State of Oregon
Department of
Environmental
Quality

BEAVERTON $PM_{2.5}$ PARTICULATE SITE VALIDATION STUDY

1999 - 2000

Conducted By

The Oregon Department Of Environmental Quality

Laboratories And Applied Research Division

Air Quality Monitoring Section

Report By: Mark Hansen, Richard Kokich, Jeff Smith

October 30, 2000

Review by:_____ **Date:** _____

Review by:_____ **Date:** _____

Review by:_____ **Date:** _____

PURPOSE:

This study is being conducted in conjunction with the establishment of a new $PM_{2.5}$ particulate sampling site in Beaverton on the property of Highland Park Middle School. Data from this study will be used to determine if this Federal Reference Method (FRM) $PM_{2.5}$ sampler is optimally placed to characterize neighborhood scale $PM_{2.5}$ levels in Beaverton. $PM_{2.5}$ measurements from Highland Park Middle School sampler will be used to determine if the site meets the new National Ambient Air Quality Standard (NAAQS) for $PM_{2.5}$ particulates.

HOW ACCOMPLISHED:

The study will begin in February, 1999 and continue for one year. The survey samplers to be used have all been successfully tested and documented as to their precision and accuracy. Two types of $PM_{2.5}$ survey samplers are available for use in this study. Both samplers are low volume devices using an inertial greased impactor as the size separation method. One is a battery powered "Mini-Vol" sampler operating at 5 lpm. The other uses a 110 VAC pump to pull 15 lpm of ambient air through a Teflon filter quick connected to a 2 meter piece of PVC pipe which is attached to the pump with a piece of tygon tubing. Both types of samplers have been used many times in the past and both have been recently re-tested at selected sites for precision and accuracy. Test results are on file at the ODEQ laboratory. For the Beaverton survey the AC powered 15 lpm samplers will be used.

The samplers will run on the same national EPA every sixth day schedule used at other particulate samplers located statewide. Sites will be serviced by the local air monitoring network personnel as required. The filters will be returned to the ODEQ laboratory for analysis.

SITE SELECTION:

Survey sites have been located to the North, South, East and West of the FRM $PM_{2.5}$ sampler with surroundings approximately similar to the FRM site and to each other, with no known major fine particulate point source nearby. The survey sites are within 1-2 kilometers of the benchmark FRM site. See the attached photos of each survey site and the map of the entire network.

Beaverton PM2.5 Survey Site Photos.

The selected sites are as follows:

Benchmark Site
Highland Park Middle School
7000 SW Wilson St.
Lat./Long. 45 28 12.72 / 122 48 57.06
FRM Site ID# 34-10-111
Survey Site ID# 99-34-013

North
Nagle Residence
4575 SW Menlo Dr.
Lat./Long. 45 28 48.48 / 122 49 3.62
Site ID# 99-34-004

East
Vose Elementary School
11350 SW Denny Rd.
Lat./Long. 45 28 6.87 / 122 47 39.37
Site ID# 99-34-003

South
Hiteon Elementary School
13800 SW Brockman Rd.
Lat./Long. 45 27 16.33 / 122 49 14.02
Site ID# 99-34-001

West
Chehalem Elementary School
15555 SW Davis Rd.
Lat./Long. 45 28 35.44 / 122 50 14.06
Site ID# 99-34-002

NETWORK QA/QC:

The Rupprecht & Patashnick (R&P) model 2025 sequential FRM $PM_{2.5}$ sampler is an EPA certified reference method sampler for the measurement of $PM_{2.5}$. It is a proven and reliable method of measuring fine particulate and will be the benchmark device for this study. It is located at the Highland Park School site. Two survey samplers will be co-located at this benchmark site where they will provide data used to determine the precision and accuracy of the study.

All of the survey samplers will be subjected to periodic independent flow audits performed by DEQ Lab staff during regularly scheduled (monthly) network reviews. The performance of the staff operators will also be reviewed during these visits.

The operators will maintain a journal of the project, noting significant events (equipment problems, unusual weather, etc.), and document the required cleaning and regreasing of the $PM_{2.5}$ impactor inlets.

Additional Quality Control will occur at the laboratory during the review of the samples and field data sheets before and after analysis.

FUND CODE:

This study is part of the calendar year 1999 work plan for the state wide $PM_{2.5}$ network. It is funded under an EPA 103 grant. The internal DEQ Lab fund code is 9811.

SUMMARY AND REPORT:

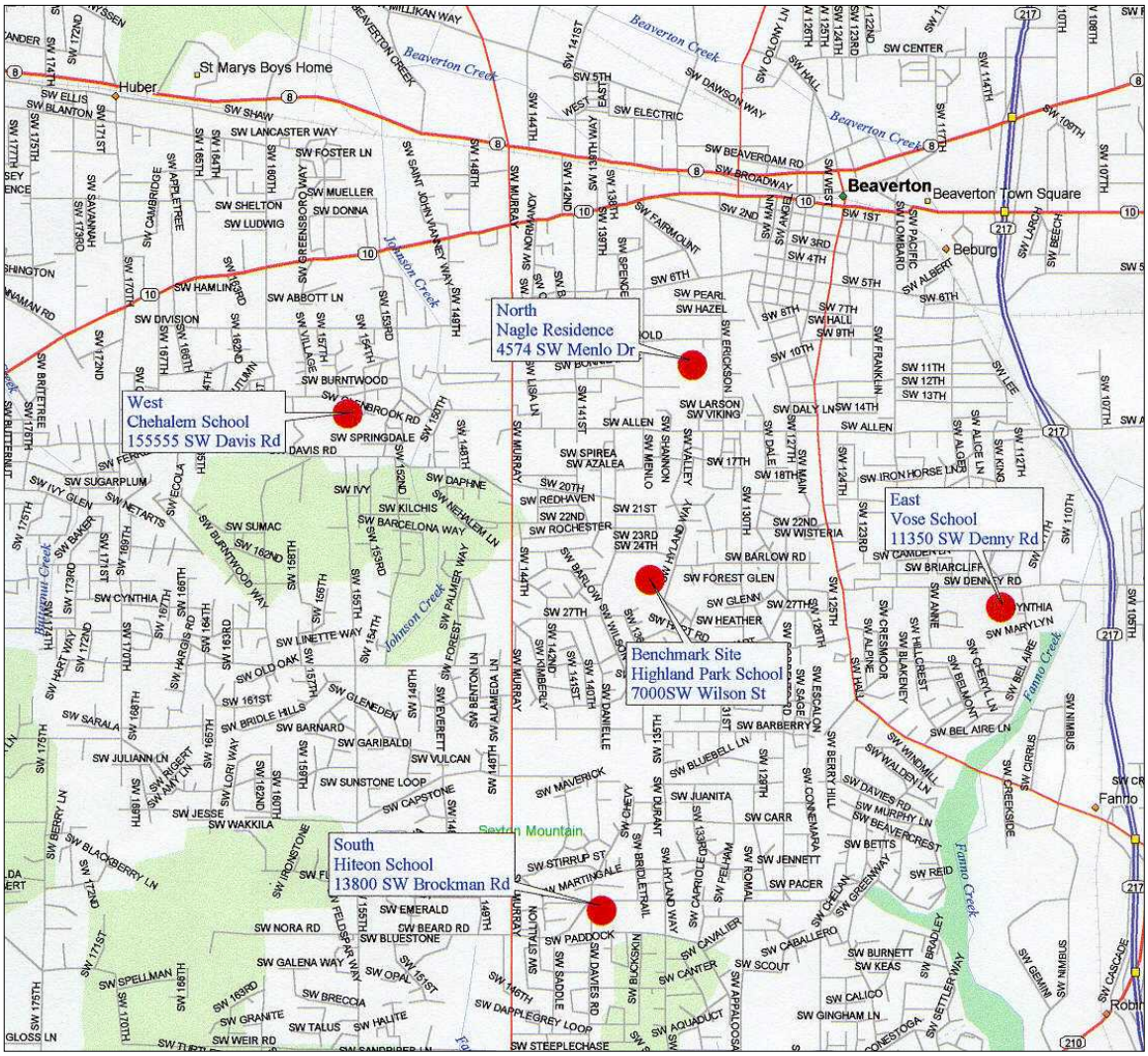
A report detailing the results of this study will be generated at the end of the one year period. The report will include all of the sampling data from all 5 sites. A comparison will be made between the performance of the co-located survey samplers (primary and duplicate) and between the co-located survey samplers and the FRM at the Highland Park School benchmark site. The results of the 4 survey sites will be compared to that of the benchmark site. A conclusion will be made as to the suitability of the current $PM_{2.5}$ siting in Beaverton.

PROJECT SCHEDULE:

Activity	Date
Develop work plan.	October –November, 1998
Site search and procurement.	November-December,1998
Equipment preparation and testing.	December,1998-January, 1999
Begin sampling.	February, 1999
End sampling.	March, 2000
Final report.	August, 2000

BEAVERTON PM 2.5 SURVEY SITES MAP

↑ North



NETWORK QA/QC:

All sampler air flow orifices used in the survey were calibrated at the DEQ Lab using a National Institute of Standards and Technology (NIST) traceable roots meter.

Prior to startup of the actual survey, all of the samplers to be used in the Beaverton study were tested as a group at the benchmark site. Four 24 hour samples were collected. This was to test each sampler's operation as well as to compare the performance of the standardized inlets used in the survey. Results of the group testing showed that the PM2.5 inlets compared favorably to one another, although they tended to over-collect $PM_{2.5}$ as compared to the reference method sampler. The results of this test appear in Appendix B. An additional test of all 15 lpm $PM_{2.5}$ inlets was also performed at the DEQ Lab. The results of this test appear in Appendix A.

Network Quality Control (QC) audits were performed at network setup on 2-10-99, and again on 6-10-99, 10-12-99, 12-16-99. A final audit was performed at the conclusion of the survey on 2-14-00. A review of audit records indicated that all of the samplers operated well within 10% of the ideal design flow (assuring a proper particulate size cut by the inlets) and that the operator's flow orifice used for the survey was also well within 10% of the audit orifice values. According to the operator's records all of the $PM_{2.5}$ impactor inlets were cleaned at their regularly scheduled (monthly) intervals throughout the duration of the survey.

The benchmark $PM_{2.5}$ FRM sampler was subject to regular monthly QC audits. All sensor and flow audits performed during the duration of the survey were within EPA established limits. Additional quarterly Quality Assurance (QA) audits of the $PM_{2.5}$ FRM sampler performed by the DEQ Laboratory QA section were all within EPA limits, confirming these results.

As a result of all of these efforts, we believe that the data quality objectives for this project were met and are confident in the quality of the data generated by this survey.

RESULTS:

Results of the Beaverton $PM_{2.5}$ survey are shown in the following tables and graphs. Table 1 contains all of the sampling data from the study. Table 2 is a summary of the data.

The precision and accuracy (P&A) of the R&P $PM_{2.5}$ FRM sampler was not tested as part of this study. P&A data for this sampler is routinely developed at a number of regular $PM_{2.5}$ sampling sites across the state. This information is available from the DEQ Lab and from EPA.

Data on the precision of the survey samplers was generated by co-locating (primary and duplicate) samplers at the benchmark site. This data is displayed in Table 3 and its accompanying graph, Figure 1. The statistical correlation between the two is 0.8622. The corresponding R squared value is 0.7434. Three of the data values appear to be obvious outliers (shaded values in Table 3). When these three data points are treated as data outliers, R squared value improves to 0.887 and the correlation becomes 0.9418. The average difference between the primary and duplicate samplers was 0.259 ug/m3 with a maximum difference of 3.3 ug/m3. The standard deviation (sigma value) between the two was 1.17.

Survey sampler accuracy is represented by the average of the co-located survey samplers vs. the benchmark PM2.5 FRM sampler. This data is displayed in Table 4 and its accompanying graph.

The survey samplers tended to over-collect particulate as compared to the benchmark FRM sampler. An analysis of the data pairs produced an R squared value of 0.8482. If adjustments are made for the 3 outliers mentioned above, R squared improves to 0.9008. The average difference between the FRM and the survey sampler average was 0.75 ug/m3, with a maximum difference of –4.2 ug/m3. The standard deviation (sigma value) between the two methods was 1.17 ug/m3.

All of the survey sites generated similar results. The data is displayed as graphs in Figures 1, 2, and 3. Survey averages from the five sites ranged from 7.6 to 8.8 ug/m3, all well below the annual $PM_{2.5}$ NAAQS of 15 ug/m3. This difference is small, approximately one sigma of the precision of the method. The North and East sites reported the highest values obtained from the survey. The highest single value from the entire survey was only 26.8 ug/m3 and occurred at the North site on 1/19/00. This is less that half of the NAAQS 24 hour standard of 65 ug/m3. The highest value from the East site was 24.5 ug/m3 and occurred on 7-5-99. Even this relatively low reading may have been influenced by late night July 4th fireworks.

CONCLUSIONS:

Overall results indicate that the $PM_{2.5}$ monitoring station at the Highland Park School Site is suitably located to characterize neighborhood scale $PM_{2.5}$ levels in Beaverton. Only 1.2 ug/m3 separated the highest and lowest survey averages which indicates a very homogenous mixture in the area surveyed. The FRM site is also not located at the maximum $PM_{2.5}$ site. The North and East sites generated the highest individual concentrations as well as the two highest survey averages. The East site was much closer to the Hwy. 217 corridor while the North site was closer to downtown Beaverton. This may explain the slightly higher readings.

For this report the average values from the survey sites was converted to “true” $PM_{2.5}$ using the correlation between the $PM_{2.5}$ FRM and the survey samplers at the benchmark site. Using this method, the Highland Park School Site $PM_{2.5}$ values fell between the averages of the two highest and the two lowest survey sites.

The ODEQ 15 lpm survey samplers appear to perform well for surveys of this nature. From the data gathered, we may conclude that this portion of Beaverton does not experience high PM2.5 concentrations. A couple of possible explanations for this exist. First, weather conditions during this winter tended to be warmer and wetter than average, and cooler and wetter than normal during the summer season. This could influence survey results by keeping particulate levels lower than might otherwise be expected. Secondly, the residents of the area surveyed do not appear to have an over-reliance upon the use of wood heating.

Although three years of monitoring are required to determine compliance with PM 2.5 NAAQS, judging from this first year it appears Beaverton will be in compliance.

Table 1.

BEAVERTON PM2.5 SURVEY RESULTS				All values in ug/m3		
	North	East	South	West	Avg of P&D	FRM (BHP)
11-Feb-99	6.1	5.4	5.3	5.9	4.7	4.6
17-Feb-99	5.3	6	4.8	4.9		5.3
23-Feb-99	2.1	2.8	2.2	2.3		2.6
1-Mar-99	4.2	5.4	4	3.9	4.7	3.5
7-Mar-99		21.5	17.4	17.9	17.7	16.9
13-Mar-99	6.3	6.2	6.9	6.7	7.2	6.6
19-Mar-99	12.8	13.2	13.5	13.5	12.2	10
25-Mar-99	4.9	5.2	3.9	3.5	4.3	2.7
31-Mar-99	6.3	7.6	6.8	6.4	7.9	6.6
6-Apr-99	8.3	8.3	6.8	5.9	7.5	6.5
12-Apr-99	8.2	8.2	6.9	7.5	6.6	6.6
18-Apr-99	5.7	12.9	10.5	9	11.1	10.4
24-Apr-99	10.3	9.4	9.1	8.5	9.2	8.4
30-Apr-99	5.3	8	9.8	6.2	7.6	7.4
6-May-99	7.1	7.6	5.6	5.8	6.2	5.5
12-May-99	4.1	2	12	3.9	5.2	
18-May-99	4	2.7	3.4		3.7	2.3
24-May-99	11		9.6	7.3	15	8.7
30-May-99		6.4	7.5	6.5	7.7	5.8
5-Jun-99	3.8	5	4.2	4.1	4.4	2.7
11-Jun-99	8	8	8.9	7.2	7.1	
17-Jun-99	6.3	7.5	7.7	6.6	7.4	6.2
23-Jun-99		6.1	5.5	4.6	5.5	4.8
29-Jun-99		5.2	5.1	4.6	5.3	5
5-Jul-99	10.6	24.5	9.2	8.5	9.8	10.2
11-Jul-99	6.8	7.7	7.2	6.4	6.9	6.7
17-Jul-99	6.3	6.4	5.8	5.8	6.6	5.6
23-Jul-99		3.6	3.4	3.9	3.4	
29-Jul-99	8.4	8.8	8.2	8.1	5.3	7.5
4-Aug-99	13.3	8.7	6	6.1	8.4	5
10-Aug-99	10.4	11.7	10.4	11.1	14.8	9.8
16-Aug-99	5.1	7.8	7.3	5.7	8.4	4.2
22-Aug-99	8.9	8.9	6.9	7.8	9.1	6.5
28-Aug-99		10.4	11.4	10.8	13.9	11
3-Sep-99	12.6	7.4	6.6	7.2	7.6	7
9-Sep-99	7.3	10.3	9.5	9.1	6.6	6.9
15-Sep-99	14.6	13.5	12	11.4	14.7	12.2
21-Sep-99	14.3	15.8	15.4	14.2	14.7	14.3
27-Sep-99	8.5	9.3	6.7	7	8.7	
3-Oct-99	11.3	11.3	8.6	9.6	10.3	9.7
9-Oct-99		8.2	7.1	8.2	7.3	8.4
15-Oct-99		11	8.5	9.3	8.4	8.8
21-Oct-99	18.6	18.8	16.4	17.1		16.2
27-Oct-99	6	6.3	6.8	7.4	6.5	5.9
2-Nov-99	18	15	11.5	8	13.3	13.5
8-Nov-99	12.7	12.8	12.1	13	12.4	14.9
14-Nov-99	13	13.2		12.1	13.1	13.8
20-Nov-99	6.5	3.5	4.2	3.2	3.5	3
26-Nov-99	6.4	10	8.8	5.6	8.4	7.4
2-Dec-99	4.2	2.7	3.7	3.1	3.1	2.7
8-Dec-99	2.8	3.6	4.4		3.9	3.4
14-Dec-99	5.5	2.2	1.6	3.2	1.8	1.6
20-Dec-99	13.2	11.9	8.2	9.1	11.6	11.7
26-Dec-99	5.8	4.9	4.6	4.5	5.7	3.8
1-Jan-00	7.5	5.2	5.1	4.9	5	4.9
7-Jan-00	16.3		14.7	12.5	14.1	15.9
13-Jan-00	7.2	5.9	5.7	8.5	5.8	6.5
19-Jan-00	26.8	19.7	9.3	11.8	13.7	14.7
25-Jan-00	8.4	8	7.6	6.6	6.7	6.8
31-Jan-00	9.3		10.6	8.2	9	9.3
6-Feb-00	9.5	6.5	6.9	8.8	7.6	7.9
12-Feb-00	11.3	7.8	10.3		9.8	11.2
Survey Avg	**8.8**	**8.7**	**7.9**	**7.6**	**8.3**	**7.7**

EXPLANATION OF MISSED SAMPLES:

NORTH
- 7-Mar Ran short
- 30-May Sampler malfunction
- 23&29 Jun Sampler damaged
- 23-Jul Sampler malfunction
- 28-Aug Sampler damaged
- 9&15-Oct Filter damaged

SOUTH
- 12-Feb Filter damaged
- 14-Nov Filter damaged

BHP-Primary
- 21-Oct Tare weight problem

BHP-Duplicate
- 17&23-Feb Sampler malfunction

EAST
- 24-May Sampler malfunction
- 7-Jan Sampler malfunction
- 31-Jan Sampler damaged

WEST
- 18-May Ran short
- 8-Dec sampler vandalized

BHP-FRM
- 12-May Ran short
- 11-Jun Power failure
- 23-Jul Shelter installation
- 27-Sep Sampler did not run

Table 2.

Site	# samples (62 possible)	Survey Avg ug/m3	Highest ug/m3	Days > 15 ug/m3	Survey Avg x correlation between FRM & Avg of primary & dupe surveys
North	54	8.8	26.8	3	8.4
East	59	8.6	24.5	4	8.2
South	61	7.9	17.4	3	7.6
West	59	7.6	17.9	2	7.3
BHP-primary	61	8	18.5	2*	7.7
BHP-dupe	60	8.6	18.6	3	8.2
Avg of P&D	59	8.6	17.7	3	8.2
BHP_FRM	58	7.7	16.9	3	7.7

* no sample on day which both FRM & Duplicate survey exceeded 15ug/m3

Table 3. **Precision Data: from the co-located survey samplers at the Highland Park School (benchmark) Site. All values in ug/m3.**

Date	Primary	Duplicate	Avg P&D	Pri-Dupe
11-Feb-99	4.5	4.9	4.7	-0.4
1-Mar-99	4.8	4.6	4.7	0.2
7-Mar-99	16.8	18.6	17.7	-1.8
13-Mar-99	7.1	7.3	7.2	-0.2
19-Mar-99	12.5	11.8	12.2	0.7
25-Mar-99	5.1	3.5	4.3	1.6
31-Mar-99	8.9	6.8	7.9	2.1
6-Apr-99	7.7	7.3	7.5	0.4
12-Apr-99	6.4	6.7	6.6	-0.3
18-Apr-99	11.3	10.8	11.1	0.5
24-Apr-99	9.4	9	9.2	0.4
30-Apr-99	7.5	7.6	7.6	-0.1
6-May-99	6.4	5.9	6.2	0.5
12-May-99	5.1	5.2	5.2	-0.1
18-May-99	3.9	3.4	3.7	0.5
24-May-99	18.5	11.4	15	7.1
30-May-99	7.5	7.8	7.7	-0.3
5-Jun-99	3.8	4.9	4.4	-1.1
11-Jun-99	7.4	6.8	7.1	0.6
17-Jun-99	7	7.7	7.4	-0.7
23-Jun-99	5.9	5.1	5.5	0.8
29-Jun-99	5.5	5	5.3	0.5
5-Jul-99	9.7	9.8	9.8	-0.1
11-Jul-99	6.8	7	6.9	-0.2
17-Jul-99	7.1	6	6.6	1.1
23-Jul-99	3.1	3.7	3.4	-0.6
29-Jul-99	8.9	8.8	5.3	0.1
4-Aug-99	6.7	10	8.4	-3.3
10-Aug-99	11.4	18.1	14.8	-6.7
16-Aug-99	7.6	9.1	8.4	-1.5
22-Aug-99	7.7	10.5	9.1	-2.8
28-Aug-99	10.1	17.7	13.9	-7.6
3-Sep-99	6.3	8.8	7.6	-2.5
9-Sep-99	5.6	7.5	6.6	-1.9
15-Sep-99	14.4	15	14.7	-0.6
21-Sep-99	14.3	15	14.7	-0.7
27-Sep-99	8.1	9.4	8.7	-1.3
3-Oct-99	9.4	11.1	10.3	-1.7
9-Oct-99	7.3	7.3	7.3	0
15-Oct-99	8	8.8	8.4	-0.8
27-Oct-99	5.8	7.2	6.5	-1.4
2-Nov-99	13.1	13.5	13.3	-0.4
8-Nov-99	11.5	13.2	12.4	-1.7
14-Nov-99	13.8	12.3	12.1	1.5
20-Nov-99	3.7	3.3	3.5	0.4
26-Nov-99	7.6	9.2	8.4	1.6
2-Dec-99	2.8	3.4	3.1	-0.6
8-Dec-99	3.1	4.7	3.9	-1.6
14-Dec-99	1.9	1.6	1.8	0.3
20-Dec-99	12.6	10.6	11.6	2
26-Dec-99	5.3	6	5.7	-0.7
1-Jan-00	5.1	4.9	5	0.2
7-Jan-00	13.9	14.2	14.1	-0.3
13-Jan-00	5.3	6.3	5.8	-1
19-Jan-00	14.9	12.4	13.7	2.5
25-Jan-00	6.7	6.6	6.7	0.1
31-Jan-00	8.9	9	9	-0.1
6-Feb-00	7.6	7.5	7.6	0.1
12-Feb-00	10.2	9.4	9.8	0.8
Survey Avg	8.1	8.5	8.3	-0.259

Count=56
Avg diff = -0.259
Sigma = 1.17
Max diff = -3.3
Correlation between Pri & Dupe=0.9418

Shaded areas are treated as data outliers and are not Included in these calculations.

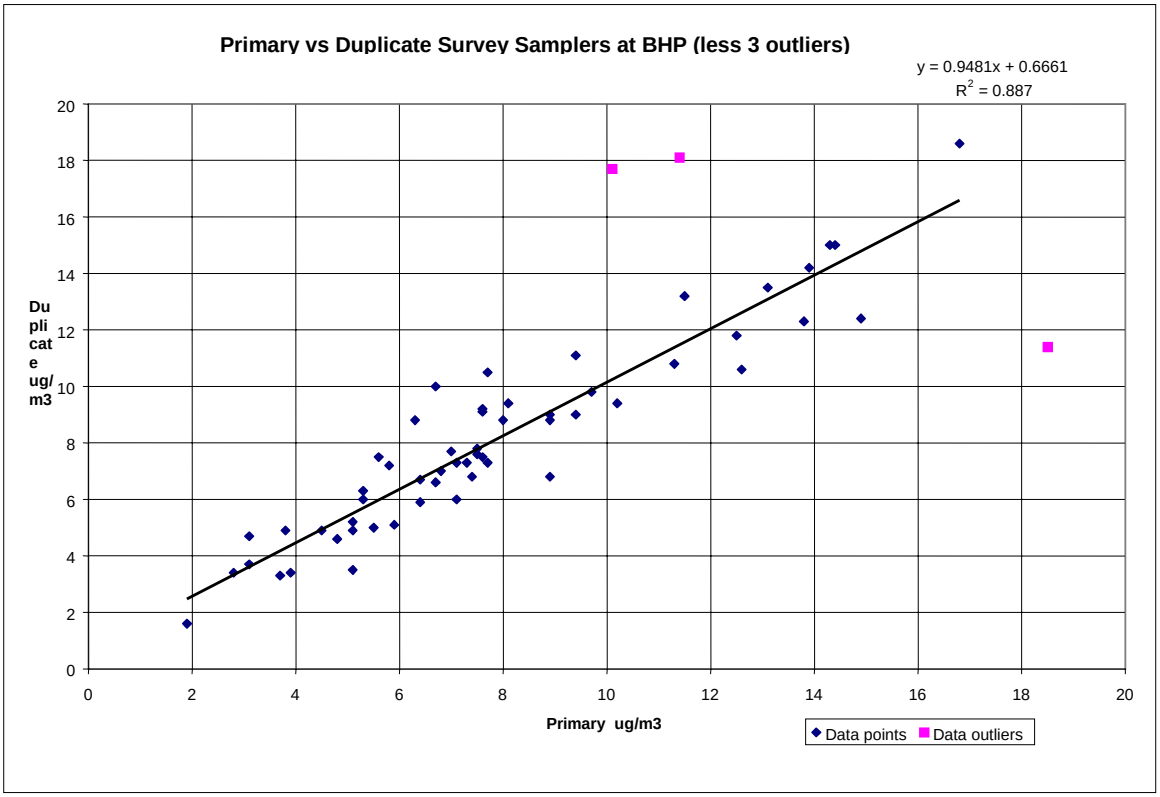


Table 4. Accuracy Data: from the average of the co-located (primary & duplicate) survey samplers & the FRM at the Highland Park School (benchmark) Site. All values in ug/m3.

Date	FRM	Avg of P&D	FRM-AvgP&D
11-Feb-00	4.6	4.7	-0.1
1-Mar-99	3.5	4.7	-1.2
7-Mar-99	16.9	17.7	-0.8
13-Mar-99	6.6	7.2	-0.6
19-Mar-99	10	12.2	-2.2
25-Mar-99	2.7	4.3	-1.6
31-Mar-99	6.6	7.9	-1.3
6-Apr-99	6.5	7.5	-1
12-Apr-99	6.6	6.6	0
18-Apr-99	10.4	11.1	-0.7
24-Apr-99	8.4	9.2	-0.8
30-Apr-99	7.4	7.6	-0.2
6-May-99	5.5	6.2	-0.7
18-May-00	2.3	3.7	-1.4
24-May-99	8.7	11.4	-2.7
30-May-99	5.8	7.7	-1.9
5-Jun-99	2.7	4.4	-1.7
17-Jun-99	6.2	7.4	-1.2
23-Jun-99	4.8	5.5	-0.7
29-Jun-99	5	5.3	-0.3
5-Jul-99	10.2	9.8	-0.4
11-Jul-99	6.7	6.9	-0.2
17-Jul-99	5.6	6.6	-1
29-Jul-99	7.5	8.9	-1.4
4-Aug-99	5	8.4	-3.4
10-Aug-99	9.8	11.4	-1.6
16-Aug-99	4.2	8.4	-4.2
22-Aug-99	6.5	9.1	-2.6
28-Aug-99	11	10.1	0.9
3-Sep-99	7	7.6	-0.6
9-Sep-99	6.9	6.6	-3
15-Sep-99	12.2	14.7	-2.5
21-Sep-99	14.3	14.7	-0.4
3-Oct-99	9.7	10.3	-0.6
9-Oct-99	8.4	7.3	1.1
15-Oct-99	8.8	8.4	0.4
21-Oct-99	16.2	16.7	-0.5
27-Oct-99	5.9	6.5	-0.6
2-Nov-99	13.5	13.3	0.2
8-Nov-99	14.9	12.4	2.5
14-Nov-99	13.8	13.1	0.7
20-Nov-99	3	3.5	-0.5
26-Nov-99	7.4	8.4	-1
2-Dec-99	2.7	3.1	-0.4
8-Dec-99	3.4	3.9	-0.5
14-Dec-99	1.6	1.8	-0.2
20-Dec-99	11.7	11.6	0.1
26-Dec-99	3.8	5.7	-1.9
1-Jan-00	4.9	5	-0.4
7-Jan-00	15.9	14.1	-0.5
13-Jan-00	6.5	5.8	0.7
19-Jan-00	14.7	13.7	-1
25-Jan-00	6.8	6.7	0.1
31-Jan-00	9.3	9	0.3
6-Feb-00	7.9	7.6	0.3
12-Feb-00	11.2	9.8	1.4
Survey Avg	7.9	8.5	-0.75

Count = 56
Avg diff = -0.75
Sigma = 1.177
Max diff = -4.2
Correlation between FRM & Average P & D= 0.9491

Shaded areas are data points where either the primary or duplicate survey values were considered outliers. For these days only the survey value closest to the FRM value is used, not the average.

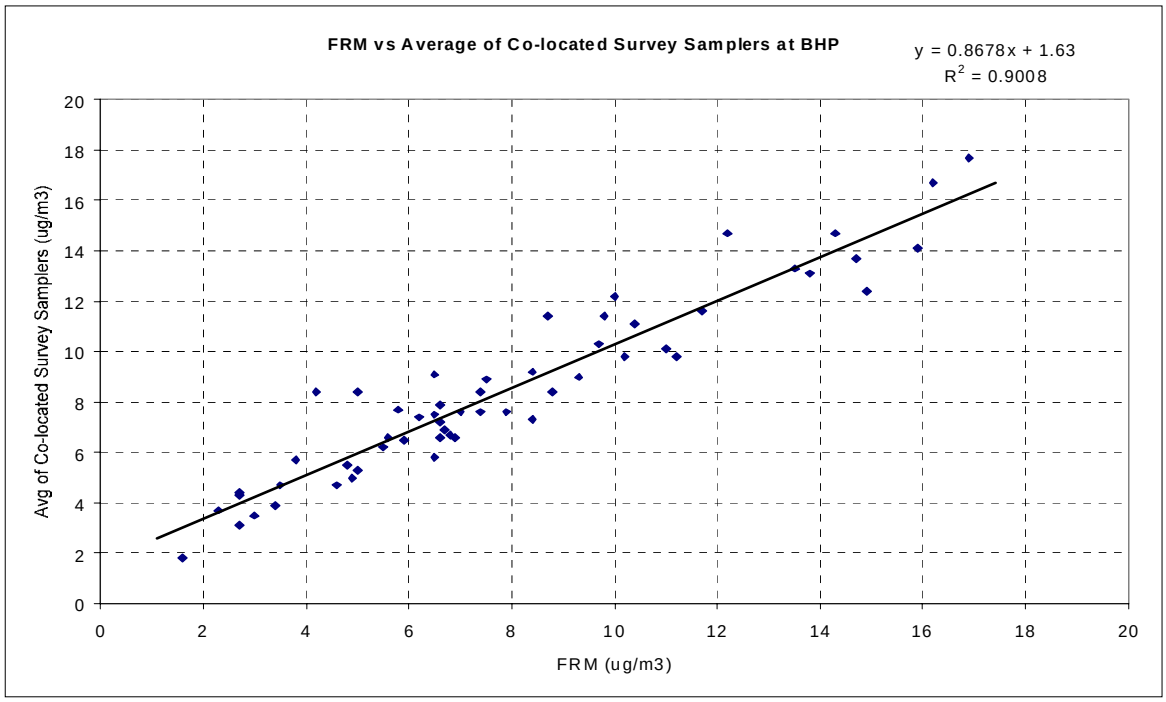


Figure 1.

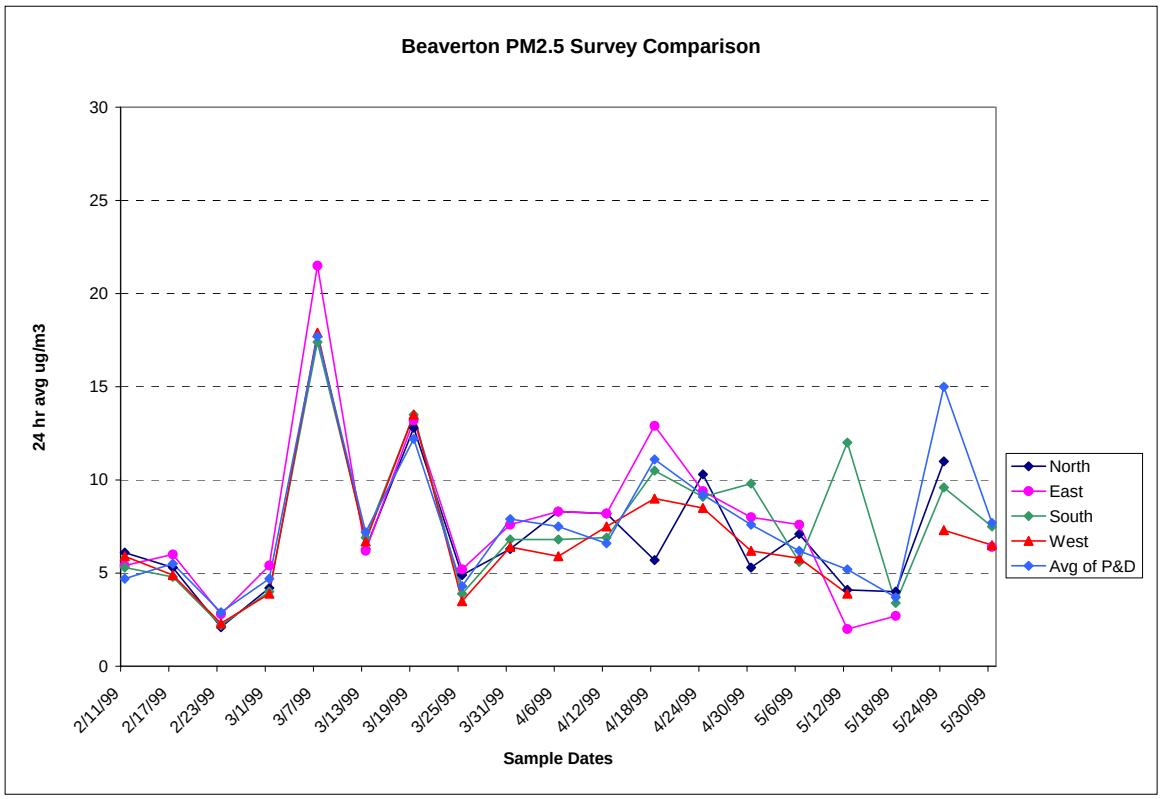


Figure 2.

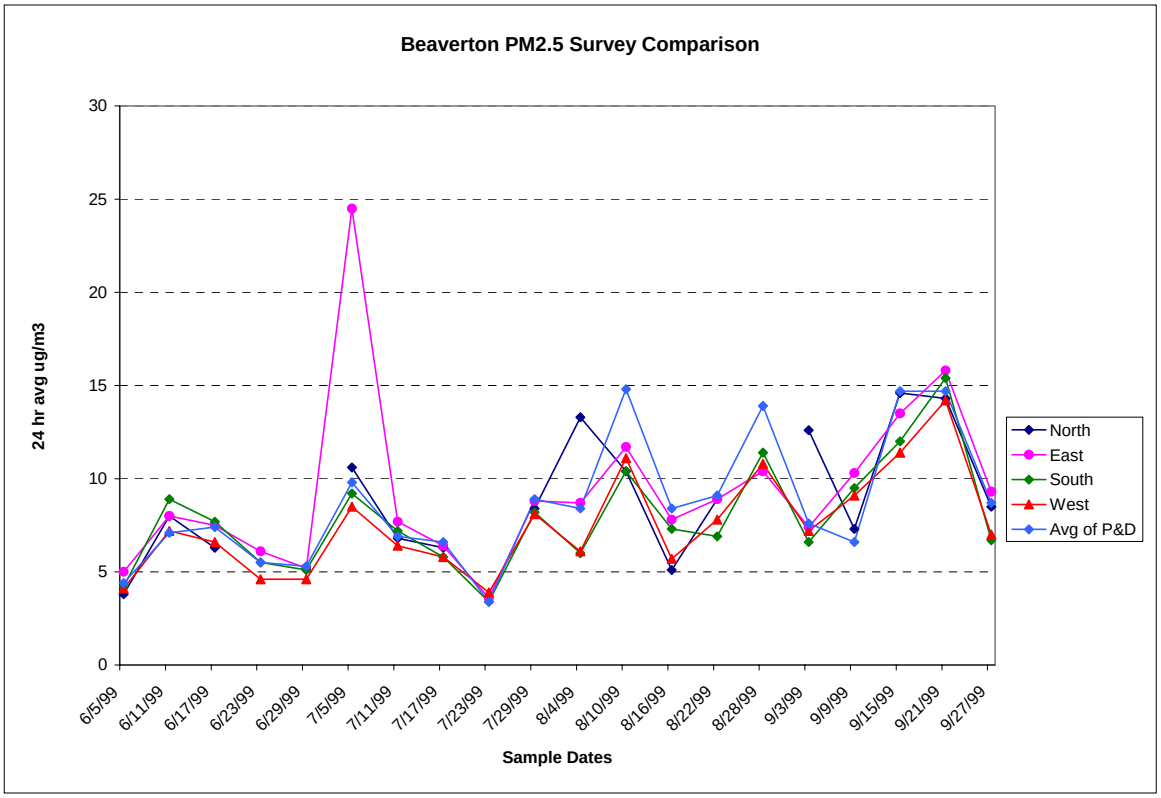
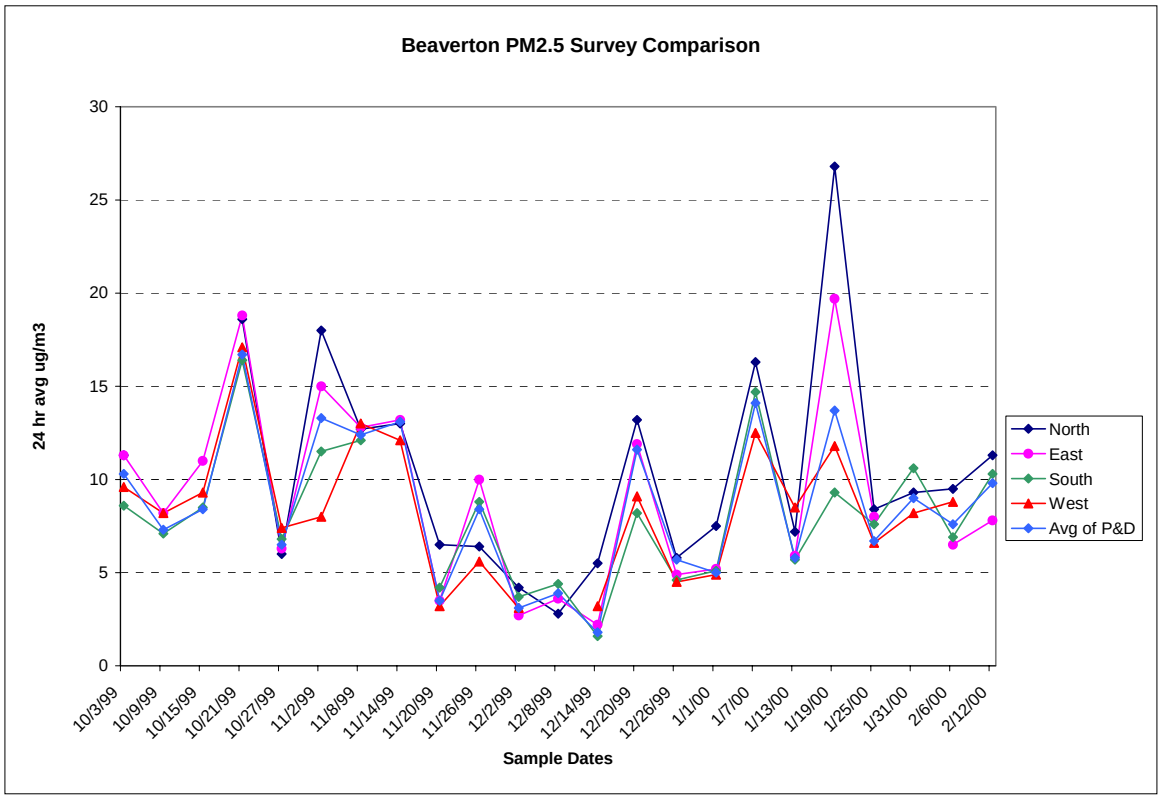


Figure 3.

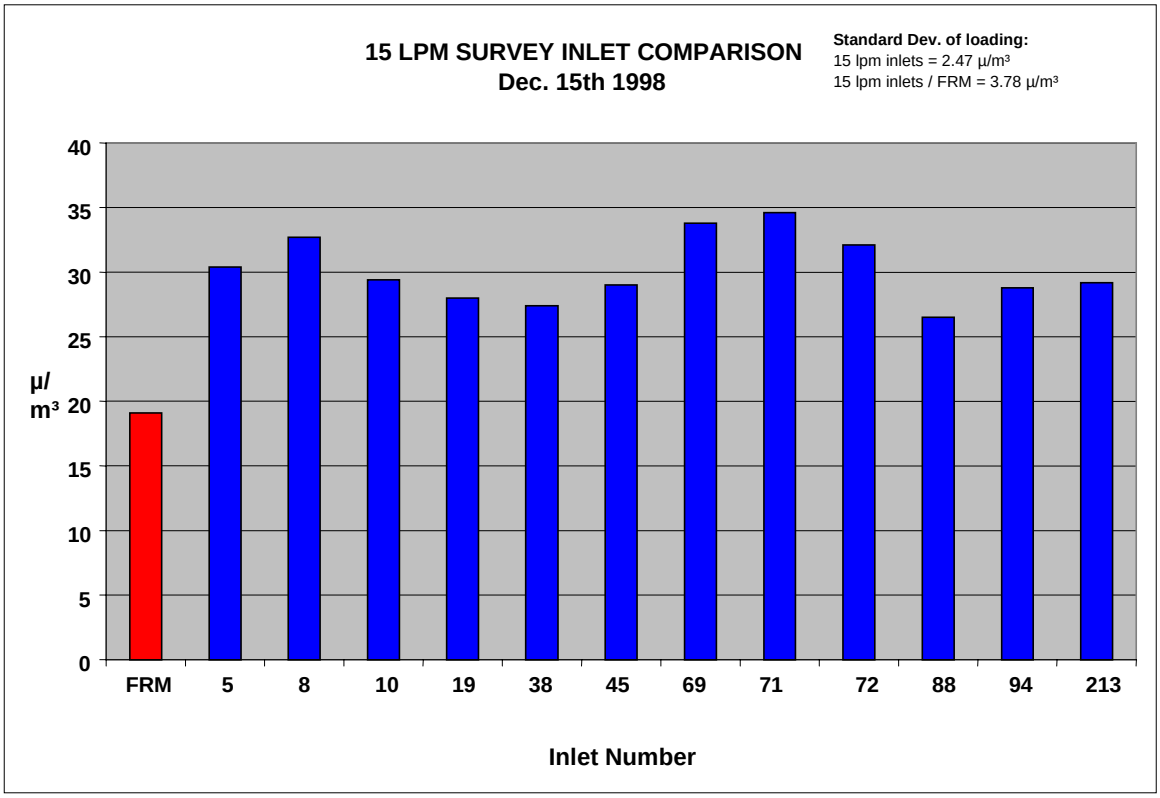

Beaverton PM2.5 Survey Comparison
24 hr avg ug/m3
30
25
20
15
10
5
0
10/3/99
10/9/99
10/15/99
10/21/99
10/27/99
11/2/99
11/8/99
11/14/99
11/20/99
11/26/99
12/2/99
12/8/99
12/14/99
12/20/99
12/26/99
1/1/00
1/7/00
1/13/00
1/19/00
1/25/00
1/31/00
2/6/00
2/12/00
Sample Dates
North
East
South
West
Avg of P&D

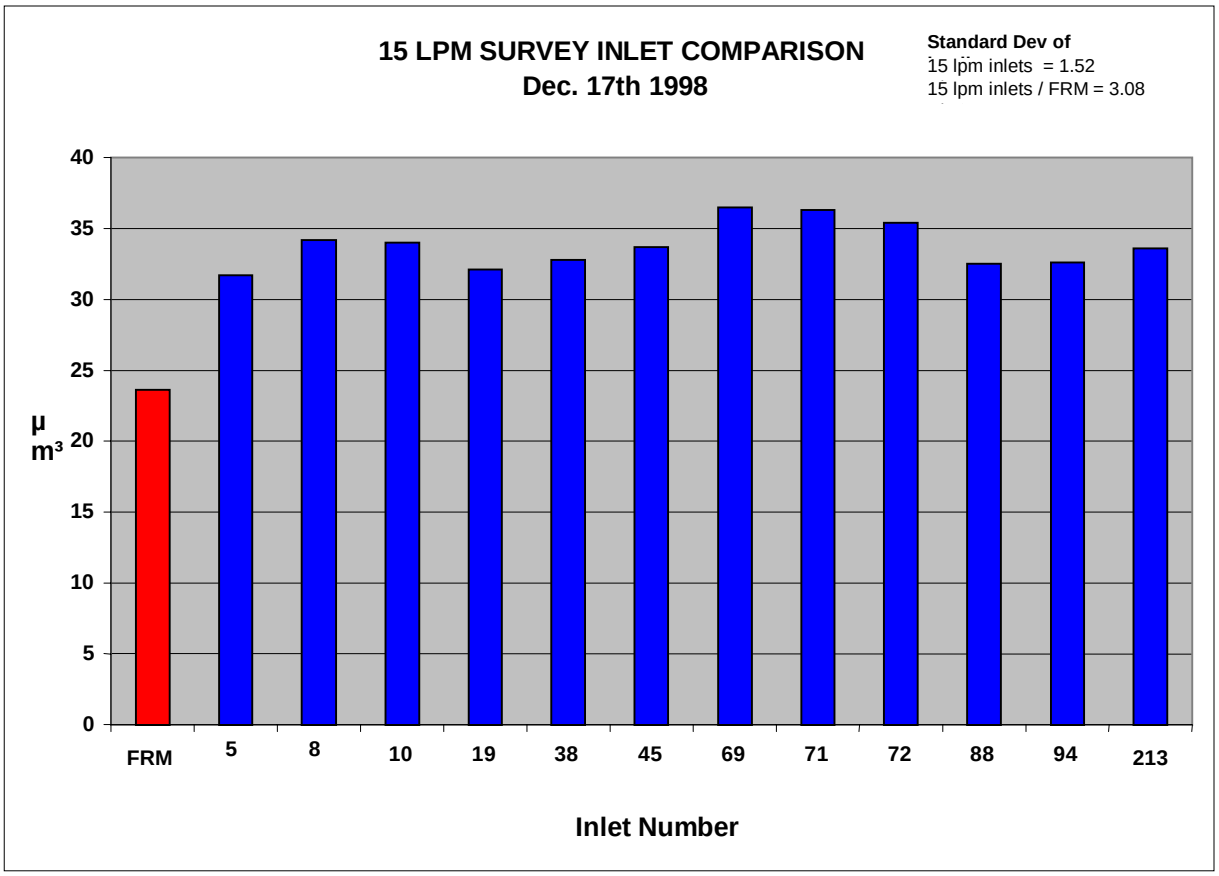
Appendix A.

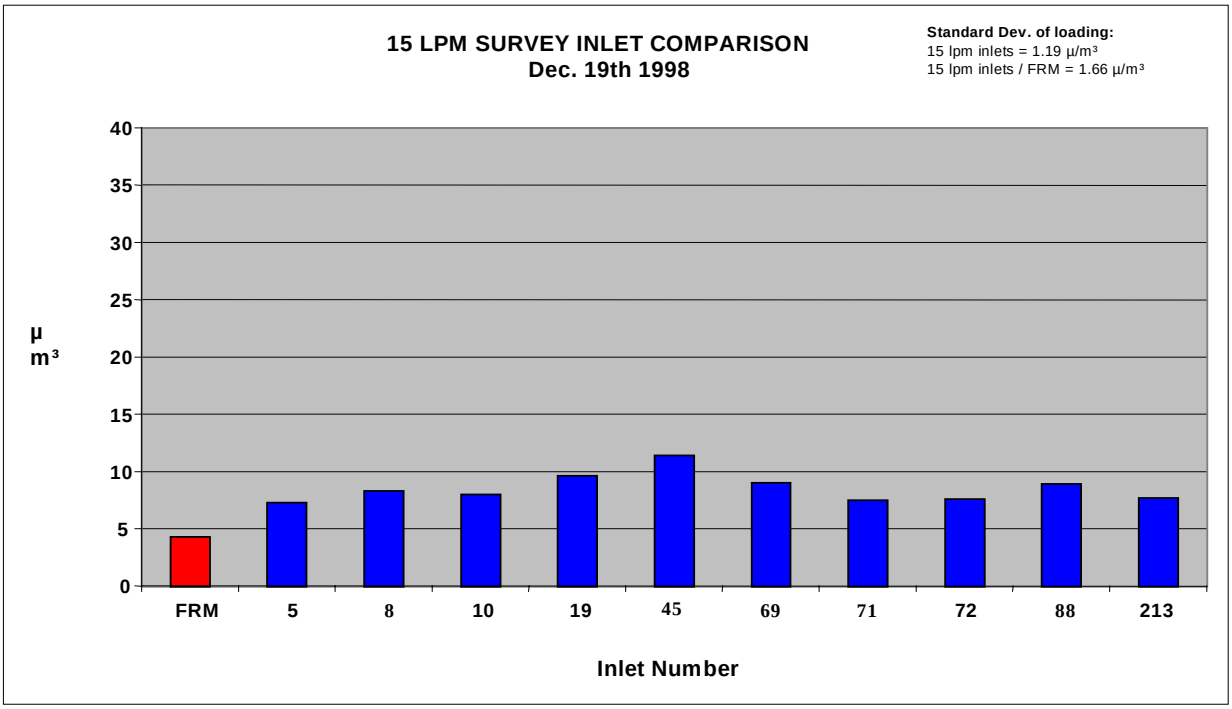
Laboratory Test of 15 LPM $PM_{2.5}$ Survey Inlets

On December 15th, 17th and 19th 1998, 5-LPM and 15-LPM low volume survey sampler inlets were tested by the ODEQ laboratory in Portland. Both 5-LPM and 15-LPM inlets were set up on ODEQ reference method medium volume samplers. The MV samplers were placed at one of our sites in the NW industrial area of town, to assure adequate filter loading, and run for 24 hours on each of the three days. In conjunction with the MV samplers, a model 2025, FRM 2.5µ sampler was run for comparison. Since the ODEQ MV sequential sampler has 12 ports available, 12 survey inlets were gang tested on each of two MV samplers; twelve 5-LPM inlets on one sampler and twelve 15-LPM inlets on another. In view of the fact we used 15-LPM inlets exclusively in Beaverton, we will only report the results of that testing.

As can be seen from the following, we found good agreement between the FRM 2.5µ sampler and the survey inlets, and also between the individual inlets. It should be noted that the survey inlets over collected in all cases and were proportionately lower at the lower loadings. From this information we can conclude the survey samplers are useful tools when compared to other samplers at different locations, however they do not generate the same data as the FRM 2.5µ sampler.




15 LPM SURVEY INLET COMPARISON
Dec. 17th 1998
Standard Dev of
15 lpm inlets = 1.52
15 lpm inlets / FRM = 3.08
40
35
30
25
20
15
10
5
0
µ
m³
FRM
5
8
10
19
38
45
69
71
72
88
94
213
Inlet Number


15 LPM SURVEY INLET COMPARISON
Dec. 19th 1998
Standard Dev. of loading:
15 lpm inlets = 1.19 µ/m³
15 lpm inlets / FRM = 1.66 µ/m³
40
35
30
25
20
15
10
5
0
µ
m³
FRM
5
8
10
19
45
69
71
72
88
213
Inlet Number

Appendix B.

INLET GANG TEST RESULTS FROM HIGHLAND PARK SCHOOL

All values in Ug/m3

Inlet Numbers							FRM	Diff. of
Sample date	**8**	**17**	**45**	**67**	**71**	**83**	**values**	**High&low**
21-Jan-99	3.4		2.9		4.4		2.1	1.5
24-Jan-99	25.7		26.4				26.1	0.8
30-Jan-99	10.4		10.4	9.9		9.3	10.9	1.1
2-Feb-99	4.1	5	6.2	3.7	5.5	4.3	4.6	2.5
5-Feb-99	4	3.4	2.9	3	2.2	3	2.5	1.8
9-Feb-99	4.4	4.2	6.3	4.4	4.8	4.9	3.9	2.1
Avg of last 3	4.2	4.2	5.1	3.7	4.2	4.1	3.7	2.1
Avg of last 4	5.7		6.5	5.3		5.4	5.5	1.9
Avg of 6	8.7		9.2				8.4	1.6