept. of Health: ID# VT-0282

Virgin Island/PADEP Certification

Virginia/VELAP Certification #: 460198

Washington Certification #: C868

West Virginia DEP Certification #: 143

West Virginia DHHR Certification #: 9964C

Wisconsin Certification

Wyoming Certification #: 8TMS-L

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: Aqua
Pace Project No.: 30220752

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30220752001	Aqua-1-226	Water	06/02/17 12:00	06/06/17 10:15
30220752002	Aqua-2-228	Water	06/02/17 12:00	06/06/17 10:15

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: Aqua
Pace Project No.: 30220752

Lab ID	Sample ID	Method	Analysts	Analytes Reported
30220752001	Aqua-1-226	EPA 903.1	WRR	1
30220752002	Aqua-2-228	EPA 904.0	JLW	1

REPORT OF LABORATORY ANALYSIS

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PROJECT NARRATIVE

Project: Aqua
Pace Project No.: 30220752

Method: EPA 903.1
Description: 903.1 Radium 226
Client: Microbac Laboratories, Inc.-OH
Date: June 19, 2017

General Information:

1 sample was analyzed for EPA 903.1. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report. .

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

REPORT OF LABORATORY ANALYSIS

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PROJECT NARRATIVE

Project: Aqua
Pace Project No.: 30220752

Method: EPA 904.0
Description: 904.0 Radium 228
Client: Microbac Laboratories, Inc.-OH
Date: June 19, 2017

General Information:

1 sample was analyzed for EPA 904.0. All samples were received in acceptable condition with any exceptions noted below or on the chain-of-custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

Analyte Comments:

QC Batch: 261657

1c: During the ingrowth process, part of the MB was lost, and the resulting chemical yield is below 10% and the associated MB MDC is greater than 1.0 pCi/L. Individual sample results are not impacted by the elevated MDC or low MB yield.

- BLANK (Lab ID: 1288491)
- Radium-228

This data package has been reviewed for quality and completeness and is approved for release.

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: Aqua
Pace Project No.: 30220752

Sample: Aqua-1-226		Lab ID: 30220752001	Collected: 06/02/17 12:00	Received: 06/06/17 10:15	Matrix: Water		
PWS:		Site ID:	Sample Type:				
Parameters	Method	Act ± Unc (MDC)	Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	791 ± 41.8 (6.84)		pCi/L	06/19/17 10:12	13982-63-3	
		C:NA T:92%					

Sample: Aqua-2-228		Lab ID: 30220752002	Collected: 06/02/17 12:00	Received: 06/06/17 10:15	Matrix: Water		
PWS:		Site ID:	Sample Type:				
Parameters	Method	Act ± Unc (MDC)	Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-228	EPA 904.0	604 ± 25.7 (11.8)		pCi/L	06/19/17 10:30	15262-20-1	
		C:82% T:74%					

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: Aqua
Pace Project No.: 30220752

QC Batch:	261657	Analysis Method:	EPA 904.0
QC Batch Method:	EPA 904.0	Analysis Description:	904.0 Radium 228
Associated Lab Samples:	30220752002		

METHOD BLANK:	1288491	Matrix:	Water
Associated Lab Samples:	30220752002		

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.246 ± 3.98 (9.19) C:78% T:7%	pCi/L	06/19/17 10:30	1c

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: Aqua
Pace Project No.: 30220752

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.
ND - Not Detected at or above adjusted reporting limit.
J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
MDL - Adjusted Method Detection Limit.
PQL - Practical Quantitation Limit.
RL - Reporting Limit.
S - Surrogate
1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.
Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.
LCS(D) - Laboratory Control Sample (Duplicate)
MS(D) - Matrix Spike (Duplicate)
DUP - Sample Duplicate
RPD - Relative Percent Difference
NC - Not Calculable.
SG - Silica Gel - Clean-Up
U - Indicates the compound was analyzed for, but not detected.
N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.
Act - Activity
Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).
Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)
(MDC) - Minimum Detectable Concentration
Trac - Tracer Recovery (%)
Carr - Carrier Recovery (%)
Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.
TNI - The NELAC Institute.

ANALYTE QUALIFIERS

1c During the ingrowth process, part of the MB was lost, and the resulting chemical yield is below 10% and the associated MB MDC is greater than 1.0 pCi/L. Individual sample results are not impacted by the elevated MDC or low MB yield.

REPORT OF LABORATORY ANALYSIS

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COC No. A-43160

158 Starlite Drive
Marietta, OH 45750



Phone: 740-373-4071
Toll Free: 800-373-4071

CHAIN-OF-CUSTODY RECORD

Company Name: **State of Ohio-DNR-Division of Oil & Gas**

Project Contact: **Chuck McCracken** Contact Phone #: **614-265-6672**

Turn Around Requirements: **RVSA 26 CFR 6.2-17** Location: **Cambridge**

Project ID: **Agua** Sampler (print): **Paul Carter** Signature: *Paul Carter*

Sample I.D. No.	Comp	Grab	Date	Time	Matrix*
Agua-1-226			6-2-17	1200	AW
Agua-2-226			6-2-17	1200	BW

NUMBER OF CONTAINERS

Hold	Ra-226 EPA 901.1 m (5day Quick Turn)	Ra-226 EPA 901.1 m (21 day Ingrowth)	Ra-226 EPA 901.1 m (5day QT & 21 day)	Ra-226 EPA 903.0 ~ Radiochemistry	Ra-226 EPA 903.1 ~ Radon Emanation	Ra-226 EPA 901.1m (5-day Quick Turn)	Ra-228 EPA 901.1m (21-day Ingrowth)	Ra-228 EPA 901.1m (5-day QT & 21-Day)	Ra-228 EPA 904.0 ~ Radiochemistry	Ra-228 EPA 901.1
					X					

Program:
 CWA
 RCRA
 DOD
 AFCEE
 Other: **DAS**

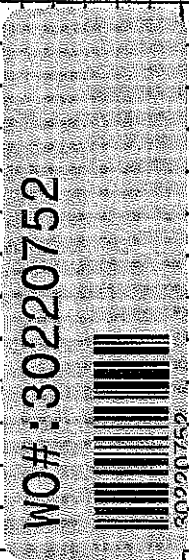
ADDITIONAL REQUIREMENTS

TOTAL # (LAB USE)

Relinquished by: *Paul Carter* Date: 6-2-17 Time: 13:51
 Received by: *Michael J. ...* Date: 6-6-17 Time: 10:15

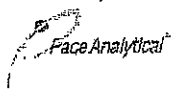
Relinquished by: *Paul Carter* Date: 6-2-17 Time: 17:00
 Received by: *Michael J. ...* Date: 6-6-17 Time: 10:15

Remarks:



Water (W), Soil (S), Solid Waste (SD), Unknown (X)

Sample Condition Upon Receipt Pittsburgh



Client Name: Microbac

Project # 30220752

Courier: Fed Ex UPS USPS Client Commercial Pace Other _____

Tracking #: 727804394288

Custody Seal on Cooler/Box Present: yes no Seals intact: yes no

Thermometer Used N/A Type of Ice: Wet Blue None

Cooler Temperature Observed Temp N/A °C Correction Factor: _____ °C Final Temp: _____ °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: ML 6-6-17

Comments:	Yes	No	N/A	
Chain of Custody Present:	X			1.
Chain of Custody Filled Out:	X			2.
Chain of Custody Relinquished:	X			3.
Sampler Name & Signature on COC:	X			4.
Sample Labels match COC:	X			5.
-Includes date/time/ID Matrix: <u>WTF</u>				
Samples Arrived within Hold Time:	X			6.
Short Hold Time Analysis (<72hr remaining):		X		7.
Rush Turn Around Time Requested:		X		8.
Sufficient Volume:	X			9.
Correct Containers Used:	X			10.
-Pace Containers Used:	X			
Containers Intact:	X			11.
Orthophosphate field filtered		X		12.
Organic Samples checked for dechlorination:			X	13.
Filtered volume received for Dissolved tests			X	14.
All containers have been checked for preservation.	X			15.
All containers needing preservation are found to be in compliance with EPA recommendation.	X			<u>PH < 2</u>
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed: <u>ML</u> Date/time of preservation: _____
				Lot # of added preservative: _____
Headspace in VOA Vials (>6mm):		X		16.
Trip Blank Present:		X		17.
Trip Blank Custody Seals Present		X		
Rad Aqueous Samples Screened > 0.5 mrem/hr		X		Initial when completed: <u>ML</u> Date: <u>6-6-17</u>

Client Notification/ Resolution: Person Contacted: _____ Date/Time: _____ Contacted By: _____

Comments/ Resolution: _____

A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)
 *PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

ATTACHMENT

2

Radiological Analytical Results for:

Lowes – Canton [purchase]
Hartville Hardware [purchase]

June 19, 2017

Ms. Michelle Taylor
Microbac Laboratories, Inc.
158 Starlite Drive
Marietta, OH 45750

RE: Project: 2017-Aqua-NE
Pace Project No.: 30220748

Dear Ms. Taylor:

Enclosed are the analytical results for sample(s) received by the laboratory on June 06, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Robbin Robl
robbin.robbl@pacelabs.com
(724)850-5613
Project Manager

Enclosures



REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
without the written consent of Pace Analytical Services, LLC.

CERTIFICATIONS

Project: 2017-Aqua-NE
Pace Project No.: 30220748

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601

L-A-B DOD-ELAP Accreditation #: L2417

Alabama Certification #: 41590

Arizona Certification #: AZ0734

Arkansas Certification

California Certification #: 04222CA

Colorado Certification

Connecticut Certification #: PH-0694

Delaware Certification

Florida/TNI Certification #: E87683

Georgia Certification #: C040

Guam Certification

Hawaii Certification

Idaho Certification

Illinois Certification

Indiana Certification

Iowa Certification #: 391

Kansas/TNI Certification #: E-10358

Kentucky Certification #: 90133

Louisiana DHH/TNI Certification #: LA140008

Louisiana DEQ/TNI Certification #: 4086

Maine Certification #: PA00091

Maryland Certification #: 308

Massachusetts Certification #: M-PA1457

Michigan/PADEP Certification

Missouri Certification #: 235

Montana Certification #: Cert 0082

Nebraska Certification #: NE-05-29-14

Nevada Certification #: PA014572015-1

New Hampshire/TNI Certification #: 2976

New Jersey/TNI Certification #: PA 051

New Mexico Certification #: PA01457

New York/TNI Certification #: 10888

North Carolina Certification #: 42706

North Dakota Certification #: R-190

Oregon/TNI Certification #: PA200002

Pennsylvania/TNI Certification #: 65-00282

Puerto Rico Certification #: PA01457

Rhode Island Certification #: 65-00282

South Dakota Certification

Tennessee Certification #: TN2867

Texas/TNI Certification #: T104704188-14-8

Utah/TNI Certification #: PA014572015-5

USDA Soil Permit #: P330-14-00213

Vermont Dept. of Health: ID# VT-0282

Virgin Island/PADEP Certification

Virginia/VELAP Certification #: 460198

Washington Certification #: C868

West Virginia DEP Certification #: 143

West Virginia DHHR Certification #: 9964C

Wisconsin Certification

Wyoming Certification #: 8TMS-L

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: 2017-Aqua-NE
Pace Project No.: 30220748

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30220748001	Lowes-1	Water	06/05/17 08:00	06/06/17 10:15
30220748002	Lowes-2	Water	06/05/17 08:02	06/06/17 10:15
30220748003	HH-1	Water	06/05/17 08:04	06/06/17 10:15
30220748004	HH-2	Water	06/05/17 08:06	06/06/17 10:15

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: 2017-Aqua-NE
Pace Project No.: 30220748

Lab ID	Sample ID	Method	Analysts	Analytes Reported
30220748001	Lowes-1	EPA 903.1	WRR	1
30220748002	Lowes-2	EPA 904.0	JLW	1
30220748003	HH-1	EPA 903.1	WRR	1
30220748004	HH-2	EPA 904.0	JLW	1

REPORT OF LABORATORY ANALYSIS

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PROJECT NARRATIVE

Project: 2017-Aqua-NE
Pace Project No.: 30220748

Method: EPA 903.1
Description: 903.1 Radium 226
Client: Microbac Laboratories, Inc.-OH
Date: June 19, 2017

General Information:

2 samples were analyzed for EPA 903.1. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

REPORT OF LABORATORY ANALYSIS

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PROJECT NARRATIVE

Project: 2017-Aqua-NE
Pace Project No.: 30220748

Method: EPA 904.0
Description: 904.0 Radium 228
Client: Microbac Laboratories, Inc.-OH
Date: June 19, 2017

General Information:

2 samples were analyzed for EPA 904.0. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

Analyte Comments:

QC Batch: 261657

1c: During the ingrowth process, part of the MB was lost, and the resulting chemical yield is below 10% and the associated MB MDC is greater than 1.0 pCi/L. Individual sample results are not impacted by the elevated MDC or low MB yield.

- BLANK (Lab ID: 1288491)
- Radium-228

This data package has been reviewed for quality and completeness and is approved for release.

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: 2017-Aqua-NE
Pace Project No.: 30220748

Sample: Lowes-1		Lab ID: 30220748001	Collected: 06/05/17 08:00	Received: 06/06/17 10:15	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	1,059 ± 136 (11.7) C:NA T:71%	pCi/L	06/19/17 10:12	13982-63-3	

Sample: Lowes-2		Lab ID: 30220748002	Collected: 06/05/17 08:02	Received: 06/06/17 10:15	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-228	EPA 904.0	604 ± 111 (11.1) C:67% T:90%	pCi/L	06/19/17 10:30	15262-20-1	

Sample: HH-1		Lab ID: 30220748003	Collected: 06/05/17 08:04	Received: 06/06/17 10:15	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	1,158 ± 144 (7.11) C:NA T:95%	pCi/L	06/19/17 10:12	13982-63-3	

Sample: HH-2		Lab ID: 30220748004	Collected: 06/05/17 08:06	Received: 06/06/17 10:15	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-228	EPA 904.0	1,333 ± 241 (14.8) C:75% T:65%	pCi/L	06/19/17 10:30	15262-20-1	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: 2017-Aqua-NE
 Pace Project No.: 30220748

QC Batch: 261657 Analysis Method: EPA 904.0
 QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
 Associated Lab Samples: 30220748002, 30220748004

METHOD BLANK: 1288491 Matrix: Water
 Associated Lab Samples: 30220748002, 30220748004

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.246 ± 3.98 (9.19) C:78% T:7%	pCi/L	06/19/17 10:30	1c

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: 2017-Aqua-NE
Pace Project No.: 30220748

QC Batch: 261516 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 30220748001, 30220748003

METHOD BLANK: 1287919 Matrix: Water
Associated Lab Samples: 30220748001, 30220748003

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.0622 ± 0.284 (0.578) C:NA T:91%	pCi/L	06/19/17 10:12	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: 2017-Aqua-NE
Pace Project No.: 30220748

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.
ND - Not Detected at or above adjusted reporting limit.
J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
MDL - Adjusted Method Detection Limit.
PQL - Practical Quantitation Limit.
RL - Reporting Limit.
S - Surrogate
1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.
Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.
LCS(D) - Laboratory Control Sample (Duplicate)
MS(D) - Matrix Spike (Duplicate)
DUP - Sample Duplicate
RPD - Relative Percent Difference
NC - Not Calculable.
SG - Silica Gel - Clean-Up
U - Indicates the compound was analyzed for, but not detected.
N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.
Act - Activity
Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).
Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)
(MDC) - Minimum Detectable Concentration
Trac - Tracer Recovery (%)
Carr - Carrier Recovery (%)
Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.
TNI - The NELAC Institute.

ANALYTE QUALIFIERS

1c During the ingrowth process, part of the MB was lost, and the resulting chemical yield is below 10% and the associated MB MDC is greater than 1.0 pCi/L. Individual sample results are not impacted by the elevated MDC or low MB yield.

REPORT OF LABORATORY ANALYSIS

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COC No. A 43160

158 Starlite Drive
Marietta, OH 45750



Phone: 740-373-4071
Toll Free: 800-373-4071

CHAIN-OF-CUSTODY RECORD



Company Name: State of Ohio-DNR-Division of Oil & Gas
 Project Contact: Chuck McCracken
 Contact Phone #: 614-265-6672
 Turn Around Requirements: HAZTVILLE TAYLOR
 Project ID: 2017-Aqua-NE
 Sampler (print): ROBERT LEIDY
 Signature: *Robert Leidy*

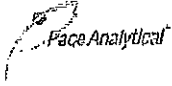
Sample I.D. No.	Grab	Comp	Date	Time	Matrix*	NUMBER OF CONTAINERS	Hold	Ra-226 EPA 901.1 m (5day Quick Turn)	Ra-226 EPA 901.1 m (21 day Ingrowth)	Ra-226 EPA 901.1 m (5day QT & 21 day)	Ra-226 EPA 903.0 ~ Radiochemistry	Ra-226 EPA 903.1 ~ Radon Emanation	Ra-228 EPA 901.1m (5-day Quick Turn)	Ra-228 EPA 901.1m (21-day Ingrowth)	Ra-228 EPA 901.1m (5-day QT & 21-Day)	Ra-228 EPA 904.0 ~ Radiochemistry	Ra-228 EPA 901.1	TOTAL # (LAB USE)	Program
Lowes-1	X		6-5-17	8:00	W	1		X											<input type="checkbox"/> CWK <input type="checkbox"/> RCRA <input type="checkbox"/> DSD <input type="checkbox"/> AFCEE <input checked="" type="checkbox"/> Other: DAS
Lowes-2	X		6-5-17	8:02	W	1		X											001
HH-1	X		6-5-17	8:04	W	1		X											002
HH-2	X		6-5-17	8:06	W	1		X											003
																			004
<p>Refriniquished by: (Signature) <i>Robert Leidy</i> Date: 6-5-17 Time: 17:00</p> <p>Refriniquished by: (Signature) <i>Robert Leidy</i> Date: 6-6-17 Time: 10:15</p> <p>Refriniquished by: (Signature) <i>Robert Leidy</i> Date: 6-5-17 Time: 11:49</p> <p>Refriniquished by: (Signature) <i>Robert Leidy</i> Date: 6-5-17 Time: 14:29</p>																			

W0#: 30220748

Received by: (Signature) *Robert Leidy*

*Water (W), Soil (S), Solid Waste (SD), Unknown (X)

Sample Condition Upon Receipt Pittsburgh



Client Name: Microbac

Project # 30220748

ML

Courier: Fed Ex UPS USPS Client Commercial Pace Other _____

Tracking #: 727804394288

Custody Seal on Cooler/Box Present: yes no Seals intact: yes no

Thermometer Used N/A Type of Ice: Wet Blue None

Cooler Temperature Observed Temp N/A °C Correction Factor: _____ °C Final Temp: _____ °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: ML 6-6-17

Comments:

	Yes	No	N/A	
Chain of Custody Present:	X			1.
Chain of Custody Filled Out:	X			2.
Chain of Custody Relinquished:	X			3.
Sampler Name & Signature on COC:	X			4.
Sample Labels match COC:	X			5.
-Includes date/time/ID Matrix: <u>WT</u>				
Samples Arrived within Hold Time:	X			6.
Short Hold Time Analysis (<72hr remaining):	X	X		7.
Rush Turn Around Time Requested:	X			8.
Sufficient Volume:	X			9.
Correct Containers Used:	X			10.
-Pace Containers Used:	X			
Containers Intact:	X			11.
Orthophosphate field filtered		X		12.
Organic Samples checked for dechlorination:			X	13.
Filtered volume received for Dissolved tests			X	14.
All containers have been checked for preservation.	X			15. <u>PH < 2</u>
All containers needing preservation are found to be in compliance with EPA recommendation.	X			
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed: <u>ML</u> Date/time of preservation: _____
				Lot # of added preservative: _____
Headspace in VOA Vials (>6mm):			X	16.
Trip Blank Present:		X		17.
Trip Blank Custody Seals Present		X		
Rad Aqueous Samples Screened > 0.5 mrem/hr	X			Initial when completed: <u>ML</u> Date: <u>6-6-17</u>

Client Notification/ Resolution:

Person Contacted: _____ Date/Time: _____ Contacted By: _____

Comments/ Resolution: _____

A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

ATTACHMENT

3

Radiological Analytical Results for:

AquaSalina / Mogadore - PRE
- POST
AquaSalina / Cleveland - PRE (1)
- POST (1)
- PRE (2)
- POST (2)
ODOT salt mixture brine - POST

June 30, 2017

Ms. Michelle Taylor
Microbac Laboratories, Inc.
158 Starlite Drive
Marietta, OH 45750

RE: Project: 2017-AQUA-MOG
Pace Project No.: 30221492

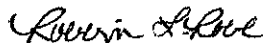
Dear Ms. Taylor:

Enclosed are the analytical results for sample(s) received by the laboratory between June 14, 2017 and June 16, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

Revision 1 - This report replaces the June 30, 2017 report. This report has been reissued to include the additional COC and SCUR. Please replace the original report with the revised report enclosed.
RLR 6/30/17

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Robbin Robl
robbin.robbl@pacelabs.com
(724)850-5613
Project Manager

Enclosures



REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
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CERTIFICATIONS

Project: 2017-AQUA-MOG
Pace Project No.: 30221492

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601

L-A-B DOD-ELAP Accreditation #: L2417

Alabama Certification #: 41590

Arizona Certification #: AZ0734

Arkansas Certification

California Certification #: 04222CA

Colorado Certification

Connecticut Certification #: PH-0694

Delaware Certification

Florida/TNI Certification #: E87683

Georgia Certification #: C040

Guam Certification

Hawaii Certification

Idaho Certification

Illinois Certification

Indiana Certification

Iowa Certification #: 391

Kansas/TNI Certification #: E-10358

Kentucky Certification #: 90133

Louisiana DHH/TNI Certification #: LA140008

Louisiana DEQ/TNI Certification #: 4086

Maine Certification #: PA00091

Maryland Certification #: 308

Massachusetts Certification #: M-PA1457

Michigan/PADEP Certification

Missouri Certification #: 235

Montana Certification #: Cert 0082

Nebraska Certification #: NE-05-29-14

Nevada Certification #: PA014572015-1

New Hampshire/TNI Certification #: 2976

New Jersey/TNI Certification #: PA 051

New Mexico Certification #: PA01457

New York/TNI Certification #: 10888

North Carolina Certification #: 42706

North Dakota Certification #: R-190

Oregon/TNI Certification #: PA200002

Pennsylvania/TNI Certification #: 65-00282

Puerto Rico Certification #: PA01457

Rhode Island Certification #: 65-00282

South Dakota Certification

Tennessee Certification #: TN2867

Texas/TNI Certification #: T104704188-14-8

Utah/TNI Certification #: PA014572015-5

USDA Soil Permit #: P330-14-00213

Vermont Dept. of Health: ID# VT-0282

Virgin Island/PADEP Certification

Virginia/VELAP Certification #: 460198

Washington Certification #: C868

West Virginia DEP Certification #: 143

West Virginia DHHR Certification #: 9964C

Wisconsin Certification

Wyoming Certification #: 8TMS-L

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: 2017-AQUA-MOG
Pace Project No.: 30221492

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30221492001	ODOT-01	Water	06/12/17 09:35	06/14/17 11:50
30221492002	ODOT-02	Water	06/12/17 09:38	06/14/17 11:50
30221492003	AS-MOG PRE 01	Water	06/12/17 12:07	06/14/17 11:50
30221492004	AS-MOG POST 01	Water	06/12/17 12:30	06/14/17 11:50
30221492005	AS-CLE-PRE-01	Water	06/15/17 10:24	06/16/17 10:15
30221492006	AS-CLE-PRE-02	Water	06/15/17 10:22	06/16/17 10:15
30221492007	AS-CLE-POST-01	Water	06/15/17 10:56	06/16/17 10:15
30221492008	AS-CLE-POST-02	Water	06/15/17 10:56	06/16/17 10:15

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: 2017-AQUA-MOG
Pace Project No.: 30221492

Lab ID	Sample ID	Method	Analysts	Analytes Reported
30221492001	ODOT-01	EPA 903.1	WRR	1
30221492002	ODOT-02	EPA 904.0	JLW	1
30221492003	AS-MOG PRE 01	EPA 903.1	WRR	1
		EPA 904.0	JLW	1
30221492004	AS-MOG POST 01	EPA 904.0	JLW	1
30221492005	AS-CLE-PRE-01	EPA 901.1	MAH	2
30221492006	AS-CLE-PRE-02	EPA 901.1	MAH	2
30221492007	AS-CLE-POST-01	EPA 901.1	MAH	2
30221492008	AS-CLE-POST-02	EPA 901.1	MAH	2

REPORT OF LABORATORY ANALYSIS

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PROJECT NARRATIVE

Project: 2017-AQUA-MOG
Pace Project No.: 30221492

Method: EPA 901.1
Description: 901.1 Gamma Spec
Client: Microbac Laboratories, Inc.-OH
Date: June 30, 2017

General Information:

4 samples were analyzed for EPA 901.1. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
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PROJECT NARRATIVE

Project: 2017-AQUA-MOG
Pace Project No.: 30221492

Method: EPA 903.1
Description: 903.1 Radium 226
Client: Microbac Laboratories, Inc.-OH
Date: June 30, 2017

General Information:

2 samples were analyzed for EPA 903.1. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

REPORT OF LABORATORY ANALYSIS

This report shall not be reproduced, except in full,
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PROJECT NARRATIVE

Project: 2017-AQUA-MOG
Pace Project No.: 30221492

Method: EPA 904.0
Description: 904.0 Radium 228
Client: Microbac Laboratories, Inc.-OH
Date: June 30, 2017

General Information:

3 samples were analyzed for EPA 904.0. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: 2017-AQUA-MOG
Pace Project No.: 30221492

Sample: ODOT-01		Lab ID: 30221492001	Collected: 06/12/17 09:35	Received: 06/14/17 11:50	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	2.77 ± 1.58 (1.45) C:NA T:87%	pCi/L	06/20/17 10:46	13982-63-3	

Sample: ODOT-02		Lab ID: 30221492002	Collected: 06/12/17 09:38	Received: 06/14/17 11:50	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-228	EPA 904.0	5.78 ± 7.69 (16.5) C:74% T:83%	pCi/L	06/26/17 12:22	15262-20-1	

Sample: AS-MOG PRE 01		Lab ID: 30221492003	Collected: 06/12/17 12:07	Received: 06/14/17 11:50	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Comments: • Low volume						
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	925 ± 116 (10.7) C:NA T:91%	pCi/L	06/21/17 11:35	13982-63-3	
Radium-228	EPA 904.0	373 ± 69.8 (15.0) C:75% T:91%	pCi/L	06/26/17 12:22	15262-20-1	

Sample: AS-MOG POST 01		Lab ID: 30221492004	Collected: 06/12/17 12:30	Received: 06/14/17 11:50	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Comments: • Low Volume						
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-228	EPA 904.0	432 ± 80.1 (13.2) C:75% T:94%	pCi/L	06/26/17 12:22	15262-20-1	
Radium-226	EPA 903.1	1,010 ± 126 (1.61) C:NA T:99%	pCi/L	06/21/17 11:49	13982-63-3	

Sample: AS-CLE-PRE-01		Lab ID: 30221492005	Collected: 06/15/17 10:24	Received: 06/16/17 10:15	Matrix: Water	
PWS:		Site ID:	Sample Type:			
Comments: • Low Volume						
Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 901.1	595.260 ± 772.180 (927.900) C:NA T:NA	pCi/L	06/29/17 10:05	13982-63-3	
Radium-228	EPA 901.1	568.050 ± 127.440 (123.800) C:NA T:NA	pCi/L	06/29/17 10:05	15262-20-1	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: 2017-AQUA-MOG
Pace Project No.: 30221492

Sample: AS-CLE-PRE-02 Lab ID: 30221492006 Collected: 06/15/17 10:22 Received: 06/16/17 10:15 Matrix: Water
PWS: Site ID: Sample Type:
Comments: • Low Volume

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 901.1	501.820 ± 462.880 (552.800) C:NA T:NA	pCi/L	06/29/17 16:41	13982-63-3	
Radium-228	EPA 901.1	387.340 ± 75.616 (64.860) C:NA T:NA	pCi/L	06/29/17 16:41	15262-20-1	

Sample: AS-CLE-POST-01 Lab ID: 30221492007 Collected: 06/15/17 10:56 Received: 06/16/17 10:15 Matrix: Water
PWS: Site ID: Sample Type:
Comments: • Low Volume

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 901.1	949.330 ± 478.650 (561.700) C:NA T:NA	pCi/L	06/29/17 12:07	13982-63-3	
Radium-228	EPA 901.1	734.080 ± 129.300 (78.340) C:NA T:NA	pCi/L	06/29/17 12:07	15262-20-1	

Sample: AS-CLE-POST-02 Lab ID: 30221492008 Collected: 06/15/17 10:56 Received: 06/16/17 10:15 Matrix: Water
PWS: Site ID: Sample Type:
Comments: • Low Volume

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 901.1	997.670 ± 545.050 (593.800) C:NA T:NA	pCi/L	06/29/17 16:42	13982-63-3	
Radium-228	EPA 901.1	713.780 ± 102.920 (84.890) C:NA T:NA	pCi/L	06/29/17 16:42	15262-20-1	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: 2017-AQUA-MOG

Pace Project No.: 30221492

QC Batch: 263462

Analysis Method: EPA 901.1

QC Batch Method: EPA 901.1

Analysis Description: 901.1 Gamma Spec

Associated Lab Samples: 30221492005, 30221492006, 30221492007, 30221492008

METHOD BLANK: 1297752

Matrix: Water

Associated Lab Samples: 30221492005, 30221492006, 30221492007, 30221492008

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.000 ± 102.870 (219.900) C:NA T:NA	pCi/L	06/28/17 12:48	
Radium-228	0.000 ± 6.503 (37.220) C:NA T:NA	pCi/L	06/28/17 12:48	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL - RADIOCHEMISTRY

Project: 2017-AQUA-MOG
Pace Project No.: 30221492

QC Batch: 261944 Analysis Method: EPA 903.1
QC Batch Method: EPA 903.1 Analysis Description: 903.1 Radium-226
Associated Lab Samples: 30221492003, 30221492004

METHOD BLANK: 1289743 Matrix: Water
Associated Lab Samples: 30221492003, 30221492004

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.0653 ± 0.339 (0.703) C:NA T:97%	pCi/L	06/21/17 11:16	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

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QUALITY CONTROL - RADIOCHEMISTRY

Project: 2017-AQUA-MOG
Pace Project No.: 30221492

QC Batch: 261946 Analysis Method: EPA 904.0
QC Batch Method: EPA 904.0 Analysis Description: 904.0 Radium 228
Associated Lab Samples: 30221492002, 30221492003, 30221492004

METHOD BLANK: 1289745 Matrix: Water
Associated Lab Samples: 30221492002, 30221492003, 30221492004

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	-0.107 ± 0.318 (0.773) C:75% T:79%	pCi/L	06/26/17 12:12	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: 2017-AQUA-MOG
Pace Project No.: 30221492

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.
ND - Not Detected at or above adjusted reporting limit.
J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
MDL - Adjusted Method Detection Limit.
PQL - Practical Quantitation Limit.
RL - Reporting Limit.
S - Surrogate
1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.
Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.
LCS(D) - Laboratory Control Sample (Duplicate)
MS(D) - Matrix Spike (Duplicate)
DUP - Sample Duplicate
RPD - Relative Percent Difference
NC - Not Calculable.
SG - Silica Gel - Clean-Up
U - Indicates the compound was analyzed for, but not detected.
N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.
Act - Activity
Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).
Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)
(MDC) - Minimum Detectable Concentration
Trac - Tracer Recovery (%)
Carr - Carrier Recovery (%)
Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.
TNI - The NELAC Institute.

REPORT OF LABORATORY ANALYSIS

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Sample Condition Upon Receipt Pittsburgh



Client Name: Microbiome

Project # 30221492

ZH.

Courier: Fed Ex UPS USPS Client Commercial Pace Other _____

Tracking #: 727804394509

Custody Seal on Cooler/Box Present: yes no Seals intact: yes no

Thermometer Used N/A Type of Ice: Wet Blue None

Cooler Temperature Observed Temp N/A °C Correction Factor: N/A °C Final Temp: N/A °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: XH 6/14/17

Comments:	Yes	No	N/A	
Chain of Custody Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.
Chain of Custody Filled Out:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.
Chain of Custody Relinquished:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3.
Sampler Name & Signature on COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.
Sample Labels match COC:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.
-Includes date/time/ID				
Matrix: <u>W+</u>				
Samples Arrived within Hold Time:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.
Short Hold Time Analysis (<72hr remaining):	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	7.
Rush Turn Around Time Requested:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	8.
Sufficient Volume:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9. Low volume, samples 003 & 004 have one IL
Correct Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10.
-Pace Containers Used:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Containers Intact:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11.
Orthophosphate field filtered	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	12.
Organic Samples checked for dechlorination:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	13.
Filtered volume received for Dissolved tests	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	14.
All containers have been checked for preservation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15.
All containers needing preservation are found to be in compliance with EPA recommendation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
exceptions: VOA, coliform, TOC, O&G, Phenolics				
				Initial when completed: <u>XH</u> Date/time of preservation
				Lot # of added preservative
Headspace in VOA Vials (>6mm):	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	16.
Trip Blank Present:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	17.
Trip Blank Custody Seals Present	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Rad Aqueous Samples Screened > 0.5 mrem/hr	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Initial when completed: <u>XH</u> Date: <u>6/14/17</u>

Client Notification/ Resolution:

Person Contacted: _____ Date/Time: _____ Contacted By: _____

Comments/ Resolution: _____

A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)
 *PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

COC No. A 43160

158 Starliffe Drive
Marietta, OH 45750



Phone: 740-373-4071
Toll Free: 800-373-4071

30221492 REC
colwell

CHAIN-OF-CUSTODY RECORD

Company Name: State of Ohio-DNR-Division of Oil & Gas
 Project Contact: Chuck McCracken
 Contact Phone #: 614-265-6672
 Turn Around Requirements: S-DAY RUSH
 Location: AS CLEVELAND

Project ID: 2017-AQUA-CLE
 Sampler (print): J. Slasada
 Signature: [Signature]

Sample I.D. No.	Qmp	Grid	Date	Time	Matrix*
AS-CLE-PRE-01		X	6-15-2017		W
AS-CLE-PRE-02		X	6-15-2017		W
AS-CLE-POST-01		X	6-15-2017		W
AS-CLE-POST-02		X	6-15-2017		W

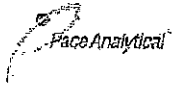
Hold	NUMBER OF CONTAINERS	Ra-226 EPA 901.1 m (5day Quick Turn)	Ra-226 EPA 901.1 m (21 day ingrowth)	Ra-226 EPA 903.0 ~ Radiochemistry	Ra-226 EPA 903.1 ~ Radon Emanation	Ra-226 EPA 901.1m (5-day Quick Turn)	Ra-228 EPA 901.1m (21-day ingrowth)	Ra-228 EPA 901.1m (5-day QT & 21-Day)	Ra-228 EPA 904.0 ~ Radiochemistry	Ra-228 EPA 901.1	Time	Date	Received by: (Signature)	Time	Date	Received by: (Signature)
	1		X	X									[Signature]	11:23	6/15/17	[Signature]
	1		X	X									[Signature]	14:26	6/15/17	[Signature]
	1		X	X									[Signature]	13:24	6/15/17	[Signature]
	1		X	X									[Signature]			[Signature]

~~S-DAY RUSH~~

WO#: 30221776
 REC 6/15/17
 [Barcode]

*Water (W), Soil (S), Solid Wastes (SD), Unknown (X)
 Relinquished: [Signature] 6/15/17 17:00
 Received by: [Signature] 6/15/17 10:50

Sample Condition Upon Receipt Pittsburgh



Client Name: Microbac

Project # 30221492

ZH

RK
blwln

Courier: Fed Ex UPS USPS Client Commercial Pace Other _____

Tracking #: 7278 04394623

Custody Seal on Cooler/Box Present: yes no Seals intact: yes no

Thermometer Used UJA Type of Ice: Wet Blue None

Cooler Temperature Observed Temp _____ °C Correction Factor: _____ °C Final Temp: _____ °C

Temp should be above freezing to 6°C

Date and Initials of person examining contents: ZH Lelliel 17

Comments:

	Yes	No	N/A	
Chain of Custody Present:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.
Chain of Custody Filled Out:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.
Chain of Custody Relinquished:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3.
Sampler Name & Signature on COC:	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	4.
Sample Labels match COC: -Includes date/time/ID	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	5. <u>No date or time on bottle</u> <u>no time on COC, time on bottles are:</u>
Matrix:	<u>WT</u>			
Samples Arrived within Hold Time:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.
Short Hold Time Analysis (<72hr remaining):	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	7.
Rush Turn Around Time Requested:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<u>5 day Rush</u>
Sufficient Volume:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9.
Correct Containers Used: -Pace Containers Used:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	10.
Containers Intact:	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11.
Orthophosphate field filtered	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	12.
Organic Samples checked for dechlorination:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	13.
Filtered volume received for Dissolved tests	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	14.
All containers have been checked for preservation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15. <u>Pt 2</u>
All containers needing preservation are found to be in compliance with EPA recommendation.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed: <u>ZH</u> Date/time of preservation: _____ Lot # of added preservative: _____
Headspace in VOA Vials (>6mm):	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	16.
Trip Blank Present:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	17.
Trip Blank Custody Seals Present	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Rad Aqueous Samples Screened > 0.5 mrem/hr	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Initial when completed: <u>ZH</u> Date: <u>Lelliel 17</u>

ZH Lelliel 17
Pre 01-1024
Pre 02-1022
Post 01-1056
Post 02-1056

Client Notification/ Resolution:

Person Contacted: _____ Date/Time: _____ Contacted By: _____

Comments/ Resolution: _____

A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

ATTACHMENT

4

Radiological Analytical Results for:

ODOT tap water	- PRE
----------------	-------

July 05, 2017

Ms. Michelle Taylor
Microbac Laboratories, Inc.
158 Starlite Drive
Marietta, OH 45750

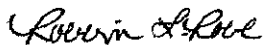
RE: Project: 2017-AQUA SAUNA-TUSC
Pace Project No.: 30222632

Dear Ms. Taylor:

Enclosed are the analytical results for sample(s) received by the laboratory on June 26, 2017. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Robbin Robl
robbin.robl@pacelabs.com
(724)850-5613
Project Manager

Enclosures



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: 2017-AQUA SAUNA-TUSC
Pace Project No.: 30222632

Pennsylvania Certification IDs

1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235
Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: 2017-AQUA SAUNA-TUSC
Pace Project No.: 30222632

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30222632001	DOTTUSC RAW-01,02	Water	06/21/17 12:52	06/26/17 09:20

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: 2017-AQUA SAUNA-TUSC

Pace Project No.: 30222632

Lab ID	Sample ID	Method	Analysts	Analytes Reported
30222632001	DOTTUSC RAW-01,02	EPA 903.1	WRR	1
		EPA 904.0	JLW	1

REPORT OF LABORATORY ANALYSIS

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PROJECT NARRATIVE

Project: 2017-AQUA SAUNA-TUSC

Pace Project No.: 30222632

Method: EPA 903.1

Description: 903.1 Radium 226

Client: Microbac Laboratories, Inc.-OH

Date: July 05, 2017

General Information:

1 sample was analyzed for EPA 903.1. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

REPORT OF LABORATORY ANALYSIS

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PROJECT NARRATIVE

Project: 2017-AQUA SAUNA-TUSC
Pace Project No.: 30222632

Method: EPA 904.0
Description: 904.0 Radium 228
Client: Microbac Laboratories, Inc.-OH
Date: July 05, 2017

General Information:

1 sample was analyzed for EPA 904.0. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: 2017-AQUA SAUNA-TUSC

Pace Project No.: 30222632

Sample: DOTTUSC RAW-01,02 Lab ID: 30222632001 Collected: 06/21/17 12:52 Received: 06/26/17 09:20 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 903.1	1.90 ± 0.805 (0.559) C:NA T:86%	pCi/L	07/03/17 13:27	13982-63-3	
Radium-228	EPA 904.0	0.922 ± 0.421 (0.696) C:73% T:84%	pCi/L	07/03/17 13:13	15262-20-1	

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: 2017-AQUA SAUNA-TUSC
Pace Project No.: 30222632

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.
ND - Not Detected at or above adjusted reporting limit.
TNTC - Too Numerous To Count
J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.
MDL - Adjusted Method Detection Limit.
PQL - Practical Quantitation Limit.
RL - Reporting Limit.
S - Surrogate
1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.
Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.
LCS(D) - Laboratory Control Sample (Duplicate)
MS(D) - Matrix Spike (Duplicate)
DUP - Sample Duplicate
RPD - Relative Percent Difference
NC - Not Calculable.
SG - Silica Gel - Clean-Up
U - Indicates the compound was analyzed for, but not detected.
N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.
Act - Activity
Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).
Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)
(MDC) - Minimum Detectable Concentration
Trac - Tracer Recovery (%)
Carr - Carrier Recovery (%)
Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.
TNI - The NELAC Institute.

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COC No. A 43160



158 Starlite Drive
Marietta, OH 45750

Phone: 740-373-4071
Toll Free: 800-373-4071

CHAIN-OF-CUSTODY RECORD

Company Name: State of Ohio-DNR-Division of Oil & Gas		Project Contact: Chuck McCracken		Contact Phone #: 614-265-6672	
Turn Around Requirements: DOTTUSC RAW		Location: DOTTUSC RAW		Project ID: 2017-AQUA SALINA - TUSC	
Sampler (print): POTBERT LESBY		Signature: <i>Potbert Lesby</i>		Additional Requirements: <input type="checkbox"/> CWA <input type="checkbox"/> RCRA <input type="checkbox"/> DDP <input type="checkbox"/> AFCEE <input checked="" type="checkbox"/> Other DAS	
Sample I.D. No.	Grid	Comp.	Date	Time	Matrix*
DOTTUSC RAW-01	X		6-21-2017	12:52	W
DOTTUSC RAW-02	X		6-21-2017	12:53	W
NUMBER OF CONTAINERS					
Hold					
Ra-226 EPA 901.1 m (5day Quick Turn)					
Ra-226 EPA 901.1 m (21 day Ingrowth)					
Ra-226 EPA 903.0 ~ Radiochemistry					
Ra-226 EPA 903.1 ~ Radon Emanation					
Ra-226 EPA 901.1					
Ra-228 EPA 901.1m (5-day Quick Turn)					
Ra-228 EPA 901.1m (21-day Ingrowth)					
Ra-228 EPA 901.1m (5-day QT & 21-Day)					
Ra-228 EPA 904.0 ~ Radiochemistry					
Ra-228 EPA 901.1					
HNO3 RESERVATING					
TOTAL # (LAB USE)					

5-DAY RUSH
WO#: 30222632



Relinquished by: (Signature) <i>Potbert Lesby</i>	Date 6-24-2017	Time 13:20	Received by: (Signature) <i>Nicholas</i>	Date 6-23-17	Time 14:50	Remarks:
Relinquished by: (Signature) <i>John Doe</i>	Date 6-23-17	Time 13:16	Received for Laboratory by: (Signature) <i>Ussiblu/PAC</i>	Date 6-23-17	Time 14:50	Remarks:

*Water (W), Soil (S), Solid Waste (SW), Unknown (X)

Received by: *Potbert Lesby* 6-23-17 12:16 PM

Relinquished by: *Potbert Lesby* 6-23-17 14:58

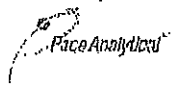
Relinquished by: *Nicholas* 6-23-17 17:00

received by: *Nicholas* 6-26-17 09:20

Sample Condition Upon Receipt Pittsburgh

30 222 632 -

ZH.



Client Name: Microbac

Project # _____

Courier: Fed Ex UPS USPS Client Commercial Pace Other _____

Tracking #: 7278 04394807

Custody Seal on Cooler/Box Present: yes no Seals Intact: yes no

Thermometer Used N/A Type of Ice: Wet Blue (None)

Cooler Temperature Observed Temp N/A °C Correction Factor: _____ °C Final Temp: _____ °C
Temp should be above freezing to 6°C

Date and Initials of person examining contents: ML 6-26-17

Comments:	Yes	No	N/A	
Chain of Custody Present:	X			1.
Chain of Custody Filled Out:	X			2.
Chain of Custody Relinquished:	X			3.
Sampler Name & Signature on COC:	X			4.
Sample Labels match COC:	X			5.
-Includes date/time/ID Matrix: <u>L</u>				
Samples Arrived within Hold Time:	X			6.
Short Hold Time Analysis (<72hr remaining):		X		7.
Rush Turn Around Time Requested:	X			8.
Sufficient Volume:	X			9.
Correct Containers Used:	X			10.
-Pace Containers Used:	X			
Containers Intact:	X			11.
Orthophosphate field filtered		X		12.
Organic Samples checked for dechlorination:			X	13.
Filled volume received for Dissolved tests			X	14.
All containers have been checked for preservation.	X			15.
All containers needing preservation are found to be in compliance with EPA recommendation.	X			<u>PH < 2</u>
exceptions: VOA, coliform, TOC, O&G, Phenolics				Initial when completed: <u>ML</u> Date/time of preservation: _____
				Lot # of added preservative: _____
Headspace in VOA Vials (>6mm):			X	16.
Trip Blank Present:		X		17.
Trip Blank Custody Seals Present		X		
Rad Aqueous Samples Screened > 0.5 mrem/hr		X		Initial when completed: <u>ML</u> Date: <u>6-26-17</u>

Client Notification/ Resolution:
Person Contacted: _____ Date/Time: _____ Contacted By: _____
Comments/ Resolution: _____

A check in this box indicates that additional information has been stored in ereports.

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

*PM review is documented electronically in LIMS. When the Project Manager closes the SRF Review schedule in LIMS. The review is in the Status section of the Workorder Edit Screen.

ODOT TGF
VOC

Chrom Revision: 2.2 25-Apr-2017 13:27:22

Report Date: 19-Jun-2017 08:32:15

TestAmerica Canton
Data File: \\ChromNA\Canton\ChromData\A3UX15\20170618-66102.b\UXC4766.D
Injection Date: 18-Jun-2017 22:53:30
Instrument ID: A3UX15
Lims ID: 240-80850-A-1
Lab Sample ID: 240-80850-1

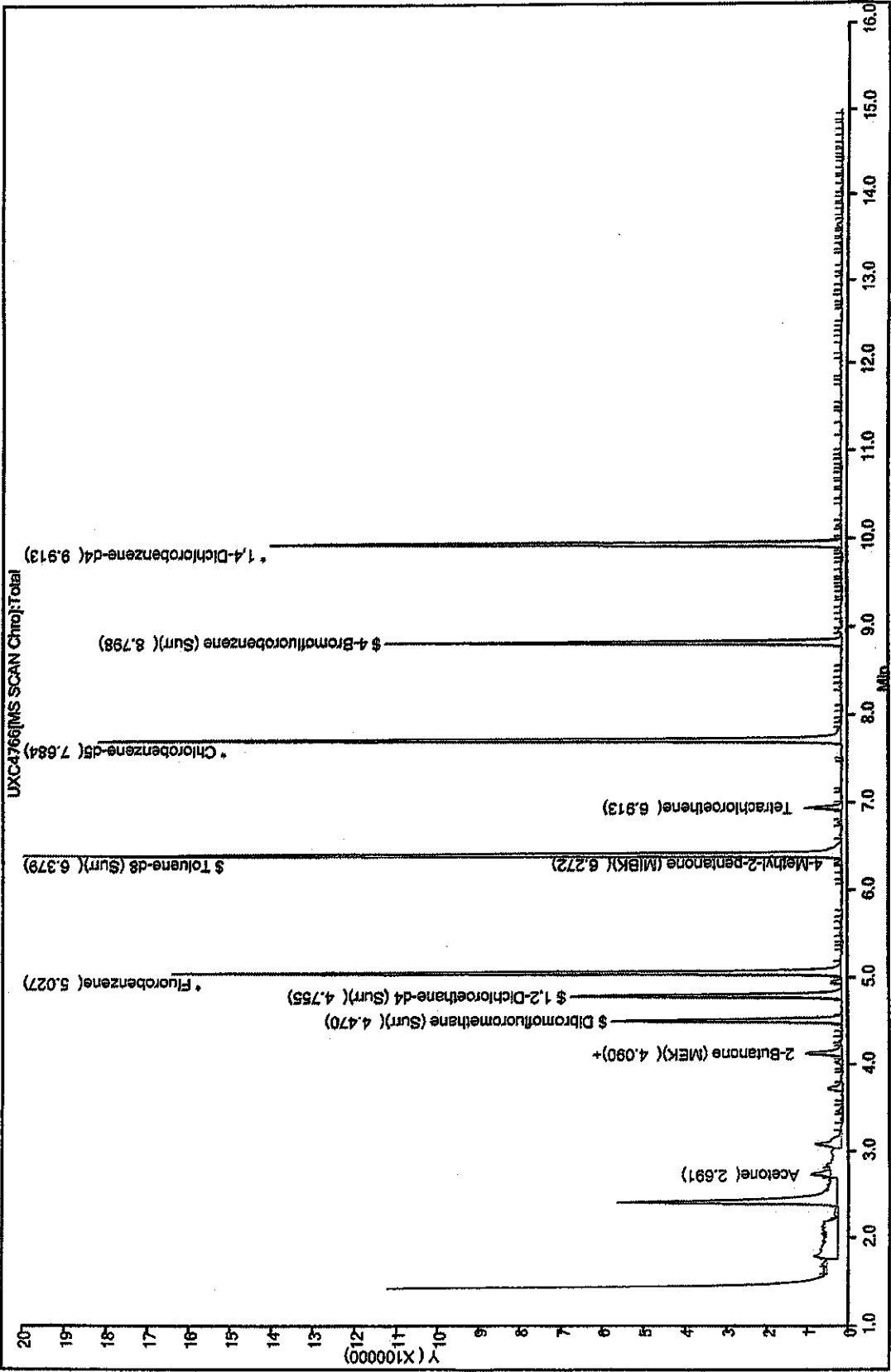
Operator ID:
Worklist Strip#: 44

ALS Bottle#: 19

Client ID: JG-098/ODOT/BRINE TANK

Dil. Factor: 5.0000
Limit Group: MSV 8260B ICAL

Purge Vol: 5.000 mL
Method: 8260_15
Column: DB-624 (0.18 mm)



ODOT 76F

SVOC

Chrom Revision: 2.2 25-Apr-2017 13:27:22

Report Date: 18-Jun-2017 13:14:36

TestAmerica Canton

Data File: \\ChromNA\Canton\ChromData\A4HP9\20170616-66038.b\70616027.D

Injection Date: 16-Jun-2017 18:44:30

Instrument ID: A4HP9

Lims ID: 240-80850-E-1-A

Lab Sample ID: 240-80850-1

Client ID: JG-098/ODOT/BRINE TANK

Operator ID: 001710

Worklist Smp#: 27

Injection Vol: 1.0 ul

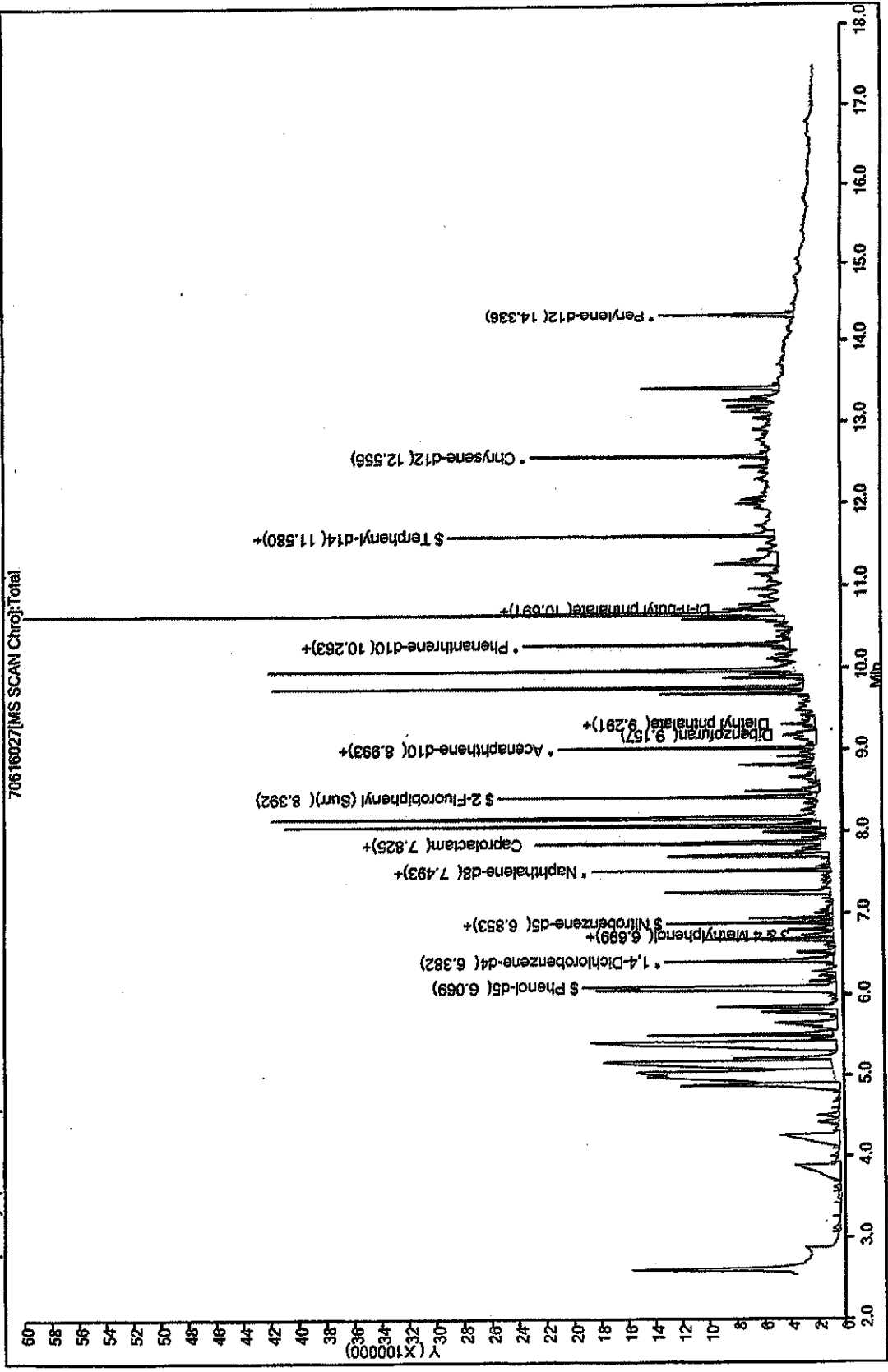
Dil. Factor: 1.0000

ALS Bottle#: 27

Method: 8270_9

Limit Group: MSS 8270C ICAL

Column: 5% phenyl (0.18 mm)



MOGAPOZE

VOC

Chrom Revision: 2.2 25-Apr-2017 13:27:22

Report Date: 19-Jun-2017 08:32:17

TestAmerica Canton

Data File: \\ChromNA\Canton\ChromData\A3UX15\20170618-66102.b\UXC4767.D

Injection Date: 18-Jun-2017 23:15:30

Instrument ID: A3UX15

Operator ID: 45

Lims ID: 240-80852-B-3

Lab Sample ID: 240-80852-3

Worklist Smp#: 45

Client ID: ~~MOGAPOZE~~ PRE-TREATMENT TANK

Purge Vol: 5.000 mL

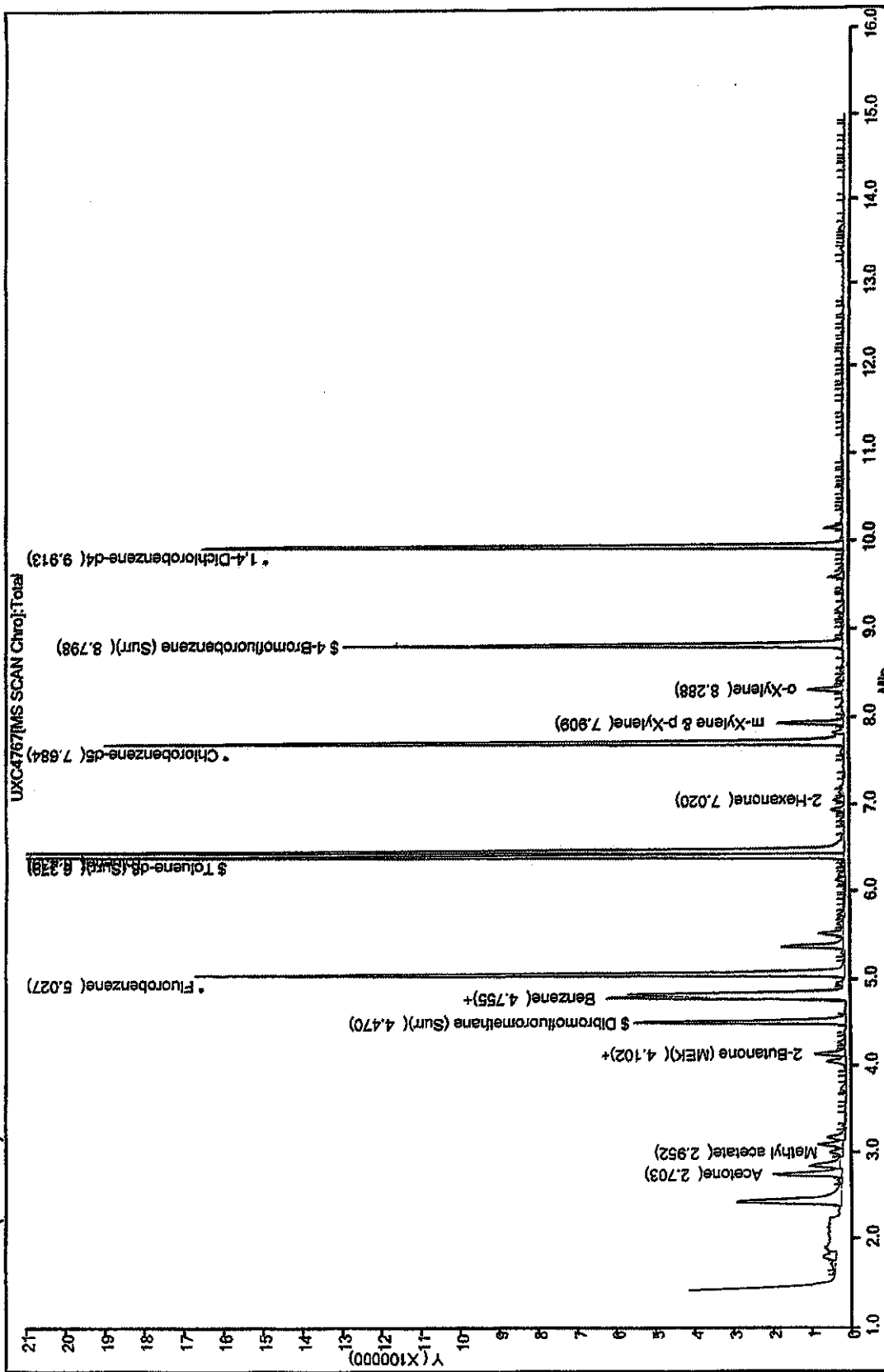
Dil. Factor: 33,3300

ALS Bottle#: 20

Method: 8260_15

Limit Group: MSV 8260B 1CAL

Column: DB-624 (0.18 mm)



Report Date: 18-Jun-2017 13:14:33

Chrom Revision: 2.2 25-Apr-2017 13:27:22

TestAmerica Canton

Data File: \\ChromNA\Canton\ChromData\A4HP9\20170616-66038.b\70616026.D

Injection Date: 16-Jun-2017 18:19:30

Instrument ID: A4HP9

Lims ID: 240-80852-A-1-A

Lab Sample ID: 240-80852-1

Client ID: UG:099/PRE-TREATMENT TANK

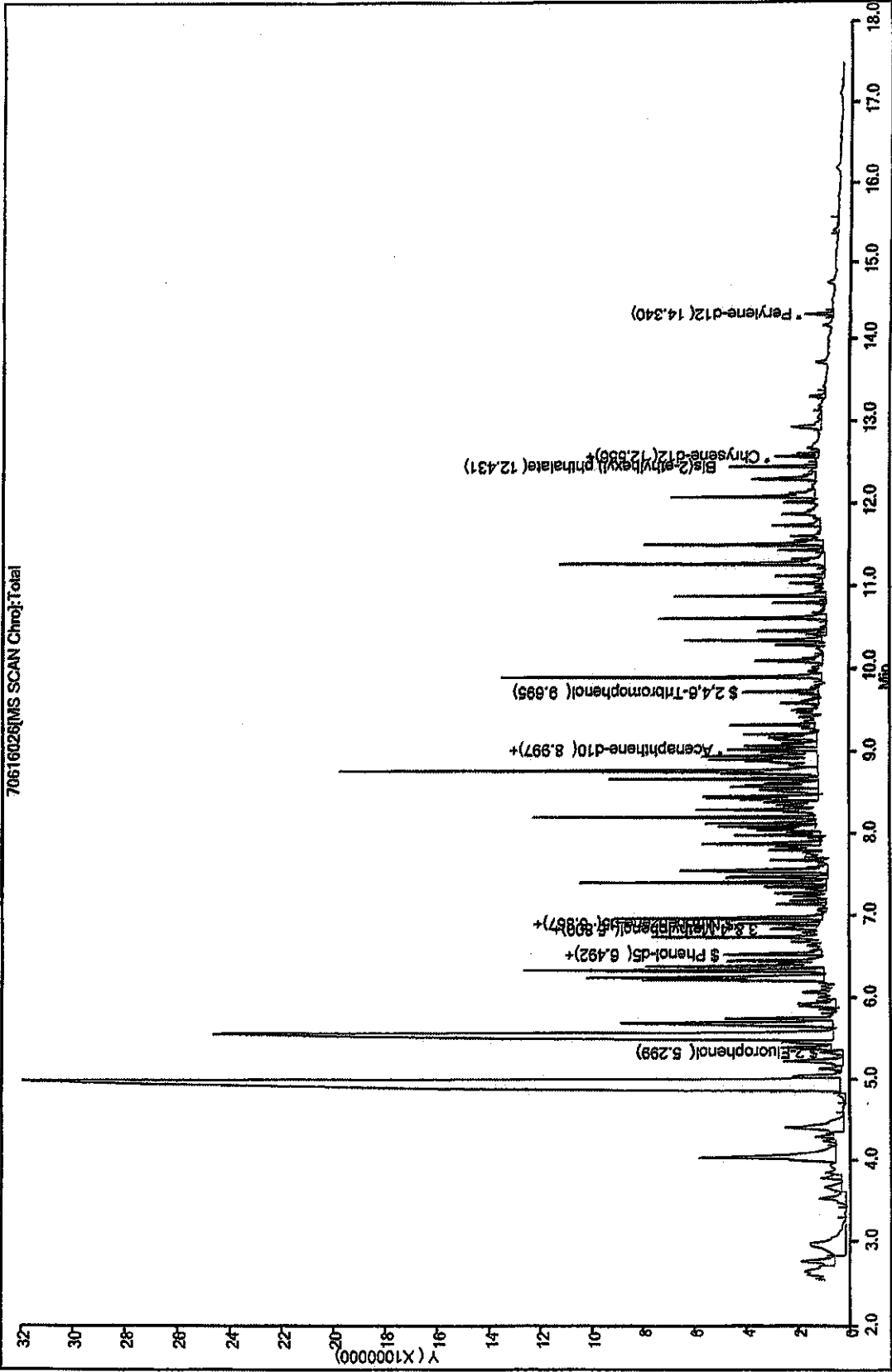
Injection Vol: 1.0 ul

DIL Factor: 1.0000

Method: 8270_9

Limit Group: MSS 8270C ICAL

Column: 5% phenyl (0.18 mm)



MAGNIZIE
SUDC

Operator ID: 001710
Worklist Smp#: 26
ALS Bottle#: 26

MOGADORE

VOC

Chrom Revision: 2.2 25-Apr-2017 13:27:22

Report Date: 19-Jun-2017 08:32:18

TestAmerica Canton

Data File: \\ChromNA\Canton\ChromData\3UX15\20170618-66102.b\UXC4768.D

Injection Date: 18-Jun-2017 23:37:30 Instrument ID: A3UX15

Lims ID: 240-80852-A-6 Lab Sample ID: 240-80852-6

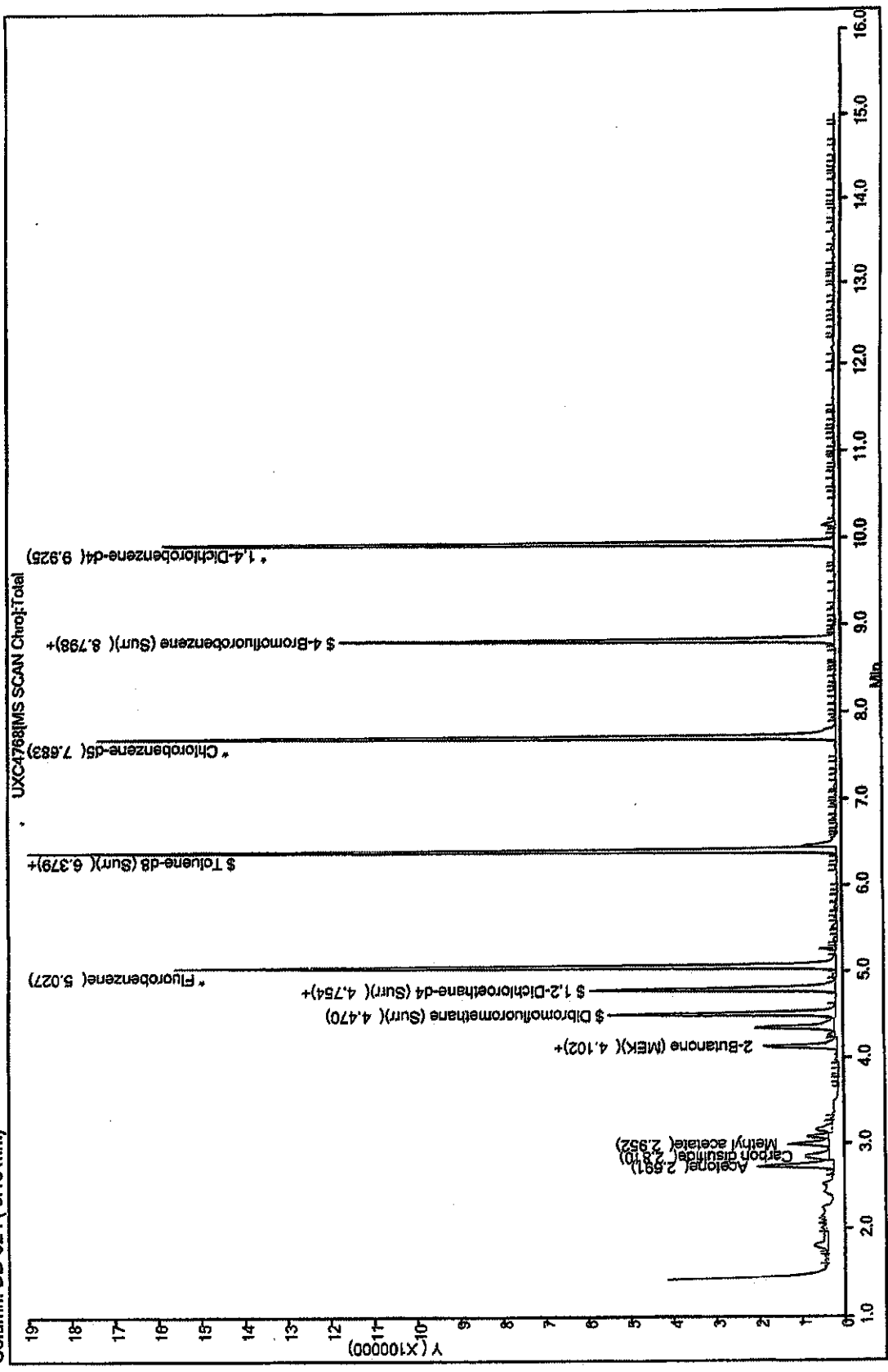
Client ID: JG100/POST-TREATMENT Dil. Factor: 14.2900

Purge Vol: 5.000 mL Method: 8260_15 Limit Group: MSV 8260B ICAL

Operator ID: 46

Worklist Smp#: 46

ALS Bottle#: 21



MagAforce

SUC

Chrom Revision: 2.2 25-Apr-2017 13:27:22

Report Date: 18-Jun-2017 13:14:30

TestAmerica Canton

Date File: \\ChromNA\Canton\ChromData\A4HP\9\20170616-66038.b\70616025.D

Injection Date: 16-Jun-2017 17:54:30

Instrument ID: A4HP9

Operator ID: 001710

Lims ID: 240-80852-A-4-A

Lab Sample ID: 240-80852-4

Worklist Smp#: 25

Client ID: JG-100/POST-TREATMENT

Injection Vol: 1.0 ul

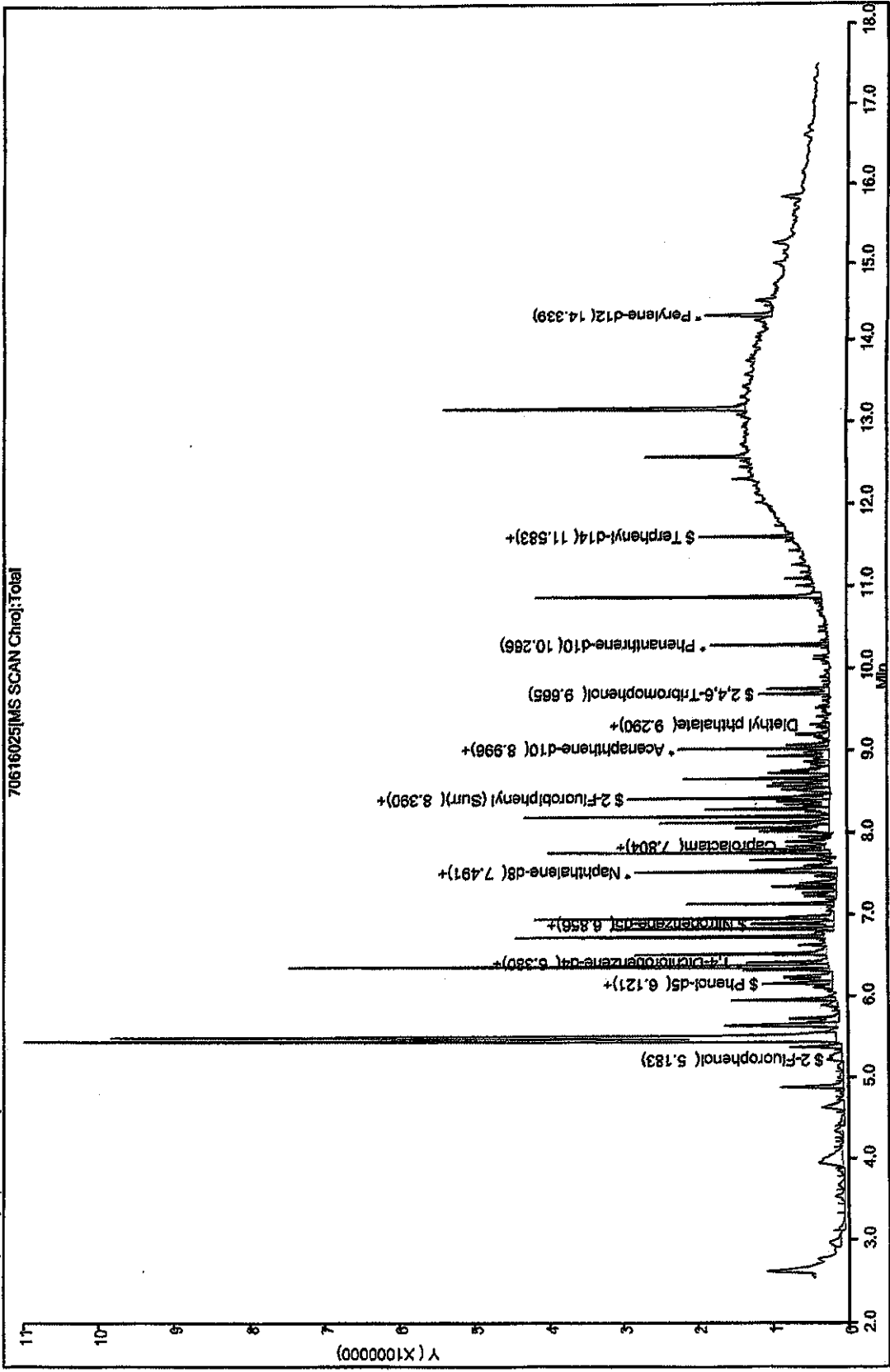
Dil. Factor: 1.0000

ALS Bottle#: 25

Method: 8270_9

Limit Group: MSS 8270C ICAL

Column: 5% phenyl (0.18 mm)



CLEVELAND
 SUDC

Chrom Revision: 2.2 20-Jun-2017 07:42:38

Report Date: 21-Jun-2017 10:02:28

TestAmerica Canton

Data File: \\Chrom\NA\Canton\ChromData\A4AG2\20170619-66109.b\70619014.D

Injection Date: 19-Jun-2017 12:02:30

Instrument ID: A4AG2

Lims ID: 240-81011-A-1-A

Lab Sample ID: 240-81011-1

Client ID: JG-107/PRE-TREATMENT

Operator ID: 14
 Worklist Simp#: 14

ALS Bottle#: 14

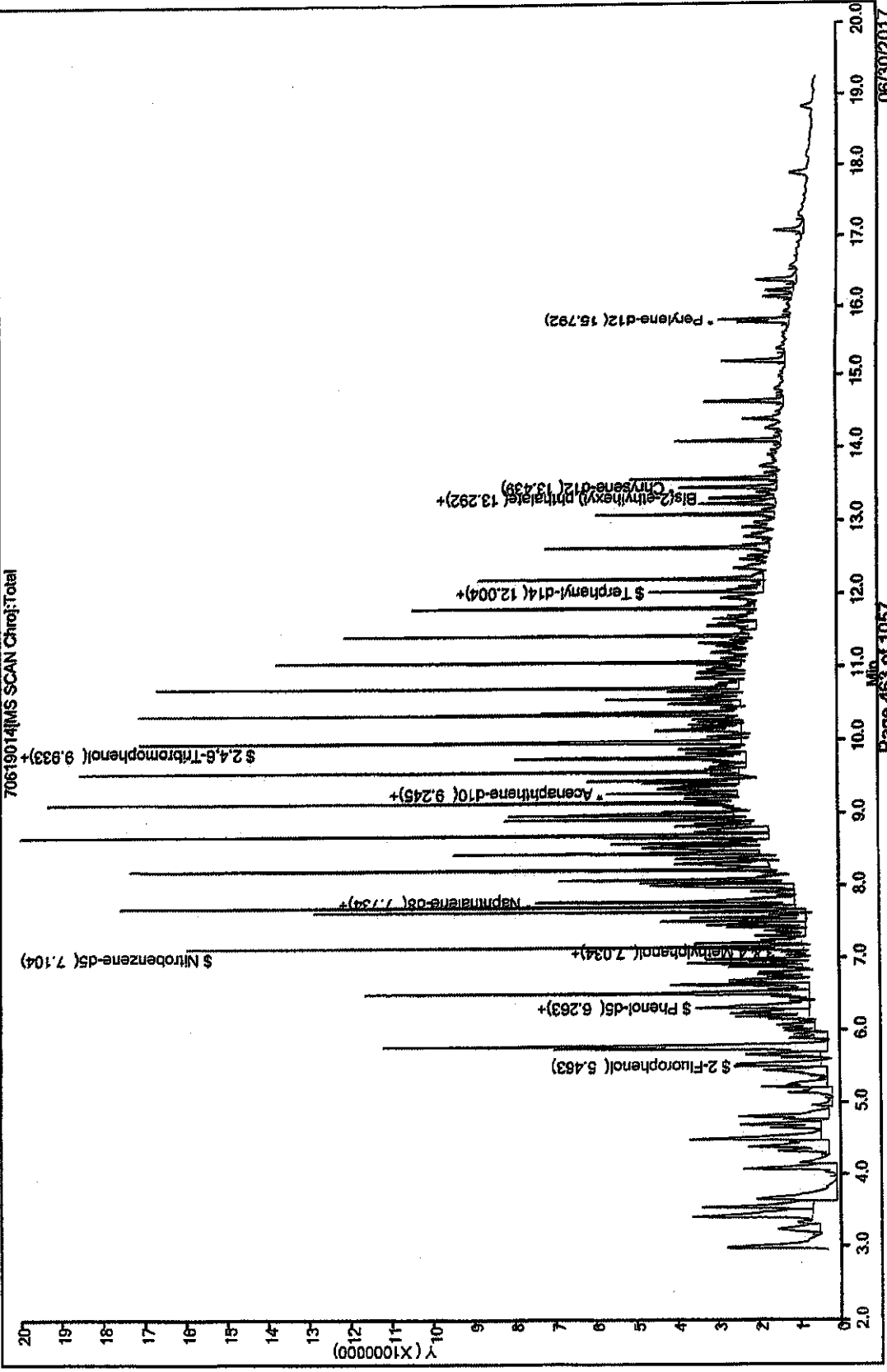
Dil. Factor: 1.0000

Limit Group: MSS 8270C ICAL

Injection Vol: 1.0 ul

Method: 8270 ag2

Column: 5% phenyl (0.18 mm)



CLEVE LAND

VOC

Chrom Revision: 2.2 20-Jun-2017 07:42:38

Report Date: 26-Jun-2017 07:40:34

TestAmerica Canton

Data File: \\ChromNA\Canton\ChromData\A3UX1120170623-66291.b\UXJ3648.D

Injection Date: 23-Jun-2017 12:51:30

Instrument ID: A3UX11

Operator ID: 43582

Lims ID: 240-81011-B-6

Lab Sample ID: 240-81011-6

Worklist Smp#: 35

Client ID: JG-102/POST-TREATMENT

Purge Vol: 5.000 mL

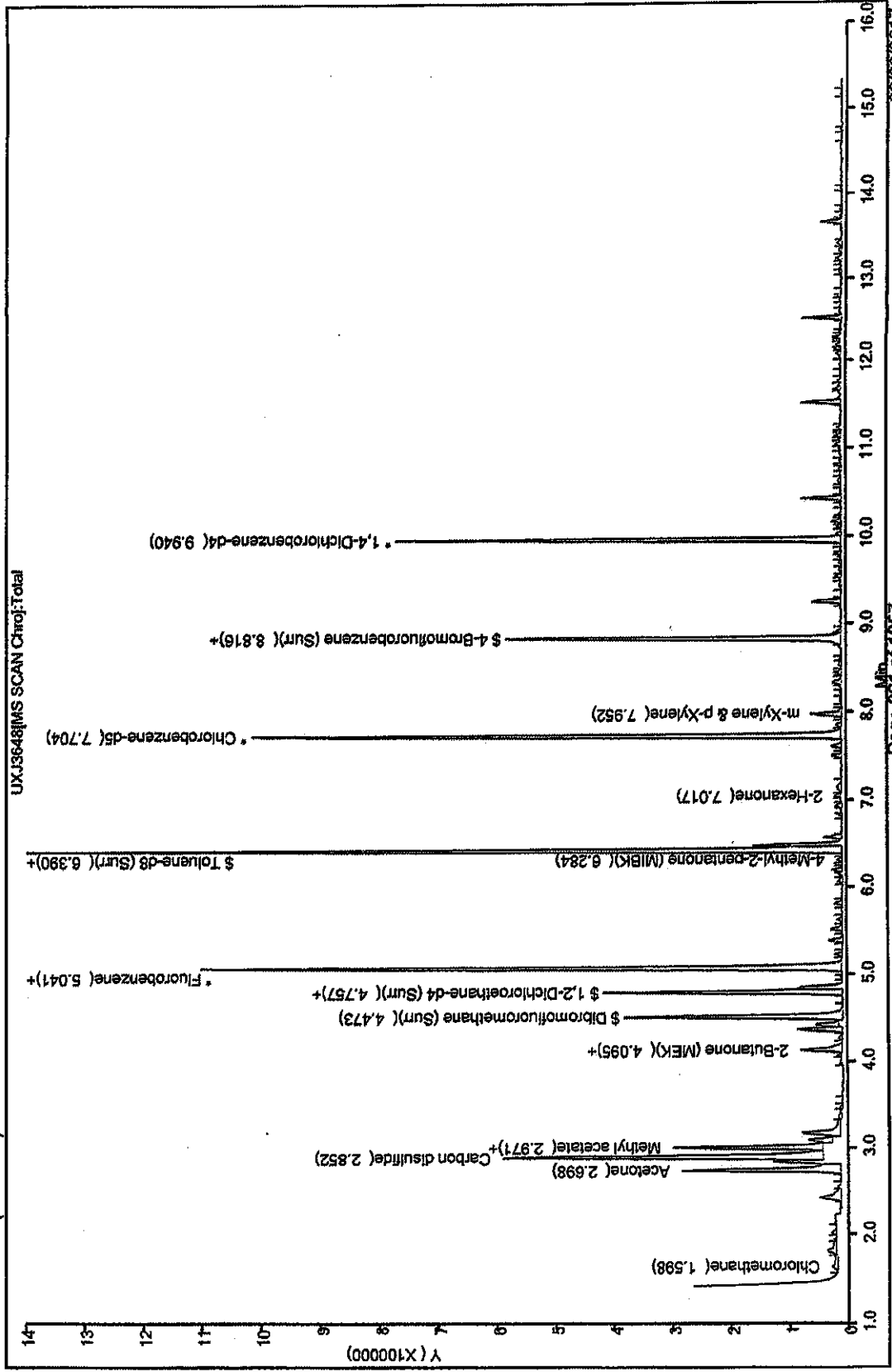
Dil. Factor: 5.0000

ALS Bottle#: 11

Method: 8260_11

Limit Group: MSY 8260B ICAL

Column: DB-624 (0.18 mm)



CLEVELAND

SVOC

Chrom Revision: 2.2 20-Jun-2017 07:42:38

Report Date: 21-Jun-2017 10:02:25

TestAmerica Canton

Data File: \\ChromNA\Canton\ChromData\A4AG2\20170619-66109.b\70619015.D

Injection Date: 19-Jun-2017 12:26:30

Instrument ID: A4AG2

Lines ID: 240-81011-A-4-A

Lab Sample ID: 240-81011-4

Client ID: AUG-102/POST-TREATMENT

Injection Vol: 1.0 ul

Dil. Factor: 1.0000

Method: 8270 ag2

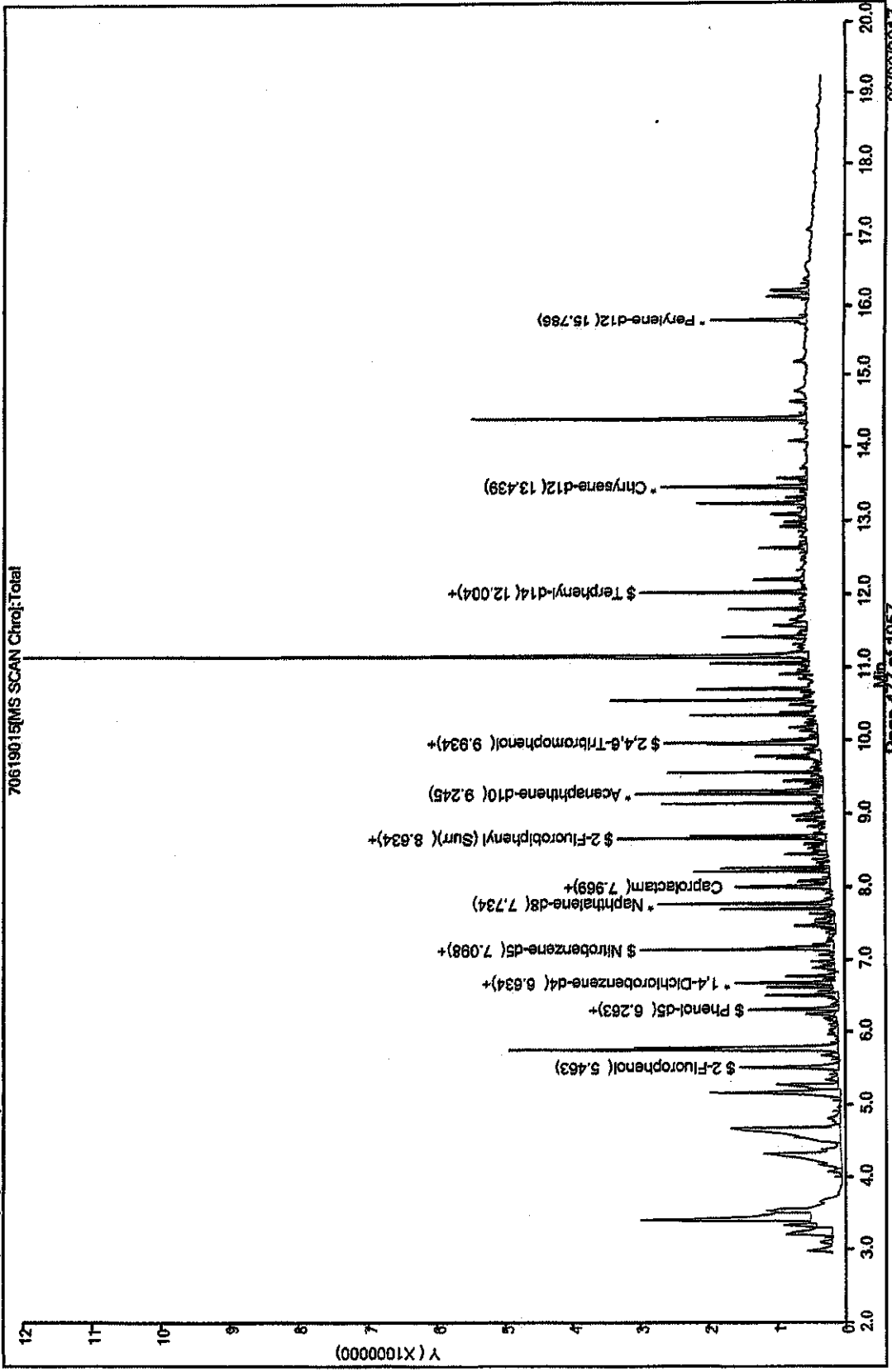
Limit Group: MSS 8270C ICAL

Column: 5% phenyl (0.18 mm)

Operator ID: 15

Worklist Smp#: 15

ALS Bottle#: 15



Gas Chromatographs of pre-treatment and post-treatment of brine tanks of Duck Creek Energy and ODOT tank containing AquaSalina

The Division of Oil and Gas Resources Management (DOGRM) sampled the pre-treatment and post-treatment brine tanks at Duck Creek Energy's Cleveland and Mogadore facilities. In addition, DOGRM sampled a tank containing AquaSalina delivered to an ODOT facility. The samples were provided to TestAmerica for gas chromatography (GC) analysis. In these samples, GC analysis was used to determine if volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC) were present in the brine sampled. Each peak or mound on an analysis represents the presence of VOC or SVOC as indicated on the analysis. Note that a mound indicates that multiple VOCs and SVOCs are present in the mound, but the analysis/equipment was unable to separate the VOCs or SVOCs into individual peaks. If VOCs or SVOCs were not present in the brine, no peaks would appear on an analysis. The table below is a summary GC analysis of the tanks sampled.

Tank Sample	Volatile Organic Compounds	Semi-Volatile Organic Compounds
Pre-Treatment Cleveland	✓	✓
Post-Treatment Cleveland	✓	✓
Pre-Treatment Mogadore	✓	✓
Post-Treatment Mogadore	✓	✓
ODOT tank of AquaSalina	✓	✓

*The DOGRM did not use the GC analysis to substantiate the peaks identified in the analysis. Rather, it was used to determine if VOCs and SVOCs were present in the tanks sampled.