Gunter, Jason

From: James, Kevin <kjames@doerun.com>
Sent: Monday, November 10, 2014 7:41 PM
To: Gunter, Jason
Cc: Yingling, Mark; Neaville, Chris; Montgomery, Michael; 'robert.hinkson@dnr.mo.gov'; 'brandon.wiles@dnr.mo.gov'; 'Ty Morris (TMorris@barr.com)'; Nations, Mark
Subject: Leadwood Progress Report - October
Attachments: removed.txt; Leadwood_October2014.pdf; 2014-10-29 LW NPDES Pace Lab Report.pdf; Remediation Air Report with 3rdQ Audit - September 2014.pdf

Jason -

Attached is the October Progress Report for the Leadwood Site.

Upon further review of last month's submission, please note that the email header was incorrectly labeled "August" instead of the correct reporting month of "September". The attachments were correctly identified as September.

Best regards,

Kevin James on behalf of Mark Nations

Kevin James
Environmental Engineering
W: 573.626.2096
C: 573.247.6766

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OICR 40482427 42
Superfund
0102

THE DOE RUN COMPANY

Remediation Group

Mark Nations
Mining Properties Manager
mnations@doerun.com

November 10, 2014

Mr. Jason Gunter
Remedial Project Manager
U.S. Environmental Protection Agency
Region 7 - Superfund Branch
11201 Renner Blvd.
Lenexa, KS 66219

Re: The Doe Run Company - Leadwood Mine Tailings Site Monthly Progress Report

Dear Mr. Gunter:

As required by Article VI, Section 50 of the Unilateral Administrative Order (Docket No. CERCLA-07-2006-0272) for the referenced project and on behalf of The Doe Run Company, the progress report for the period October 1, 2014 through October 31, 2014 is enclosed. If you have any questions or comments, please call me at 573-518-0800.

Sincerely,

Mark Nations
Mining Properties Manager

Enclosures
c: Mark Yingling – TDRC (electronic only)
Kevin James – TDRC (electronic only)
Chris Neaville – TDRC (electronic only)
Michael Montgomery – TDRC (electronic only)
Robert Hinkson – MDNR
Brandon Wiles – MDNR
Ty Morris – Barr Engineering

1221 Mill Street, Leadwood, MO 63653
Telephone: (573) 562-7793

Leadwood Mine Tailings Site
Leadwood, Missouri
Removal Action - Monthly Progress Report
Period: October 1, 2014 – October 31, 2014

1. **Actions Performed or Completed This Period:**
   a. Work continued on the development of the Post Removal Site Control Plan for the site.
   b. Work continued to implement the surface water management plan. This work included clearing and stripping, grading the area to drain as shown on the construction drawings, and closing the decant tower. As of the end of the period, the work on these task was completed
   c. Work on the implementation of the surface water management plan also included applying the low permeability soil cover to the designated area. As of the end of the period, the work on these tasks continued.
2. **Data and Results Received This Period:**
   a. During this period, water samples were collected from downstream of Leadwood Dam and the East Seep and Erosion Area, as well as from upstream and downstream of the confluence of Eaton Creek with Big River. The analytical results for this event are included with this progress report.
   b. During this period, the ambient air monitoring samples for September were processed and the Ambient Air Monitoring Report for September 2014 was completed. A copy of the Ambient Air Monitoring Report for September is attached.
3. **Scheduled Activities not Completed This Period:**
   a. None.
4. **Planned Activities for Next Period:**
   a. Continue developing the Post Removal Site Control Plan for the site.
   b. Continue to place low permeability soil cover over the East Seep and Erosion Area, as described in the surface water management plan.
   c. Complete monthly water sampling activities as described in the Removal Action Work Plan.
   d. Complete air monitoring activities as described in the Removal Action Work Plan.
5. **Changes in Personnel:**
   a. None.
6. **Issues or Problems Arising This Period:**
   a. None.
7. **Resolution of Issues or Problems Arising This Period:**
   a. None.

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Lenexa, KS 66219
(913)599-5665

November 10, 2014

Amy Sanders
The Doe Run Company
P. O. Box 500
Viburnum, MO 65566

RE: Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

Dear Amy Sanders:
Enclosed are the analytical results for sample(s) received by the laboratory on October 30, 2014. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI 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,

Jamie Church
jamie.church@pacelabs.com
Project Manager

Enclosures

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(913)599-5665

CERTIFICATIONS

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

Kansas Certification IDs
9608 Loiret Boulevard, Lenexa, KS 66219
WY STR Certification #: 2456.01
Arkansas Certification #: 13-012-0
Illinois Certification #: 003097
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212008A
Oklahoma Certification #: 9205/9935
Texas Certification #: T104704407
Utah Certification #: KS00021

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SAMPLE SUMMARY

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60181498001	**21693 / LEADWOOD DOWNSTREAM**	Water	10/29/14 12:02	10/30/14 06:15
60181498002	**21694 / LEADWOOD UPSTREAM**	Water	10/29/14 12:12	10/30/14 06:15
60181498003	**21695 / LEADWOOD 001**	Water	10/29/14 12:33	10/30/14 06:15
60181498004	**21696 / LEADWOOD 002**	Water	10/29/14 12:23	10/30/14 06:15

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SAMPLE ANALYTE COUNT

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
60181498001	**21693 / LEADWOOD DOWNSTREAM**	EPA 200.7	NDJ	6	PASI-K
		EPA 200.7	NDJ	3	PASI-K
		SM 2540D	MER	1	PASI-K
		EPA 300.0	OL	1	PASI-K
60181498002	**21694 / LEADWOOD UPSTREAM**	EPA 200.7	NDJ	6	PASI-K
		EPA 200.7	NDJ	3	PASI-K
		SM 2540D	MER	1	PASI-K
		EPA 300.0	OL	1	PASI-K
60181498003	**21695 / LEADWOOD 001**	EPA 200.7	NDJ	3	PASI-K
		SM 2540D	MER	1	PASI-K
		SM 2540F	MER	1	PASI-K
		EPA 300.0	OL	1	PASI-K
60181498004	**21696 / LEADWOOD 002**	EPA 200.7	NDJ	3	PASI-K
		SM 2540D	MER	1	PASI-K
		SM 2540F	MER	1	PASI-K
		EPA 300.0	OL	1	PASI-K

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ANALYTICAL RESULTS

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

Sample: 21693 / LEADWOOD DOWNSTREAM **Lab ID: 60181498001** Collected: 10/29/14 12:02 Received: 10/30/14 06:15 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Cadmium	ND	ug/L	5.0	0.56	1	11/04/14 17:50	11/05/14 13:43	7440-43-9	
Calcium	**54900**	ug/L	100	7.8	1	11/04/14 17:50	11/05/14 13:43	7440-70-2	
Lead	ND	ug/L	5.0	2.2	1	11/04/14 17:50	11/05/14 13:43	7439-92-1	
Magnesium	**34000**	ug/L	50.0	17.0	1	11/04/14 17:50	11/05/14 13:43	7439-95-4	
Total Hardness by 2340B	**277000**	ug/L	500		1	11/04/14 17:50	11/05/14 13:43		
Zinc	**19.4J**	ug/L	50.0	12.5	1	11/04/14 17:50	11/05/14 13:43	7440-66-6	
200.7 Metals, Dissolved (LF)	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Cadmium, Dissolved	**0.72J**	ug/L	5.0	0.56	1	11/05/14 15:50	11/06/14 12:29	7440-43-9	
Lead, Dissolved	ND	ug/L	5.0	2.2	1	11/05/14 15:50	11/06/14 12:29	7439-92-1	
Zinc, Dissolved	**13.9J**	ug/L	50.0	12.5	1	11/05/14 15:50	11/06/14 12:29	7440-66-6	
2540D Total Suspended Solids	Analytical Method: SM 2540D								
Total Suspended Solids	ND	mg/L	5.0	5.0	1		11/04/14 12:23		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Sulfate	**43.0**	mg/L	5.0	2.5	5		11/08/14 09:33	14808-79-8	

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ANALYTICAL RESULTS

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

Sample: 21694 / LEADWOOD UPSTREAM **Lab ID: 60181498002** Collected: 10/29/14 12:12 Received: 10/30/14 06:15 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Cadmium	ND	ug/L	5.0	0.56	1	11/04/14 17:50	11/05/14 13:49	7440-43-9	
Calcium	**48600**	ug/L	100	7.8	1	11/04/14 17:50	11/05/14 13:49	7440-70-2	
Lead	ND	ug/L	5.0	2.2	1	11/04/14 17:50	11/05/14 13:49	7439-92-1	
Magnesium	**31900**	ug/L	50.0	17.0	1	11/04/14 17:50	11/05/14 13:49	7439-95-4	
Total Hardness by 2340B	**253000**	ug/L	500		1	11/04/14 17:50	11/05/14 13:49		
Zinc	ND	ug/L	50.0	12.5	1	11/04/14 17:50	11/05/14 13:49	7440-66-6	
200.7 Metals, Dissolved (LF)	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Cadmium, Dissolved	ND	ug/L	5.0	0.56	1	11/05/14 15:50	11/06/14 12:36	7440-43-9	
Lead, Dissolved	ND	ug/L	5.0	2.2	1	11/05/14 15:50	11/06/14 12:36	7439-92-1	
Zinc, Dissolved	ND	ug/L	50.0	12.5	1	11/05/14 15:50	11/06/14 12:36	7440-66-6	
2540D Total Suspended Solids	Analytical Method: SM 2540D								
Total Suspended Solids	ND	mg/L	5.0	5.0	1		11/04/14 12:23		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Sulfate	**23.0**	mg/L	2.0	1.0	2		11/08/14 10:20	14808-79-8	

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ANALYTICAL RESULTS

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

Sample: 21695 / LEADWOOD 001 **Lab ID: 60181498003** Collected: 10/29/14 12:33 Received: 10/30/14 06:15 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Cadmium	**2.1J**	ug/L	5.0	0.56	1	11/04/14 17:50	11/05/14 13:52	7440-43-9	
Lead	**3.3J**	ug/L	5.0	2.2	1	11/04/14 17:50	11/05/14 13:52	7439-92-1	
Zinc	**2340**	ug/L	50.0	12.5	1	11/04/14 17:50	11/05/14 13:52	7440-66-6	
2540D Total Suspended Solids	Analytical Method: SM 2540D								
Total Suspended Solids	ND	mg/L	5.0	5.0	1		11/04/14 12:23		
2540F Total Settleable Solids	Analytical Method: SM 2540F								
Total Settleable Solids	ND	mL/L/hr	0.20	0.20	1		10/30/14 14:35		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Sulfate	**332**	mg/L	50.0	25.0	50		11/08/14 11:08	14808-79-8	

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ANALYTICAL RESULTS

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

Sample: 21696 / LEADWOOD 002 **Lab ID: 60181498004** Collected: 10/29/14 12:23 Received: 10/30/14 06:15 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
200.7 Metals, Total	Analytical Method: EPA 200.7 Preparation Method: EPA 200.7								
Cadmium	**3.4J**	ug/L	5.0	0.56	1	11/04/14 17:50	11/05/14 13:54	7440-43-9	
Lead	**9.4**	ug/L	5.0	2.2	1	11/04/14 17:50	11/05/14 13:54	7439-92-1	
Zinc	**4920**	ug/L	50.0	12.5	1	11/04/14 17:50	11/05/14 13:54	7440-66-6	
2540D Total Suspended Solids	Analytical Method: SM 2540D								
Total Suspended Solids	ND	mg/L	5.0	5.0	1		11/04/14 12:23		
2540F Total Settleable Solids	Analytical Method: SM 2540F								
Total Settleable Solids	ND	mL/L/hr	0.20	0.20	1		10/30/14 14:35		
300.0 IC Anions 28 Days	Analytical Method: EPA 300.0								
Sulfate	**455**	mg/L	50.0	25.0	50		11/08/14 11:24	14808-79-8	

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QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

QC Batch: MPRP/29640 Analysis Method: EPA 200.7
QC Batch Method: EPA 200.7 Analysis Description: 200.7 Metals, Total
Associated Lab Samples: 60181498001, 60181498002, 60181498003, 60181498004

METHOD BLANK: 1472874 Matrix: Water
Associated Lab Samples: 60181498001, 60181498002, 60181498003, 60181498004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Cadmium	ug/L	ND	5.0	11/05/14 13:37	
Calcium	ug/L	ND	100	11/05/14 13:37	
Lead	ug/L	ND	5.0	11/05/14 13:37	
Magnesium	ug/L	ND	50.0	11/05/14 13:37	
Total Hardness by 2340B	ug/L	ND	500	11/05/14 13:37	
Zinc	ug/L	ND	50.0	11/05/14 13:37	

LABORATORY CONTROL SAMPLE: 1472875

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Cadmium	ug/L	1000	1010	101	85-115	
Calcium	ug/L	10000	10600	106	85-115	
Lead	ug/L	1000	1020	102	85-115	
Magnesium	ug/L	10000	10600	106	85-115	
Total Hardness by 2340B	ug/L		70200			
Zinc	ug/L	1000	1030	103	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1472876 1472877

Parameter	Units	60181498001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Cadmium	ug/L	ND	1000	1000	1040	1050	104	105	70-130	1	20	
Calcium	ug/L	54900	10000	10000	65400	64800	105	100	70-130	1	20	
Lead	ug/L	ND	1000	1000	1030	1050	103	105	70-130	1	20	
Magnesium	ug/L	34000	10000	10000	45000	45100	110	111	70-130	0	20	
Total Hardness by 2340B	ug/L	277000			349000	348000				0		
Zinc	ug/L	19.4J	1000	1000	1020	1030	100	101	70-130	1	20	

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REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

QC Batch: MPRP/29660
QC Batch Method: EPA 200.7
Analysis Method: EPA 200.7
Analysis Description: 200.7 Metals, Dissolved
Associated Lab Samples: 60181498001, 60181498002

METHOD BLANK: 1473409
Matrix: Water
Associated Lab Samples: 60181498001, 60181498002

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Cadmium, Dissolved	ug/L	ND	5.0	11/06/14 12:25	
Lead, Dissolved	ug/L	ND	5.0	11/06/14 12:25	
Zinc, Dissolved	ug/L	ND	50.0	11/06/14 12:25	

LABORATORY CONTROL SAMPLE: 1473410

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Cadmium, Dissolved	ug/L	1000	1020	102	85-115	
Lead, Dissolved	ug/L	1000	1030	103	85-115	
Zinc, Dissolved	ug/L	1000	1040	104	85-115	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1473411 1473412

Parameter	Units	60181498001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Cadmium, Dissolved	ug/L	0.72J	1000	1000	1040	1030	104	103	70-130	0	20	
Lead, Dissolved	ug/L	ND	1000	1000	1030	1020	103	102	70-130	1	20	
Zinc, Dissolved	ug/L	13.9J	1000	1000	1030	1030	102	101	70-130	1	20	

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QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

QC Batch: WET/51336 Analysis Method: SM 2540D
QC Batch Method: SM 2540D Analysis Description: 2540D Total Suspended Solids
Associated Lab Samples: 60181498001, 60181498002, 60181498003, 60181498004

METHOD BLANK: 1472391 Matrix: Water
Associated Lab Samples: 60181498001, 60181498002, 60181498003, 60181498004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Suspended Solids	mg/L	ND	5.0	11/04/14 12:22	

SAMPLE DUPLICATE: 1472392

Parameter	Units	60181485001 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Suspended Solids	mg/L	19.0	18.0	5	10	

SAMPLE DUPLICATE: 1472393

Parameter	Units	60181507002 Result	Dup Result	RPD	Max RPD	Qualifiers
Total Suspended Solids	mg/L	ND	ND		10	

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QUALITY CONTROL DATA

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

QC Batch: WETA/31707 Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 Analysis Description: 300.0 IC Anions
Associated Lab Samples: 60181498001, 60181498002, 60181498003, 60181498004

METHOD BLANK: 1474946 Matrix: Water
Associated Lab Samples: 60181498001, 60181498002, 60181498003, 60181498004

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Sulfate	mg/L	ND	1.0	11/08/14 08:56	

LABORATORY CONTROL SAMPLE: 1474947

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Sulfate	mg/L	5	4.8	96	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1474948 1474949

Parameter	Units	60181498001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Sulfate	mg/L	43.0	25	25	68.7	68.2	103	101	80-120	1	15	

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QUALIFIERS

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

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 (8270 listed analyte) decomposes to Azobenzene.

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.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

LABORATORIES

PASI-K Pace Analytical Services - Kansas City

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: NPDES (LEADWOOD)
Pace Project No.: 60181498

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60181498001	**21693 / LEADWOOD DOWNSTREAM**	EPA 200.7	MPRP/29640	EPA 200.7	ICP/22226
60181498002	**21694 / LEADWOOD UPSTREAM**	EPA 200.7	MPRP/29640	EPA 200.7	ICP/22226
60181498003	**21695 / LEADWOOD 001**	EPA 200.7	MPRP/29640	EPA 200.7	ICP/22226
60181498004	**21696 / LEADWOOD 002**	EPA 200.7	MPRP/29640	EPA 200.7	ICP/22226
60181498001	**21693 / LEADWOOD DOWNSTREAM**	EPA 200.7	MPRP/29660	EPA 200.7	ICP/22239
60181498002	**21694 / LEADWOOD UPSTREAM**	EPA 200.7	MPRP/29660	EPA 200.7	ICP/22239
60181498001	**21693 / LEADWOOD DOWNSTREAM**	SM 2540D	WET/51336		
60181498002	**21694 / LEADWOOD UPSTREAM**	SM 2540D	WET/51336		
60181498003	**21695 / LEADWOOD 001**	SM 2540D	WET/51336		
60181498004	**21696 / LEADWOOD 002**	SM 2540D	WET/51336		
60181498003	**21695 / LEADWOOD 001**	SM 2540F	WET/51263		
60181498004	**21696 / LEADWOOD 002**	SM 2540F	WET/51263		
60181498001	**21693 / LEADWOOD DOWNSTREAM**	EPA 300.0	WETA/31707		
60181498002	**21694 / LEADWOOD UPSTREAM**	EPA 300.0	WETA/31707		
60181498003	**21695 / LEADWOOD 001**	EPA 300.0	WETA/31707		
60181498004	**21696 / LEADWOOD 002**	EPA 300.0	WETA/31707		

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Pace Analytical
www.pacelabs.com

Sample Condition Upon Receipt

WO#: 60181498

60181498

Optional
Proj Due Date:
Proj Name:

Client Name: DRC

Courier: Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ Other ☒ VIA

Tracking #: _____ Pace Shipping Label Used? Yes ☐ No ☒

Custody Seal on Cooler/Box Present: Yes ☒ No ☐ Seals intact: Yes ☒ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☒ 2P/C

Thermometer Used: T-239 / T-194 **Type of Ice:** Wet Blue None ☐ Samples received on ice, cooling process has begun.
(circle one)

Cooler Temperature: 3.2/3.2

Temperature should be above freezing to 6°C

Date and initials of person examining contents: PV 10/30/14

Chain of Custody present:	☒Yes ☐No ☐N/A	1.	pv10/30/14
Chain of Custody filled out:	☒Yes ☐No ☐N/A	2.	received one ~~unp~~ unpreserved
Chain of Custody relinquished:	☒Yes ☐No ☐N/A	3.	for 21693 and 21694
Sampler name & signature on COC:	☒Yes ☐No ☐N/A	4.	
Samples arrived within holding time:	☒Yes ☐No ☐N/A	5.	
Short Hold Time analyses (<72hr):	☒Yes ☐No ☐N/A	6.	S.S
Rush Turn Around Time requested:	☐Yes ☒No ☐N/A	7.	
Sufficient volume:	☒Yes ☐No ☐N/A	8.	
Correct containers used:	☒Yes ☐No ☐N/A		
Pace containers used:	☒Yes ☐No ☐N/A	9.	
Containers intact:	☒Yes ☐No ☐N/A	10.	
Unpreserved 5035A soils frozen w/in 48hrs?	☐Yes ☐No ☒N/A	11.	
Filtered volume received for dissolved tests?	☐Yes ☐No ☒N/A	12.	
Sample labels match COC:	☒Yes ☐No ☐N/A		
Includes date/time/ID/analyses Matrix:	WT	13.	
All containers needing preservation have been checked.	☒Yes ☐No ☐N/A		
All containers needing preservation are found to be in compliance with EPA recommendation.	☒Yes ☐No ☐N/A	14.	
Exceptions: VOA, coliform, TOC, O&G, WI-DRO (water), Phenolics	☐Yes ☒No	Initial when completed	Lot # of added preservative
Trip Blank present:	☐Yes ☐No ☒N/A		
Pace Trip Blank lot # (if purchased): _____		15.	
Headspace in VOA vials (>6mm):	☐Yes ☐No ☒N/A	16.	
Project sampled in USDA Regulated Area:	☐Yes ☐No ☒N/A	17. List State:	

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: Jami Church Date: 10/30/14

F-KS-C-003-Rev.7, 04December2012

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

THE DOE RUN COMPANY

Section A Required Client Information:

Company: The Doe Run Company
Address: PO Box 500
Email To: asanders@doerun.com
Phone: (573) 689-4535 Fax: (573) 244-8179
Requested Due Date/TAT: 5 To 7 Days

Section B Required Project Information:

Report To: Amy Sanders
Copy To:
Purchase Order No.: 11200-13795
Project Name: NPDES (Leadwood)
Project Number:

Section C Invoice Information:

Attention: Cliff Asberry
Company Name: The Doe Run Company
Address: PO Box 500 Viburnum MO 6556
Pace Quote Reference:
Pace Project Manager:
Pace Profile #:

REGULATORY AGENCY: ☐ NPDES ☐ GROUND WATER ☐ UST ☐ RCRA

Site Location STATE: MO

Page: 1 of 1

COC#: 957 (6158498)

Section C Required Sample Information

Valid Matrix Codes: MATRIX (WATER, WASTE WATER, SOIL/SOLID) CODE (WT, WW, SL)

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N): N N N N N N N N N N N N N N N N

*See Additional Comments Below

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COMPOSITE START DATE (mm/dd/yy)	COMPOSITE START TIME (Military)	COMPOSITE END / GRAB DATE (mm/dd/yy)	COMPOSITE END / GRAB TIME (Military)	SAMPLE TEMP AT COLLECTION	Total # OF CONTAINERS	250 mL Unpreserved	500 mL Unpreserved	1 L Unpreserved	250 mL Nitric	250 mL Amber Glass H_2SO_4	250 mL Plastic H_2SO_4	1000 mL Amber HCL	250 mL ZnAc/NaOH	500 mL Amber Glass H_2SO_4	Analysis Test	SEMO Lab Project No./ Lab I.D.	
1	21693 1BP3N2-0 1BP2U	WT	G			10/29/14	1202		3	2			1						CD-D, PB-D, ZN-D, HARD, SO4, CD-T, PB-T, TSS-T, ZN-T	adwood Downstrea	W1
2																					
3	21694 ↓ ↓	WT	G			10/29/14	1212		3	2			1						CD-D, PB-D, ZN-D, HARD, SO4, CD-T, PB-T, TSS-T, ZN-T	adwood Upstream	02
4																					
5	21695 ↓ ↓ 1BP1U	WW	G			10/29/14	1233		3	1		1	1						SO4, SS, TSS, CD-T, PB-T, ZN-T	Leadwood 001	03
6																					
7	21696 ↓ ↓ ↓	WW	G			10/29/14	1223		3	1		1	1						SO4, SS, TSS, CD-T, PB-T, ZN-T	Leadwood 002	04
8																					
9																					
10																					
11																					
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ADDITIONAL COMMENTS
*200.7 Total Recoverable and Dissolved Metals

RELINQUISHED BY / AFFILIATION	DATE	TIME (Military)	ACCEPTED BY / AFFILIATION	DATE	TIME (Military)
Amy Sanders	10/29/14	1530	PHI/PACE	10/30/14	0615

SAMPLE CONDITIONS

Temp in °C	pH in SU	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)
3.2		Y	X
3.2		Y	Y

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: Amy Sanders
SIGNATURE of SAMPLER: Amy Sanders DATE Signed (MM/DD/YY): 10/29/14

Monthly Ambient Air Monitoring Report

The Doe Run Company
Old Lead Belt Sites:
Federal, Rivermines, National, and Leadwood

September-2014

THE DOE RUN COMPANY | 150 YEARS

SUITE 300
1801 PARK 270 DRIVE
ST. LOUIS, MO 63146

Federal Site

Sample Results for **September-2014**

	St. Joe (Ballfields)		Big River#4		Water Treatment Plant	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
9/2/14	22	0.007	14	0.007	27	0.042
9/3/14	26	0.007	20	0.014	19	0.007
9/4/14	31	0.007	25	0.014	27	0.007
9/5/14	17	0.007	19	0.007	17	0.035
9/8/14	27	0.007	20	0.007	16	0.007
9/9/14	40	0.021	28	0.007	29	0.007
9/10/14	11	0.000	7	0.000	11	0.000
9/11/14	8	0.007	7	0.007	5	0.000
9/12/14	7	0.007	6	0.000	7	0.007
9/15/14	15	0.007	10	0.007	9	0.014
9/16/14	17	0.007	15	0.007	12	0.007
9/17/14	16	0.007	13	0.007	8	0.007
9/18/14	22	0.007	20	0.007	16	0.014
9/19/14	23	0.007	17	0.007	17	0.021
9/22/14	21	0.014	20	0.013	19	0.020
9/23/14	18	0.014	21	0.013	24	0.068
9/24/14	21	0.007	24	0.027	17	0.014
9/25/14	28	0.014	26	0.014	25	0.014
9/26/14	28	0.007	34	0.013	29	0.007
9/29/14	28	0.014	37	0.020	33	0.021
9/30/14	27	0.014	32	0.088	36	0.049

Monthly Avg. TSP	22	20	19
Monthly Avg. Pb	0.009	0.013	0.017
Aug-14	0.014	0.019	0.024
Jul-14	0.015	0.023	0.028
Rolling 3-Month	**0.012**	**0.019**	**0.023**

Three month rolling average must be less than 0.15 ug/m3

NOTES:

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007
9/4/14	25	0.021
9/9/14	30	0.007
9/11/14	6	0.007
9/16/14	14	0.007
9/18/14	18	0.007
9/23/14	22	0.014
9/25/14	28	0.014
9/30/14	32	0.021

National Site

Sample Results for **September-2014**

Sample Date	Big River #4 **PM10** (ug/m3)	Ozark #1 **PM10** (ug/m3)	Soccer Park #2 **PM10** (ug/m3)	Water Treatment **PM10** (ug/m3)
9/2/14	16	9	13	15
9/5/14	18	19	17	18
9/8/14	21	14	25	22
9/11/14	6	3	4	9
9/14/14	9	4	5	11
9/17/14	19	13	14	15
9/20/14	15	10	15	14
9/23/14	10	8	14	13
9/26/14	23	21	24	25
9/29/14	23	24	24	28

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	16	12	16	17

NOTES:

Sample Date	Big River QA **PM10** (ug/m3)
9/2/14	15
9/8/14	9
9/14/14	6
9/20/14	15
9/26/14	16

Rivermines

Sample Results for **September-2014**

Sample Date	Big River #4 **PM10** (ug/m3)	Rivermines South #1 **PM10** (ug/m3)	Rivermines North #2 **PM10** (ug/m3)	Rivermines East #3 **PM10** (ug/m3)
9/2/14	16	11	15	15
9/5/14	18	13	9	18
9/8/14	21	17	20	22
9/11/14	6	32	invalid	9
9/14/14	9	10	5	11
9/17/14	19	12	15	15
9/20/14	15	15	14	14
9/23/14	10	14	12	13
9/26/14	23	23	17	25
9/29/14	23	25	30	28

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	16	17	15	17

NOTES: Rivermines North - 9/11: <23hr run time, vandalism, unplugged

Sample Date	Big River QA **PM10** (ug/m3)
9/2/14	15
9/8/14	9
9/14/14	6
9/20/14	15
9/26/14	16

Federal Site

Sample Results for **September-2014**

Sample Date	St. Joe (Ballfields) **PM10** (ug/m3)	Big River#4 **PM10** (ug/m3)	Water Treatment **PM10** (ug/m3)
9/2/14	14	16	15
9/5/14	20	18	18
9/8/14	19	21	22
9/11/14	3	6	9
9/14/14	6	9	11
9/17/14	15	19	15
9/20/14	15	15	14
9/23/14	12	10	13
9/26/14	21	23	25
9/29/14	24	23	28

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	15	16	17

NOTES:

Sample Date	Big River QA **PM10** (ug/m3)
9/2/14	15
9/8/14	9
9/14/14	6
9/20/14	15
9/26/14	16

Leadwood

Sample Results for **September-2014**

	Big River #4		Leadwood South #1		Leadwood East #2		Leadwood North #3	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007	14	0.007	12	0.007	10	0.000
9/3/14	20	0.014	invalid	invalid	27	0.034	16	0.014
9/4/14	25	0.014	29	0.007	78	0.055	24	0.000
9/5/14	19	0.007	20	0.007	21	0.007	15	0.000
9/8/14	20	0.007	29	0.007	28	0.027	18	0.007
9/9/14	28	0.007	37	0.007	83	0.061	25	0.000
9/10/14	7	0.000	17	0.000	12	0.000	15	0.000
9/11/14	7	0.007	5	0.007	3	0.000	4	0.000
9/12/14	6	0.000	4	0.007	2	0.000	5	0.000
9/15/14	10	0.007	15	0.014	27	0.014	9	0.007
9/16/14	15	0.007	20	0.013	25	0.020	11	0.007
9/17/14	13	0.007	15	0.013	14	0.007	10	0.007
9/18/14	20	0.007	23	0.014	24	0.014	24	0.007
9/19/14	17	0.007	21	0.013	20	0.013	14	0.007
9/22/14	20	0.013	28	0.026	29	0.020	15	0.007
9/23/14	21	0.013	24	0.013	34	0.047	19	0.014
9/24/14	24	0.027	71	0.047	45	0.089	10	0.014
9/25/14	26	0.014	54	0.040	35	0.020	19	0.007
9/26/14	34	0.013	45	0.020	40	0.013	32	0.007
9/29/14	37	0.020	116	0.068	55	0.021	27	0.014
9/30/14	32	0.088	60	0.054	63	0.082	22	0.007

Monthly Avg. TSP	20	32	32	16
Monthly Avg. Pb	0.013	0.019	0.026	0.006
Aug-14	0.019	0.020	0.026	0.004
Jul-14	0.023	0.025	0.028	0.004
Rolling 3-Month	**0.019**	**0.021**	**0.026**	**0.005**

Three month rolling average must be less than 0.15 ug/m3

NOTES: Leadwood South - 9/3: <23hr run time

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007
9/4/14	25	0.021
9/9/14	30	0.007
9/11/14	6	0.007
9/16/14	14	0.007
9/18/14	18	0.007
9/23/14	22	0.014
9/25/14	28	0.014
9/30/14	32	0.021

National Site

Sample Results for **September-2014**

	Big River #4		Ozark #1		Soccer Park #2		Water Treatment Plant	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007	23	0.007	15	0.007	27	0.042
9/3/14	20	0.014	24	0.007	25	0.014	19	0.007
9/4/14	25	0.014	38	0.021	29	0.014	27	0.007
9/5/14	19	0.007	14	0.007	16	0.007	17	0.035
9/8/14	20	0.007	20	0.007	32	0.021	16	0.007
9/9/14	28	0.007	34	0.007	103	0.035	29	0.007
9/10/14	7	0.000	10	0.000	12	0.007	11	0.000
9/11/14	7	0.007	4	0.000	4	0.000	5	0.000
9/12/14	6	0.000	2	0.000	4	0.007	7	0.007
9/15/14	10	0.007	11	0.007	9	0.007	9	0.014
9/16/14	15	0.007	13	0.007	14	0.007	12	0.007
9/17/14	13	0.007	10	0.007	24	0.021	8	0.007
9/18/14	20	0.007	17	0.007	25	0.021	16	0.014
9/19/14	17	0.007	20	0.014	25	0.021	17	0.021
9/22/14	20	0.013	25	0.014	23	0.020	19	0.020
9/23/14	21	0.013	28	0.020	28	0.034	24	0.068
9/24/14	24	0.027	43	0.014	24	0.014	17	0.014
9/25/14	26	0.014	35	0.014	38	0.027	25	0.014
9/26/14	34	0.013	31	0.007	47	0.014	29	0.007
9/29/14	37	0.020	41	0.021	39	0.021	33	0.021
9/30/14	32	0.088	21	0.007	36	0.021	36	0.049

Monthly Avg. TSP	20	22	27	19
Monthly Avg. Pb	0.013	0.009	0.016	0.017
Aug-14	0.019	0.012	0.015	0.024
Jul-14	0.023	0.009	0.014	0.028
Rolling 3-Month	**0.019**	**0.010**	**0.015**	**0.023**

Three month rolling average must be less than 0.15 ug/m3

NOTES:

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007
9/4/14	25	0.021
9/9/14	30	0.007
9/11/14	6	0.007
9/16/14	14	0.007
9/18/14	18	0.007
9/23/14	22	0.014
9/25/14	28	0.014
9/30/14	32	0.021

Rivermines

Sample Results for **September-2014**

	Big River #4		Rivermines South #1		Rivermines North #2		Rivermines East #3	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007	18	0.048	13	0.014	27	0.042
9/3/14	20	0.014	16	0.007	27	0.105	19	0.007
9/4/14	25	0.014	22	0.007	23	0.042	27	0.007
9/5/14	19	0.007	invalid	invalid	15	0.014	17	0.035
9/8/14	20	0.007	21	0.007	15	0.007	16	0.007
9/9/14	28	0.007	24	0.007	29	0.042	29	0.007
9/10/14	7	0.000	47	0.222	10	0.007	11	0.000
9/11/14	7	0.007	13	0.074	23	0.000	5	0.000
9/12/14	6	0.000	4	0.013	2	0.000	7	0.007
9/15/14	10	0.007	10	0.020	13	0.028	9	0.014
9/16/14	15	0.007	19	0.027	14	0.007	12	0.007
9/17/14	13	0.007	8	0.007	11	0.007	8	0.007
9/18/14	20	0.007	25	0.020	19	0.035	16	0.014
9/19/14	17	0.007	15	0.020	16	0.021	17	0.021
9/22/14	20	0.013	36	0.099	16	0.014	19	0.020
9/23/14	21	0.013	58	0.215	24	0.109	24	0.068
9/24/14	24	0.027	22	0.040	21	0.048	17	0.014
9/25/14	26	0.014	28	0.027	26	0.028	25	0.014
9/26/14	34	0.013	34	0.019	29	0.007	29	0.007
9/29/14	37	0.020	44	0.102	47	0.112	33	0.021
9/30/14	32	0.088	39	0.047	30	0.021	36	0.049

Monthly Avg. TSP	20	25	20	19
Monthly Avg. Pb	0.013	0.051	0.032	0.017
Aug-14	0.019	0.087	0.043	0.024
Jul-14	0.023	0.112	0.029	0.028
Rolling 3-Month	**0.019**	**0.083**	**0.035**	**0.023**

Three month rolling average must be less than 0.15 ug/m3

NOTES: Rivermines South - 9/5: <23hr run time

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
9/2/14	14	0.007
9/4/14	25	0.021
9/9/14	30	0.007
9/11/14	6	0.007
9/16/14	14	0.007
9/18/14	18	0.007
9/23/14	22	0.014
9/25/14	28	0.014
9/30/14	32	0.021

Leadwood

Sample Results for **September-2014**

Sample Date	Big River #4 **PM10** (ug/m3)	Leadwood South #1 **PM10** (ug/m3)	Leadwood East #2 **PM10** (ug/m3)	Leadwood North #3 **PM10** (ug/m3)
9/2/14	16	12	13	12
9/5/14	18	13	13	10
9/8/14	21	19	33	15
9/11/14	6	3	8	3
9/14/14	9	9	8	9
9/17/14	19	17	17	10
9/20/14	15	17	16	11
9/23/14	10	13	17	15
9/26/14	23	24	22	20
9/29/14	23	28	30	20

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	16	15	18	12

NOTES:

Sample Date	Big River QA **PM10** (ug/m3)
9/2/14	15
9/8/14	9
9/14/14	6
9/20/14	15
9/26/14	16

Meterological Data - Old Lead Belt
September-2014

24hr average

Date	Wind Speed (MPH)	Wind Direction	Sigma-Theta	Temperature (C)	Air Pressure (mmHg)	Rain (Inches)	Power Supply (Volts)
01-Sep-14	4.723	207.7	26.55	25.17	742	0.03	13.2
02-Sep-14	2.024	249.5	35.52	22.88	744	0.16	13.22
03-Sep-14	2.703	189.4	33.28	23.93	745	0.01	13.21
04-Sep-14	3.759	202	30.01	27.56	744	0.25	13.16
05-Sep-14	2.674	211.8	39.36	26.75	746	1.7	13.16
06-Sep-14	4.098	336.6	22.33	18.08	748	0	13.26
07-Sep-14	2.16	88.8	25.94	17.22	749	0	13.28
08-Sep-14	2.369	161.7	31.16	20.25	746	0	13.26
09-Sep-14	4.099	174.5	26.81	24.89	743	0	13.22
10-Sep-14	6.19	215.5	24.02	25.5	739	0.26	13.21
11-Sep-14	5.303	0.892	23.12	16	747	0.03	13.31
12-Sep-14	4.799	0.839	22.86	12.06	750	0.01	13.4
13-Sep-14	4.184	12.75	27.79	11.35	753	0	13.37
14-Sep-14	1.315	173.1	41.59	13.26	750	0	13.36
15-Sep-14	3.206	289.5	32.19	18.84	747	0.03	13.3
16-Sep-14	2.734	31.6	29.44	16.17	749	0	13.31
17-Sep-14	2.407	152.9	32.22	13.91	745	0.02	13.38
18-Sep-14	2.005	64.58	31.44	17.93	745	0	13.3
19-Sep-14	1.846	160.1	27.59	18.23	745	0	13.29
20-Sep-14	1.933	221.6	26.49	21.94	745	0	13.25
21-Sep-14	4.462	319.8	25.69	20.5	745	0	13.23
22-Sep-14	2.194	192.5	27.95	14.51	751	0	13.31
23-Sep-14	1.825	152.9	31.56	14.21	751	0	13.33
24-Sep-14	1.985	156.2	31.16	16.33	750	0	13.32
25-Sep-14	1.502	204.2	32.87	19.59	749	0	13.26
26-Sep-14	1.743	165.5	32.26	19.91	749	0	13.25
27-Sep-14	1.825	166	27.23	19.41	748	0	13.27
28-Sep-14	1.83	209.3	30.32	19.46	747	0	13.26
29-Sep-14	2.014	218.1	30.7	19.75	745	0	13.25
30-Sep-14	1.615	199.6	33.15	19.75	743	0	13.25

INQUEST
ENVIRONMENTAL INC.

3609 Mojave Ct., Ste E ◆ COLUMBIA, MO 65202
(573) 474-8110 ◆ FAX: (573) 474-8371

July 21, 2014

Mr. Greg Henson
Chemist
The Doe Run Company
881 Main Street
Herculaneum, MO 63048

RE: 3rd Quarter 2014 Park Hills Network Lead/PM10 Samplers Flow Rate Verifications Performance Audit Report.

Dear Mr. Henson,

Please find enclosed the worksheets detailing the Lead/PM10 sampler's one-point flow verifications that were recently performed on the Doe Run Park Hills Monitoring Network. A copy of the current certification for the audit device that was used has also been enclosed.

All of the flow rate verification checks of the samplers were found to be within guidelines.

After reviewing the enclosed information, please feel free to call with any comments or questions. Thank you for your business.

Sincerely,

John A. Kunkel
Inquest Environmental, Inc.

PM10 Sampler Flow Rate Verifications

INQUEST
Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 Primary PM10	Temperature	20.0 °C 293.2 °K
Flow Controller	P2952	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.072	24.50	45.76	0.940	1.128	**5.22**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.20	45.20	0.941	1.129	1.070	**-5.31**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 QA PM10	Temperature	20.0 °C 293.2 °K
Flow Controller	P1019	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.30	1.089	25.20	47.06	0.938	1.139	**4.59**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
25.10	46.88	0.939	1.140	1.088	**-3.72**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	National - Ozark Insulation	Intercept (Qa)	-0.00227
Sampler	#1 PM10	Temperature	20.3 °C 293.5 °K
Flow Controller	P2950	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.073	24.00	44.82	0.941	1.127	**5.03**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.30	45.38	0.941	1.127	1.070	**-5.31**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	St Joe Park	Intercept (Qa)	-0.00227
Sampler	#4 PM10	Temperature	21.4 °C 294.6 °K
Flow Controller	P4353	Station Pressure	30.10 "Hg 764.5 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.075	24.50	45.76	0.940	1.120	**4.19**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.30	45.38	0.941	1.121	1.074	**-4.96**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	National - Crane Street	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	21.4 °C 294.6 °K
Flow Controller	P2949	Station Pressure	30.10 "Hg 764.5 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.075	24.00	44.82	0.941	1.128	**4.93**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.10	45.01	0.941	1.128	1.072	**-5.13**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Water Plant	Intercept (Qa)	-0.00227
Sampler	#3 PM10	Temperature	21.8 °C 295.0 °K
Flow Controller	P2951	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.076	23.70	44.26	0.942	1.135	**5.48**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.90	44.64	0.942	1.135	1.073	**-5.04**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Quarry	Intercept (Qa)	-0.00227
Sampler	#1 PM10	Temperature	21.8 °C 295.0 °K
Flow Controller	P4601	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.10	1.059	25.40	47.44	0.938	1.102	**4.06**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
25.30	47.25	0.938	1.102	1.057	**-6.46**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Wood Street	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	21.8 °C 295.0 °K
Flow Controller	P4507	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.076	25.30	47.25	0.938	1.122	**4.28**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
25.00	46.69	0.939	1.123	1.075	**-4.87**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood Mill Street	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	27.4 °C 300.6 °K
Flow Controller	P1018	Station Pressure	30.07 "Hg 763.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.40	1.120	24.00	44.82	0.941	1.157	**3.30**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.10	45.01	0.941	1.157	1.119	**-0.97**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood School	Intercept (Qa)	-0.00227
Sampler	#3 PM10	Temperature	27.4 °C 300.6 °K
Flow Controller	P6071	Station Pressure	30.07 "Hg 763.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.40	1.120	24.40	45.57	0.940	1.166	**4.11**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.40	45.57	0.940	1.166	1.118	**-1.06**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood South	Intercept (Qa)	-0.00227
Sampler	#1 PM10	Temperature	25.5 °C 298.7 °K
Flow Controller	P1500	Station Pressure	30.07 "Hg 763.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.164	23.10	43.14	0.944	1.156	**-0.69**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.00	42.96	0.944	1.156	1.164	**3.01**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Lead/TSP Sampler's Flow Rate Verifications

INQUEST
Environmental, Inc.

Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 Primary TSP	Temperature	20.0 °C 293.2 °K
Flow Controller	P4557	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.80	1.168	23.20	43.35	0.943	1.225	**4.88**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.40	43.72	0.943	1.225	**1.165**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Environmental, Inc.

Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 QA TSP	Temperature	20.0 °C 293.2 °K
Flow Controller	P4558	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.75	1.161	22.00	41.10	0.946	1.222	**5.25**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.20	41.48	0.946	1.222	**1.158**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	National Ozark Insulation	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	20.3 °C 293.5 °K
Flow Controller	P2939	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
4.00	1.199	22.50	42.04	0.945	1.224	**2.09**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.50	42.04	0.945	1.224	**1.198**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

INQUEST
Environmental, Inc.

Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	St Joe Park	Intercept (Qa)	-0.00227
Sampler	#4 TSP	Temperature	21.4 °C 294.6 °K
Flow Controller	P6792	Station Pressure	30.10 "Hg 764.5 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.156	22.80	42.60	0.944	1.222	**5.71**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.20	41.48	0.946	1.225	**1.155**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	National Crane Street	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	21.4 °C / 294.6 °K
Flow Controller	P4474	Station Pressure	30.10 "Hg / 764.5 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.156	23.20	43.35	0.943	1.211	**4.76**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.10	43.16	0.944	1.212	**1.154**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Columbia, Missouri 65202
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Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Water Plant	Intercept (Qa)	-0.00227
Sampler	#3 TSP	Temperature	21.8 °C 295.0 °K
Flow Controller	P4475	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.90	1.188	22.10	41.29	0.946	1.221	**2.78**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.40	41.85	0.945	1.220	**1.186**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Quarry	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	21.8 °C 295.0 °K
Flow Controller	P2940	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.65	1.149	23.50	43.91	0.943	1.222	**6.35**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.60	44.09	0.942	1.221	**1.143**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Columbia, Missouri 65202
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Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Wood Street	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	21.8 °C 295.0 °K
Flow Controller	P2941	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.157	22.90	42.78	0.944	1.226	**5.96**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.90	42.78	0.944	1.226	**1.153**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Volumetric Flow Control

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Columbia, Missouri 65202
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Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood Mill Street	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	27.4 °C 300.6 °K
Flow Controller	P4476	Station Pressure	30.07 "Hg 763.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.80	1.184	22.10	41.29	0.946	1.233	**4.14**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.40	41.85	0.945	1.232	**1.181**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood School	Intercept (Qa)	-0.00227
Sampler	#3 TSP	Temperature	27.4 °C 300.6 °K
Flow Controller	P6793	Station Pressure	30.07 "Hg 763.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.168	22.60	42.22	0.945	1.230	**5.31**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.70	42.41	0.944	1.228	**1.163**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Volumetric Flow Control

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Date	July 16, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood South	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	25.5 °C 298.7 °K
Flow Controller	P4559	Station Pressure	30.07 "Hg 763.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.164	23.10	43.16	0.943	1.242	**6.70**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.00	42.97	0.944	1.244	**1.161**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Calibration Orifice Certification Worksheet

TISCH Environmental

TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVES, OH
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ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Jan 09, 2014 Rootsmeter S/N 0438320 Ta (K) - 292
Operator Tisch Orifice I.D. - 1882 Pa (mm) - 759.46

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3530	4.1	1.50
2	NA	NA	1.00	1.0430	6.8	2.50
3	NA	NA	1.00	0.9510	8.1	3.00
4	NA	NA	1.00	0.8790	9.5	3.50
5	NA	NA	1.00	0.6660	16.3	6.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
1.0143	0.7496	1.2368		0.9945	0.7350	0.7594
1.0106	0.9690	1.5967		0.9910	0.9501	0.9804
1.0089	1.0608	1.7491		0.9893	1.0402	1.0740
1.0070	1.1456	1.8893		0.9874	1.1233	1.1600
0.9978	1.4983	2.4736		0.9784	1.4691	1.5188

Qstd slope (m) = 1.65282
intercept (b) = -0.00370
coefficient (r) = 0.99999

y axis = SQRT[H2O(Pa/760)(298/Ta)]

Qa slope (m) = 1.03497
intercept (b) = -0.00227
coefficient (r) = 0.99999

y axis = SQRT[H2O(Ta/Pa)]

CALCULATIONS

Vstd = Diff. Vol[(Pa-Diff. Hg)/760](298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{[SQRT(H2O(Pa/760)(298/Ta))]- b}
Qa = 1/m{[SQRT H2O(Ta/Pa)]- b}