Annual PM_{10} Monitoring Data Report

For

Norfolk Southern's Coal Pier –

Lamberts Point, Norfolk, Virginia

Reporting Period: August 1, 2015 – July 31, 2016

Simpson Weather Associates, Inc.

Environment and Energy Division

908 E. Jefferson Street

Charlottesville, Virginia 22902

October 11, 2016

Background

Per a voluntary agreement between Norfolk Southern Railway Company (NS) and the Virginia Department of Environmental Quality (VADEQ), Simpson Weather Associates (SWA) was contracted by NS to operate and analyze the results from PM_{10} samplers located in Lamberts Point, Norfolk, VA. This annual data report provides the results covering a 12-month period, August 1, 2015 through July 31, 2016.

Monitoring Data Discussion

PM_{10} was measured using a Tisch Environmental Model TE-7060V high volume air sampler. Following the EPA's prescribed PM_{10} annual monitoring schedule, samples were collected once every six days, with the sampler running for a 24-hour period, 12 AM – 12 AM, Standard Time. Beginning in May 2016, the sampling frequency was increased to once every three days. Each pre-weighed filter was placed in the sampler, exposed for 24 hours, and retrieved after completion of the sampling period. Upon retrieval, the samples are weighed and the PM_{10} concentration was calculated at the SWA laboratory located in Charlottesville, Virginia.

Figure 1 below shows a summary of the data analysis during a 12-month monitoring period, August 1, 2015 – July 31, 2016. The maximum concentrations reported at NSPM ADMIN and NSPM HRSD sites during this period were 31.29 and 37.31 µg/m^3, respectively, which is well below the 24-hour National Ambient Air Quality Standard (NAAQS) of 150 µg/m^3. Details of each sampling occasion can be found in the filter reports provided in Appendix I.

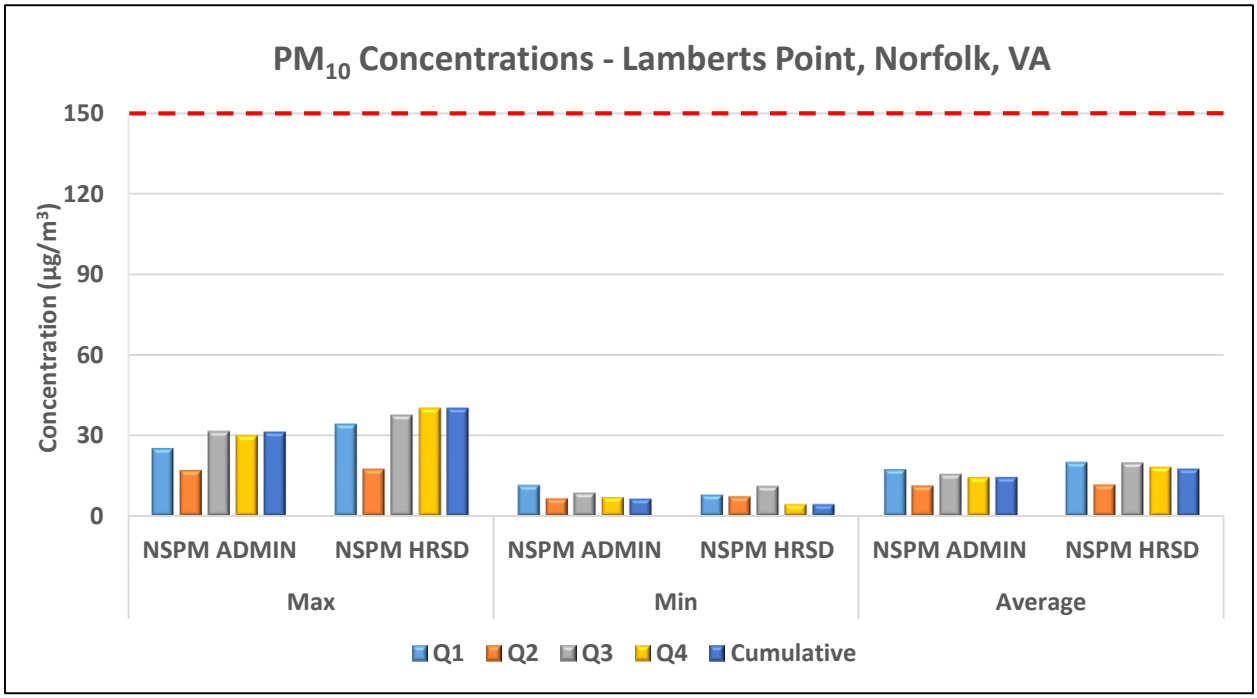

Figure 1: PM_{10} concentrations calculated for two monitoring sites at Lamberts Point, Norfolk, VA. Maximum, minimum, and average concentrations for Q1 (08/01 – 10/31/2015), Q2 (11/01/2015 – 01/31/2016), Q3 (02/01/2016 – 04/30/2016), Q4 (05/01/2016 – 07/31/2016), and the cumulative averages shown. Red line indicates the 24-hour NAAQS, 150 µg/m^3.

The average concentrations since the monitoring program began on August 1, 2015 are 14.46 and 17.58 µg/m^3, for NSPM ADMIN and NSPM HRSD, respectively. The concentrations reported for NSPM HRSD site is slightly higher than that for NSPM ADMIN site, which may be due to the construction activities in the immediate vicinity to the monitor. However, even with the potentially adverse effect of the construction activities at NSPM HRSD site, values reported for both sites are still well below the NAAQS. We note that the average concentrations for the second quarter (11.21 and 11.54 µg/m^3, NSPM ADMIN and NSPM HRSD, respectively) during the winter months are lower than the other three monitoring quarters. This observation is consistent with the expectation that lower specific humidity during the winter months inhibit the accumulation of fine particles to become sized up above the threshold to be collected as PM_{10}.

Precision Measurements

In recognition of the required precision assessments of the PM_{10} samplers, a collocated sampler (A Tisch Model TE-6070V unit) was installed at NSPM HRSD site on April 29, 2016. The collocated sampler is located approximately 8 feet apart from the primary sampler used for reporting purposes, in compliance with the siting requirement given in 40 CFR Part 58 Appendix A Subsection 3.2.5.6. The precision measurements were initiated in May 2016, operating on a 1 in 3 days sampling schedule (for all samplers) following the EPA's designated monitoring schedule.

Table 1 shows calculated concentrations for the primary and collocated samplers at NSPM HRSD site since the initiation of precision test on May 3, 2016, through August 10, 2016, collecting every 3 days. Based on the proposed duration of the monitoring program (18 months), it was suggested that the precision test requires a total of 30 collected pairs regardless of the values, and that the CV is calculated only using the pairs where both concentration values are greater than the minimum of 15 µg/m^3. During the time period May 3, 2016 – August 10, 2016, 16 valid pairs were identified among a total of 32 collected pairs. The calculated CV, using the equations specified in 40 CFR Part 58 § 4.2 is **5.48%,** which satisfies the conditions for precision via duplicate measurements, CV < 10%. While the measurements for precision estimate is still currently ongoing, the results shown here indicate that the precision sample requirements have been met. SWA advises that, upon approval by VADEQ, the sampling frequency returns to the originally proposed 1 in 6-day scheduling coinciding with the EPA prescribed PM_{10} monitoring schedule.

	PM_{10} Concentration ($\mu g/m^3$)		
Exposure Date	**HRSD Primary**	**HRSD Collocated**	
5/3/2016	13.45	12.46	
5/6/2016	4.54	7.54	
5/9/2016	28.61	N/A**	
5/12/2016	15.05	13.98	
5/15/2016	12.64	11.37	
5/18/2016	10.48	10.41	
5/21/2016	7.78	8.20	
5/24/2016	18.66	17.94	valid
5/27/2016	25.89	22.85	valid
5/30/2016	9.84	9.68	
6/2/2016	11.12	10.33	
6/5/2016	22.88	20.87	valid
6/8/2016	18.31	14.48	
6/11/2016	31.32	30.51	valid
6/14/2016	20.93	19.10	valid
6/17/2016	12.69	12.01	
6/20/2016	19.41	18.79	valid
6/23/2016	21.09	19.60	valid
6/26/2016	12.45	12.77	
6/29/2016	14.73	14.22	
7/2/2016	13.26	12.84	
7/5/2016	18.97	17.97	valid
7/8/2016	15.20	14.59	
7/11/2016	17.21	16.42	valid
7/14/2016	40.21	38.00	valid
7/17/2016	10.71	10.89	
7/20/2016	28.01	21.88	valid
7/23/2016	23.83	21.45	valid
7/26/2016	35.85	33.16	valid
7/29/2016	16.01	15.82	valid
8/4/2016	18.55	15.84	valid
8/7/2016	15.64	14.79	
8/10/2016	22.29	19.80	valid

Table 1: PM_{10} concentrations calculated from samples collected using Primary and Collocated sampler at NSPM HRSD site for precision test, May 3, 2016 – August 10, 2016. Green highlights indicate valid pairs where both concentration values are greater than 15 $\mu g/m^3$.

**** Invalid data entry – untraceable pre-weight of the deployed filter**

Performance, System, and Laboratory Audit Reports

In compliance with QAPP A6.4 and A9.1, quarterly calibrations of the samplers were performed by trained SWA field personnel, each calibration preceded by routine swapping of the unit's motor. Calibration results provided in Appendix II show that both NSPM-Admin and NSPM-HRSD Primary units are operating within their designed flow rate. The operational integrity of the samplers was further validated by a performance audit conducted by Environmental Standards, Inc. (Environmental Standards) on June 9, 2016. The collocated sampler at NSPM HRSD site was initially calibrated upon installation on April 30, 2016. The performance audit found that the collocated sampler was operating within tolerance for the audit, but suggested that it may be approaching the need for service. On July 1, 2016, a replacement unit was installed and verified to be operating optimally. This unit continues to operate to date.

In addition to a performance audit, Environmental Standards also conducted systems and laboratory audits of SWA's operation for the program on June 9, 2016. A summary of audit findings is provided in Appendix III. Upon receiving the audit results on August 16, 2016, SWA has implemented necessary corrective actions, outlined in Appendix IV, with assistance from Environmental Standards.

While most of the findings were minor and non-serious in nature, adjustments made to the reported local pressure and samplers' run times resulted in small changes to the reported PM_{10} concentration values. The resulting changes in PM_{10} concentrations were inconsequential to overall representation of concentration levels at both NSPM ADMIN and NSPM HRSD sites. The details of these adjustments are provided in Appendix IV, and the values in Filter Reports presented in Appendix I of this report reflects all relevant adjustments made following the June 9th systems audit.

Appendix I: Filter Reports, August 1, 2015 – July 31, 2016

Filters Report

NSPM-ADMIN

8/1/2015 To 07/31/2016

Date	Filter #	Run Time (min)	Pre Wt (g)	Post Wt (g)	Difference (g)	Flow Rate (ft^3/min)	Conc. (µg/m3)	Temp (ºF)	Pressure (in Hg)	Precip (in)	Comments
8/10/2015	2710	1425	4.2542	4.2745	0.0203	37.90	13.27	76.00	29.99	0.00	Wind 3 mph(SE)
8/16/2015	2717	1420	4.2517	4.2726	0.0209	38.16	13.62	75.00	30.14	0.00	Wind 3 mph(ESE)
8/22/2015	2718	1420	4.2586	4.2866	0.0280	37.77	18.43	79.00	30.04	0.00	Wind 10 mph(NNE)
8/28/2015	2723	1415	4.2196	4.2528	0.0332	38.17	21.70	75.00	30.15	0.00	Wind 7 mph(NE)
9/3/2015	2728	1425	4.2293	4.2673	0.0380	37.45	25.14	81.00	29.89	0.00	Wind 5 mph(WNW)
9/9/2015	2731	1430	4.2295	4.2470	0.0175	37.30	11.58	84.00	29.93	0.00	Wind 6 mph(SSW)
9/15/2015	2736	N/A	4.2440	4.2664	0.0224			Equipment malfunction - power issue			
9/21/2015	2741	1415	4.2567	4.2901	0.0334	38.32	21.75	76.00	30.32	0.00	Wind 12 mph(NE)
10/4/2015	2742	N/A	4.2343	4.2766	0.0423			Double run due to not being able to access the site			
10/15/2015	2749	1415	4.3684	4.3904	0.0220	38.99	14.08	61.00	30.03	0.00	Wind 7 mph(NNE)
10/21/2015	2752	1420	4.3705	4.3945	0.0240	39.36	15.16	61.00	30.32	0.00	Wind 4 mph(SSW)
10/27/2015	2756	1425	4.3664	4.3958	0.0294	39.30	18.54	62.00	30.33	0.06	Wind 13 mph(ENE)
11/2/2015	2758	1425	4.3808	4.4008	0.0200	38.88	12.75	63.00	30.06	0.74	Wind 6 mph (NE)
11/10/2015	2762	1425	4.3666	4.3793	0.0127	39.05	8.06	66.00	30.35	0.25	power outage on 11/8/15) -- Wind 7 mph (WSW)
11/14/2015	2763	1425	4.3549	4.3803	0.0254	40.09	15.70	49.00	30.21	0.00	Wind 6 mph (NW)
11/20/2015	2767	1420	4.3680	4.3833	0.0153	39.16	9.72	60.00	30.11	0.01	Wind 13 mph (N)
11/26/2015	2769	1425	4.3850	4.4029	0.0179	40.35	10.99	54.00	30.69	0.00	Wind 4 mph (NE)
12/2/2015	2772	1425	4.3730	4.3833	0.0103	38.79	6.58	61.00	29.88	0.01	Wind 10 mph (SSW)
12/8/2015	2774	1420	4.3565	4.3837	0.0272	40.18	16.83	46.00	30.11	0.00	Wind 4 mph (N)
12/14/2015	2776	1420	4.3849	4.4026	0.0177	38.15	11.54	69.00	29.81	0.01	Wind 14 mph (SSW)
12/20/2015	2778	1420	4.3712	4.3882	0.0170	41.19	10.26	40.00	30.52	0.00	Wind 4 mph (ESE)
12/26/2015	2781	1425	4.3723	4.3928	0.0205	39.17	12.97	63.00	30.28	0.00	Wind 6 mph (NNE)
1/1/2016	2782	1415	4.3536	4.3672	0.0136	39.87	8.51	50.00	30.10	0.00	wind 8 mph (N)
1/7/2016	2784	1425	4.3701	4.3916	0.0215	40.16	13.26	48.00	30.21	0.00	wind 12 mph (NNE)
1/13/2016	2786	1415	4.3685	4.3829	0.0144	41.08	8.75	34.00	30.10	0.00	wind 6 mph (W)
1/19/2016	2788	N/A	4.3693	4.3953	0.0260			Water on top of timer box spilled onto the filter and the water stain remained on the filter; not included in the analysis			
1/25/2016	2790	1440	4.3505	4.3718	0.0213	41.08	12.71	37.00	30.27	0.00	Wind 7 mph (SSW)
1/31/2016	2792	1425	4.3696	4.3848	0.0152	39.60	9.51	52.00	30.01	0.00	Wind 14 mph (SSW)

2/6/2016	2795	1425	4.3698	4.3894	0.0196	41.15	11.80	38.00	30.38	0.00	Wind 6 mph (NNE)
2/12/2016	2797	1425	4.3872	4.4018	0.0146	41.60	8.70	28.00	30.13	0.04	Wind 5 mph (NE)
2/18/2016	2800	1425	4.3789	4.4003	0.0214	41.13	12.89	39.00	30.42	0.00	Wind 14 mph (NNE)
2/24/2016	2802	1425	4.3999	4.4210	0.0211	38.75	13.49	58.00	29.69	0.72	Wind 17 mph (SSE)
3/1/2016	2804	1420	4.3755	4.4250	0.0495	39.33	31.29	55.00	29.97	0.00	Wind 10 mph (SSE)
3/7/2016	2807	1420	4.3783	4.3980	0.0197	40.16	12.20	49.00	30.26	0.00	Wind 10 mph (SW)
3/13/2016	2811	1415	4.3650	4.3854	0.0204	38.59	13.19	65.00	29.94	0.65	Wind 6 mph (SE)
3/19/2016	2812	1425	4.3776	4.4029	0.0253	39.80	15.75	49.00	29.99	0.08	Wind 16 mph (NE)
3/25/2016	2814	1430	4.3627	4.3885	0.0258	38.09	16.72	70.00	29.82	0.07	Wind 13 mph (SW)
3/31/2016	2816	1420	4.3906	4.4270	0.0364	38.69	23.39	65.00	30.02	0.00	Wind 16 mph (S)
4/6/2016	2818	1425	4.3666	4.3884	0.0218	40.29	13.41	47.00	30.25	0.00	Wind 10 mph (SSE)
4/12/2016	2820	1425	4.3918	4.4088	0.0170	39.28	10.73	58.00	30.09	0.42	Wind 12 mph (SW)
4/18/2016	2822	1415	4.3751	4.4085	0.0334	39.14	21.30	62.00	30.20	0.00	Wind 4 mph (SW)
4/24/2016	2826	1425	4.3759	4.3988	0.0229	39.37	14.41	56.00	30.05	0.00	Wind 11 mph (NE)
4/30/2016	2828	1425	4.3619	4.3856	0.0237	39.43	14.90	57.00	30.15	0.00	Wind 9 mph (NE)
5/3/2016	2850	1425	4.4062	4.4234	0.0172	40.66	10.48	69.00	29.77	0.28	Wind 8 mph (SW)
5/6/2016	2830	1425	4.3535	4.3650	0.0115	39.99	7.13	56.00	29.66	1.04	Wind 4 mph (W)
5/9/2016	2853	1420	4.4159	4.4460	0.0301	40.35	18.55	65.00	30.05	0.00	Wind 5 mph (ESE)
5/12/2016	2833	1425	4.3400	4.3600	0.0200	40.17	12.34	64.00	30.08	0.00	Wind 6 mph (NE)
5/15/2016	2856	1425	4.4133	4.4295	0.0162	40.16	10.00	60.00	29.96	0.00	Wind 10 mph (WNW)
5/18/2016	2836	1425	4.3770	4.3947	0.0177	40.08	10.95	60.00	30.05	0.01	Wind 12 mph (NE)
5/21/2016	2859	1420	4.4327	4.4466	0.0139	40.40	8.56	66.00	29.88	0.29	Wind 7 mph (N)
5/24/2016	2839	1415	4.3463	4.3723	0.0260	40.32	16.09	69.00	30.01	0.00	Wind 6 mph (WSW)
5/27/2016	2864	1420	4.3930	4.4223	0.0293	40.74	17.89	78.00	30.11	0.00	Wind 12 mph (SSW)
5/30/2016	2843	1420	4.3889	4.4026	0.0137	40.76	8.36	74.00	29.98	0.75	Wind 5 mph (SE)
6/2/2016	2865	1425	4.4189	4.4361	0.0172	40.62	10.49	73.00	30.03	0.00	Wind 7 mph (NE)
6/5/2016	2848	1420	4.3962	4.4167	0.0205	40.68	12.53	81.00	29.82	2.11	Wind 12 mph (SSW)
6/8/2016	2870	1420	4.4372	4.4621	0.0249	40.62	15.25	74.00	29.78	0.00	Wind 9 mph (NW)
6/11/2016	2878	1425	4.3927	4.4216	0.0289	40.86	17.53	79.00	30.01	0.00	Wind 11 mph (SW)
6/14/2016	2871	1415	4.4173	4.4446	0.0273	40.53	16.81	71.00	29.94	0.00	Wind 8 mph (ESE)
6/17/2016	2879	1425	4.4139	4.4347	0.0208	40.54	12.72	70.00	29.80	0.87	Wind 13 mph (NE)
6/20/2016	2904	1410	4.3826	4.4069	0.0243	40.69	14.96	76.00	30.16	0.00	Wind 8 mph (WSW)
6/23/2016	2884	1425	4.4215	4.4442	0.0227	41.17	13.66	81.00	29.92	0.53	Wind 10 mph (SW)
6/26/2016	2907	1410	4.3886	4.4073	0.0187	40.51	11.56	70.00	30.17	0.00	Wind 7 mph (ENE)
6/29/2016	2888	1425	4.4072	4.4333	0.0261	40.89	15.82	77.00	29.92	0.00	Wind 4 mph (NE)
7/2/2016	2910	975	4.3983	4.4212	0.0229			Equipment malfunction - power issue			

7/5/2016	2891	1410	4.4055	4.4318	0.0263	41.10	16.03	85.00	29.88	0.00	Wind 11 mph (WSW)
7/8/2016	2913	1410	4.3929	4.4174	0.0245	40.91	15.00	84.00	29.81	0.54	Wind 7 mph (W)
7/11/2016	2894	1410	4.4262	4.4566	0.0304	41.29	18.44	79.00	30.05	0.00	Wind 6 mph (ENE)
7/14/2016	2916	1410	4.3943	4.4435	0.0492	41.01	30.05	87.00	29.95	0.00	Wind 8 mph (SW)
7/17/2016	2897	1410	4.4198	4.4368	0.0170	41.71	10.21	82.00	30.14	0.04	Wind 5 mph (SW)
7/20/2016	2917	1410	4.3828	4.4052	0.0224	40.82	13.74	79.00	30.13	0.00	Wind 5 mph (ENE)
7/23/2016	2927	1420	4.4768	4.5067	0.0299	41.43	17.95	88.00	29.94	0.00	Wind 9 mph (SW)
7/26/2016	2951	1405	4.4785	4.5149	0.0364	40.70	22.48	87.00	29.93	0.00	Wind 9 mph (SW)
7/29/2016	2930	1410	4.4870	4.5145	0.0275	41.66	16.53	84.00	29.85	0.00	Wind 7 mph (NW)

Average Concentration : **14.46**

Maximum Concentration : **31.29**

Minimum Concentration : **6.58**

Laboratory Control Filters

	2722	1440	4.2576	4.2612	0.0036	40	2.207	N/A	N/A	N/A	
	2747	1440	4.3294	4.3297	0.0003	40	0.184	N/A	N/A	N/A	
	2773	1440	4.3560	4.3541	-0.0019	40	-1.165	N/A	N/A	N/A	
	2798	1440	4.3806	4.3814	0.0008	40	0.490	N/A	N/A	N/A	
	2824	1440	4.3660	4.3666	0.0006	40	0.368	N/A	N/A	N/A	
	2849	1440	4.3727	4.3770	0.0043	40	2.636	N/A	N/A	N/A	
	2874	1440	4.4298	4.4318	0.0020	40	1.226	N/A	N/A	N/A	
	2899	1440	4.4186	4.4206	0.0020	40	1.226	N/A	N/A	N/A	
	2924	1440	4.4123	4.4145	0.0022	40	1.349	N/A	N/A	N/A	

Field Blank Filters

11/14/2015	2764	1440	4.3512	4.3530	0.0018	40	1.104	N/A	N/A	N/A	Wind 6 mph (NW)
12/20/2015	2766	1440	4.3774	4.3785	0.0011	40	0.674	N/A	N/A	N/A	Wind 4 mph (ESE)
**1/31/2016	2794	1440	4.3737	4.3753	0.0016	40	0.981	N/A	N/A	N/A	Wind 14 mph (SSW)
3/1/2016	2806	1440	4.3709	4.3734	0.0025	40	1.533	N/A	N/A	N/A	Wind 10 mph (SSE)
3/19/2016	2810	1440	4.4075	4.4104	0.0029	40	1.778	N/A	N/A	N/A	Wind 16 mph (NE)
4/23/2016	2825	1440	4.3557	4.3624	0.0067	40	4.108	N/A	N/A	N/A	Wind 9 mph (NNW)
5/15/2016	2873	1440	4.4082	4.4135	0.0053	40	3.249	N/A	N/A	N/A	Wind 10 mph (WNW)
5/24/2016	2841	1440	4.3540	4.3615	0.0075	40	4.598	N/A	N/A	N/A	Wind 6 mph (WSW)
6/2/2016	2872	1440	4.4201	4.4256	0.0055	40	3.372	N/A	N/A	N/A	Wind 7 mph (NE)
6/11/2016	2877	1440	4.4043	4.4082	0.0039	40	2.391	N/A	N/A	N/A	Wind 11 mph (SW)
6/20/2016	2923	1440	4.4019	4.4058	0.0039	40	2.391	N/A	N/A	N/A	Wind 8 mph (WSW)
6/29/2016	2886	1440	4.4175	4.4201	0.0026	40	1.594	N/A	N/A	N/A	Wind 4 mph (NE)
7/8/2016	2922	1440	4.3882	4.3948	0.0066	40	4.046	N/A	N/A	N/A	Wind 7 mph (W)
7/17/2016	2898	1440	4.4143	4.4176	0.0033	40	2.023	N/A	N/A	N/A	Wind 5 mph (SW)

**Field Blank was exposed 1/25-1/31 due to snowstorm

Notes: Flow rates adjusted to Standard Atmosphere (760 mmHg and 25ºC)

Weather data obtained from KORF - Norfolk International Airport

Laboratory control filters are stored, exposed in the lab, and weighed only to monitor the conditions of the analytical environment, for the associated filter lot (box of 25)

Filters Report
NSPM-HRSD
8/1/2015 To 07/31/2016

Date	Filter #	Run Time (min)	Pre Wt (g)	Post Wt (g)	Difference (g)	Flow Rate (ft^3/min)	Conc. ($\mu g/m^3$)	Temp (°F)	Pressure (in Hg)	Precip (in)	Comments
8/4/2015	2711	N/A	4.2709	4.3237	0.0528			Filter badly torn - not used in analysis			
8/10/2015	2713	1460	4.2630	4.3160	0.0530	37.87	33.85	76.00	29.96	0.00	Wind 3 mph(SE)
8/16/2015	2716	1425	4.2436	4.2672	0.0236	38.12	15.34	75.00	30.11	0.00	Wind 3 mph(ESE)
8/22/2015	2720	1425	4.2411	4.2653	0.0242	37.73	15.89	79.00	30.01	0.00	Wind 10 mph(NNE)
8/28/2015	2725	1430	4.2183	4.2527	0.0344	38.14	22.27	75.00	30.12	0.00	Wind 7 mph(NE)
9/3/2015	2727	1415	4.2292	4.2412	0.0120	37.41	8.00	81.00	29.86	0.00	Wind 5 mph(WNW)
9/9/2015	2732	1460	4.2438	4.2621	0.0183	37.27	11.88	84.00	29.90	0.00	Wind 6 mph(SSW)
9/15/2015	2737	1465	4.2303	4.2554	0.0251	38.76	15.61	69.00	30.29	0.00	Wind 4 mph(ENE)
9/21/2015	2739	1465	4.2566	4.3102	0.0536	37.90	34.08	76.00	29.99	0.00	Wind 12 mph(NE)
9/27/2015	2743	1460	4.2461	4.2906	0.0445	38.17	28.19	75.00	30.15	0.00	Wind 17 mph(ENE)
10/3/2015	2744	1455	4.2505	4.2832	0.0327	37.93	20.92	73.00	29.85	0.07	Wind 16 mph(NE)
10/9/2015	2748	1440	4.3676	4.4001	0.0325	38.15	20.89	72.00	29.97	0.00	Wind 8 mph(SSW)
10/15/2015	2751	1425	4.3784	4.3973	0.0189	38.95	12.02	61.00	30.00	0.00	Wind 7 mph(NNE)
10/21/2015	2753	1465	4.3518	4.3919	0.0401	39.32	24.58	61.00	30.29	0.00	Wind 4 mph(SSW)
10/27/2015	2755	1465	4.3353	4.3631	0.0278	39.26	17.06	62.00	30.30	0.06	Wind 13 mph(ENE)
11/2/2015	2759	1430	4.3839	4.4063	0.0224	38.84	14.24	63.00	30.03	0.74	Wind 6 mph (NE)
11/8/2015	2761	1460	4.3662	4.3797	0.0135	39.65	8.23	57.00	30.32	0.00	no chart run - tear at top -- Wind 13 mph (NNE)
11/14/2015	2765	N/A	4.3811	4.3872	0.0061			Power outage during exposure			
11/20/2015	2768	1440	4.3724	4.3937	0.0213	39.12	13.35	60.00	30.08	0.01	Wind 13 mph (N)
11/26/2015	2770	1425	4.3452	4.3650	0.0198	40.31	12.17	54.00	30.66	0.00	Wind 4 mph (NE)
12/2/2015	2771	1425	4.3559	4.3673	0.0114	38.75	7.29	61.00	29.85	0.01	Wind 10 mph (SSW)
12/8/2015	2775	1440	4.3719	4.4002	0.0283	40.14	17.29	46.00	30.08	0.00	Wind 4 mph (N)
12/14/2015	2777	1425	4.3955	4.4196	0.0241	38.11	15.67	69.00	29.78	0.01	Wind 14 mph (SSW)
12/20/2015	2779	1430	4.3625	4.3812	0.0187	41.15	11.22	40.00	30.49	0.00	Wind 4 mph (ESE)
12/26/2015	2780	1420	4.3842	4.4035	0.0193	39.13	12.26	63.00	30.25	0.00	Wind 6 mph (NNE)
1/1/2016	2783	1435	4.3608	4.3751	0.0143	39.83	8.83	50.00	30.07	0.00	wind 8 mph (N)
1/7/2016	2785	1440	4.3506	4.3704	0.0198	40.12	12.10	48.00	30.18	0.00	wind 12 mph (NNE)
1/13/2016	2787	1440	4.3528	4.3666	0.0138	41.04	8.24	34.00	30.07	0.00	wind 6 mph (W)
1/19/2016	2789	1425	4.3565	4.3695	0.0130	42.10	7.65	24.00	30.26	0.00	wind 10 mph (NW)

1/25/2016	2791	1415	4.3832	4.4055	0.0223	41.04	13.56	37.00	30.24	0.00	wind 7 mph (SSW)
1/31/2016	2793	1425	4.3797	4.3973	0.0176	39.56	11.02	52.00	29.98	0.00	wind 14 mph (SSW)
2/6/2016	2796	1420	4.3564	4.3765	0.0201	41.11	12.16	38.00	30.35	0.00	Wind 6 mph (NNE)
2/12/2016	2799	1430	4.3899	4.4220	0.0321	41.56	19.07	28.00	30.10	0.04	Wind 5 mph (NE)
2/18/2016	2801	1425	4.3628	4.3813	0.0185	41.09	11.16	39.00	30.39	0.00	Wind 14 mph (NNE)
2/24/2016	2803	1425	4.3749	4.3944	0.0195	38.71	12.48	58.00	29.66	0.72	Wind 17 mph (SSE)
3/1/2016	2805	1425	4.3500	4.4043	0.0543	39.29	34.24	55.00	29.94	0.00	Wind 10 mph (SSE)
3/7/2016	2808	1425	4.3567	4.3945	0.0378	40.12	23.35	49.00	30.23	0.00	Wind 10 mph (SW)
3/13/2016	2809	1425	4.4009	4.4247	0.0238	38.55	15.30	65.00	29.91	0.65	Wind 6 mph (SE)
3/19/2016	2813	1425	4.3919	4.4226	0.0307	39.76	19.13	49.00	29.96	0.08	Wind 16 mph (NE)
3/25/2016	2815	1425	4.3686	4.3972	0.0286	38.05	18.62	70.00	29.79	0.07	Wind 13 mph (SW)
3/31/2016	2817	1425	4.3630	4.4212	0.0582	38.65	37.31	65.00	29.99	0.00	Wind 16 mph (S)
4/6/2016	2819	1425	4.3934	4.4266	0.0332	40.25	20.44	47.00	30.22	0.00	Wind 10 mph (SSE)
4/12/2016	2821	1425	4.3770	4.3959	0.0189	39.24	11.94	58.00	30.06	0.42	Wind 12 mph (SW)
4/18/2016	2823	1425	4.3935	4.4349	0.0414	39.10	26.24	62.00	30.17	0.00	Wind 4 mph (SW)
4/24/2016	2827	1420	4.3819	4.4056	0.0237	39.33	14.98	56.00	30.02	0.00	Wind 11 mph (NE)
4/30/2016	2829	1410	4.3533	4.3840	0.0307	39.39	19.52	57.00	30.12	0.00	Wind 9 mph (NE)
5/3/2016	2851	1410	4.4197	4.4414	0.0217	40.39	13.45	69.00	29.74	0.28	Wind 8 mph (SW)
5/6/2016	2831	1410	4.3883	4.3956	0.0073	40.23	4.54	56.00	29.63	1.04	Wind 4 mph (W)
5/9/2016	2854	1410	4.4126	4.4586	0.0460	40.27	28.61	65.00	30.02	0.00	Wind 5 mph (ESE)
5/12/2016	2835	1440	4.3702	4.3948	0.0246	40.08	15.05	64.00	30.05	0.00	Wind 6 mph (NE)
5/15/2016	2858	1410	4.4077	4.4279	0.0202	40.03	12.64	60.00	29.93	0.00	Wind 10 mph (WNW)
5/18/2016	2838	1415	4.3759	4.3927	0.0168	40.01	10.48	60.00	30.02	0.01	Wind 12 mph (NE)
5/21/2016	2860	1410	4.4296	4.4422	0.0126	40.54	7.78	66.00	29.85	0.29	Wind 7 mph (N)
5/24/2016	2842	1440	4.3811	4.4117	0.0306	40.21	18.66	69.00	29.98	0.00	Wind 6 mph (WSW)
5/27/2016	2862	1410	4.4392	4.4812	0.0420	40.63	25.89	78.00	30.08	0.00	Wind 12 mph (SSW)
5/30/2016	2844	1410	4.3902	4.4061	0.0159	40.48	9.84	74.00	29.95	0.75	Wind 5 mph (SE)
6/2/2016	2866	1410	4.4200	4.4380	0.0180	40.53	11.12	73.00	30.00	0.00	Wind 7 mph (NE)
6/5/2016	2847	1410	4.3857	4.4230	0.0373	40.84	22.88	81.00	29.79	2.11	Wind 12 mph (SSW)
6/8/2016	2868	1410	4.4088	4.4385	0.0297	40.62	18.31	74.00	29.75	0.00	Wind 9 mph (NW)
6/11/2016	2875	1440	4.4265	4.4785	0.0520	40.72	31.32	79.00	29.98	0.00	Wind 11 mph (SW)
6/14/2016	2900	1410	4.3848	4.4186	0.0338	40.44	20.93	71.00	29.91	0.00	Wind 8 mph (ESE)
6/17/2016	2880	1410	4.4052	4.4257	0.0205	40.47	12.69	70.00	29.77	0.87	Wind 13 mph (NE)
6/20/2016	2903	1405	4.3851	4.4165	0.0314	40.67	19.41	76.00	30.13	0.00	Wind 8 mph (WSW)
6/23/2016	2882	1410	4.4182	4.4528	0.0346	41.10	21.09	81.00	29.89	0.53	Wind 10 mph (SW)
6/26/2016	2905	1410	4.3966	4.4167	0.0201	40.43	12.45	70.00	30.14	0.00	Wind 7 mph (ENE)

6/29/2016	2885	1410	4.4128	4.4369	0.0241	40.97	14.73	77.00	29.89	0.00	Wind 4 mph (NE)
7/2/2016	2909	1405	4.3970	4.4185	0.0215	40.74	13.26	77.00	29.99	0.24	Wind 8 mph (N)
7/5/2016	2889	1410	4.4045	4.4360	0.0315	41.58	18.97	85.00	29.85	0.00	Wind 11 mph (WSW)
7/8/2016	2912	1410	4.4170	4.4418	0.0248	40.86	15.20	84.00	29.78	0.54	Wind 7 mph (W)
7/11/2016	2892	1410	4.4259	4.4544	0.0285	41.48	17.21	79.00	30.02	0.00	Wind 6 mph (ENE)
7/14/2016	2914	1410	4.3923	4.4581	0.0658	40.98	40.21	87.00	29.92	0.00	Wind 8 mph (SW)
7/17/2016	2895	1415	4.4294	4.4473	0.0179	41.70	10.71	82.00	30.11	0.04	Wind 5 mph (SW)
7/20/2016	2919	1410	4.4100	4.4556	0.0456	40.78	28.01	79.00	30.10	0.00	Wind 5 mph (ENE)
7/23/2016	2926	1420	4.4817	4.5217	0.0400	41.75	23.83	88.00	29.91	0.00	Wind 9 mph (SW)
7/26/2016	2921	1410	4.3887	4.4476	0.0589	41.15	35.85	87.00	29.90	0.00	Wind 9 mph (SW)
7/29/2016	2928	1425	4.4712	4.4981	0.0269	41.64	16.01	84.00	29.82	0.00	Wind 7 mph (NW)

Average Concentration : **17.58**

Maximum Concentration : **40.21**

Minimum Concentration : **4.54**

Laboratory Control Filters

	2722	1440	4.2576	4.2612	0.0036	40	2.207	N/A	N/A	N/A
	2747	1440	4.3294	4.3297	0.0003	40	0.184	N/A	N/A	N/A
	2773	1440	4.3560	4.3541	-0.0019	40	-1.165	N/A	N/A	N/A
	2798	1440	4.3806	4.3814	0.0008	40	0.490	N/A	N/A	N/A
	2824	1440	4.3660	4.3666	0.0006	40	0.368	N/A	N/A	N/A
	2849	1440	4.3727	4.3770	0.0043	40	2.636	N/A	N/A	N/A
	2874	1440	4.4298	4.4318	0.002	40	1.226	N/A	N/A	N/A
	2899	1440	4.4186	4.4206	0.0020	40	1.226	N/A	N/A	N/A
	2924	1440	4.4123	4.4145	0.0022	40	1.349	N/A	N/A	N/A

Field Blank Filters

11/14/2015	2764	1440	4.3512	4.3530	0.0018	40	1.104	N/A	N/A	N/A	Wind 6 mph (NW)
12/20/2015	2766	1440	4.3774	4.3785	0.0011	40	0.674	N/A	N/A	N/A	Wind 4 mph (ESE)
**1/31/2016	2794	1440	4.3737	4.3753	0.0016	40	0.981	N/A	N/A	N/A	Wind 14 mph (SSW)
3/1/2016	2806	1440	4.3709	4.3734	0.0025	40	1.533	N/A	N/A	N/A	Wind 10 mph (SSE)
3/19/2016	2810	1440	4.4075	4.4104	0.0029	40	1.778	N/A	N/A	N/A	Wind 16 mph (NE)
4/23/2016	2825	1440	4.3557	4.3624	0.0067	40	4.108	N/A	N/A	N/A	Wind 9 mph (NNW)
5/15/2016	2873	1440	4.4082	4.4135	0.0053	40	3.249	N/A	N/A	N/A	Wind 10 mph (WNW)
5/24/2016	2841	1440	4.3540	4.3615	0.0075	40	4.598	N/A	N/A	N/A	Wind 6 mph (WSW)
6/2/2016	2872	1440	4.4201	4.4256	0.0055	40	3.372	N/A	N/A	N/A	Wind 7 mph (NE)
6/11/2016	2877	1440	4.4043	4.4082	0.0039	40	2.391	N/A	N/A	N/A	Wind 11 mph (SW)
6/20/2016	2923	1440	4.4019	4.4058	0.0039	40	2.391	N/A	N/A	N/A	Wind 8 mph (WSW)
6/29/2016	2886	1440	4.4175	4.4201	0.0026	40	1.594	N/A	N/A	N/A	Wind 4 mph (NE)
7/8/2016	2922	1440	4.3882	4.3948	0.0066	40	4.046	N/A	N/A	N/A	Wind 7 mph (W)
7/17/2016	2898	1440	4.4143	4.4176	0.0033	40	2.023	N/A	N/A	N/A	Wind 5 mph (SW)

**Field Blank was exposed 1/25-1/31 due to snowstorm

Notes: Flow rates adjusted to Standard Atmosphere (760 mmHg and 25ºC)

Weather data obtained from KORF - Norfolk International Airport

Laboratory control filters are stored, exposed in the lab, and weighed only to monitor the conditions of the analytical environment, for the associated filter lot (box of 25)

Appendix II: Quarterly Calibrations of PM_{10} Samplers, Q4

Simpson Weather Associates
PM_{10} Hi-Vol Monitor (Tisch TE-6070V) Calibration

Site:	**Norfolk Southern - Lamberts Point**	**NSPM HRSD Co-Located**	
Date:	**04-29-2016**	**Time:**	**14:30**
Sampler:	**TE-6070V**	**Serial #:**	**P6158**
VFC G-Factor:	**0.08558637**		
Technician Completing Calibration:	Eun P. Yi, Dave Emmitt		

Calibration Orifice Information

Make:	Tisch Environmental	**Qa Slope:**	0.99281
Model:	TE-5028A	**Qa Intercept:**	-0.02866
Serial #:	2777	**Calibration Due Date:**	**June 5, 2016**

Ambient Conditions

Ambient Temperature (°F):	**56**	**Ambient Temperature (K):**	286.48
Ambient Pressure (in Hg):	**29.99**	**Ambient Pressure (mm Hg):**	761.75

Sampler Calibration Information

	Flow - Orifice (in H_2O)	Qa (m_3/min)	Flow - Sampler (in H_2O)	Pf (mm Hg)	Po/Pa	Calculated Flow Rate (m_3/min)	% Difference
1	**4.00**	1.264	**6.90**	12.877	0.9831	1.259	**0.40**
2	**3.95**	1.257	**10.45**	19.503	0.9744	1.247	**0.72**
3	**3.80**	1.233	**16.95**	31.633	0.9585	1.226	**0.57**
4	**3.80**	1.233	**20.40**	38.072	0.9500	1.215	**1.46**
5	**3.75**	1.225	**26.35**	49.176	0.9354	1.195	**2.45**

Simpson Weather Associates
PM_{10} Hi-Vol Monitor (Tisch TE-6070V) Calibration

Site:	**Norfolk Southern - Lamberts Point**	**NSPM ADMIN**	
Date:	**05-14-2016**	**Time:**	**15:30**
Sampler:	**TE-6070V**	**Serial #:**	**P8813**
VFC G-Factor:	**0.02566593**		
Technician Completing Calibration:		Eun P. Yi, James Crippen	

Calibration Orifice Information

Make:	Tisch Environmental	**Qa Slope:**	0.99281
Model:	TE-5028A	**Qa Intercept:**	-0.02866
Serial #:	2777	**Calibration Due Date:**	**June 5, 2016**

Ambient Conditions

Ambient Temperature (°F):	**71**	**Ambient Temperature (K):**	294.82
Ambient Pressure (in Hg):	**29.79**	**Ambient Pressure (mm Hg):**	756.67

Sampler Calibration Information

	Flow - Orifice (in H_2O)	Qa (m_3/min)	Flow - Sampler (in H_2O)	Pf (mm Hg)	Po/Pa	Calculated Flow Rate (m_3/min)	% Difference
1	**3.55**	1.213	**10.50**	19.596	0.9741	1.192	**1.73**
2	**3.40**	1.188	**15.45**	28.834	0.9619	1.177	**1.01**
3	**3.35**	1.180	**18.95**	35.366	0.9533	1.165	**1.19**
4	**3.25**	1.162	**23.05**	43.018	0.9431	1.152	**0.86**
5	**3.15**	1.145	**27.00**	50.389	0.9334	1.140	**0.44**

Simpson Weather Associates
PM_{10} Hi-Vol Monitor (Tisch TE-6070V) Calibration

Site:	**Norfolk Southern - Lamberts Point**	**NSPM HRSD Primary**	
Date:	**05-14-2016**	**Time:**	**16:30**
Sampler:	**TE-6070V**	**Serial #:**	**P8892**
VFC G-Factor:	**0.02544876**		
Technician Completing Calibration:		Eun P. Yi, James Crippen	

Calibration Orifice Information

Make:	Tisch Environmental	**Qa Slope:**	0.99281
Model:	TE-5028A	**Qa Intercept:**	-0.02866
Serial #:	2777	**Calibration Due Date:**	**June 5, 2016**

Ambient Conditions

Ambient Temperature (°F):	**71**	**Ambient Temperature (K):**	294.82
Ambient Pressure (in Hg):	**29.79**	**Ambient Pressure (mm Hg):**	756.67

Sampler Calibration Information

	Flow - Orifice (in H_2O)	Qa (m_3/min)	Flow - Sampler (in H_2O)	Pf (mm Hg)	Po/Pa	Calculated Flow Rate (m_3/min)	% Difference
1	**3.65**	1.230	**9.00**	16.796	0.9778	1.197	**2.68**
2	**3.40**	1.188	**15.05**	28.087	0.9629	1.178	**0.93**
3	**3.40**	1.188	**18.75**	34.993	0.9538	1.166	**1.85**
4	**3.25**	1.162	**22.40**	41.805	0.9448	1.154	**0.69**
5	**3.20**	1.154	**26.35**	49.176	0.9350	1.142	**1.04**

Simpson Weather Associates
PM_{10} Hi-Vol Monitor (Tisch TE-6070V) Calibration

Site:	**Norfolk Southern - Lamberts Point**	**NSPM HRSD Co-Located**	
Date:	**07-01-2016**	**Time:**	**20:30**
Sampler:	**TE-6070V**	**Serial #:**	**P8789**
VFC G-Factor:	**0.02679361**		
Technician Completing Calibration:		Eun P. Yi, James Crippen	

Calibration Orifice Information

Make:	Tisch Environmental	**Qa Slope:**	1.00707
Model:	TE-5028A	**Qa Intercept:**	-0.01651
Serial #:	2777	**Calibration Due Date:**	**May 20, 2017**

Ambient Conditions

Ambient Temperature (°F):	**74**	**Ambient Temperature (K):**	296.48
Ambient Pressure (in Hg):	**29.93**	**Ambient Pressure (mm Hg):**	760.22

Sampler Calibration Information

	Flow - Orifice (in H_2O)	Qa (m_3/min)	Flow - Sampler (in H_2O)	Pf (mm Hg)	Po/Pa	Calculated Flow Rate (m_3/min)	% Difference
1	**3.70**	1.209	**5.85**	10.918	0.9856	1.212	**0.17**
2	**3.55**	1.185	**10.30**	19.223	0.9747	1.197	**1.10**
3	**3.35**	1.151	**14.45**	26.968	0.9645	1.184	**2.87**
4	**3.25**	1.134	**18.50**	34.526	0.9546	1.171	**3.26**
5	**3.15**	1.117	**24.30**	45.350	0.9403	1.153	**3.22**

Appendix III: Performance, Systems, and Laboratory Audit Memoranda, Environmental Standards, Inc.

ENVIRONMENTAL® STANDARDS

Setting the Standards for Innovative Environmental Solutions

July 1, 2016

Mr. Bill Wagner, P.E.
Norfolk Southern Corporation
1200 Peachtree Street, NE
Atlanta, GA 30309

VIA ELECTRONIC MAIL

RE: 2016 Lamberts Point Audits

Dear Mr. Wagner:

Enclosed is Environmental Standards, Inc.'s (Environmental Standards') findings associated with the Systems Audit and Laboratory Audit of Simpson Weather Associates (SWA) conducted on June 9, 2016. Also attached, is a memorandum summarizing the Performance Audit conducted the same day by Environmental Standards.

The Systems and Laboratory Audits were conducted against the requirements listed in the project Quality Assurance Project Plan (QAPP). Environmental Standards saw much improvement from the baseline review we performed, approximately 9 months ago (about a third less findings). The findings presented herein are, in general, non-serious in nature; however, we recommend that the findings are immediately addressed by SWA. Environmental Standards will continue to provide quality assurance oversight of the sampling and analysis processes and will periodically review data and reports submitted by SWA to ensure continued compliance and implementation of corrective action. Environmental Standards appreciates the opportunity to provide auditing services to Norfolk Southern Corporation.

Should you have any questions regarding these audits, please do not hesitate to call me at (610) 935-5577.

Sincerely,

Shaun M. Gilday, PMP, CPEA
Senior Compliance Specialist

Sincerely,

Erin E. Rodgers
Senior Quality Assurance Chemist

SMG/EER:cg
Enc.

Copy to: Rock Vitale – Environmental Standards

June 9, 2016 Systems and Laboratory Audit Findings

FINDING NUMBER	CITATION			FINDING	ADDITIONAL INFORMATION
	Document	Section/Page	Citation Text		
			SYSTEMS AUDIT FINDINGS		
1	QAPP	Section A5	"…The monitoring frequency will follow EPA's prescribed PM10 annual monitoring schedule…All PM10 monitors will follow this identical schedule…"	The SWA Operator did not maintain the sampling equipment to standard time.	The Auditor observed the samplers to be set to daylight savings time.
		Section A6.1.1	"…The operational schedule will remain on standard time throughout the length of the study…"		
		Section B2.1	"…The midnight to midnight run schedule will remain on standard time throughout the project…		
	Code of Federal Regulations	40 CFR 58.12(e)	40 CFR 58.12 Operating Schedules - "…(e) For PM10 samplers, a 24-hour sample must be taken from midnight to midnight (local standard time) to ensure national consistency…"		
2	TISCH Instruction Manual	Operational Flow Rate (pg. 56)	"…the barometric pressure needs to be reported in millimeters of mercury (if sea level barometric pressure is used it must be corrected to the site elevation)…"	SWA improperly utilized the sea-level corrected barometric pressure to report standard PM10 concentrations.	SWA provided the data source for sample run ambient pressures. The pressures listed on the information provided by SWA stated that the values are corrected to sea-level.
		Total Volume Calculations for Volumetric Flow Controlled Systems (pg. 61)	"…1. Suppose the ambient conditions are: Temperature: Ta = 24°C Barometric Pressure: Pa = 762 mm Hg (this must be station pressure which is not corrected to sea level)…"		
	Code of Federal Regulations	40 CFR PART 50 Appendix J 9.6	"…Barometric pressure readings obtained from airports must be station pressure, not corrected to sea level, and may need to be corrected for differences in elevation between the sampling site and the airport."		
3	Code of Federal Regulations	40 CFR PART 50 Appendix J 2.2	"…The total volume of air sampled…is determined from the measured flow rate and the sampling time…"	The SWA Operator did not accurately record the run time.	Half of the run (6 of 12) times reviewed by the auditor were not accurate when compared to the wheel chart. Filter 2834 appeared to be run for approximately 1405 minutes and the calculation utilized 1440 minutes as the run time. Additionally, upon interview with SWA personnel, the elapsed time indicator on the sampler was not being utilized.
		40 CFR PART 50 Appendix J 6.6	"Air Volume Determination. Errors in the air volume determination may result from errors in the...sampling time measurements...an elapsed time meter (section 7.1.5) is required to minimize the error in the sampling time measurement."		
		40 CFR PART 50 Appendix J 7.1.5	"A timing/control device capable of starting and stopping the sampler shall be used to obtain a sample collection period of 24 +/-1 hr. (1,440 +/-60 min). An elapsed time meter, accurate to within +/-15 minutes, shall be used to measure sampling time. This meter is optional for samplers with continuous flow recorders if the sampling time measurement obtained by means of the recorder meets the +/-15 minute accuracy specification."		
			LABORATORY AUDIT FINDINGS		
1	QAPP	Section B10.3 Laboratory Records	"…Someone other than the person performing the analyses will review the data forms. All laboratory reports will be signed by the analyst and the person performing the review…"	The SWA Project Manager indicated that he reviews the data entry and performs checks of the calculations; however, the supervisory reviews were not documented. Additionally, the laboratory reports were not signed by the analyst.	
2	QAPP	Section A6.3: Table A-4	"Particulate Matter Gravimetric Laboratory Measurements. Filter Conditioning: Start Date & Time, Filter Number, Relative Humidity, Temperature, End Date & Time"	SWA recorded the majority of items contained on Table A-4; however, the documentation of the filter conditioning parameters, specifically start and end date and time of the filter conditioning, were not being recorded.	
3	QAPP	Section B10.3	"Lab QC Checks - Balance Check (Standard Weight Check and Calibration Check); beginning, 15th sample, end."	SWA laboratory personnel performed a daily balance weight check; however, it was not clear that the a balance weight check was performed every 15^{h} sample or at the end of the weighing session. If additional balance weight checks were being performed, they were not documented.	SWA recently implemented a new data sheet to capture the weighing information; however, there were no dedicated spaces for the balance weight checks.
4	QAPP	Section B10.3	"Lab QC Checks - "Routine" duplicate weighing; 5-7 per weighing session"	Based on the documentation reviewed, duplicate filter weighings were not being performed during sample analysis.	SWA recently implemented a new data sheet to capture the weighing information; however, there were no dedicated spaces for the duplicate weighings.

ENVIRONMENTAL® STANDARDS

Setting the Standards for Innovative Environmental Solutions

MEMORANDUM

Date: July 1, 2016

To: William Wagner, P.E. – Norfolk Southern Corporation

From: Shaun Gilday, CPEA – Environmental Standards, Inc.

cc: G. D. Emmitt, Ph.D. – Simpson Weather Associates, Inc.
Eun Pierce Yi – Simpson Weather Associates, Inc.
Rock J. Vitale, CEAC – Environmental Standards, Inc.

Subject: June 2016 Performance Audit Results at Lamberts Point, Norfolk, Virginia

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On June 9, 2016, Environmental Standards, Inc. (Environmental Standards), conducted a performance audit of the PM10 air samplers at Lambert's Point, Virginia. The three air samplers are being operated and maintained by Simpson Weather Associates, Inc. (SWA) for the purpose of collecting and analyzing air samples for PM10 in accordance with the project Quality Assurance Project Plan (QAPP). The collection and analysis program is being conducted to support Norfolk Southern Railway Company's (NSRC's) voluntary community ambient air quality monitoring efforts. Specifically, the air monitoring is being performed to determine ambient PM10 concentrations at NSRC's coal loading operations at Lamberts Point in Norfolk, Virginia.

The QAPP specifies that performance audits will be conducted semiannually, by an independent Quality Assurance Auditor, and in accordance with 40 CFR Part 58 Paragraph 3.3.3 and the manufacturer's instructions. The QAPP goes on to require,

> *The audit will be conducted by a trained experienced technician other than the routine site operator. The audit will be made by measuring the analyzer's normal operating flow rate using a flow rate audit standard certified in accordance with section 2.6 of Appendix A. The flow rate audit standard used for auditing will not be the same flow rate transfer standard used to calibrate the analyzer … The percent differences between these flow rates will be used to validate the one-point flow rate verification checks used to estimate bias as described in section 4.2.3 of Appendix A.*

Environmental Standards' Auditor, Shaun Gilday, was trained by Tisch Environmental, Inc. (Tisch; Appendix A), the air sampler's manufacturer, and has performed a number of quality assurance oversights and audits of similar PM10 programs. Mr. Gilday utilized a calibrated (see Appendix B) Tisch TE-5028 calibration kit, rented from Tisch, to conduct the performance audit. The TE-5028 was calibrated against a National Institute of Standards and Technology- (NIST-) traceable certified device in December 2015. In accordance with the manufacturer's

instructions, Environmental Standards audited five different flow points, of which at least three were between 1.02 and 1.24 cubic meters per minute (m_3/min).

The results of the performance audits conducted by Environmental Standards at the NSRC Administrative Building (NS ADMIN) and the Hampton Roads Sanitation District (HRSD and HRSD CO-LOCATED) Plant are presented in Appendix C. The percent difference between the performance audit and the sampler's volume measurement ranged from -0.36% to 3.02% (average of 0.89%) for the NS ADMIN device; -1.81% to 0.45% (average of -0.38%) for the HRSD device; and -1.15% to 2.34% (average of 0.58%) for the HRSD Co-located device. These percent differences for both devices in the air monitoring program are within the percent difference criterion listed in the QAPP of ± 4% difference. While it was noted that several flow rates collected during the performance audit of the HRSD Co-located sampler were outside of the designed flow rate (1.02 – 1.24 m_3/min) of the sampler, three of the five flow rate audit points were within tolerance for the performance audit, thus satisfying the performance audit criterion. Nonetheless, that fact that several of these flow rates were outside of the designed flow rate (1.02 – 1.24 m_3/min), suggests that the sampler may be approaching the need for service and perhaps should be monitored more frequently. The Auditor did review recent pre-run filter pressures and associated flow rates and determined that the calculated flow rate for a new filter was within the design flow rate specifications and, therefore, the sampler was still operating as designed.

END OF MEMORANDUM.

APPENDIX A

Certificate of Completion

This certificate acknowledges that

Shaun Gilday
(Name)

has completed training on "High Volume (TSP and PM10) Volumetric & Mass Flow Controlled Ambient Air Samplers."

The training was provided by Tisch Environmental, Inc., located in Cleves, Ohio.

Trainer Signature
Jim Tisch
Tisch Environmental, Inc.
145 South Miami Avenue
Cleves, OH 45002

February 1, 2010
Date

Trainee Signature

ENVIRONMENTAL TISCH

ENVIRONMENTAL STANDARDS

APPENDIX B

TISCH Environmental

TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVES, OH
45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Dec 02, 2015 Rootsmeter S/N 0438320 Ta (K) - 293
Operator Tisch Orifice I.D. - 0226 Pa (mm) - 746.76

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	1.2350	4.3	1.50
2	NA	NA	1.00	0.9640	7.0	2.50
3	NA	NA	1.00	0.8780	8.4	3.00
4	NA	NA	1.00	0.8120	9.8	3.50
5	NA	NA	1.00	0.6120	17.0	6.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
0.9935	0.8045	1.2243		0.9942	0.8050	0.7672
0.9899	1.0269	1.5806		0.9906	1.0276	0.9904
0.9880	1.1253	1.7315		0.9887	1.1261	1.0849
0.9862	1.2145	1.8702		0.9868	1.2153	1.1719
0.9766	1.5957	2.4487		0.9772	1.5967	1.5343
Qstd slope (m) =		1.54405		Qa slope (m) =		0.96686
intercept (b) =		-0.00990		intercept (b) =		-0.00620
coefficient (r) =		0.99981		coefficient (r) =		0.99981
y axis = SQRT[H2O(Pa/760)(298/Ta)]				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}

APPENDIX C

TE-6070V Sampler Calibration Worksheet
(Using G-Factor)

Site and Calibration Information

Site		Calibration Orifice	
Location:	NS ADMIN	**Make:**	TE-5028A
Date:	Jun 9, 2016	**Model:**	Tisch Environmental
Tech.:	Shaun Gilday	**Serial:**	0226
Sampler:	TE-6070V	**Qa Slope (m):**	0.96686
Serial #:	P8813	**Qa Int (b):**	-0.00620
VFC G-Factor:	0.0256659300	**Calibration Due Date:**	12/02/16

Ambient Conditions

Temp (deg F):	77.0		
Ta (deg K):	298	**Barometric Press (in Hg):**	29.92
Ta (deg C):	25.0	**Pa (mm Hg):**	760.0

Calibration Information

Run Number	Orifice "H2O	Qa m3/min	Sampler "H2O	Pf mm Hg	Po/Pa	Calculated m3/min	% of Diff
1	3.50	1.218	5.60	10.452	0.986	1.214	-0.36
2	3.40	1.201	10.60	19.784	0.974	1.198	-0.24
3	3.30	1.183	14.10	26.317	0.965	1.187	0.31
4	2.90	1.110	27.90	52.074	0.931	1.143	3.02
5	3.10	1.147	20.50	38.262	0.950	1.167	1.71

Calculate Total Air Volume Using G-Factor

Enter Average Temperature During Sampling Duration (Deg F)
Average Temperature During Sampling Duration (Deg K)
Enter Average Barometric Pressure During Sampling Duration (In Hg)
Average Barometric Pressure During Sampling (mm Hg)
Enter Clean Filter Sampler Inches of Water
Enter Dirty Filter Sampler Inches of Water
Average Filter Sampler (mm Hg)
Enter Total Runtime in Hours (xx.xx)

Po/Pa
Calculated Flow Rate (m3/min)
Total Flow (m3)

Calculations

Calibrator Flow (Qa) = 1/Slope*(SQRT(H20*(Ta/Pa))-Intercept)
Pressure Ratio (Po/Pa) = 1-Pf/Pa
% Difference = (Look Up Flow-Calibrator Flow)/Calibrator Flow*100

NOTE: Ensure calibration orifice has been certified within 12 months of use

TE-6070V Sampler Calibration Worksheet
(Using G-Factor)

Site and Calibration Information

Site		Calibration Orifice	
Location:	HRSD	**Make:**	TE-5028A
Date:	Jun 9, 2016	**Model:**	Tisch Environmental
Tech.:	Shaun Gilday	**Serial:**	0226
Sampler:	TE-6070V	**Qa Slope (m):**	0.96686
Serial #:	P8892	**Qa Int (b):**	-0.00620
VFC G-Factor:	0.0254487600	**Calibration Due Date:**	12/02/16

Ambient Conditions

Temp (deg F):	81.0		
Ta (deg K):	300	**Barometric Press (in Hg):**	29.90
Ta (deg C):	27.2	**Pa (mm Hg):**	759.5

Calibration Information

Run Number	Orifice "H2O	Qa m3/min	Sampler "H2O	Pf mm Hg	Po/Pa	Calculated m3/min	% of Diff
1	3.50	1.223	5.70	10.639	0.986	1.217	-0.48
2	3.50	1.223	7.90	14.745	0.981	1.210	-1.05
3	3.30	1.188	11.20	20.904	0.972	1.200	1.00
4	3.40	1.206	16.20	30.237	0.960	1.184	-1.81
5	3.10	1.152	24.70	46.101	0.939	1.157	0.45

Calculate Total Air Volume Using G-Factor

Enter Average Temperature During Sampling Duration (Deg F)
Average Temperature During Sampling Duration (Deg K)
Enter Average Barometric Pressure During Sampling Duration (In Hg)
Average Barometric Pressure During Sampling (mm Hg)
Enter Clean Filter Sampler Inches of Water
Enter Dirty Filter Sampler Inches of Water
Average Filter Sampler (mm Hg)
Enter Total Runtime in Hours (xx.xx)

Po/Pa
Calculated Flow Rate (m3/min)
Total Flow (m3)

Calculations

Calibrator Flow (Qa) = 1/Slope*(SQRT(H20*(Ta/Pa))-Intercept)
Pressure Ratio (Po/Pa) = 1-Pf/Pa
% Difference = (Look Up Flow-Calibrator Flow)/Calibrator Flow*100

NOTE: Ensure calibration orifice has been certified within 12 months of use

TE-6070V Sampler Calibration Worksheet
(Using G-Factor)

Site and Calibration Information

Site		Calibration Orifice	
Location:	HRSD-Co-located	**Make:**	TE-5028A
Date:	Jun 9, 2016	**Model:**	Tisch Environmental
Tech.:	Shaun Gilday	**Serial:**	0226
Sampler:	TE-6070V	**Qa Slope (m):**	0.96686
Serial #:		**Qa Int (b):**	-0.00620
VFC G-Factor:	0.0855863700	**Calibration Due Date:**	12/02/16

Ambient Conditions

Temp (deg F):	78.0		
Ta (deg K):	299	**Barometric Press (in Hg):**	29.91
Ta (deg C):	25.6	**Pa (mm Hg):**	759.7

Calibration Information

Run Number	Orifice "H2O	Qa m3/min	Sampler "H2O	Pf mm Hg	Po/Pa	Calculated m3/min	% of Diff
1	3.90	1.287	6.40	11.945	0.984	1.284	-0.21
2	3.90	1.287	10.00	18.665	0.975	1.272	-1.15
3	3.40	1.202	22.50	41.995	0.945	1.230	2.34
4	3.40	1.202	26.60	49.648	0.935	1.217	1.19
5	3.40	1.202	28.20	52.634	0.931	1.211	0.75

Calculate Total Air Volume Using G-Factor

Enter Average Temperature During Sampling Duration (Deg F)
Average Temperature During Sampling Duration (Deg K)
Enter Average Barometric Pressure During Sampling Duration (In Hg)
Average Barometric Pressure During Sampling (mm Hg)
Enter Clean Filter Sampler Inches of Water
Enter Dirty Filter Sampler Inches of Water
Average Filter Sampler (mm Hg)
Enter Total Runtime in Hours (xx.xx)

Po/Pa
Calculated Flow Rate (m3/min)
Total Flow (m3)

Calculations

Calibrator Flow (Qa) = 1/Slope*(SQRT(H20*(Ta/Pa))-Intercept)
Pressure Ratio (Po/Pa) = 1-Pf/Pa
% Difference = (Look Up Flow-Calibrator Flow)/Calibrator Flow*100

NOTE: Ensure calibration orifice has been certified within 12 months of use

Appendix IV: SWA's Response to Systems and Laboratory Audit and Implementation Summary of Corrective Actions

September 27, 2016

VIA ELECTRONIC MAIL

TO: William Wagner, Norfolk Southern Corp.

FROM: Eun P. Yi – Simpson Weather Associates, Inc.

CC: Dave Emmitt – Simpson Weather Associates, Inc.
Shaun Gilday – Environmental Standards, Inc.
Erin Rodgers – Environmental Standards, Inc.

SUBJECT: Response and corrective actions to Systems and Laboratory Audit conducted by Environmental Standards, Inc., on operations for Norfolk Southern's PM_{10} monitoring program at Lamberts Point, Norfolk, VA

On June 9, 2016, Environmental Standards, Inc. (Environmental Standards) conducted systems and laboratory audits of Simpson Weather Associates' (SWA) operations for Norfolk Southern's PM_{10} monitoring program at Lamberts Point, Norfolk, VA. On August 16, 2016, SWA received a memorandum summarizing the findings from the audits. Upon receiving the list of findings, SWA has internally reviewed its operations and with the assistance from Environmental Standards, has implemented necessary corrective actions to ensure compliance. We outline corrective actions per each audit finding below:

Systems Audit Findings

Finding #1: "The SWA Operator did not maintain the sampling equipment to Standard Time. The Auditor observed the samplers to be set to daylight savings time"

It was found that the two of the three currently operating samplers were set to daylight savings time (manual timer trigger set to 12 AM – 12 AM), while the most recently installed 'collocated' sampler was set to standard time. While the triggers for these two units (NSPM-Admin and NSPM-Primary) have not been moved upon the end of daylight savings time on November 1, 2015, the operators have taken into account the time difference by simply setting the timer wheel one hour forward at the time of setting out the filter. However, following the June 9th audit, the triggers have been physically moved to 11 PM – 11 PM so that the operators use the observed time at set-out.

Finding #2: "SWA improperly utilized the sea-level corrected barometric pressure to report standard PM_{10} concentrations. SWA provided the data source for sample run ambient pressures. The pressures listed on the information provided by SWA stated that the values are corrected to sea-level."

While most airports only publish sea-level corrected pressure without the barometric pressure as measured, it has been SWA's practice to use the reported airport pressure in Norfolk, VA and surrounding areas which are effectively at sea-level. It has been noted that in instances where barometric pressure measurements are desired for particulate matter sampling, the required resolution for the ambient pressure measurement is commonly on the order of 0.1 in Hg.

40 CFR Part 60 Appendix A-3, Method 5:

Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in). *Note: The barometric pressure reading may be obtained from a nearby National Weather Service station. In this case, the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be made at a rate of minus 2.5 mm Hg (0.1 in) per 30 m (100 ft) elevation increase or plus 2.5 mm Hg (0.1 in) per 30 m (100 ft) elevation decrease.*

The elevations considered for measurements at Lamberts Point are the following:

Station	Elevation (ft)
KORF	26
NSPM-ADMIN	13
NSPM-HRSD	35

Since the elevation differences to consider are on the order of 10 ft, the adjustments due to elevation differences are well below the commonly required resolution. For this particular project in Norfolk, VA, SWA has opted to directly use the pressure measurements published by the local airport station. However, in recognition of the requirement outlined in 40 CFR Part 50 Appendix J 9.6, SWA has adjusted the reported pressure by (1) eliminating the contribution of 26 ft elevation at KORF station to be set as uncorrected barometric pressure, and (2) adjusting the site pressure taking into account the elevation difference between the KORF station and the sites. A sample calculation results are shown below:

	KORF Station Pressure (26 ft)	Uncorrected Barometric Pressure	Adjust Pressure, NSPM-ADMIN (13 ft)	Adjusted Pressure, NSPM-HRSD (35 ft)
Pressure (in Hg)	30.00	29.97	29.99	29.96

The adjustments made are well below 0.1 in Hg resolution, and their effect on calculated PM_{10} concentration values are inconsequential to overall representation of both sites' concentration levels. Updates to the database has been made to take into account the adjustments made to the reported ambient pressure and the concentration values, and are reflected in the filter reports included in the fourth quarterly report.

Finding #3: "The SWA Operator did not accurately record the run time. Half of the run (6 of 12) times reviewed by the auditor were not accurate when compared to the wheel chart."

Due to increased sampling frequency beginning in May, 2016, SWA has employed a second site operator to accommodate more frequent site visits required. It was observed that one of the two operators has not been accurately recording the run time, which is consistent with the audit finding where half of the run times reviewed were not in agreement with the scanned wheel chart. SWA has reviewed all of the wheel charts to verify the reported run times by both operators, and has updated its database using the run time as appeared on the wheel charts. This update resulted in slight changes to the reported concentration values, which are reflected in the filter reports included in the fourth quarterly report.

Laboratory Audit Findings

We find that audit findings listed here are, in all parts, on the note of documentation. All tasks being performed related to the project have been distributed among SWA staff with specific assignments, and have been routinized. While proper execution of analytical components has been enabled by frequent communication and checks among the staff, we recognize that more 'completion of assignments' type documentation is needed to be transparent to anyone outside the working group.

Finding #1: "The SWA Project Manager indicated that he reviews the data entry and performs checks of the calculations; however, the supervisory reviews were not documented. Additionally, the laboratory reports were not signed by the analyst."

The laboratory technician submits the data sheet to the project manager, and another SWA analyst transfers the manually entered data into the electronic database where calculations are performed. The database and the user-interface specifically constructed solely for this project allows the project manager to check all outputs side by side against the original data sheet. While 100% of entries and calculated values have been checked by the project manager, it was suggested that documenting of supervisory review was necessary. The datasheet has been revised and implemented for use following the audit, which requires a signature by laboratory technician upon completing the laboratory work (Appendix A). Upon receiving a copy of the signed datasheet, the project manager is then to provide his signature on it to indicate the review process has been completed.

Finding #2: "SWA recorded the majority of items contained on Table A-4 (QAPP); however, the documentation of the filter conditioning parameters, specifically start and end date and time of the filter conditioning, were not being recorded."

Per a section of the standard operating procedure dedicated for the laboratory personnel at SWA, the filters are inspected and rested prior to deployment. While all inspection procedures have been properly conducted under a controlled condition with verified stability in regard to temperature and relative humidity, the duration of the resting period has not been documented. It was observed that the laboratory technician inspects and sets out the filters to rest at least one day prior to shipping them to the site operators, thus upholding the procedural integrity. However, placing the time stamps to retrieve the exact duration of the resting period is desired. On this note, the technician has been instructed to report the start and end date/time of the resting period next to each lot number prior to shipping.

Finding #3: "SWA laboratory personnel performed a daily balance weight check; however, it was not clear that the balance weight check was performed every 15th sample or at the end of the weighing session. If additional balance weight checks were being performed, they were not documented."

Finding #4: "Based on the documentation reviewed, duplicate filter weighings were not being performed during sample analysis."

The revised datasheet (Appendix A) demands entries for duplicate weighing and routine balance check every 10th sample during the session.

Appendix A

NORFOLK SOUTHERN - LAMBERT'S POINT PM_{10} MONITORING FILTERS DATASHEET

TECHNICIAN: **FILTER LOT #:**

FILTER NUMBER	PRE-WEIGHT (g)	DATE	TIME	TEMP (°C)	RH (%)	POST-WEIGHT (g)	DATE	TIME	TEMP (°C)	RH (%)	SITE	EXPOSURE DATE	PRESSURE, SET-OUT (in H_2O)	PRESSURE, PICK-UP (in H_2O)	SAMPLING TIME (min)	COMMENTS
		DUPLICATE WEIGHING					DUPLICATE WEIGHING				STANDARD WEIGHT:		g			BALANCE CHECK ☐
		DUPLICATE WEIGHING					DUPLICATE WEIGHING				STANDARD WEIGHT:		g			BALANCE CHECK ☐

ADDITIONAL NOTES/OBSERVATIONS: **TECHNICIAN'S SIGNATURE**