TECHNICAL MEMORANDUM

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SUBJECT: Experimental Inter-comparison of Speciation Laboratories

Introduction

This study was conducted as part of the EPA's quality assurance oversight for the $PM_{2.5}$ chemical speciation air monitoring networks that include the Speciation Trends Network (STN) and the Interagency Monitoring of Protected Visual Environments (IMPROVE) Program. The purpose of this study was to evaluate specific laboratory performance at those laboratories that routinely analyze $PM_{2.5}$ chemical speciation samples.

This study required each participating laboratory to analyze a set of blind Performance Evaluation (PE) filter samples. The PE samples were prepared at the National Air and Radiation Environmental Laboratory (NAREL) located in Montgomery, AL. NAREL was able to create replicate filter samples for this study by using co-located Met One speciation samplers. The co-located samplers were programmed to collect $PM_{2.5}$ from the Montgomery air and simultaneously load several filters during each collection event. A sufficient number of replicates were prepared so that each laboratory could receive the following set of PE samples.

- Gravimetric Mass Analysis – ten Teflon® filter samples and two metallic weights
- Ion Chromatography (IC) Analysis – six Nylon® filter samples or six Teflon® filter samples
- Carbon by Thermal Optical Analysis (TOA) – six quartz filter samples
- Elemental analysis by X-Ray Fluorescence (XRF) – six Teflon® filter samples

Detailed instructions for analyzing and reporting the PE samples were provided by NAREL. This report will compare and discuss the analytical results received from all of the laboratories. Some of the laboratories received a full set of PE samples, and some received a partial set due to limitations that will be explained later in the appropriate section of this report. Table 1 identifies all of the laboratories along with their level of participation.

Table 1. List of Participating Laboratories

Laboratory	Location	Analyses Reported
California Air Resources Board (CARB)	Sacramento, CA	Gravimetric mass IC analysis, Nylon® filters TOA carbon, modified STN method TOA carbon, IMPROVE_A method Elements by XRF
Desert Research Institute (DRI)	Reno, NV	Gravimetric mass IC analysis, Teflon® filters IC analysis, Nylon® filters TOA carbon, STN method TOA carbon, IMPROVE_A method Elements by XRF
Oregon Dept. of Environmental Quality (ODEQ)	Portland, OR	Gravimetric mass IC analysis, Nylon® filters Elements by XRF
Research Triangle Institute (RTI)	Research Triangle Park, NC	Gravimetric mass IC analysis, Nylon® filters TOA carbon, STN method TOA carbon, IMPROVE_A method Elements by XRF
University of California / Davis (UCD)	Davis, CA	Gravimetric mass Elements by XRF
EPA's National Exposure Research Laboratory (NERL)	Research Triangle Park, NC	Elements by XRF
EPA's National Air and Radiation Environmental Laboratory (NAREL)	Montgomery, AL	Gravimetric mass IC analysis, Teflon® filters IC analysis, Nylon® filters TOA carbon, STN method TOA carbon, IMPROVE_A method

Mass determination typically proceeds by weighing the Teflon® collection filter before and after the sampling event. The amount of Particulate Matter ($PM_{2.5}$) captured onto the surface of the filter can be calculated by a simple subtraction of the tare mass from the loaded filter mass. Each speciation laboratory routinely provides clean PRE-weighed air filters to the supported field sites. At the field site, an approved sampling device must be used to deposit the $PM_{2.5}$ onto the collection filter. The loaded filter is returned to the originating laboratory where the gravimetric analysis is completed by POST-weighing the filter. After the gravimetric measurements are complete, the Teflon® filter is examined further using XRF to determine the elemental composition of the filter deposit. Usually XRF is the final analysis of the Teflon® filter after which the filter is placed into an archive for storage, but in some cases the filter is subjected to one more [final] analysis to determine the ions present in the filter deposit. If the Teflon® filter is examined for ions, it must be extracted, and the extract is subsequently analyzed using ion chromatography.

Most of the speciation laboratories provide clean Nylon® filters to the field sites. It is usually the Nylon® filter that is used to capture $PM_{2.5}$ for subsequent IC analysis. After the loaded filter is returned to the laboratory, the IC analysis typically proceeds by first extracting the filter using an appropriate solvent. The extract must be analyzed using an IC instrument that is optimized to determine the ions of interest. Target anions and target cations must be analyzed on separate IC instruments.

The laboratories also provide clean quartz filters to the supported field sites. The quartz filter is used to capture $PM_{2.5}$ for subsequent carbon analysis. A thermal/optical analysis (TOA) is performed at the laboratory to determine the carbon present on the quartz filter. A carefully measured portion of the quartz filter is placed into a special oven equipped to shine a laser at the sample. The TOA technique requires heating the quartz filter material to release captured $PM_{2.5}$. Carbon components released from the filter are catalytically converted to methane and measured by a flame ionization detector (FID) positioned at the end of the sample train. A thermogram produced by the analysis contains signals from the FID and from the laser. Interpretation of the thermogram provides results for the organic carbon (OC) and the elemental carbon (EC) the sum of which represents the total carbon (TC) present in the sample. Three slightly different TOA methods were used to analyze samples during this study. A more detailed description of each TOA method will be provided later in this report.

Gravimetric Analysis

Ten new filters and two metallic transfer weights were supplied by NAREL to each laboratory for this study. These samples were placed into individual Petri slides and shipped by overnight mail to the receiving lab with instructions to PRE-weigh each filter and metallic weight using the local standard procedures. After tare measurements were completed at the receiving lab, the filters and metallic weights were returned to Montgomery and immediately placed into the weighing chamber at NAREL for equilibration and determination of a stable tare mass. Shortly after NAREL's tare measurements were complete, some of the filters were loaded with $PM_{2.5}$ captured from the Montgomery air. Co-located Met One SuperSASS air samplers were used to load seven of the filters in each sample set according to the sampling schedule presented in Table 2.

Table 2. Sampling Schedule for Gravimetric PE Filters

Filter ID	Serial Number	Sample Start	Event Duration	Receiving Lab
T06-11693	T6056193	25-Apr-06	24-hour	CARB
T06-11694	T6056194	26-Apr-06	48-hour	CARB
T06-11695	T6056195	26-Apr-06	48-hour	CARB
T06-11696	T6056196	28-Apr-06	24-hour	CARB
T06-11697	T6056197	28-Apr-06	24-hour	CARB
T06-11698	T6056198	29-Apr-06	18-hour	CARB
T06-11699	T6056199	29-Apr-06	18-hour	CARB
T06-11703	T6056254	25-Apr-06	24-hour	DRI
T06-11704	T6056255	26-Apr-06	48-hour	DRI
T06-11705	T6056256	26-Apr-06	48-hour	DRI
T06-11706	T6056257	28-Apr-06	24-hour	DRI
T06-11707	T6056258	28-Apr-06	24-hour	DRI
T06-11708	T6056259	29-Apr-06	18-hour	DRI
T06-11709	T6056260	29-Apr-06	18-hour	DRI
T06-11713	T6056264	25-Apr-06	24-hour	ODEQ
T06-11714	T6056265	26-Apr-06	48-hour	ODEQ
T06-11715	T6056266	26-Apr-06	48-hour	ODEQ
T06-11716	T6056267	28-Apr-06	24-hour	ODEQ

Table 2. Sampling Schedule for Gravimetric PE Filters

Filter ID	Serial Number	Sample Start	Event Duration	Receiving Lab
T06-11717	T6056268	28-Apr-06	24-hour	ODEQ
T06-11718	T6056269	29-Apr-06	18-hour	ODEQ
T06-11719	T6056270	29-Apr-06	18-hour	ODEQ
T06-11723	T6056275	25-Apr-06	24-hour	RTI
T06-11724	T6056277	26-Apr-06	48-hour	RTI
T06-11725	T6056278	26-Apr-06	48-hour	RTI
T06-11726	T6056280	28-Apr-06	24-hour	RTI
T06-11727	T6056281	28-Apr-06	24-hour	RTI
T06-11728	T6056282	29-Apr-06	18-hour	RTI
T06-11729	T6056283	29-Apr-06	18-hour	RTI
T06-11733	none*	25-Apr-06	24-hour	UCD
T06-11734	none*	26-Apr-06	48-hour	UCD
T06-11735	none*	26-Apr-06	48-hour	UCD
T06-11736	none*	28-Apr-06	24-hour	UCD
T06-11737	none*	28-Apr-06	24-hour	UCD
T06-11738	none*	29-Apr-06	18-hour	UCD
T06-11739	none*	29-Apr-06	18-hour	UCD

**** The 25-mm filters supplied to UCD did not have serial numbers***.

Table 2 shows thirty-five filters that were loaded during four separate collection events. A sufficient number of replicates were prepared during each event such that each lab could be provided with an almost identical set of loaded filters. For example, five replicates were created during a 24-hour collection event that started on April 25, and one of these replicates was submitted to each lab for analysis. Similarly, ten replicates were created during a 48-hour collection event that started on April 26, and two of these replicates were submitted to each lab for analysis. Table 2 does not list all of the filters that were PRE-weighed at the participating labs. Three of the ten filters that were PRE-weighed at each lab were not scheduled for loading because they were used as filter blanks for this study.

Following sample collection, the filters and the metallic weights were returned to the weighing chamber at NAREL and POST-weighed multiple times over the course of several days to demonstrate a stable final mass. Finally, the filters and metallic weights were placed into small Igloo® coolers with ice substitute and shipped back to the participating labs for POST-weighing. It is worth mentioning that the metallic weights were included in this study because they are usually less susceptible to weighing errors due to factors such as electrical static and volatility of filter constituents.

Gravimetric Results

The results from this study are summarized in Figure 1. The critical information needed by the program is the mass of $PM_{2.5}$ deposited onto the surface of a collection filter, and therefore, $PM_{2.5}$ capture is plotted in Figure 1 for the seven loaded filters, three travel blanks, and two metallic weights.

Figure 2 presents the inter-laboratory differences along with advisory limits. Inter-laboratory differences were calculated by subtracting the $PM_{2.5}$ capture value determined at each speciation lab from the capture value determined at NAREL. Notice that a negative bar on the Figure 2 graph represents a smaller $PM_{2.5}$ capture value determined at NAREL. The 3-sigma advisory limits were derived from all of the gravimetric PE studies administered by NAREL during the past few years.

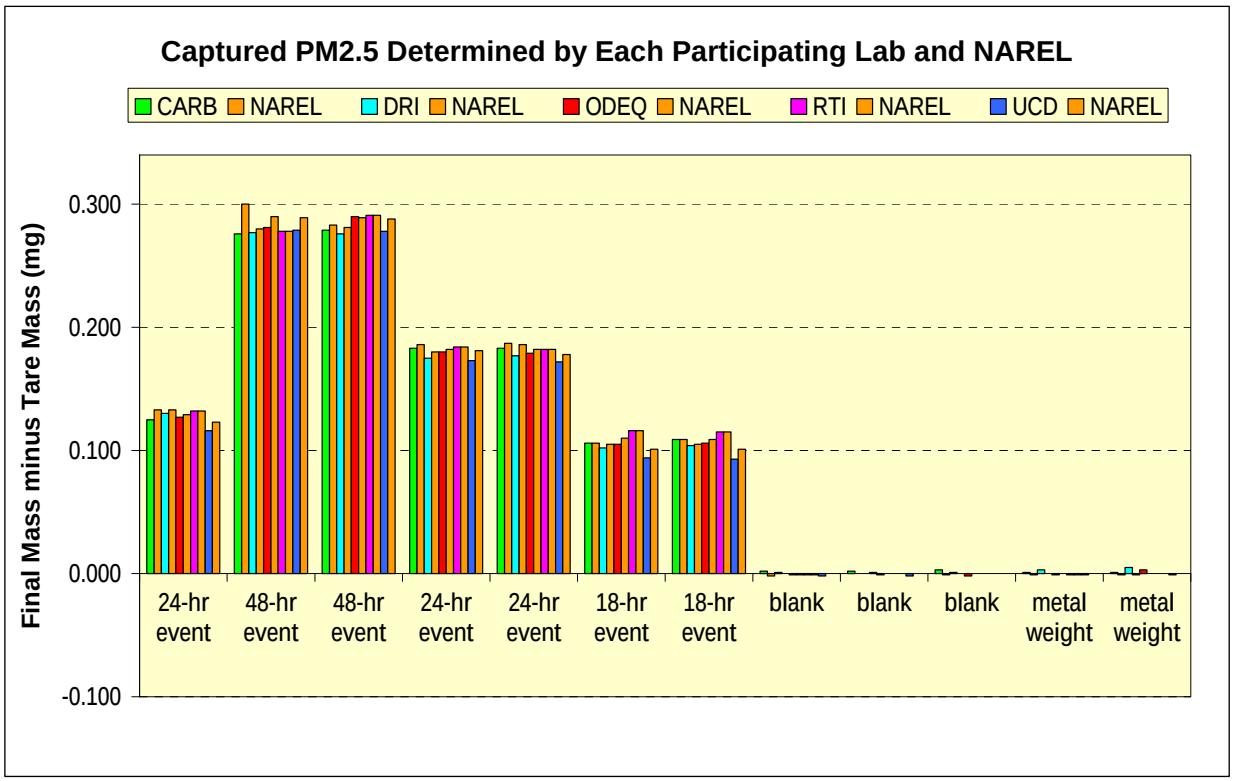
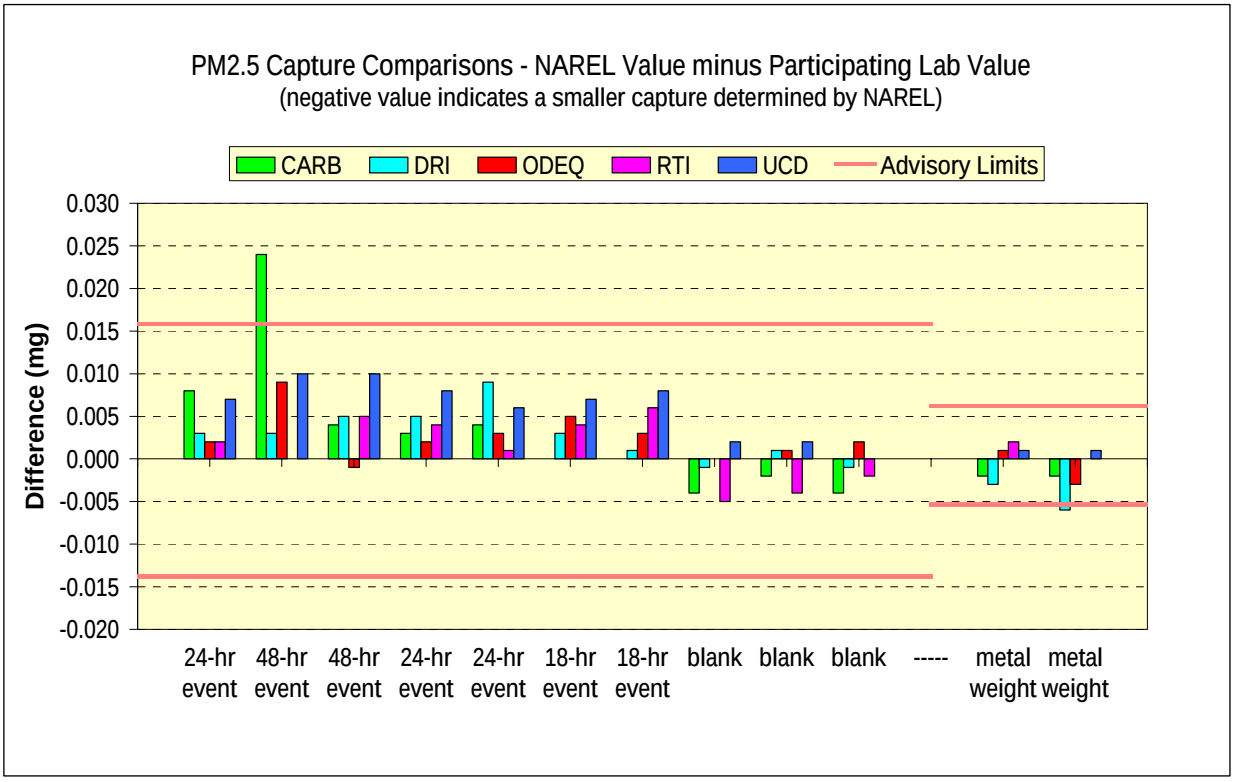


Figure 1

Figure 2



For most samples good agreement is observed between the capture value determined at NAREL and the capture value reported by the test lab. However, one of the 48-hour filters analyzed at CARB and one of the metallic weights analyzed at DRI appear to be outliers. Both of these samples exceed the 3-sigma advisory limits shown in Figure 2.

The appearance of an outlier prompted investigation at NAREL. The first outlier was a 48-hour filter sample identified as T06-11694 (see Table 2). The raw data from this sample has been summarized along a time line in Table 3. The tare mass reported by CARB was only three micrograms smaller than the tare mass reported by NAREL, but the POST-mass was 28 micrograms smaller than the POST-mass reported by NAREL. The raw data shows us that the discrepancy associated with this sample was a large difference in the POST-mass reported by both labs. Table 3 also shows us that NAREL performed an extra POST-mass determination on May 24 after the analysis had officially ended at both labs. The last extra measurement performed at NAREL was almost identical to the POST-mass reported by CARB. Based upon the raw data presented in Table 3, can we determine which lab was more accurate? Unfortunately no! It is possible that a small fiber was attached to the filter when NAREL determined the POST-mass on May 3, and perhaps the fiber was lost from the filter after that date. Other explanations are also possible.

The second outlier was a metallic weight identified as MW06-11746 which was analyzed at NAREL and also at DRI. A similar examination of the raw data was carried out for this outlier, but again, the evidence was not absolutely conclusive. Raw data from all of the samples have been tabulated for viewing. At the end of this report, Table 11 contains the tare weight, the final loaded weight, and the calculated $PM_{2.5}$ capture for each sample. Table 11 also contains the calculated inter-laboratory differences for measuring the $PM_{2.5}$ capture which is graphed in Figure 2.

All of the participating labs have an SOP for measuring the gravimetric mass of $PM_{2.5}$ filter samples. Most of the SOP's are currently available on the web for easy viewing (see reference 1 through 5).

Table 3. Summary of Raw Data for Sample T06-11694

Date	Events and Comments	Filter Mass (mg)
05-Apr-06	Filter inspected at NAREL	-----
11-Apr-06	Filter shipped to CARB by express mail	-----
13-Apr-06	***Tare mass of record*** reported by CARB	**145.079**
18-Apr-06	Filter returned to NAREL	-----
19-Apr-06	***Tare mass of record*** reported by NAREL	**145.082**
24-Apr-06	Extra tare measured at NAREL	145.081
26-Apr-06	48-hour collection event started	-----
01-May-06	First POST-weighing at NAREL	145.382
03-May-06	***POST-mass of record*** reported by NAREL	**145.383**
04-May-06	Filter shipped to CARB by express mail	-----
10-May-06	***POST-mass of record*** reported by CARB	**145.355**
23-May-06	Filter returned to NAREL	-----
24-May-06	Extra POST-weighing performed at NAREL	145.356

IC Analysis

This study included the analysis of selected ions using three slightly different IC methods. Five labs analyzed a set of Nylon® filters using the STN method, two labs analyzed a set of Teflon® filters using the STN method, and finally two labs analyzed a set of Nylon® filters using the IMPROVE method. NAREL provided each lab with a set of six filters for each method tested. Each sample set contained two blank filters and four filters that were loaded with PM2.5 collected from the Montgomery air. Co-located Met One SuperSASS air samplers were used to load filters and create replicates in each sample set according the sampling schedule presented in Table 4

Table 4. Sampling Schedule for Ion Chromatography PE Filters

Filter ID	Filter Medium	Sample Start	Event Duration	Receiving Lab	Method
N05-11555	Nylon®	08-Dec-05	159-hour	CARB	STN
N05-11556	Nylon®	08-Dec-05	159-hour	CARB	STN
N06-11575	Nylon®	09-Jan-06	144-hour	CARB	STN
N06-11576	Nylon®	09-Jan-06	144-hour	CARB	STN
N05-11557	Nylon®	08-Dec-05	159-hour	DRI	STN
N05-11558	Nylon®	08-Dec-05	159-hour	DRI	STN
N06-11577	Nylon®	09-Jan-06	144-hour	DRI	STN
N06-11578	Nylon®	09-Jan-06	144-hour	DRI	STN
N05-11559	Nylon®	08-Dec-05	159-hour	ODEQ	STN
N05-11560	Nylon®	08-Dec-05	159-hour	ODEQ	STN
N06-11579	Nylon®	09-Jan-06	144-hour	ODEQ	STN
N06-11580	Nylon®	09-Jan-06	144-hour	ODEQ	STN
N05-11561	Nylon®	08-Dec-05	159-hour	RTI	STN
N05-11562	Nylon®	08-Dec-05	159-hour	RTI	STN
N06-11581	Nylon®	09-Jan-06	144-hour	RTI	STN
N06-11582	Nylon®	09-Jan-06	144-hour	RTI	STN
N05-11563	Nylon®	08-Dec-05	159-hour	NAREL	STN
N05-11564	Nylon®	08-Dec-05	159-hour	NAREL	STN
N06-11583	Nylon®	09-Jan-06	144-hour	NAREL	STN
N06-11584	Nylon®	09-Jan-06	144-hour	NAREL	STN
N06-11585	Nylon®	18-Jan-06	192-hour	RTI	IMPROVE
N06-11586	Nylon®	18-Jan-06	192-hour	RTI	IMPROVE
N06-11593	Nylon®	27-Jan-06	188-hour	RTI	IMPROVE
N06-11594	Nylon®	27-Jan-06	188-hour	RTI	IMPROVE
N06-11587	Nylon®	18-Jan-06	192-hour	NAREL	IMPROVE
N06-11588	Nylon®	18-Jan-06	192-hour	NAREL	IMPROVE
N06-11595	Nylon®	27-Jan-06	188-hour	NAREL	IMPROVE
N06-11596	Nylon®	27-Jan-06	188-hour	NAREL	IMPROVE
T06-11589	Teflon®	18-Jan-06	192-hour	DRI	STN
T06-11590	Teflon®	18-Jan-06	192-hour	DRI	STN
T06-11597	Teflon®	27-Jan-06	188-hour	DRI	STN
T06-11598	Teflon®	27-Jan-06	188-hour	DRI	STN
T06-11591	Teflon®	18-Jan-06	192-hour	NAREL	STN
T06-11592	Teflon®	18-Jan-06	192-hour	NAREL	STN
T06-11599	Teflon®	27-Jan-06	188-hour	NAREL	STN
T06-11600	Teflon®	27-Jan-06	188-hour	NAREL	STN

Table 4 shows thirty-six filters that were loaded during four separate collection events. A sufficient number of replicates were prepared during each event such that each participating lab was provided with an almost identical set of loaded filters. For example, ten replicates were created during a 159-hour collection event that started on December 8, and two of these replicates were submitted to each lab for analysis. Likewise, ten replicates were created during a 144-hour collection event that started on January 9, and two of these replicates were submitted to each lab for analysis. The collection times used for this study were significantly longer than the usual twenty-four hours to boost the amount of $PM_{2.5}$ collected and raise the level of most analytes to above the detection threshold. Table 4 does not list the filter blanks that were provided to each participating lab.

A filter set was provided to each participating lab with instructions to use the local standard procedures, as closely as possible, for the extraction and the IC analysis. No information was given to the labs about the history of the individual filters. The results were reported for each sample based upon the amount of analyte present on the filter (µg/filter). All of the participating labs have an SOP for analyzing $PM_{2.5}$ filter samples by IC. Most of the SOP's are currently available on the web for easy viewing (see reference 6 through 13).

IC Results

Results from the analysis of twenty Nylon® filters using the STN method are presented as a bar graph in Figure 3 and Figure 4. The ten replicates from the December 8 event are shown on the left side of the graphs, and ten replicates from the January 9 event are shown on the right side of the graphs. We can see from Figure 3 that DRI reported only the anions from their filters. Nitrate, sulfate, and ammonium were the most abundant analytes captured from the Montgomery air, and these mid-level ions are plotted together in Figure 3.

Sodium and potassium were present in the air at relatively low levels, and these ions are plotted in Figure 4. For those bar graphs that show the low-level components, an extra bar was added that represents the lowest calibration standard analyzed at NAREL. The

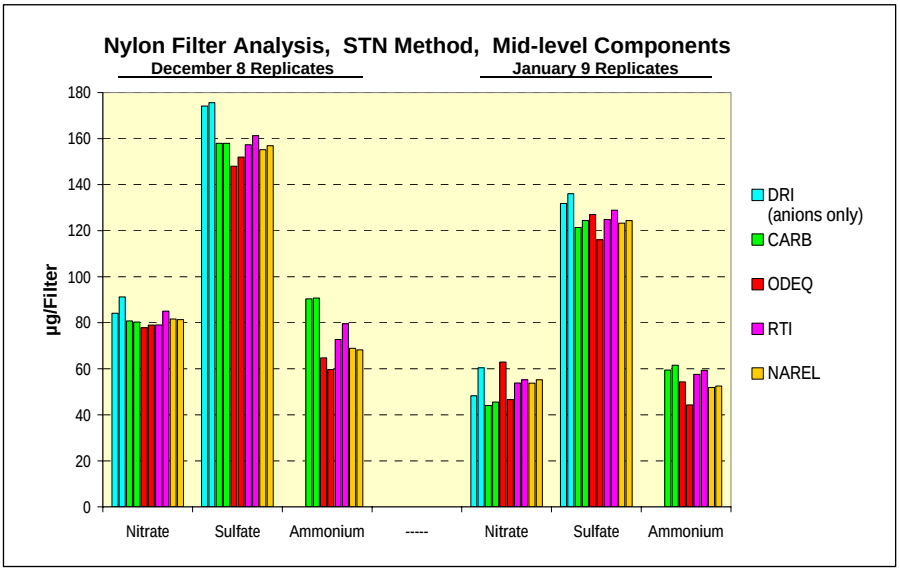


Figure 3

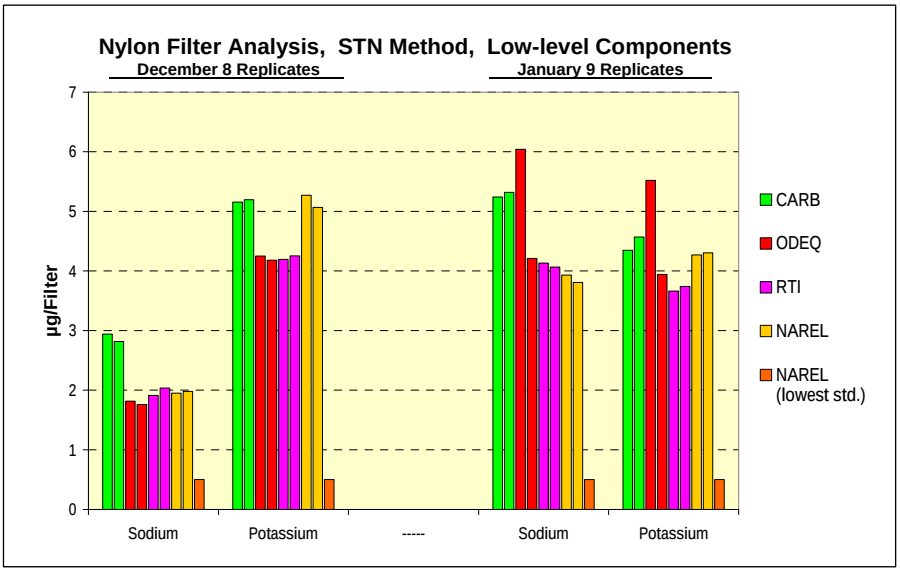


Figure 4

lowest calibration standard is a good estimate of the practical quantitation limit for the analysis. Each cluster of bars in the graph is labeled with the ion reported, but the individual samples within each cluster are not identified. It is important to understand that the replicate samples within each cluster were consistently arranged, from left to right, in the same order. Reasonably good precision can be seen in Figure 3 and Figure 4 for all of the ions. Since each lab received two replicate filters from both sampling events, it is possible to examine the inter-laboratory precision as well as the precision within each lab.

According to Table 4, sixteen more filters were loaded during the January 18 and January 27 events, and these two sampling events were special because four Nylon® and four Teflon® filters were loaded during each event. Since both filter types were used during the same sampling event, we must remember to look for differences in the analytical results that may be attributed to the filter matrix.

Figure 5 and Figure 6 show the results from the replicate Teflon® filters. Half of the replicates were submitted to DRI for analysis using the STN method, and half were retained at NAREL for analysis using the same method. Teflon® filter samples are routinely analyzed at DRI as part of their work for the Texas Commission on Environmental Quality (TCEQ). The mid-level and the low-level components are presented as separate graphs. It is worth noting that nitrate appears as a low-level component from the Teflon® filters shown in Figure 6. Previously it was a mid-level component from Nylon® filters shown in Figure 3. The lower nitrate values from the Teflon® filters are probably due to a sampling artifact, and not due to low recovery from the filter extraction or artifacts of the analysis.

Reasonably good precision was observed for all of the ions shown in Figure 5 and Figure 6.

Figure 5

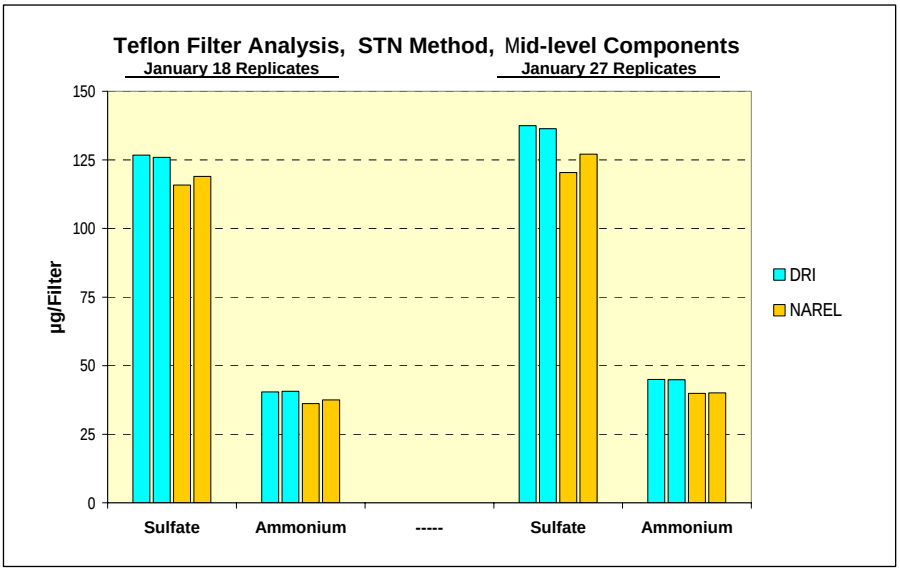
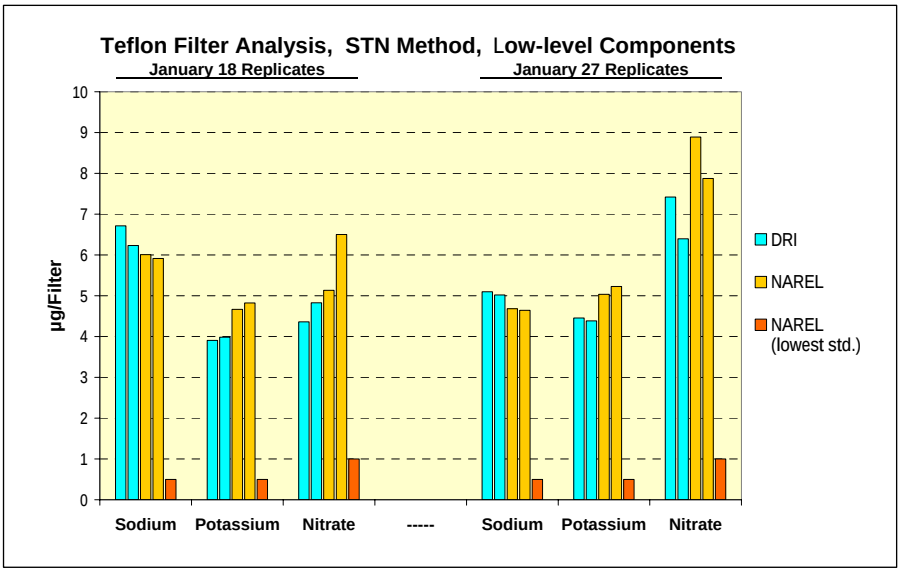


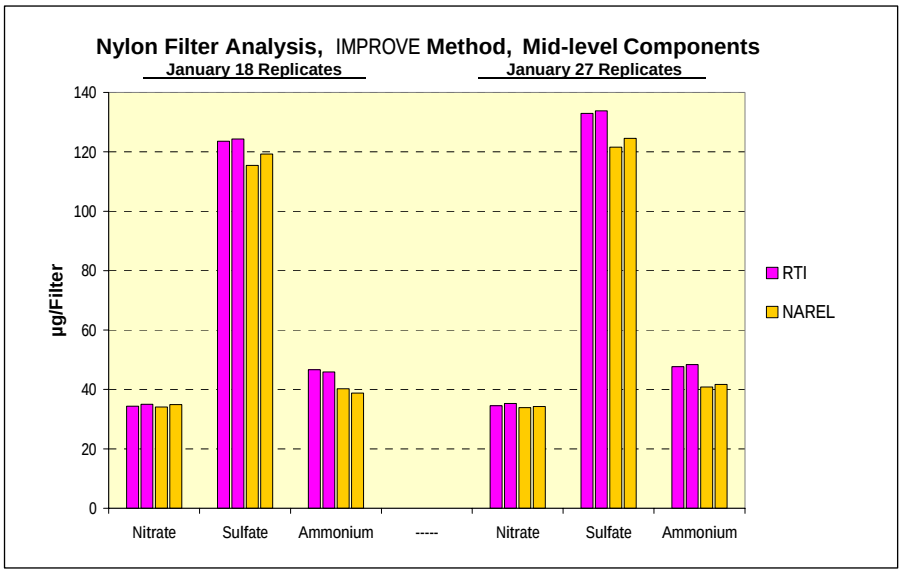
Figure 6



We have seen in Table 4 that both Teflon® and Nylon® filters were loaded during the January 18 and January 27 collection events. Figure 7 and Figure 8 show the results from the Nylon® filters using the IMPROVE method for filter extraction and analysis.

Once again the mid-level components and the low-level components are presented in separate graphs. It is not surprising to see nitrate as a mid-level component again since Nylon® was the filter matrix. Nylon filters are routinely analyzed at RTI using the IMPROVE method which is slightly different from the STN method with respect to the extraction procedure and the list of reported ions.

Figure 7



The mid-level ions are shown in Figure 7, and reasonably good precision was observed for all of the mid-level ions. Two new components are shown in Figure 8. Chloride and nitrite are routinely determined using the IMPROVE method, even though these two anions were not reported previously using the STN method. Note also that potassium and sodium are not normally reported using the IMPROVE method.

Figure 8

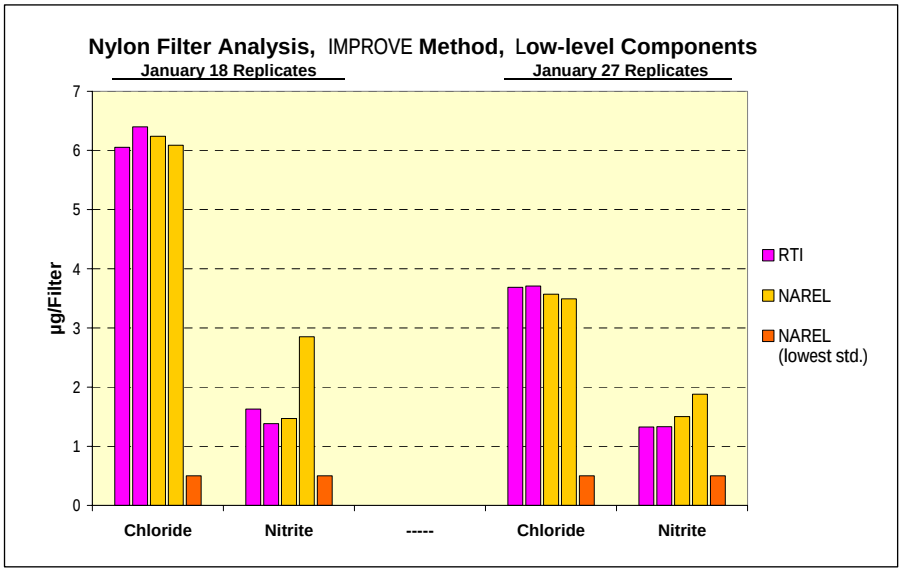


Figure 8 presents the chloride and nitrite as low-level components. Good precision was observed for the chloride results, but worse precision was observed for nitrite. One of the results from NAREL was significantly higher than the other results reported for the January 18 filters. The variability observed in the nitrite results may be due to contamination which is frequently observed in blanks. Blanks were provided to all of the labs for this study even though the blank results are not presented in graphical format. The numerical results for all of the blanks and for all of the loaded filters are available in Table 12 at the end of this report.

Carbon Analysis

This study included the Thermal-Optical Analysis (TOA) of quartz fiber filters to determine the amount of carbon present in captured $PM_{2.5}$. NAREL provided each participating laboratory with a set of six 47-mm filters. Each sample set contained two blank filters and four filters that were loaded with $PM_{2.5}$ collected from the Montgomery air. Co-located Met One SuperSASS air samplers were used to load filters and create replicates in each sample set according to the sampling schedule presented in Table 5.

Table 5. Sampling Schedule for TOA Carbon PE Filters

Filter ID	Filter Medium	Sample Start	Event Duration	Receiving Lab	Method(s)
Q05-11545	quartz	01-Nov-05	260-hour	CARB	STN (modified) and IMPROVE_A
Q05-11546	quartz	01-Nov-05	260-hour	CARB	STN (modified) and IMPROVE_A
Q06-11604	quartz	06-Feb-06	194-hour	CARB	STN (modified) and IMPROVE_A
Q06-11605	quartz	06-Feb-06	194-hour	CARB	STN (modified) and IMPROVE_A
Q05-11547	quartz	01-Nov-05	260-hour	DRI	STN and IMPROVE_A
Q05-11548	quartz	01-Nov-05	260-hour	DRI	STN and IMPROVE_A
Q06-11606	quartz	06-Feb-06	194-hour	DRI	STN and IMPROVE_A
Q06-11607	quartz	06-Feb-06	194-hour	DRI	STN and IMPROVE_A
Q05-11551	quartz	01-Nov-05	260-hour	RTI	STN and IMPROVE_A
Q05-11552	quartz	01-Nov-05	260-hour	RTI	STN and IMPROVE_A
Q06-11610	quartz	06-Feb-06	194-hour	RTI	STN and IMPROVE_A
Q06-11611	quartz	06-Feb-06	194-hour	RTI	STN and IMPROVE_A
Q05-11553	quartz	01-Nov-05	260-hour	NAREL	STN and IMPROVE_A
Q05-11554	quartz	01-Nov-05	260-hour	NAREL	STN and IMPROVE_A
Q06-11612	quartz	06-Feb-06	194-hour	NAREL	STN and IMPROVE_A
Q06-11613	quartz	06-Feb-06	194-hour	NAREL	STN and IMPROVE_A

Table 5 shows sixteen filters that were loaded during two separate collection events. A sufficient number of replicates were prepared during each event such that each participating lab was provided with an almost identical set of loaded filters. Eight replicates were created during the 260-hour autumn event that started on November 1, and two of these replicates were submitted to each lab for analysis. Likewise, eight replicates were created during the 194-hour winter event that started on February 6, and two of these replicates were submitted to each lab for analysis. The collection times used for this study were significantly longer than the normal 24-hours to boost the amount of elemental carbon deposited on the filter. Table 5 does not list the two filter blanks that were provided to each participating lab.

A filter set was provided to each lab with instructions to use local standard procedures, as closely as possible, for the analysis. No information was given to the participating labs about the history of the individual filters. ODEQ did not participate in this part of the study because their quartz filters are shipped to RTI for analysis. The DRI and RTI labs are set up to analyze a large volume of samples and routinely operate several TOA instruments. Both DRI and RTI were able to analyze each filter several times using more than one instrument and more than one TOA method. The results were reported for each sample based upon the amount of carbon per square centimeter of the filter deposit ($\mu g\ C/cm^2$). Raw data were also supplied to NAREL so that some of the thermograms are included in this report.

This study has provided an excellent opportunity to see replicate filter samples analyzed by a variety of TOA methods. Therefore it is appropriate to ask, “what distinguishes one TOA method from another?” To answer this question we must first identify the critical elements of a TOA method. At least three different TOA methods have been identified in this report based upon the temperature protocol used during the analysis. The following table provides a brief description of each temperature protocol.

Table 6. Comparison of Temperature Protocols for Three TOA Methods

STN Method TOT Analysis	CARB Method (modified STN) TOT Analysis	IMPROVE_A Method TOR Analysis	Carrier Gas	Carbon Fraction*
heater off (90s)	heater off (90s)	heater off (90s)	He Purge	-----
310°C (60s)	250°C (180s)	140°C (150-580s)	He	OC1
480°C (60s)	400°C (150s)	280°C (150-580s)	He	OC2
615°C (60s)	550°C (150s)	480°C (150-580s)	He	OC3
900°C (90s)	700°C (270s)	580°C (150-580s)	He	OC4
heater off (40s)**	heater off (60s)**	-----	He	
600°C (35s)	550°C (100s)	580°C (150-580s)	He/O_2	EC1
675°C (45s)	650°C (100s)	740°C (150-580s)	He/O_2	EC2
750°C (45s)	750°C (100s)	840°C (150-580s)	He/O_2	EC3
825°C (45s)	850°C (100s)	-----	He/O_2	
920°C (120s)	900°C (170s)	-----	He/O_2	
heater off (110s)**	heater off (200s)**	heater off (200s)**	He/O_2+ IS	

**** The Carbon fractions are not consistently defined among the different methods. See text for explanation.***

***** The "heater off" times are approximate and may have varied slightly among instruments during this study.***

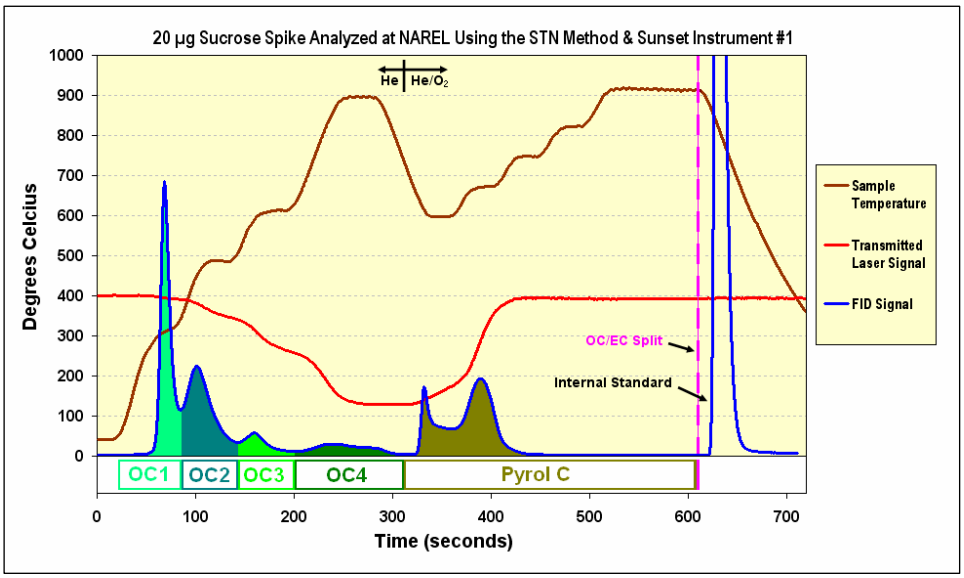
Beyond the thermal protocols listed in Table 6, each TOA method is further defined by the way optical measurements are made and utilized to calculate carbon fractions. For example, the optical measurements are used to distinguish the elemental carbon (EC) from the organic carbon (OC) present in the sample. In fact we shall see, all of the carbon fractions have a functional definition that depends upon the method of analysis.

All of the instruments used for this study are equipped with a small tubular quartz oven and a laser/diode system. The sample analysis begins by placing a carefully measured [punched] segment of the filter sample into the oven directly in the path of the laser. A purge gas removes air from the oven and surrounds the sample with a stream of pure helium before the heating and data acquisition begin. Light from the laser will interact with the sample during the analysis. A diode detector can be positioned to measure the light transmitted through the sample, and this configuration is needed for a TOT (thermal optical transmittance) analysis. A diode can also be positioned to measure the reflected light, and this configuration is needed for a TOR (thermal optical reflectance) analysis. As the sample segment is heated and the pure helium phase of the analysis proceeds, some of the organic carbon may char to form a darker pyrolized carbon (PyrolC). All of the methods in this study use either TOT or TOR to evaluate the PyrolC. Three different instruments were used for this study. The older Sunset [single mode] instruments are equipped with only one diode detector configured for the TOT analysis. The DRI Model 2001 instruments and the Sunset Dual Mode instruments are newer designs capable of measuring the transmitted and the reflected light simultaneously. These newer instruments provide more optical information since each instrument is equipped with two diode detectors giving the user a choice of the TOT or the TOR analysis. Table 7 shows specifically how the different instruments were used for analyzing the samples in this study.

Table 7. Summary of Report Packages for the TOA Analyses					
Temperature Protocol	**Optical Analysis**	**Instrument Model**	**Specific Instrument Reporting**	**Parameters Reported**	**Report Package Count**
Modified STN	TOT	DRI Model 2001	CARB Instr. #1	OC, EC, TC	1
STN	TOT	DRI Model 2001	DRI Instr. #8, #9	OC, EC, TC, OCsub, ECsub	2
			DRI Instr. #9, #10, #12	OC, EC, TC, OCsub, ECsub	3
		Sunset (single mode)	RTI Instr. R	OC, EC, TC, OCsub	4
			RTI Instr. S	OC, EC, TC, OCsub	5
			RTI Instr. T	OC, EC, TC, OCsub	6
			NAREL Instr. #1	OC, EC, TC, OCsub	7
IMPROVE_A	TOR	DRI Model 2001	CARB Instr. #1	OC, EC, TC, OCsub, ECsub	8
			DRI Instr. #6, #10, #11	OC, EC, TC, OCsub, ECsub	9
			DRI Instr. #7, #10, #14	OC, EC, TC, OCsub, ECsub	10
			RTI Instr. #5	OC, EC, TC, OCsub, ECsub	11
		Sunset (dual mode)	RTI Instr. F	OC, EC, TC, OCsub, ECsub	12
			NAREL Instr. #2	OC, EC, TC, OCsub, ECsub	13

All of the instruments in this study operate by heating a punched segment of the sample in the presence of a controlled carrier gas. Any carbonaceous material released from the quartz filter segment is swept through a series of zones that rapidly convert the released carbon to methane which is measured by a Flame Ionization Detector (FID) positioned at the end of the sample train. During the first [non-oxidizing] stage of the analysis, the carrier gas is pure helium. Oxygen is added to the carrier during the second stage of the analysis which is designed to remove any remaining carbonaceous material from the quartz residue. Most of the OC is released during the first stage of the analysis, but the EC and any PyrolC that may have formed are more difficult to volatilize, and they are expected to release during the second stage of the analysis. A known mass of methane is injected through the oven at the end of the analysis to serve as an Internal Standard (IS). Signals from the FID and from the laser may be plotted along a time axis to construct a thermogram. An example thermogram is shown in Figure 9. This is a thermogram of a sucrose spike which was analyzed at NAREL as a routine calibration check sample. The sucrose spike contains no EC but has a strong tendency to char and form PyrolC.

Figure 9



After the raw data acquisition is complete, the thermogram must be evaluated to determine those carbon fractions that will be reported for the sample. All of the participating labs report the Total Carbon (TC) as the sum of the OC and the EC fractions: TC = OC + EC. Other carbon fractions may be calculated such as the OC subfractions: OC = OC1 + OC2 + OC3 + OC4 + PyrolC. Figure 9 shows an example of OC subfractions that were calculated by a Sunset instrument. EC subfractions may be calculated as well. For example, three EC subfractions have been reported for IMPROVE samples for many years. To better understand how the EC subfractions are calculated, we should look back at Table 6 to notice that the IMPROVE_A method heats the sample at three different temperatures during the final [oxidizing] stage of the analysis. EC1 is defined by the method as that carbon released from the sample at 580 ºC after oxygen has been added to the carrier gas. And similarly, EC2 and EC3 represent the carbon released at 740 ºC and 840 ºC respectively (see Table 6). It should be obvious from these examples that the heating requirements and the precision of the method will likely affect the amount of carbon assigned to each subfraction.

A recent article by Chow *et al* (see reference 14) describes the importance of accurate temperature measurement and offers a procedure to refine the temperature calibration of each instrument. The procedure uses a set of commercially available temperature-indicating materials (Tempil Inc., South Plainfield, NJ) which may be spiked onto a blank filter segment. Each temperature-indicating material has a certified characteristic temperature at which it will transition from optically opaque to relatively transparent. Once the spiked filter segment is placed into the oven and heating begins, the laser signal must be used to detect the transition point of the spiked material. By spiking several of these materials, a calibration curve can be constructed that relates a certified temperature of the sample fragment to the oven's thermocouple reading. This procedure for temperature calibration has been applied, at least initially, to all the DRI Model 2001 instruments used in this study. A different simple procedure has been used for the calibration of the Sunset ovens, however. The Sunset software uses a cubic equation to convert signals from the thermocouple to temperature values, and the cubic equation was provided by the thermocouple manufacturer. The Sunset calibration does not account for any spatial difference between the thermocouple junction and the sample segment. Both of the Sunset dual mode instruments used in this study were modified from the standard configuration by bending the thermocouple to place the junction closer to the sample segment.

Clearly, all of the carbon fractions are defined by the method. The method controls the instrument during data acquisition and also controls the calculation of results from the raw data. Let us take a closer look at how results are calculated from the raw data. A "split point" must be established in each thermogram that separates the OC and the EC. The laser signal must be examined as part of determining the split point. If any of the original OC chars during the first stage of the analysis, the laser signal will decrease from its initial value, and will not recover until later in the run. The point at which the recovering laser signal reaches its initial value is usually the split point. Some samples do not form char, however, and the laser signal does not decrease and fall below its initial value. In this case, the OC/EC split is usually assigned to that point at which the oxygen valve opens for the second phase of the analysis to begin. All of the instruments follow these general rules, but there is a specific case that is controversial, and it occurs when the laser signal indicates an "early" split point. The split point is considered early if it is assigned during the first phase of the analysis before the oxygen valve opens. Figure 10 shows an example of an early split point.

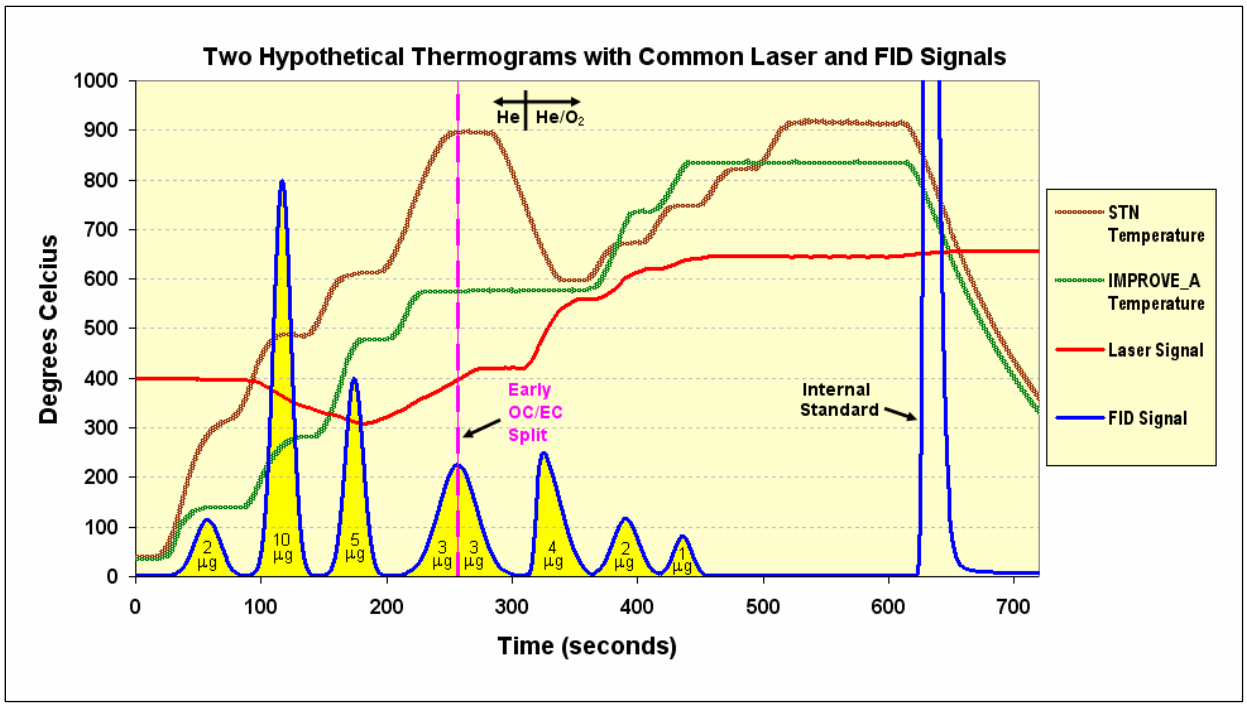


Figure 10

Figure 10 was created by considering two hypothetical samples that produce very similar thermograms even though a different method was used to analyze each sample. Both thermograms are shown superimposed in Figure 10. The two hypothetical samples are not duplicates even though the FID peaks (shown in blue) overlap exactly. According to the temperature profiles shown in the figure, one of the samples was analyzed using the STN method, and the other was analyzed by the IMPROVE_A method. We might expect very similar results from these two hypothetical samples since the FID and laser signals from both samples are identical. Table 8 shows us, however, that different results are calculated for some of the fractions. The important question from this exercise should be "why are the results from the two hypothetical samples not identical?" It is logical from the information given that each sample must contain a different set of compounds, but this fact does not answer the question. This hypothetical case was chosen to spotlight differences in the set of calculation rules embedded within each method.

Table 8. Hypothetical Results

Carbon Fraction	IMPROVE_A Analysis (µg)	STN Analysis (µg)
TC	30	30
OC	20	20
EC	10	10
OC1	2	2
OC2	10	10
OC3	5	5
OC4	6	3
EC1	4	NR*
EC2	2	NR*
EC3	1	NR*
PyrolC	-3	0

**** Not usually Reported for the STN method.***

Let us first examine the set of calculation rules programmed into the IMPROVE_A method. The carbon fractions OC1, OC2, OC3, OC4, EC1, EC2, and EC3 are calculated with no consideration for the laser signal. Each of these fractions is defined by the temperature and purge gas surrounding the sample during the analysis. For example, OC3 begins when the sample is surrounded by pure helium and the temperature advances from 280 to 480 °C (see Table 6). Immediately following OC3 in the thermogram, the OC4 fraction begins when the sample temperature advances from 480 to 580 °C. EC1 immediately follows the OC4 fraction and starts when the oxygen valve opens. These fractions are constructed within the thermogram such that the sum of these fractions is the total carbon in the sample.

$$TC = OC1 + OC2 + OC3 + OC4 + EC1 + EC2 + EC3 \qquad \textit{equation 1}$$

It may be useful to consider EC1, EC2, and EC3 as the elemental carbon leaving the hot sample residue during the analysis itself. But we must remember that PyrolC (char) may have formed during the sample heating as revealed by the laser signal. If the laser signal supports an OC/EC split point after the oxygen valve has opened, a positive value of PyrolC will be calculated, and the PyrolC may be considered as the original OC that was converted to EC during the analysis. If the laser signal supports an early split point, a negative value of PyrolC will be calculated, and in this case, the PyrolC may be considered as that EC which leaves the sample residue earlier than expected due to catalysts present in the sample or due to a small amount of invasive air reaching the sample. In both cases, the PyrolC value is used to adjust the OC/EC ratio so that only the original OC and all of original EC are reported for the sample.

$$OC = OC1 + OC2 + OC3 + OC4 + PyrolC \qquad \textit{equation 2}$$

$$EC = TC - OC \qquad \textit{equation 3}$$

Unfortunately, the rules for calculating the carbon fractions depend upon the method of analysis. Now let us examine how carbon fractions are calculated using the STN method. Table 8 tells us that the EC subfractions are normally not reported. So how does the STN method calculate TC if it does not use equation 1? Equation 4 offers a simple response to this question.

$$TC = \text{all FID peaks in the thermogram that appear before the IS peak} \qquad \textit{equation 4}$$

Equation 4 will produce the same result as equation 1, and it is essentially the same as equation 1 without utilizing a peak naming convention. If all the peaks in the thermogram were given names in a manner that is consistent with the IMPROVE_A method, more than three EC subfractions would be possible since the STN method includes more than three temperature steps after the oxygen valve has opened.

The STN method does not calculate a negative PyrolC value, and therefore equation 2 needs further discussion. Table 8 confirms that the STN method assigns a zero value to PyrolC in all cases of an early split point. Furthermore, it is important to notice that the OC4 fraction was terminated at the early OC/EC split point drawn in Figure 10. Although these two rules for calculating the PyrolC and OC4 are explicitly different from the IMPROVE_A rules, the OC value determined by equation 2 remains unchanged.

As we examine the results from all of the participating labs, it is important to understand the methods that were used, so that valid comparisons can be made. All of the results presented in this report have been identified with the instrument that performed the analysis as well as the thermal protocol and optical configuration that was used. All of the participating labs have an SOP for the TOA method(s) used at their laboratory. SOP's are currently available on the web for easy viewing (see reference 15 through 19).

Carbon Results

Results from the analysis of replicate quartz filters using the STN method are presented below as bar graphs. Notice that each bar in the graph is labeled with the instrument number, the lab, and the last three digits of the sample number. Figure 11 shows results from replicates that were created on November 1, and Figure 12 shows the results from replicates created on February 6. The bar segments show the OC and EC components of the total carbon but do not show the more detailed fractions. The results are

Figure 11

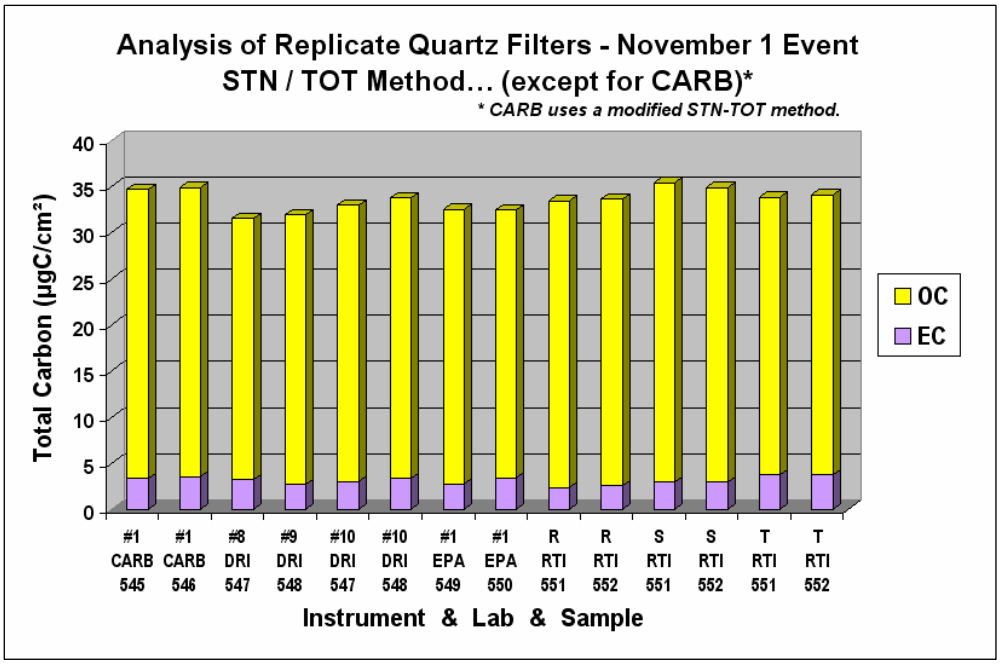
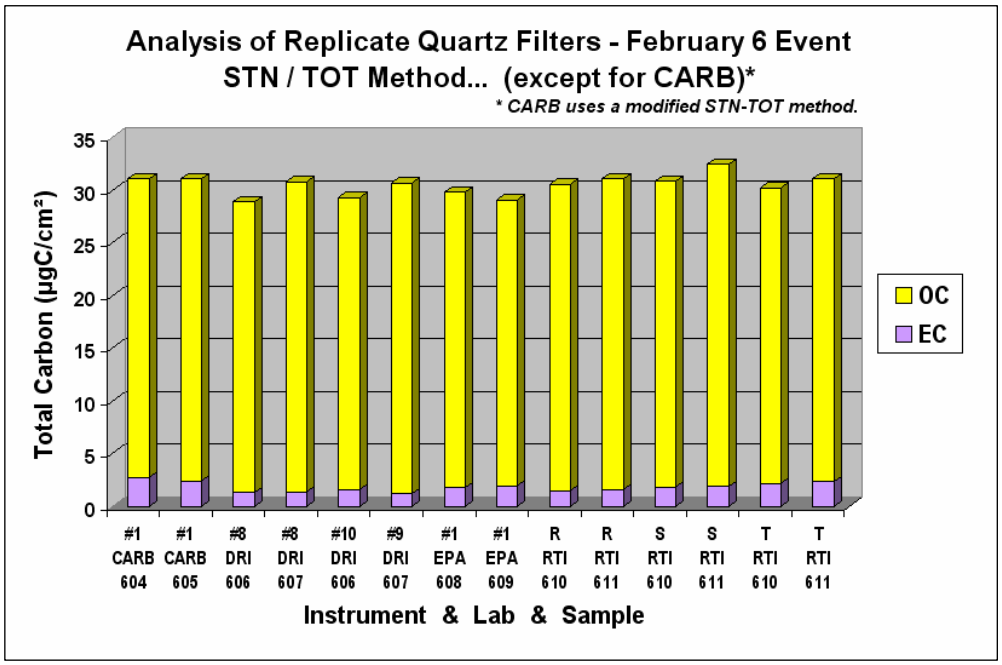


Figure 12



presented again in Figures 13 and 14 with more detail, and this time the OC subfractions are revealed. The subfractions from CARB are not presented since CARB does not use the STN temperature protocol. As explained earlier in this report, the subfractions are directly influenced by the temperature protocol used for the analysis. Even though all of the instruments identified in the figures below are using the same temperature protocol, there is noticeable variability for some of the subfractions. The worst precision is observed for OC4 and PyrolC. The thermograms for half of the samples reported in Figure 13 will be presented later in this report so it will be possible to examine the raw data that produced these results.

Figure 13

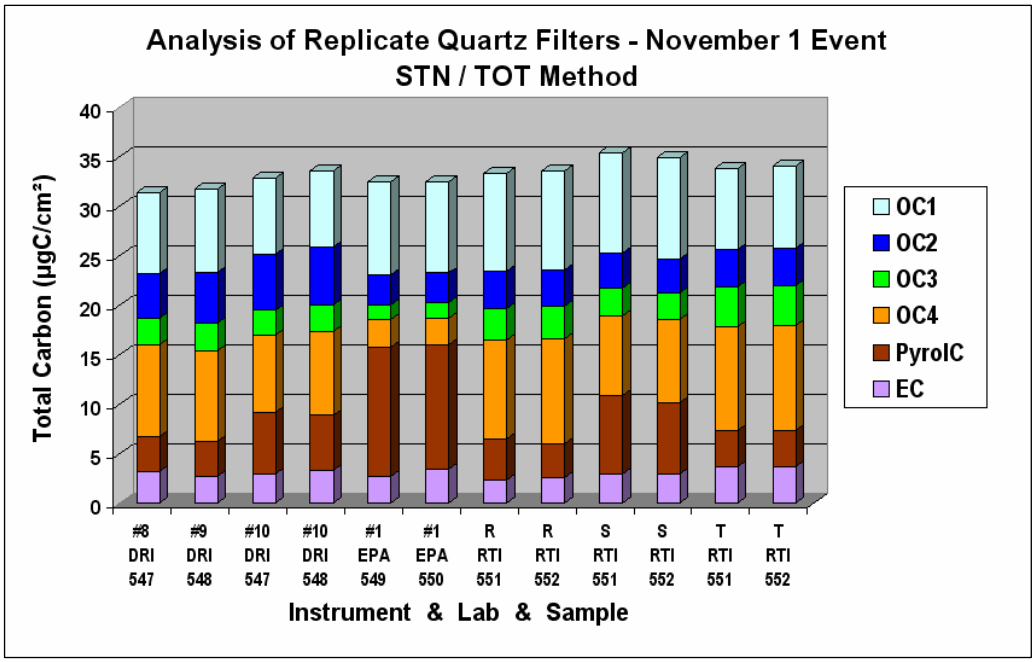
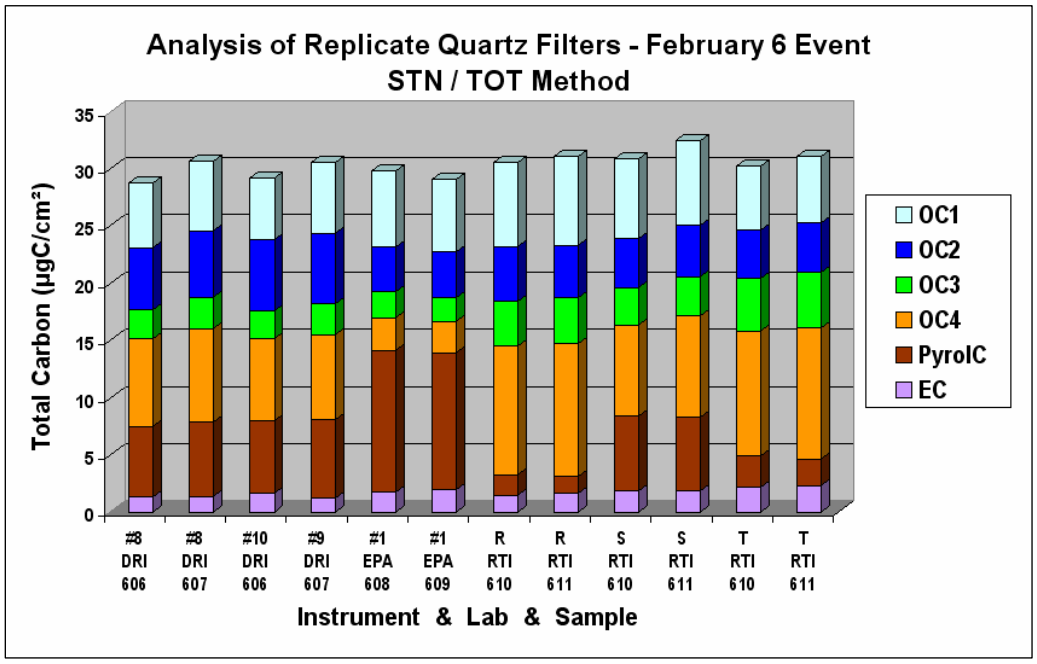


Figure 14



Only two labs were able to report results from the IMPROVE_A method during last year's study, but this year all of the labs were able to report the results that are presented below. Reasonably good precision is observed in the TC as well as the OC and EC fractions. Since all of these samples were analyzed by two different methods, it is appropriate to compare the IMPROVE_A results with the STN results presented earlier. It is not surprising that the EC results presented here in Figures 15 and 16 are significantly larger than the EC results reported from the STN method (compare with Figures 11 and 12). The OC/EC split point is usually earlier in the thermogram for the TOR analysis compared to the TOT analysis.

Figure 15

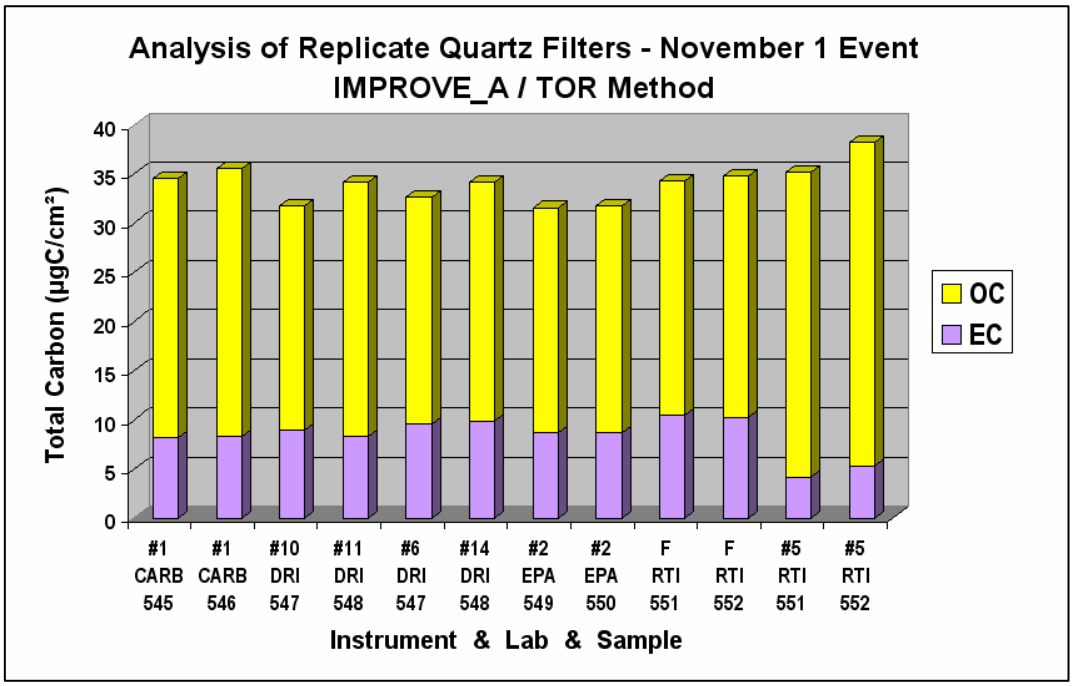
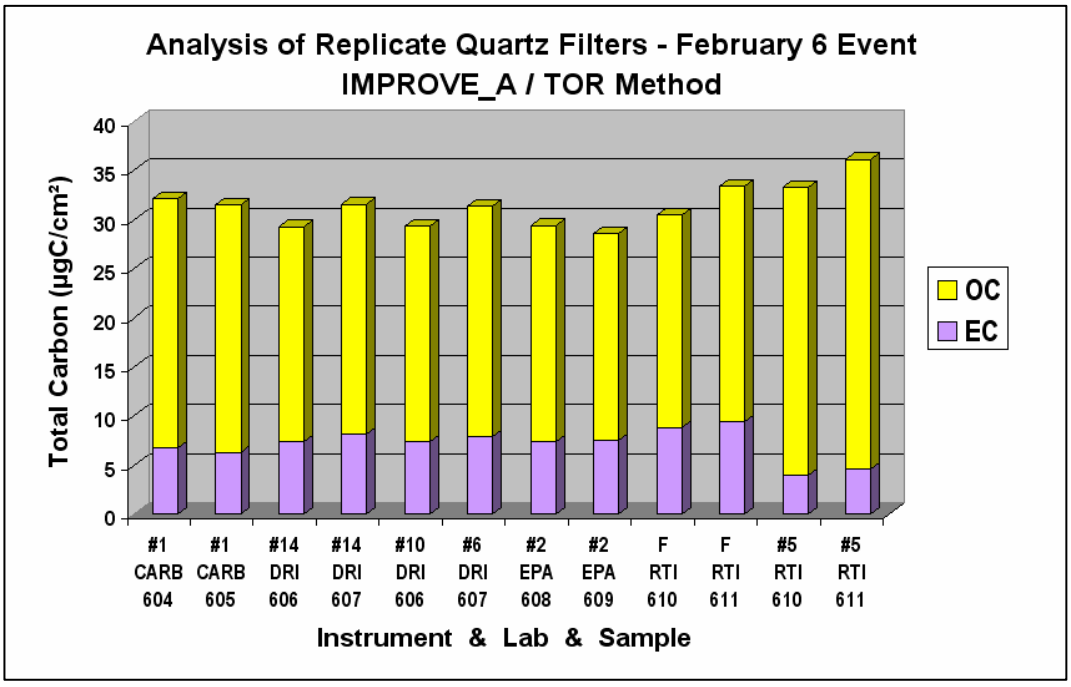


Figure 16



Figures 17 and 18 show the IMPROVE_A results again with more detail. Reasonably good precision is observed for OC2, OC3, and OC4. Worse precision is observed for OC1 and PyrolC. The reader may have already noticed a consistently low bias in the EC results from RTI's #5 instrument. We should keep this bias in mind as we examine more results that will include raw data. The thermograms for half of the samples reported in Figure 17 will be presented later in this report so it will be possible to examine the raw data that produced these results.

Figure 17

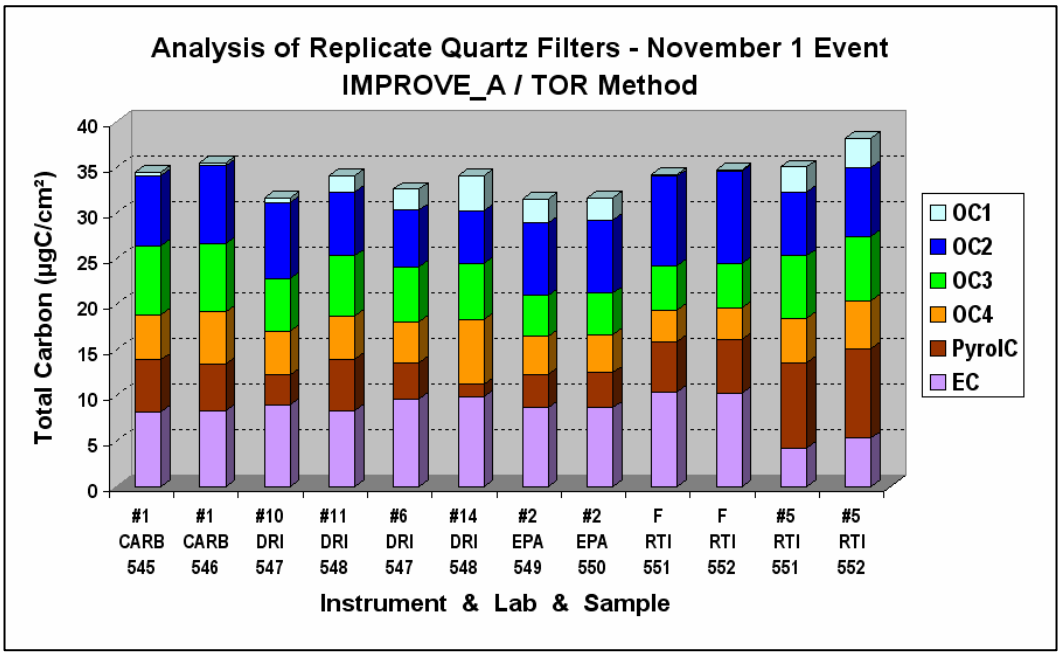
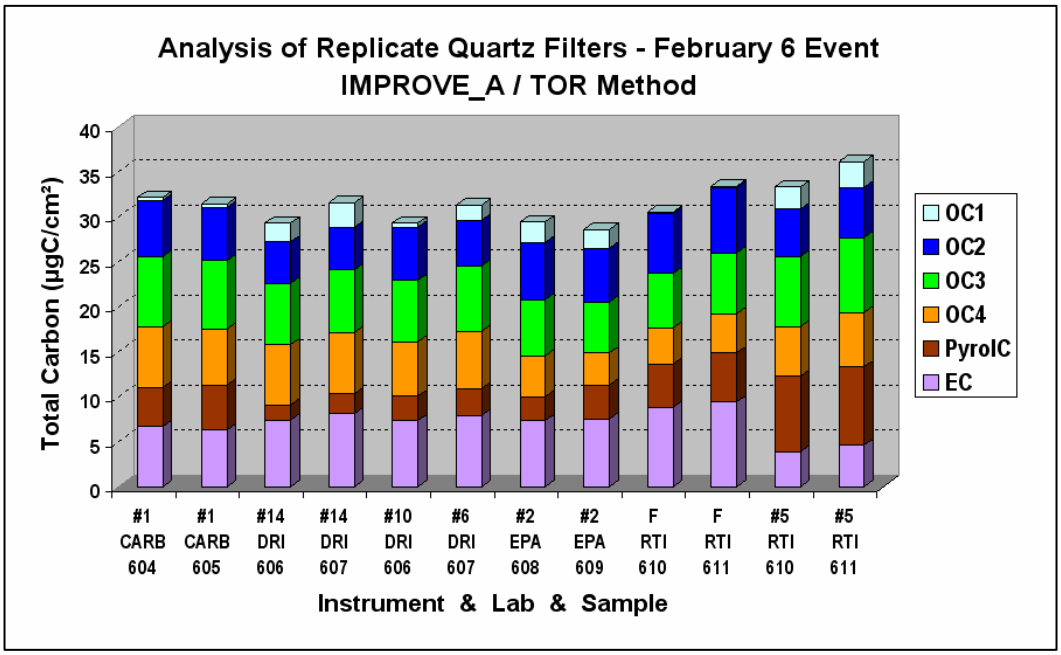


Figure 18



Figures 19 and 20 are included in this report as a bonus! The results presented below were calculated at NAREL from the data delivered by the participating labs. It was possible to calculate these results because all of the instruments running the IMPROVE_A method are dual mode instruments. The results presented below are different from the results presented previously in Figures 17 and 18, because the transmitted laser signal was used to establish the OC/EC split point. The only significant change observed in the new results is a smaller EC and a larger PyrolC. These changes were predicted, but now we can observe the size of the difference using experimental data. Notice that the low bias in EC results previously observed from RTI's instrument #5 has vanished. There may be clues in the thermograms.

Figure 19

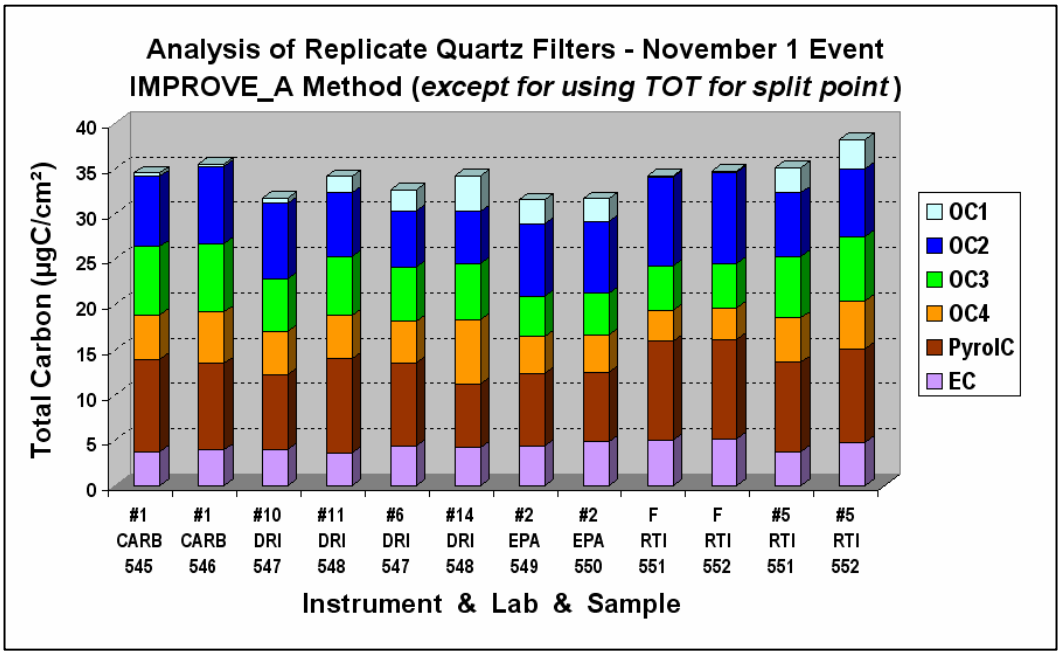
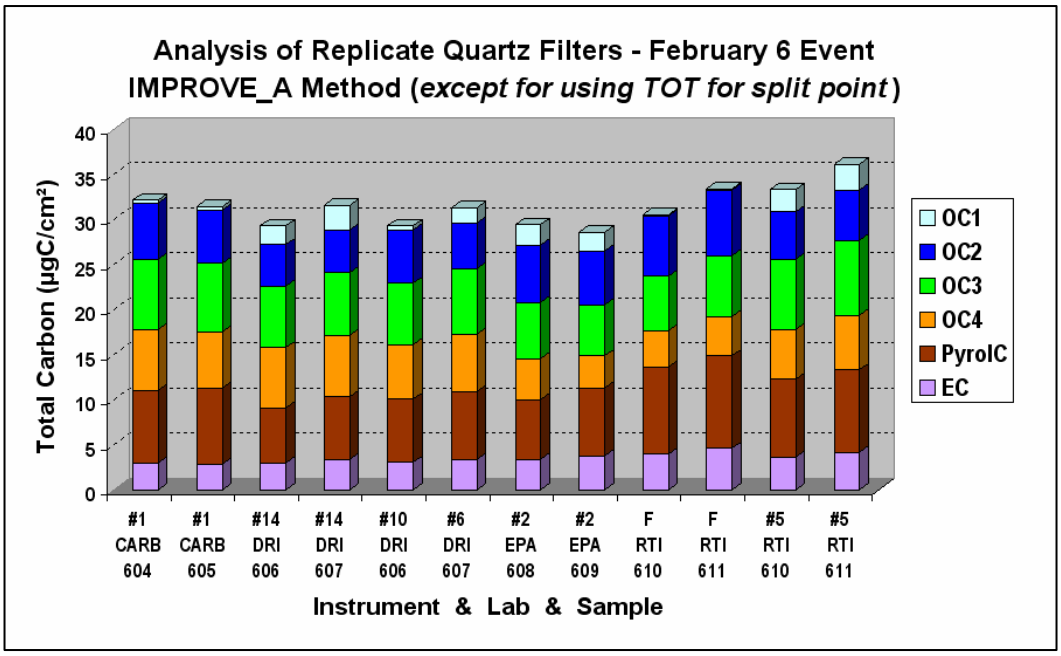


Figure 20



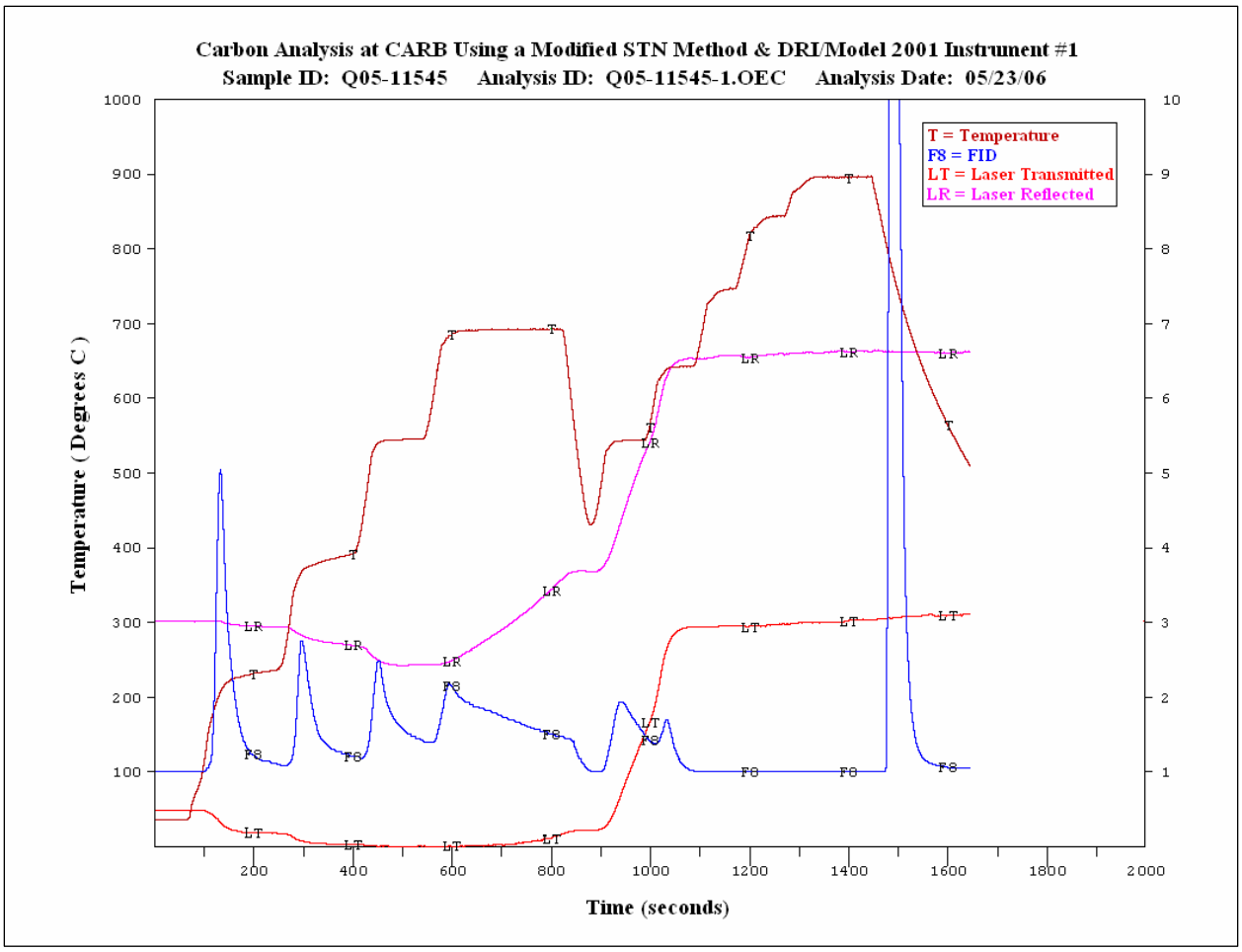
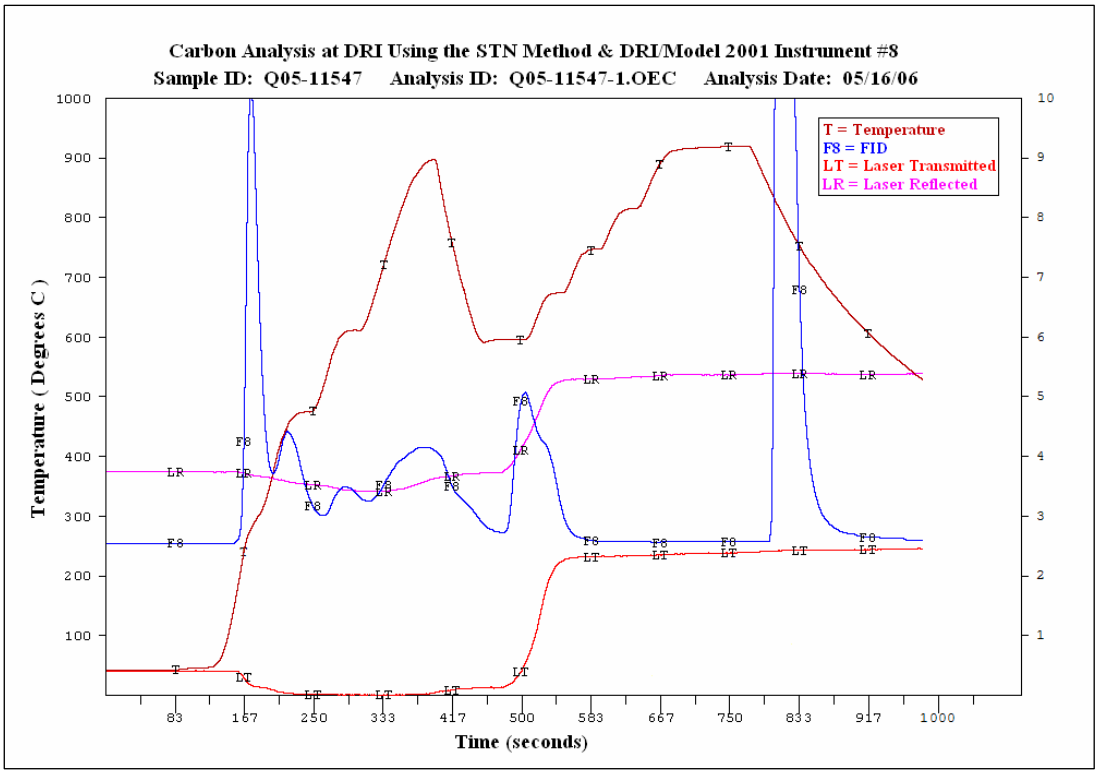


Figure 21

This report includes several thermograms from most of the instruments that were used for this study, and each thermogram was derived from the analysis of a replicate PE sample that was loaded during the collection event that started on November 1, 2005. Figure 21 shows the first thermogram submitted by CARB using their modified STN method and DRI /Model 2001 #1 instrument. CARB has adopted a modified temperature protocol because about four years ago they observed symptoms of trace oxygen contamination during the first [non-oxidizing] stage of their analysis using the STN method. Experiments were performed to learn more about the problem (see reference 20). Their experiments included changes to the temperature protocol. During their experiments, CARB observed the leak symptoms to become less severe as the first stage maximum temperature was reduced from the STN method value of 900 °C. The thermogram shows that CARB's method currently uses a 700 °C maximum temperature for the first stage of the analysis. The laser signals in Figure 21 still show some evidence of a possible small intrusive ambient air leak. Both laser signals decrease normally from their initial values as char forms. Unfortunately, both signals increase significantly before the oxygen valve opens at approximately 850 seconds into the run. It could be argued that the sample itself contains oxidizing compounds that cause the char to oxidize prematurely. If this were the case, we should see the same symptoms in the thermograms that follow Figure 21.

Figures 22 through 25 show individual thermograms from various instruments using the STN method.

Figure 22



Figures 22 and 23 were produced at DRI using the STN method and DRI/Model 2001 instruments.

Figure 23

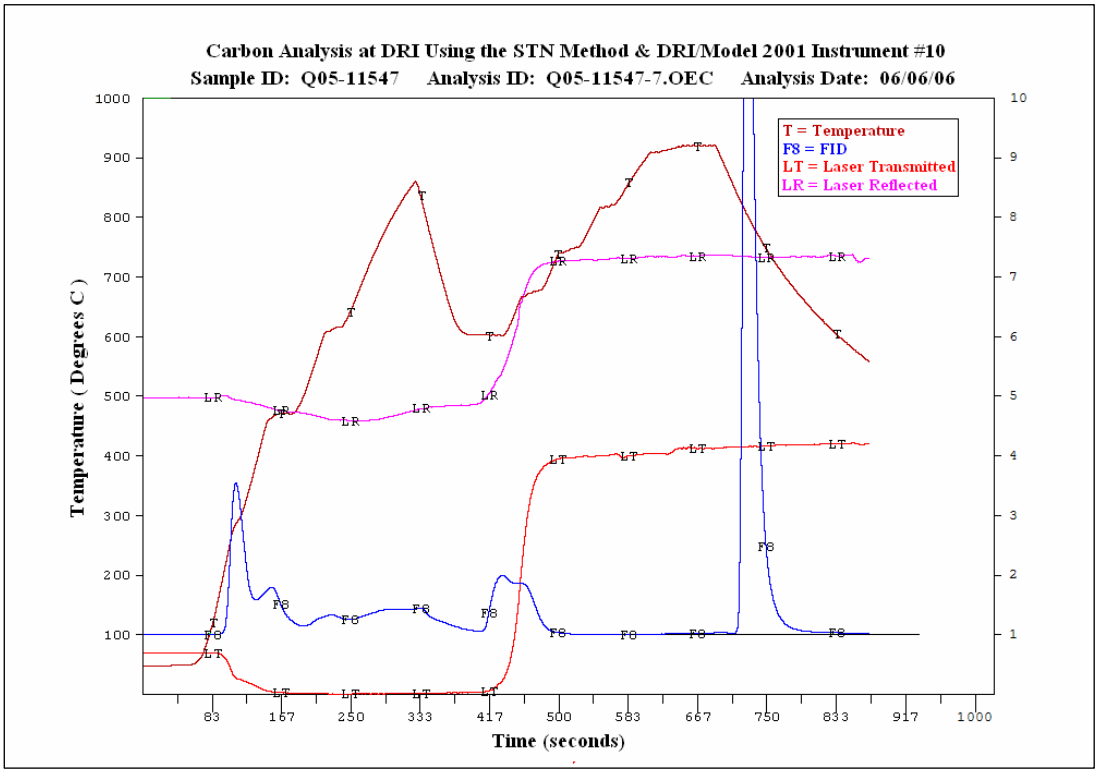
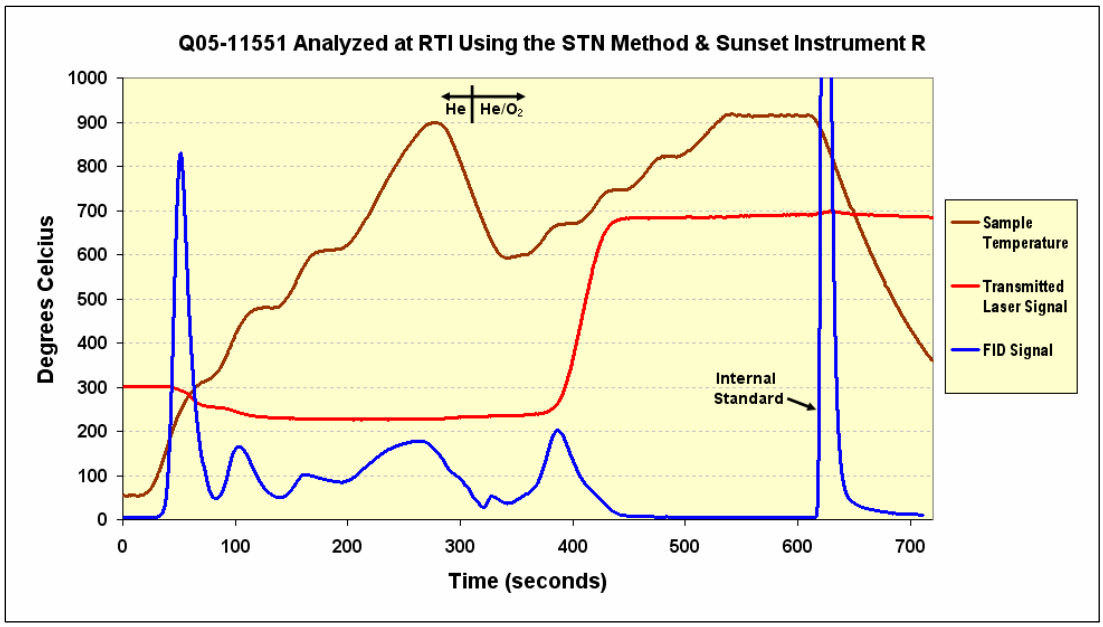


Figure 24



Figures 24 is a thermogram produced at RTI using the STN method and their Sunset instrument R. Figure 25 is a thermogram produced at NAREL using the STN method and their Sunset instrument #1. Both thermograms were produced by an older model Sunset [single mode] instrument, as indicated by a single laser signal, configured to perform the TOT analysis. It should be explained that all of the Sunset thermograms were produced at NAREL from the information inside the raw data files. And the laser signal(s) presented here were not processed using the Sunset software to correct for temperature dependence of the laser/diode system.

Figure 25

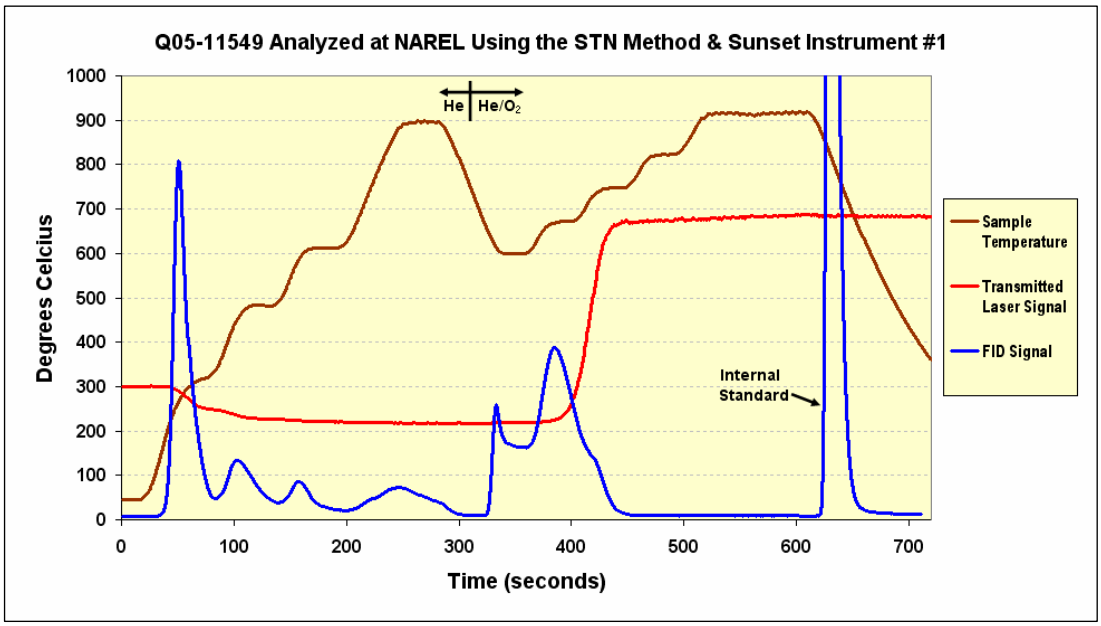


Figure 26

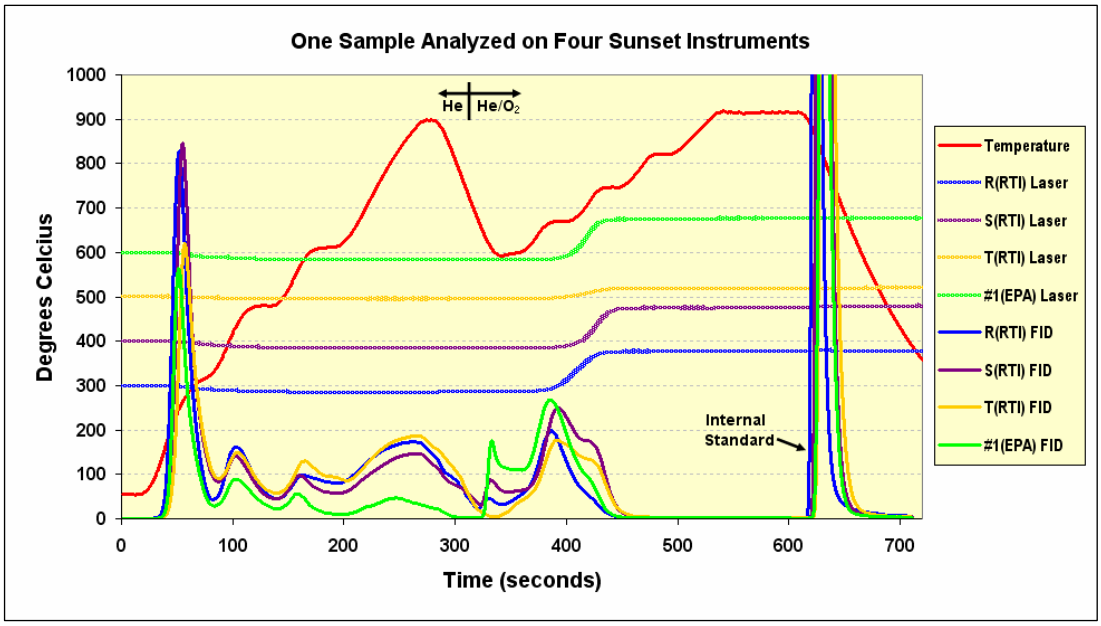


Figure 26 is a composite of four thermograms. Two from this collection were presented earlier as individual thermograms in Figures 24 and 25. The single temperature trace was taken from the first analysis using the "R" instrument. The laser signals have been scaled with an offset for clarity.

Figure 27 is the first IMPROVE_A thermogram produced at CARB using DRI/Model 2001 instrument #1.

Figure 27

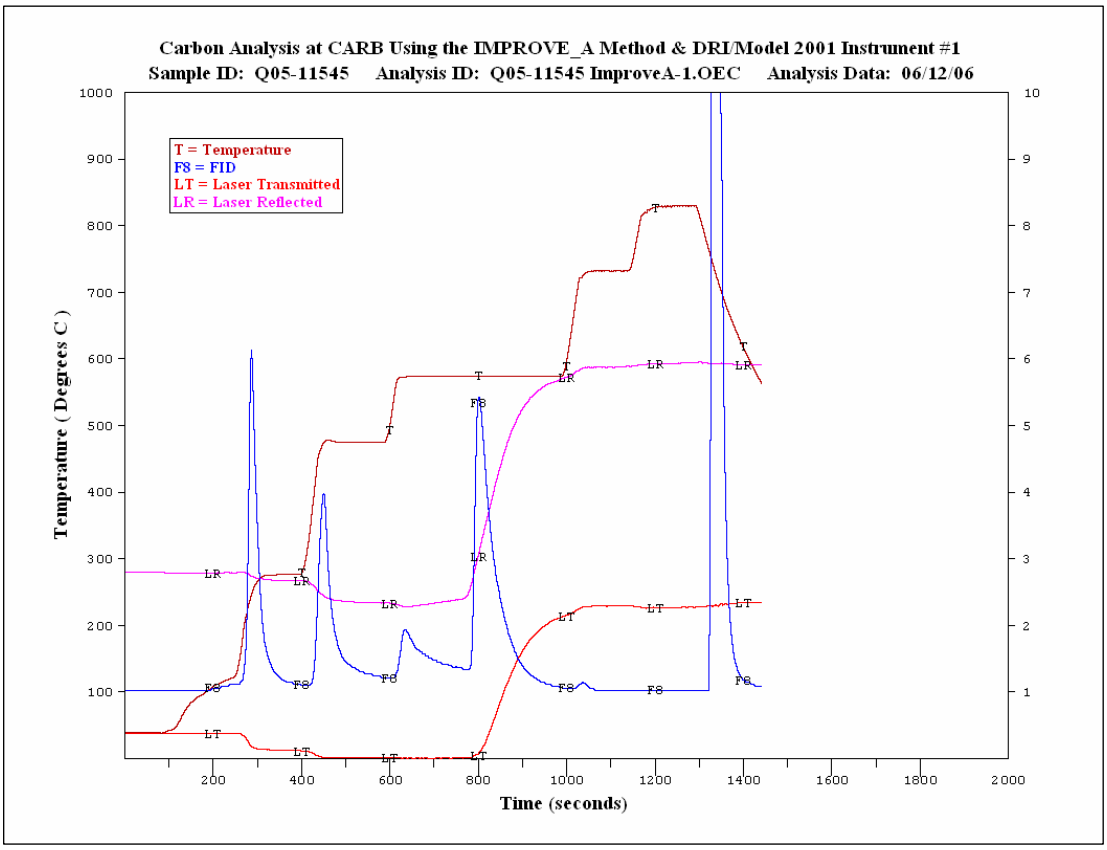
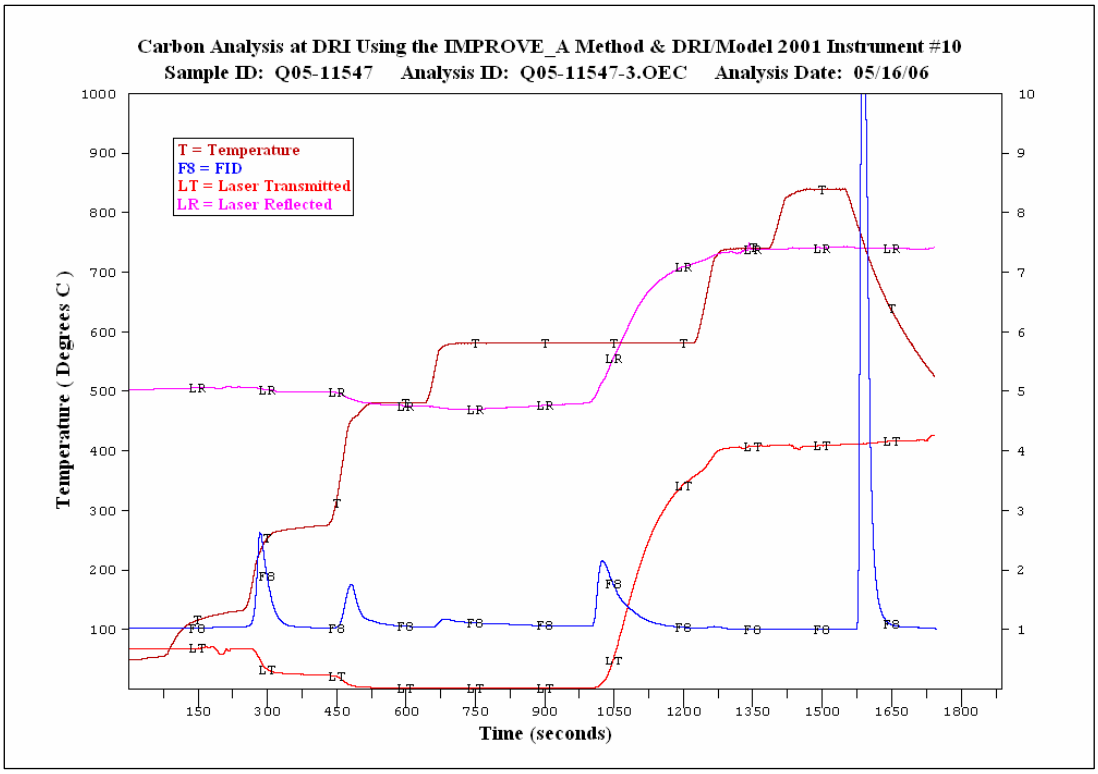


Figure 28



Figures 28 and 29 were produced at DRI using the IMPROVE_A method and two of their DRI/Model 2001 instruments.

Figure 29

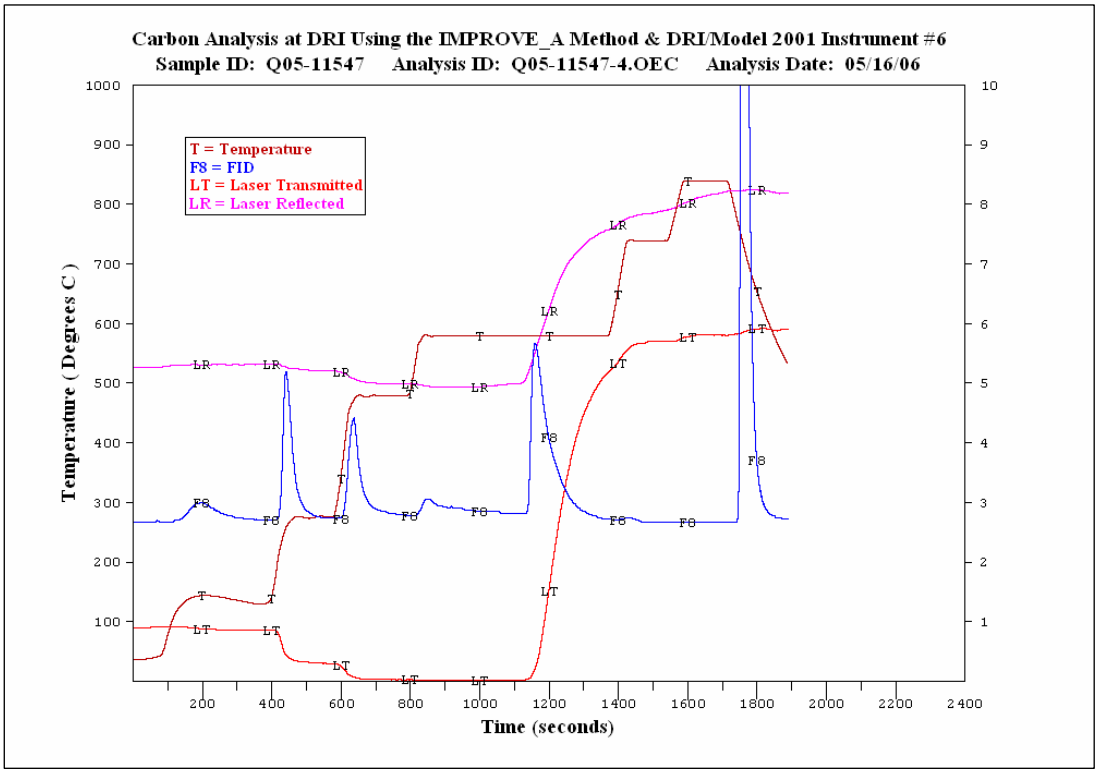
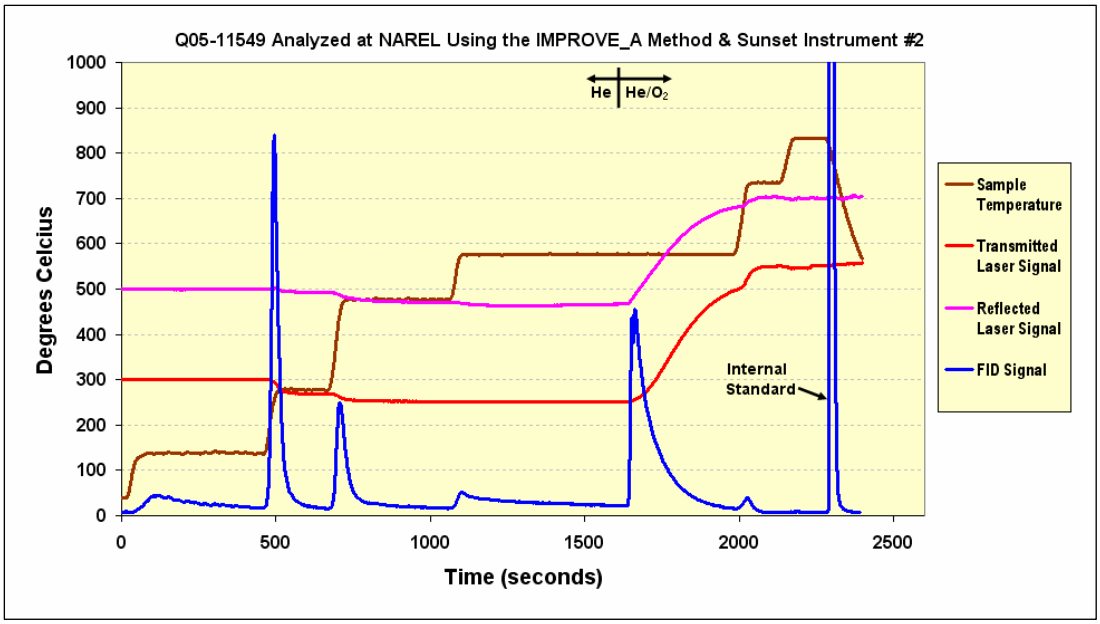


Figure 30



The IMPROVE_A thermogram shown in Figure 30 was produced at NAREL using a Sunset Dual Mode instrument. At about 2400 seconds, this is the longest thermogram presented in this report. It contrasts sharply with the thermogram in Figure 31 which was produced at RTI also using a Sunset Dual Mode instrument. These two thermograms are good examples for showing how the peak resolution may be affected by shortening the run.

This may be a good time to remind our readers that results from the IMPROVE_A thermograms were presented earlier as a bar graph in Figure 17.

Figure 31

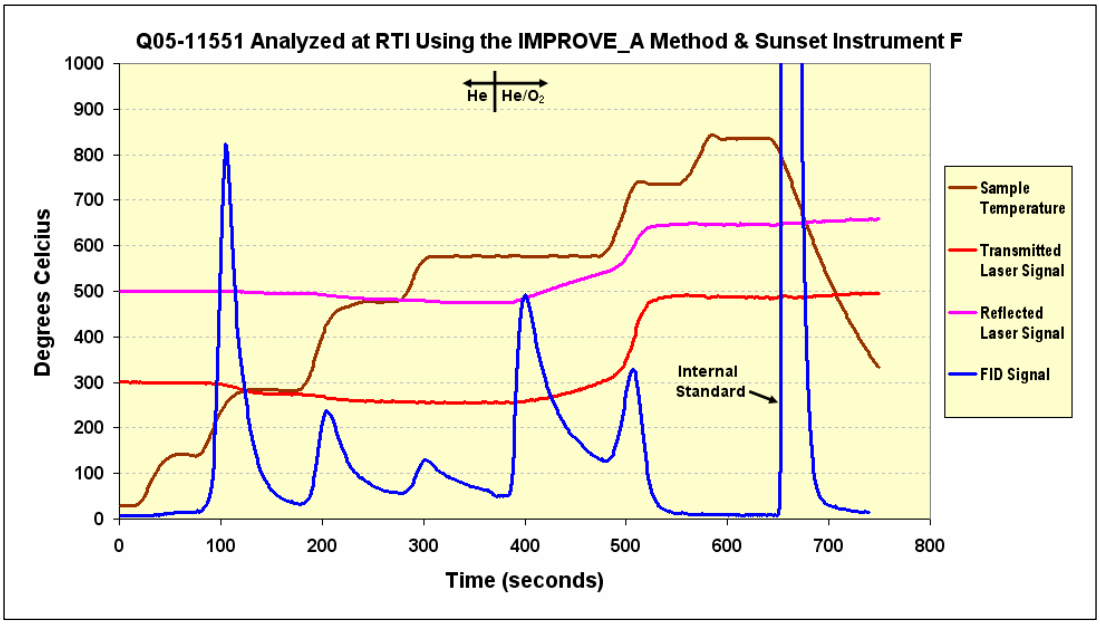


Figure 32

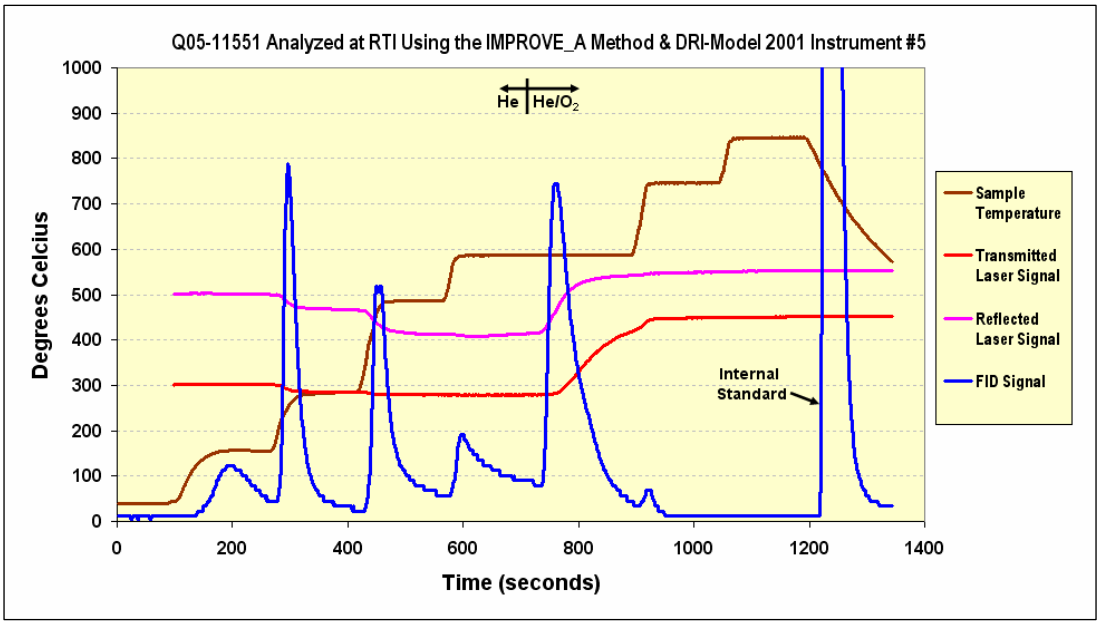


Figure 32 is the last thermogram presented in this report. It was produced at RTI using the IMPROVE_A method and a DRI/Model 2001 instrument. The reader may recall that a low bias was observed in the EC results from RTI's instrument #5 when the OC/EC split point was determined by the reflected laser signal (see Figures 15 through 18), but the bias vanished when the split point was determined by the transmitted laser signal (see Figures 19 and 20). Figure 32 shows a very small difference between the TOR and TOT split points which were reported at 779 and 784 seconds respectively. All of the other dual mode instruments showed a larger shift in the split point that ranged from 34 to 56 seconds.

Twelve thermograms have been presented, and each one represents the analysis of a stable residue that was loaded onto the filter during a single collection event. Results from all of the quartz filters are presented in Table 13 at the end of this report. This table includes the uncertainty of measurement when it was available. Table 13 also contains results from the blank filters that were part of each set of PE samples.

XRF analysis

NAREL provided each participating laboratory with a set of six 47-mm filters for elemental analysis using energy dispersive XRF. Each sample set contained two blank filters and four filters that were loaded with $PM_{2.5}$ collected from the Montgomery air. Co-located Met One SuperSASS air samplers were used to load filters and create replicates in each sample set according to the sampling schedule presented in Table 9.

Table 9. Sampling Schedule for XRF PE Filters

Filter ID	Serial Number	Sample Start	Event Duration	Receiving Lab
T05-11565	T6056165	19-Dec-05	205-hour	CARB
T05-11566	T6056166	19-Dec-05	205-hour	CARB
T06-11614	T6056201	16-Feb-06	231-hour	CARB
T06-11615	T6056202	16-Feb-06	231-hour	CARB
T05-11567	T6056167	19-Dec-05	205-hour	DRI
T05-11568	T6056168	19-Dec-05	205-hour	DRI
T06-11616	T6056203	16-Feb-06	231-hour	DRI

Table 9. Sampling Schedule for XRF PE Filters

Filter ID	Serial Number	Sample Start	Event Duration	Receiving Lab
T06-11617	T6056204	16-Feb-06	231-hour	DRI
T05-11569	T6056169	19-Dec-05	205-hour	ODEQ
T05-11570	T6056170	19-Dec-05	205-hour	ODEQ
T06-11618	T6056205	16-Feb-06	231-hour	ODEQ
T06-11619	T6056206	16-Feb-06	231-hour	ODEQ
T05-11571	T6056171	19-Dec-05	205-hour	RTI
T05-11572	T6056172	19-Dec-05	205-hour	RTI
T06-11620	T6056207	16-Feb-06	231-hour	RTI
T06-11621	T6056208	16-Feb-06	231-hour	RTI
T05-11573	T6056173	19-Dec-05	205-hour	UCD
T05-11574	T6056175	19-Dec-05	205-hour	UCD
T06-11622	T6056209	16-Feb-06	231-hour	UCD
T06-11623	T6056210	16-Feb-06	231-hour	UCD

The quality of the replicates described in Table 9 was first tested at NAREL by measuring the gravimetric mass of PM2.5 captured onto each filter. Furthermore it was decided that all of the filters should be analyzed at a single laboratory before they were redistributed to the other labs participating in the study. Consequently all of the samples for the study were submitted to EPA's National Exposure Research Laboratory (NERL) for the first XRF analysis.

After the first XRF results were reported to NAREL a problem was discovered with the loaded filter replicates regarding the trace-level nickel results. A request was made for NERL to reanalyze the samples. At the same time, experiments were performed at NAREL to investigate a possible source of nickel contamination. Ultimately the investigation revealed the source of nickel contamination. It was the sharp-cut cyclones that had been used to load the filters. Some of the cyclones were nickel plated, and there were signs of corrosion inside the cyclone chamber which is seldom opened for cleaning. By the end of the investigation, all of the filters had been analyzed three times at NERL, and good precision was observed for the three determinations.

All of the filters were returned to NAREL for redistribution to the other XRF labs. Each lab received the four loaded replicates described in Table 9 along with two blanks. Results were reported to NAREL as mass of the element per square centimeter ($\mu g/cm^2$), and a one-sigma uncertainty was provided for each analytical result. Those results were multiplied by the total area of the filter deposit, 11.3 cm^2, to produce final results in units of micrograms of the element per filter (µg/filter).

A request was made for each lab to provide specific information that will help us better understand how the analytical results were produced. A questionnaire was prepared and distributed to each lab. The questionnaire was designed to document those instrument conditions that were used to produce the XRF spectra. The information provided by each lab may be viewed in Tables 15 through 21 at the end of this report.

A second request was made for each lab to provide two specific XRF spectra. As requested, each lab provided the primary spectrum from which silicon was determined for two samples. Each lab submitted the requested spectra from a blank and from a December 19 replicate. These spectra are included in this report to serve as examples of the raw data produced at each lab.

Our story is not finished yet! After all the redistributed filters had been analyzed and returned [once again] to EPA, they were analyzed one last time at NERL. The purpose of this last analysis was to gain more knowledge about the stability of the PE filters over time and with plenty of handling.

All of the participating labs have an SOP for their XRF analysis. Most of the SOP's are currently available on the web for easy viewing (see reference 21 through 25).

XRF Results

A large number of XRF results were reported for this study. Forty-eight elements are routinely reported for each sample, thirty samples were reported, and each sample was reported from two labs.

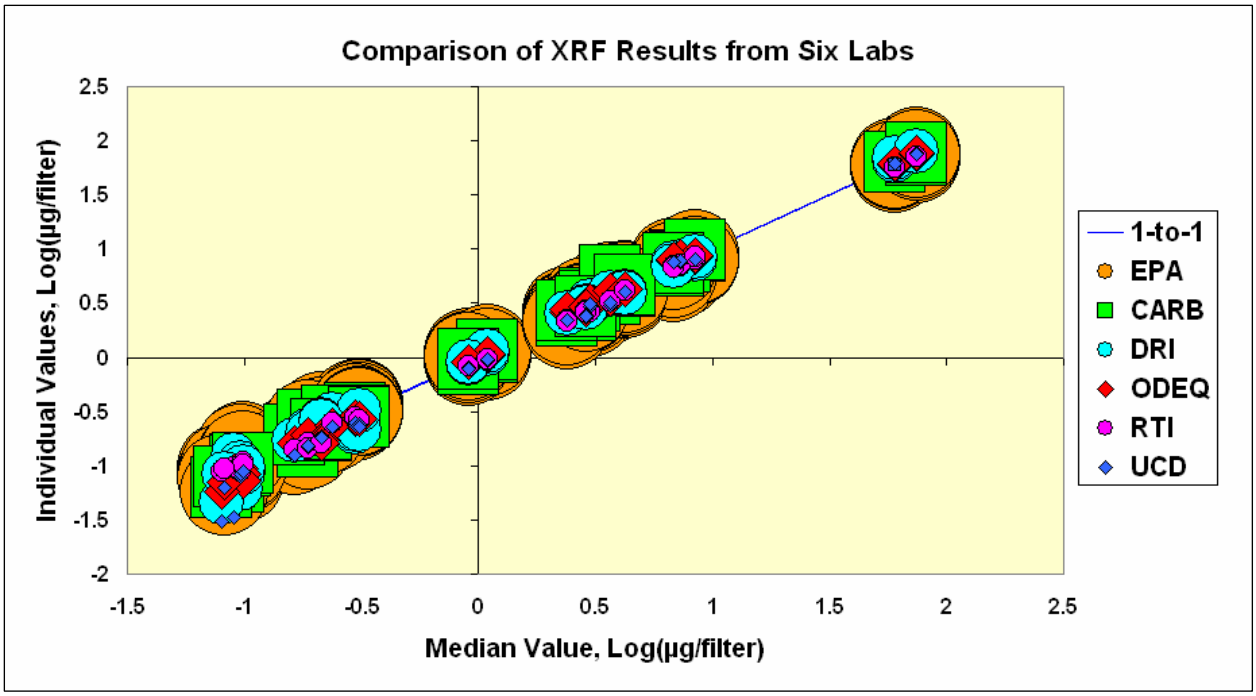
(48 results/sample/lab) x (30 samples) x (2 labs) = 2880 results

Some of the labs did not report all forty-eight elements, however. For example, NERL consistently used their older research grade instrument for this study and reported forty-seven elements, but eight of the elements included in this report were not determined at NERL. The UCD laboratory invested a significant amount of time and effort to participate in this study. Their instruments were originally designed for the thin-membrane 25-mm filters that are used within the IMPROVE air monitoring network. Both hardware and software modifications to their instruments were required to participate in this study. The UCD lab reported twenty-four elements for this study. Only two labs, DRI and RTI, reported all forty-eight elements described in this report.

All of the results have been compared to the median values by constructing a scatter plot shown in Figure 33. A log-log plot was constructed with the median values forming a straight line of unity slope. The corresponding results from all of the labs were superimposed on the median line. Most of the results were very near the median indicating good agreement among the participating labs. Even though Figure 33 gives a quick visual impression of many results that cover a wide range of concentrations, this scatter plot does not identify the element plotted nor the sample.

The more significant XRF results are presented again as stacked-bar graphs in Figures 34 and 35. Each bar segment represents an individual value reported by one of the labs. You will notice that every other segment of each bar in the graph represents a value determined by the EPA lab. By presenting the results in this manner, it is possible to show the test lab result immediately below the EPA result with both labs having analyzed the same filter. Elements are identified along the horizontal axis, and the elements are arranged from left to right in order of decreasing concentration. The vertical axis of each bar graph is a linear scale, and each bar is normalized to the sum of results reported by all instruments identified in the legend. Each bar segment is color coded to identify the lab and labeled to show the reported concentration value.

Figure 33



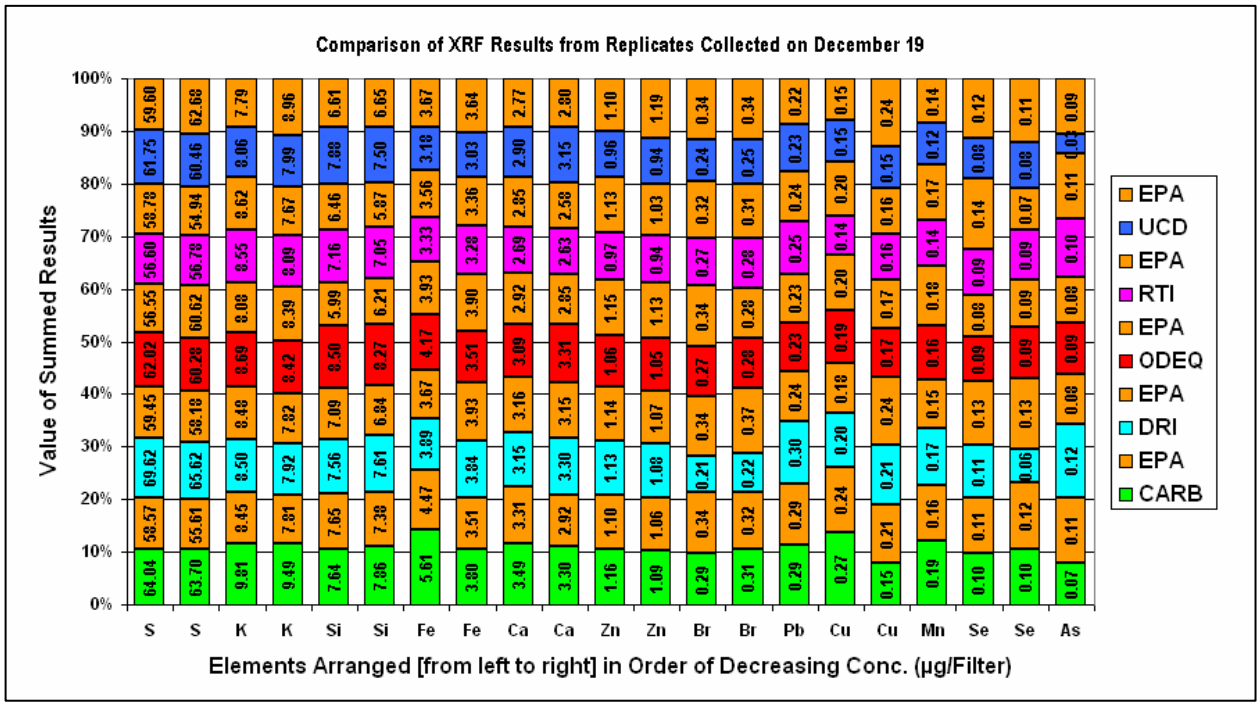


Figure 34

The normalized stacked-bar graphs presented in Figures 34 and 35 show at a glance the level of agreement among the different labs for several elements. Each bar in the graph would have equal segments if all of the results were in perfect agreement. Again, the only results shown in the graphs are those that are significantly above the reported uncertainty. Those significant results can be identified in Table 14 by looking for a calculated median.

Figure 35

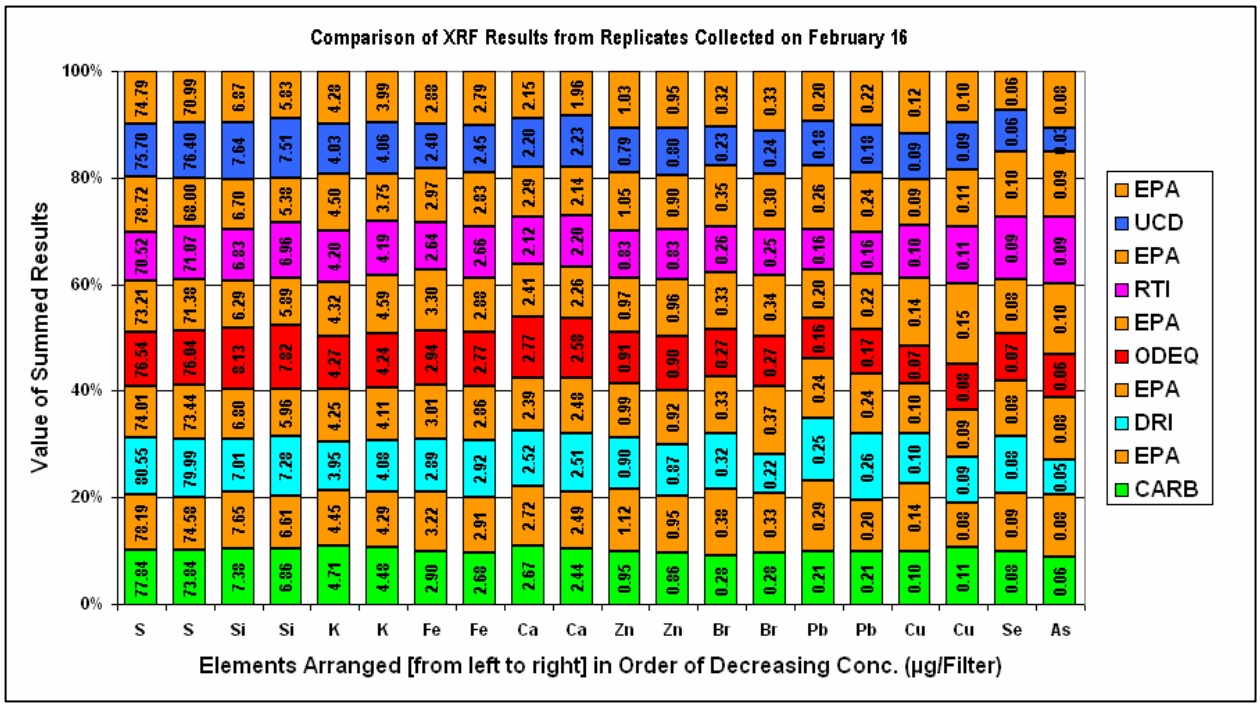
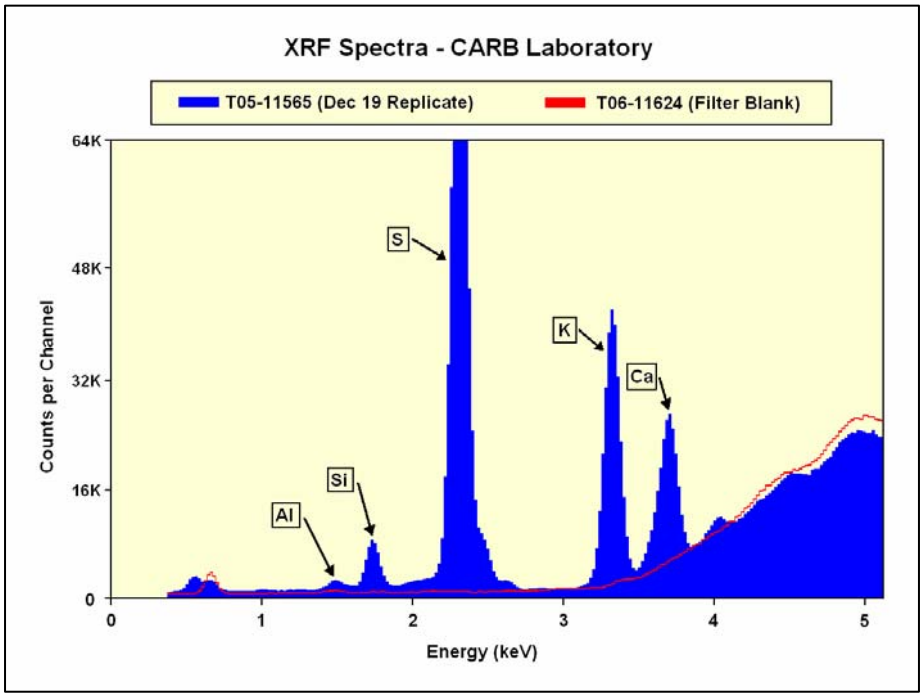


Figure 36



A few spectra have been included in this report to give us examples of the raw data produced at each lab. Remember that all of the spectra presented in this report were used to determine silicon from one of the December 19 replicates. Figure 36 shows two superimposed spectra that were produced at the CARB lab. The conditions that produced these spectra are listed in Table 15 at the end of this report. Al, Si, S, K, and Ca were determined above background in sample T05-11565 based upon these spectra.

Figure 37 shows two superimposed spectra that were produced at the DRI lab. The conditions that produced these spectra are listed in Table 16 at the end of this report. Al, Si, S, K, and Ca were also determined above background in sample T05-11567 based upon these spectra.

Figure 37

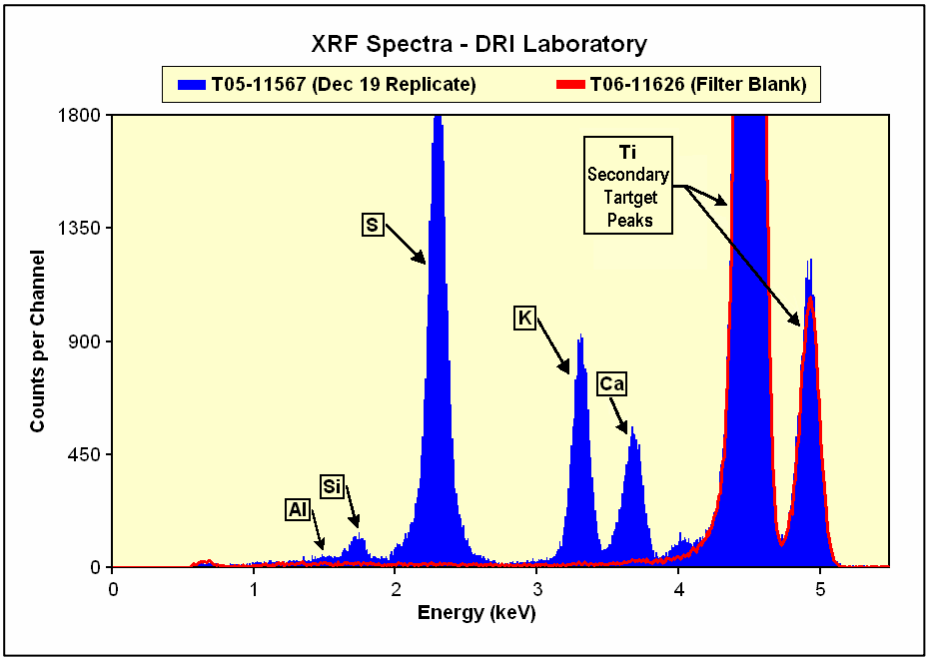


Figure 38

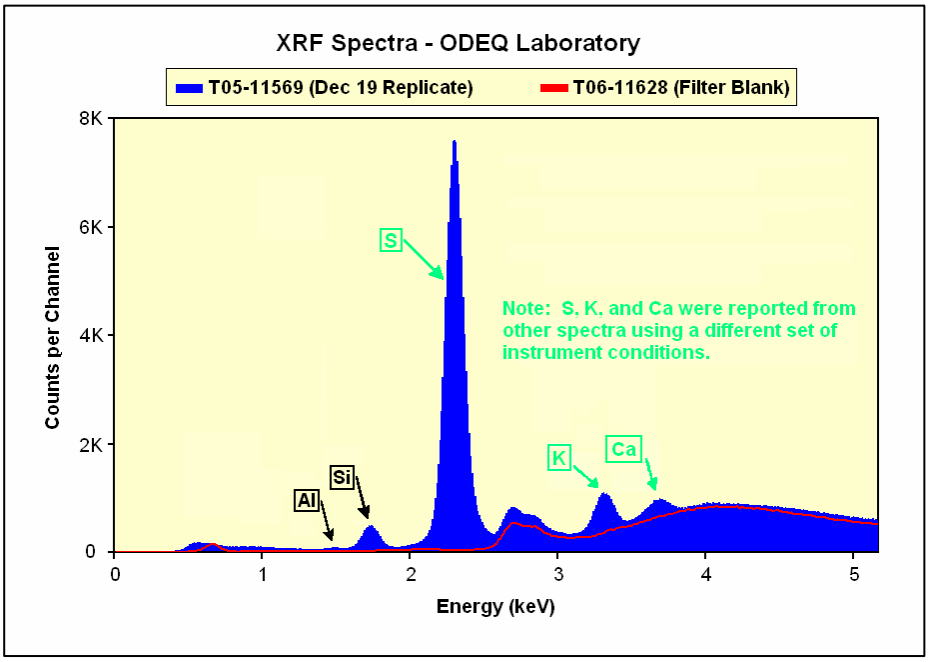


Figure 38 shows spectra that were produced at the ODEQ lab. The conditions that produced these spectra are listed in Table 17 at the end of this report. Al and Si were determined above background in sample T05-11569 based upon these spectra. Even though S, K, and Ca are prominent in Figure 38, these elements were determined from other spectra using the #2 conditions listed in Table 17.

Figure 39 shows spectra that were produced at the RTI lab. The conditions that produced these spectra are listed in Table 18 at the end of this report. Again the Al, Si, S, K, and Ca were determined above background in sample T05-11571 based upon these spectra.

Figure 39

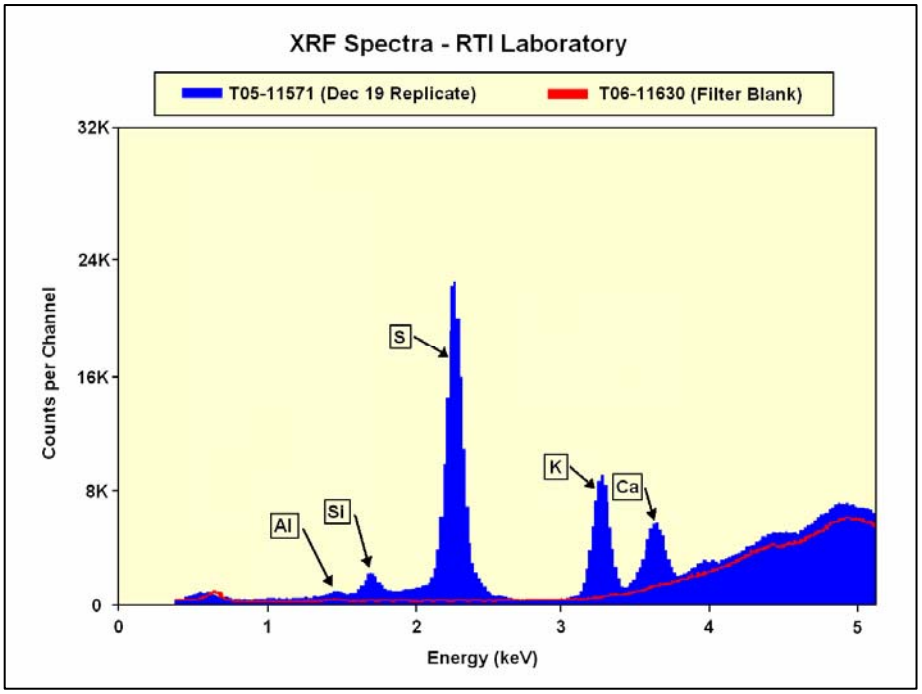


Figure 40

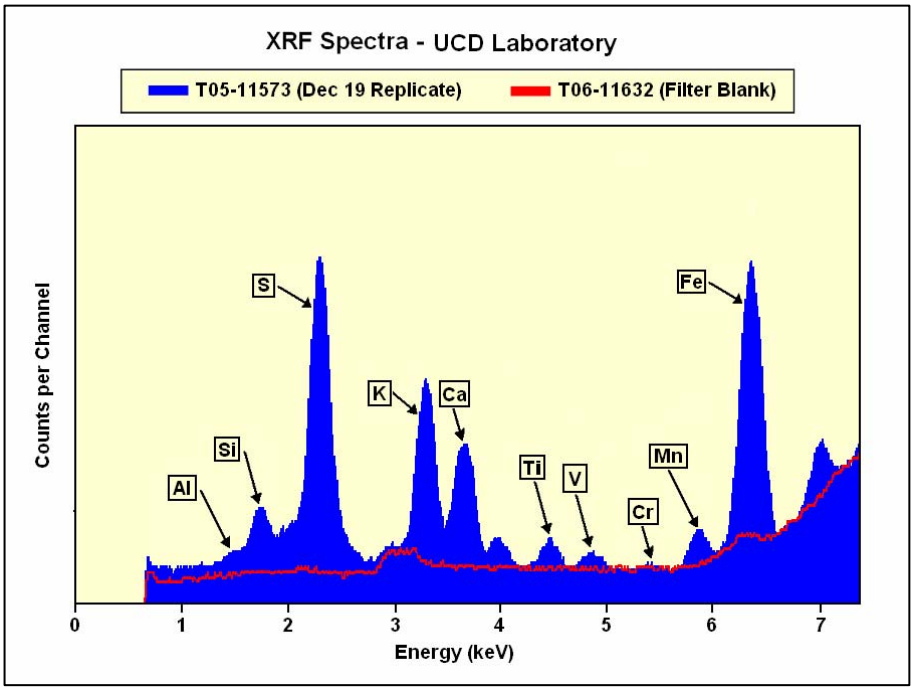


Figure 40 shows spectra that were produced at the UCD lab. The conditions that produced these spectra are listed in Table 20 at the end of this report. Al, Si, S, K, Ca, Ti, V, Cr, Mn, and Fe were determined above background in sample T05-11573 based upon these spectra.

Figure 41 shows spectra that were produced at the EPA lab. The conditions that produced these spectra are listed in Table 21 at the end of this report. Si, S, K, and Ca were determined above background in sample T05-11565 based upon these spectra. EPA reported Al present in this sample at a level that was only two times the one-sigma uncertainty. You may notice that this sample was also analyzed at the CARB lab.

Figure 41

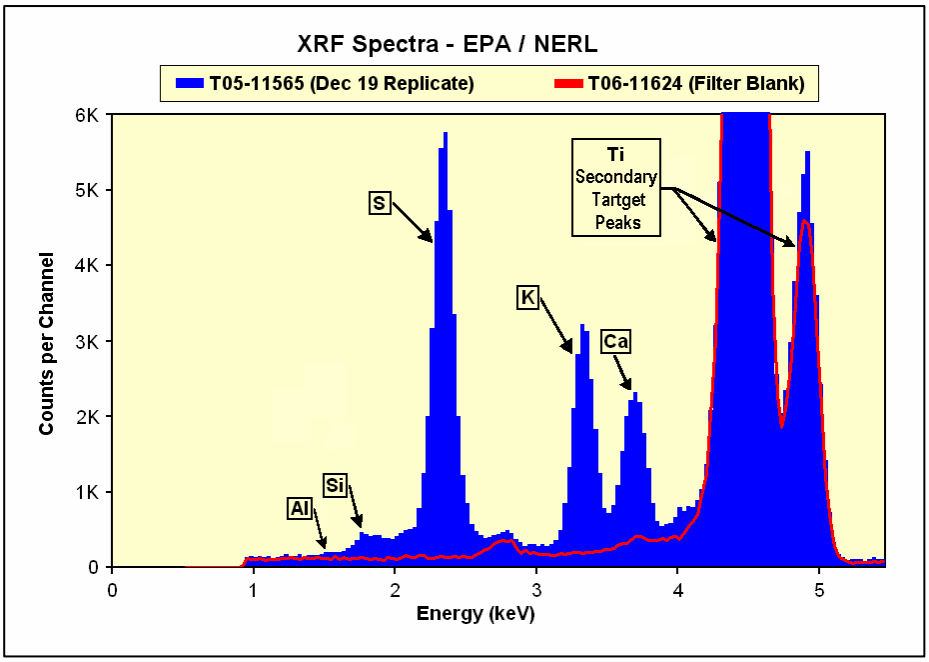
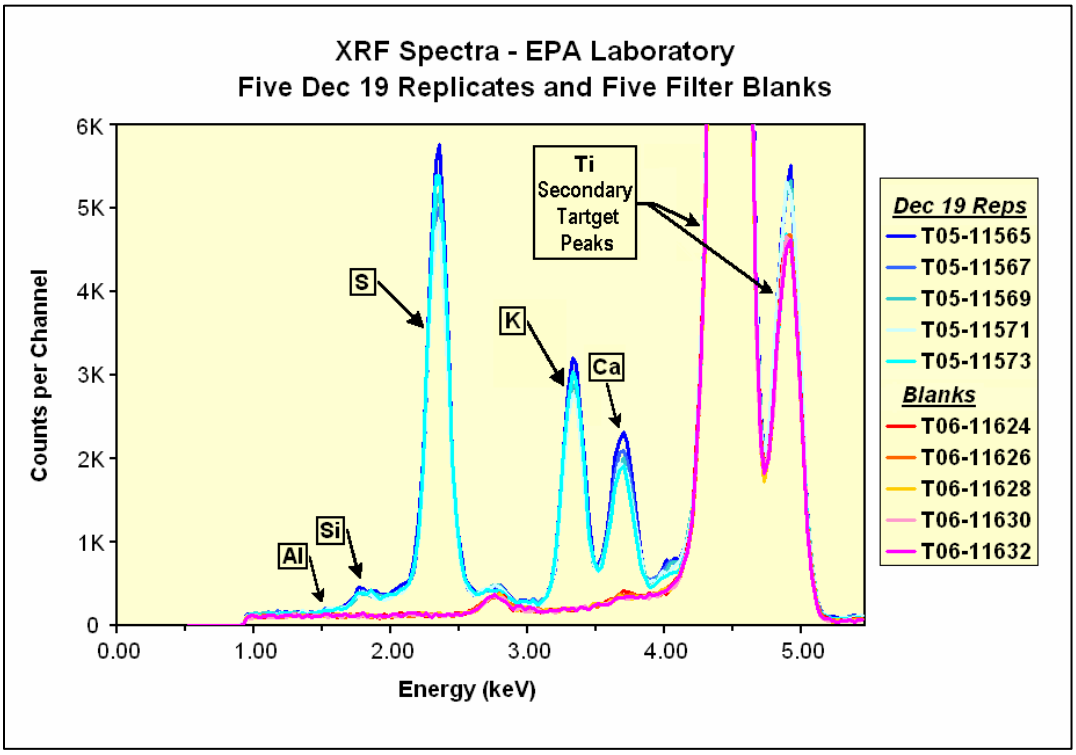


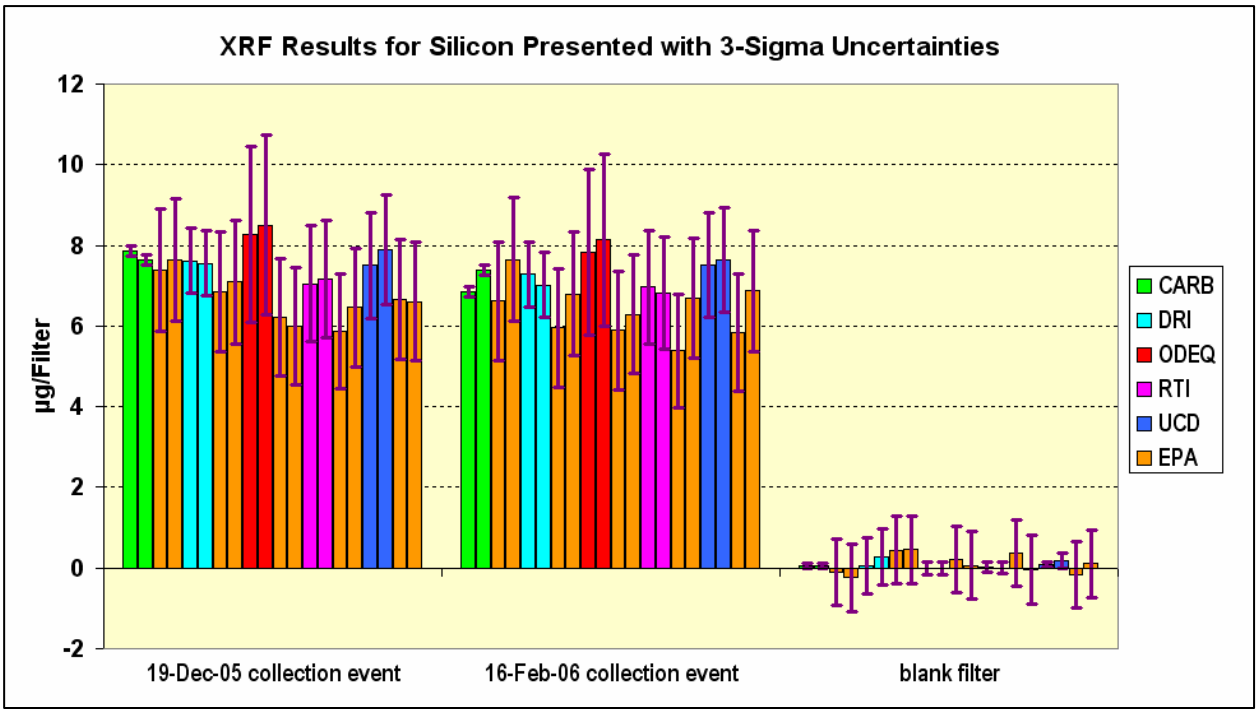
Figure 42



The EPA lab has provided us with a few bonus images! The ten overlaid spectra in Figure 42 were produced by their instrument using the same filter samples presented earlier in Figures 36 through 41.

Figure 43 presents another view of the XRF results for silicon which allows us to examine the uncertainty reported by each lab. Notice that the error bars represent a 3-sigma uncertainty which was used to select those results presented previously in Figures 33 through 35.

Figure 43



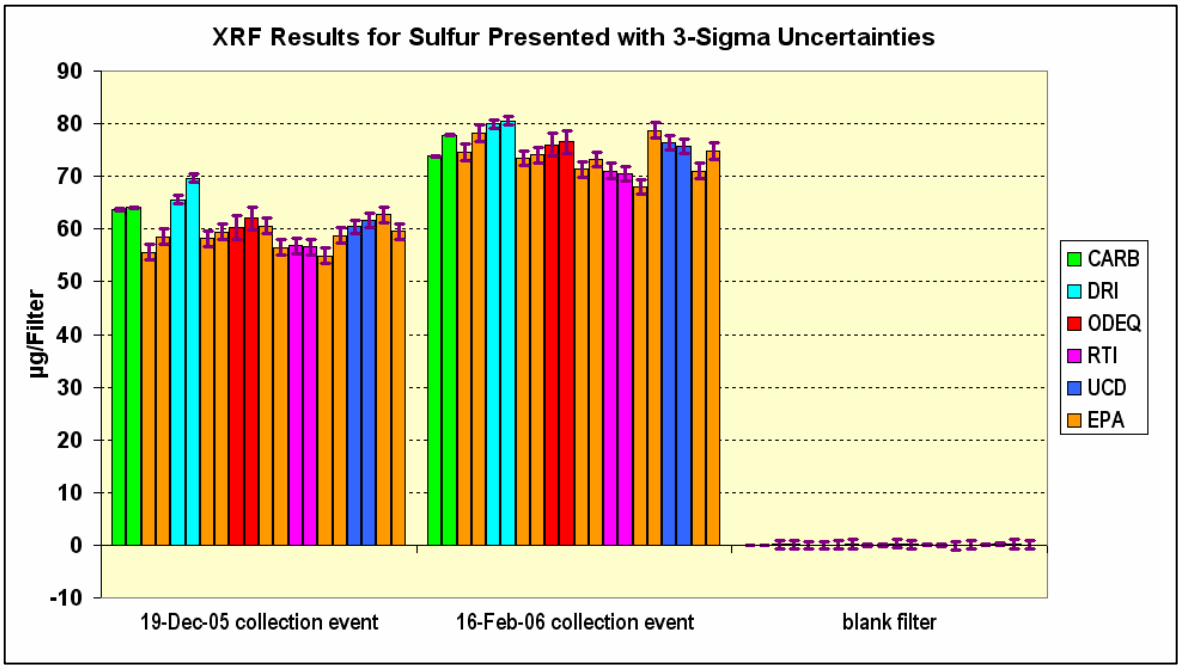


Figure 44

Results for sulfur are presented in Figure 44. It was the most abundant element reported by all of the labs. The sulfur produced a large peak compared to the silicon peak in the spectra presented earlier. Reasonably good agreement is observed in the silicon and the sulfur concentrations, but an outlier is observed in the reported uncertainties. CARB reported smaller uncertainties for this study because their calculation was based exclusively upon the Poisson count statistics.

Table 10a is a summary of results for several elements grouped by sample type. Each statistical value in the table was derived from the results of two replicates analyzed at the lab identified in each column.

Table 10a. Summary of XRF Results for Twenty-one Elements (µg/filter)

	CARB Results	EPA Results	DRI Results	EPA Results	ODEQ Results	EPA Results	RTI Results	EPA Results	UCD Results	EPA Results
Dec 19 Replicates										
Mean	4.580	4.135	4.704	4.099	4.179	4.071	3.976	3.956	4.096	4.186
Max	64.04	58.57	69.62	59.45	62.02	60.62	56.78	58.78	61.75	62.68
Min	0.019	0.007	0.002	0.005	-0.519	-0.015	0.000	0.000	0.000	-0.006
Std. Dev.	13.68	12.23	14.45	12.60	13.15	12.55	12.15	12.18	13.12	13.09
Count	42	42	42	42	42	42	42	42	42	42
Feb 16 Replicates										
Mean	4.667	4.805	4.704	4.486	4.542	4.404	4.377	4.466	4.526	4.417
Max	77.84	78.19	69.62	74.01	76.54	73.21	71.07	78.72	76.40	74.79
Min	0.005	0.011	0.002	-0.329	-0.943	-0.013	0.000	0.008	0.000	-0.002
Std. Dev.	16.22	16.31	14.45	15.76	16.36	15.46	15.13	15.72	16.29	15.59
Count	42	42	42	42	42	42	42	42	42	42
Blank Filters										
Mean	0.012	0.031	0.018	0.107	-0.003	0.141	0.004	0.055	0.038	0.069
Max	0.060	1.002	0.267	1.668	0.023	2.418	0.016	1.243	0.374	1.340
Min	0.000	-0.243	0.000	-0.101	-0.038	-0.126	0.000	-0.064	0.000	-0.185
Std. Dev.	0.017	0.169	0.042	0.363	0.014	0.515	0.005	0.201	0.080	0.285
Count	42	42	42	42	42	42	42	42	42	42

Table 10b. Summary of XRF Uncertainties for Twenty-one Elements (µg/filter)

	CARB Uncert.	EPA Uncert.	DRI Uncert.	EPA Uncert.	ODEQ Uncert.	EPA Uncert.	RTI Uncert.	EPA Uncert.	UCD Uncert.	EPA Uncert.
Dec 19 Replicates										
Mean	0.026	0.190	0.076	0.192	0.381	0.191	0.220	0.187	0.217	0.191
Max	0.106	1.285	0.444	1.301	4.987	1.322	2.845	1.289	3.115	1.365
Min	0.005	0.013	0.005	0.013	0.010	0.013	0.004	0.014	0.000	0.013
Std. Dev.	0.025	0.334	0.112	0.341	1.050	0.341	0.608	0.333	0.661	0.345
Count	42	42	42	42	42	42	42	42	42	42
Feb 16 Replicates										
Mean	0.025	0.190	0.076	0.200	0.420	0.196	0.240	0.197	0.238	0.196
Max	0.121	1.285	0.444	1.588	6.153	1.574	3.560	1.676	3.846	1.605
Min	0.005	0.013	0.005	0.013	0.009	0.013	0.001	0.013	0.000	0.012
Std. Dev.	0.026	0.334	0.112	0.390	1.307	0.383	0.756	0.387	0.820	0.385
Count	42	42	42	42	42	42	42	42	42	42
Blank Filters										
Mean	0.013	0.086	0.053	0.087	0.026	0.087	0.017	0.087	0.012	0.086
Max	0.040	0.768	0.289	0.781	0.087	0.781	0.096	0.765	0.112	0.769
Min	0.002	0.012	0.005	0.012	0.008	0.012	0.003	0.012	0.000	0.011
Std. Dev.	0.009	0.167	0.071	0.170	0.022	0.170	0.021	0.167	0.027	0.168
Count	42	42	42	42	42	42	42	42	42	42

Table 10b is a summary of the reported uncertainties grouped by sample type. Both tables are structured to offer the same information matrix so that each statistical value in Table 10a can be identified with the corresponding uncertainty value in Table 10b. For example, the mean of forty-two results reported by CARB for the December 19 replicates was 4.580 µg/filter, and the mean uncertainty for the same set of results was 0.026 µg/filter. It may be helpful to identify those elements that are summarized in Tables 10a and 10b. Since only two labs reported the full set of forty-eight elements, a decision was made to calculate the statistical parameters based upon the largest subset of twenty-one elements that were reported by all of the labs. The statistical values in Tables 10a and 10b were based upon results and uncertainties reported for the following elements: Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, As, Se, Br, Rb, Sr, and Pb.

Some of the results in Table 10a are negative values. It is not unusual for a lab to report a small negative concentration when the element is either absent from the sample or present at a level near the detection limit. One can argue that reporting a zero concentration is a form of censorship. On the other hand, one should question a zero uncertainty. With this in mind, a comment is appropriate regarding the uncertainty values that are presented in Table 10b. A request was made for all participating labs to report a one-sigma uncertainty, but several labs reported more than one expression of uncertainty. For example, the UCD lab reported a Method Detection Limit (MDL) along with the one-sigma uncertainty. Table 10b shows us that the smallest single uncertainty was reported from the UCD lab. It appears that zero uncertainty was reported for some of their results. It is important to understand, however, that in every case a reasonable MDL was also reported with each sample result, and zero uncertainty was reported only when the element was not detected in the sample. There was some evidence presented earlier in Figures 43 and 44 that the uncertainties reported from the CARB lab were too small, and now Table 10b shows more evidence that this may be true, at least for the samples that were not filter blanks. The largest single uncertainty in Table 10b was reported from the ODEQ lab. It was the uncertainty associated with sulfur reported for one of the February 16 replicates (i.e. 76.54 ±6.15 µg/filter reported sulfur). This largest single uncertainty represented 8 % of the sulfur concentration that was reported.

Conclusions

This study was designed to evaluate the analytical performance of several $PM_{2.5}$ speciation labs. The approach was similar to the study conducted in 2005 (see reference 26). Each lab analyzed an almost identical set of blind PE samples, and the results reported from all of the labs have been compared. The scope of the study included four analytical techniques, and multiple methods were reported for the IC, TOA carbon, and XRF. At least one EPA lab was able to report results for most of the methods used during this study.

Five labs analyzed a set of PE samples for gravimetric mass, and only two results were outside the 3-sigma advisory limits established by NAREL. Raw data were examined to identify the source of error responsible for the two outliers, but the information available did not support a single explanation. With these two exceptions, all of the results reported from the participating labs showed good agreement with the gravimetric results reported from NAREL.

Five different labs reported IC results from at least one set of PE samples, and three different methods were tested. Both Nylon® and Teflon® filters were analyzed for selected ions during this study. It is interesting to note that the analytical results from this study have confirmed a sampling bias that is well documented in the scientific literature. Nylon® filters capture nitrate from the ambient air better than Teflon® filters. Good performance was observed from all of the participating labs, and no significant problems were observed in the IC results from this study.

Four labs analyzed a set of quartz PE filters, and all of the labs analyzed each filter multiple times in order to report results using more that one TOA method. All of the labs, except CARB, reported results from more than one instrument. A total of thirteen data packages were reported with TOA carbon results. Each lab received an almost identical set of filters, and every set of filters contained hidden replicates and blanks. The results from this study are useful to evaluate performance at several different levels. Precision can be evaluated within one lab and among different labs. Three different methods were reported, and results were reported from three different models of instrumentation. Care must be exercised to make valid comparisons! Extra text was included in this report to help support and explain the comparisons that have been made. Precision was very good for the TC, and this was true when results were compared among labs, among methods, and among instruments. Carbon fractions are affected by the choice of method. Results from this study show good precision within the same method for the major carbon fractions, OC and EC, regardless of which instrument performed the analysis. The smaller carbon fractions, such as OC1, EC1, and PyrolC, are referred to as subfractions in this report. As expected, some of the subfractions show the worst precision even within the same method and within the same model of instrument. It was also expected to see a method bias in the EC results: EC values reported from the STN/TOT method were about half of the EC values reported from the IMPROVE_A/TOR method regardless of lab and model of instrumentation. This report includes a bonus presentation. Since all of the labs reported IMPROVE_A results from a modern dual mode instrument, an extra graph was constructed to show the carbon fractions based upon the transmitted laser signal (TOT). This extra graphical presentation, hopefully, will make the reader more aware of the increased information that a dual mode instrument provides about the sample compared to a single mode instrument.

Six XRF labs participated in this study. By design, the results reported from five labs were compared to the results from a single lab, EPA's NERL. All thirty of the filters used in this study were first analyzed at NERL. By having a single lab analyze all of the samples, a new level of confidence can be achieved in the quality of hidden replicates distributed to all of the labs. The most critical element in the design of this study was to supply good replicates to the participating labs, and that was achieved. None of the labs used the same instrument to report XRF results. The most similar instrumentation was at the CARB and RTI labs. Even though their instruments were supplied by the same vendor, different hardware configurations were used for this study. Considering the differences in hardware and software used during this study, one might expect to see corresponding differences in the results reported from different

labs. Despite these gloomy predictions, remarkably good agreement was observed in the results from different labs for those elements reported at higher abundance in the samples. The most significant issue observed in the data continues to be the reported uncertainty. Most of the labs used a custom method to estimate the uncertainty. Spectra from the analysis of replicate samples have been included in this report to illustrate the differences as well as similarities in the raw data produced at different labs.

This report would not be complete without giving thanks to those individuals who answered questions, responded to the questionnaire, and made raw data available for this report.

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Table 11. Gravimetric Mass PE Results

Sample ID	Sample Description	Tare Mass		Final Mass		Captured $PM_{2.5}$		Inter-Lab Difference* of Captured $PM_{2.5}$ (mg)	Name of the Test Lab
		Test Lab (mg)	NAREL (mg)	Test Lab (mg)	NAREL (mg)	Test Lab (mg)	NAREL (mg)		
T06-11693	24-hr collection event	144.442	144.439	144.567	144.572	0.125	0.133	0.008	CARB
T06-11694	48-hr collection event	145.079	145.082	145.355	145.382	0.276	0.300	0.024	CARB
T06-11695	48-hr collection event	143.650	143.651	143.929	143.934	0.279	0.283	0.004	CARB
T06-11696	24-hr collection event	143.615	143.618	143.798	143.804	0.183	0.186	0.003	CARB
T06-11697	24-hr collection event	144.273	144.274	144.456	144.461	0.183	0.187	0.004	CARB
T06-11698	18-hr collection event	147.342	147.344	147.448	147.450	0.106	0.106	0.000	CARB
T06-11699	18-hr collection event	145.282	145.284	145.391	145.393	0.109	0.109	0.000	CARB
T06-11700	filter blank	147.145	147.148	147.147	147.146	0.002	-0.002	-0.004	CARB
T06-11701	filter blank	146.805	146.806	146.807	146.806	0.002	0.000	-0.002	CARB
T06-11702	filter blank	145.287	145.291	145.290	145.290	0.003	-0.001	-0.004	CARB
MW06-11743	metallic transfer weight	181.334	181.337	181.335	181.336	0.001	-0.001	-0.002	CARB
MW06-11744	metallic transfer weight	88.206	88.208	88.207	88.207	0.001	-0.001	-0.002	CARB
T06-11703	24-hr collection event	150.293	150.277	150.423	150.410	0.130	0.133	0.003	DRI
T06-11704	48-hr collection event	146.218	146.202	146.495	146.482	0.277	0.280	0.003	DRI
T06-11705	48-hr collection event	147.067	147.052	147.343	147.333	0.276	0.281	0.005	DRI
T06-11706	24-hr collection event	145.101	145.084	145.276	145.264	0.175	0.180	0.005	DRI
T06-11707	24-hr collection event	143.762	143.745	143.939	143.931	0.177	0.186	0.009	DRI
T06-11708	18-hr collection event	146.869	146.853	146.971	146.958	0.102	0.105	0.003	DRI
T06-11709	18-hr collection event	145.437	145.423	145.541	145.528	0.104	0.105	0.001	DRI
T06-11710	filter blank	145.819	145.805	145.820	145.805	0.001	0.000	-0.001	DRI
T06-11711	filter blank	146.816	146.801	146.816	146.802	0.000	0.001	0.001	DRI
T06-11712	filter blank	146.303	146.289	146.304	146.289	0.001	0.000	-0.001	DRI
MW06-11745	metallic transfer weight	186.986	186.995	186.989	186.995	0.003	0.000	-0.003	DRI
MW06-11746	metallic transfer weight	90.595	90.603	90.600	90.602	0.005	-0.001	-0.006	DRI
T06-11713	24-hr collection event	146.917	146.921	147.044	147.050	0.127	0.129	0.002	ODEQ
T06-11714	48-hr collection event	148.583	148.584	148.864	148.874	0.281	0.290	0.009	ODEQ

Table 11. Gravimetric Mass PE Results

Sample ID	Sample Description	Tare Mass		Final Mass		Captured $PM_{2.5}$		Inter-Lab Difference* of Captured $PM_{2.5}$ (mg)	Name of the Test Lab
		Test Lab (mg)	NAREL (mg)	Test Lab (mg)	NAREL (mg)	Test Lab (mg)	NAREL (mg)		
T06-11715	48-hr collection event	148.002	148.005	148.292	148.294	0.290	0.289	-0.001	ODEQ
T06-11716	24-hr collection event	146.686	146.689	146.866	146.871	0.180	0.182	0.002	ODEQ
T06-11717	24-hr collection event	147.280	147.281	147.459	147.463	0.179	0.182	0.003	ODEQ
T06-11718	18-hr collection event	146.283	146.282	146.388	146.392	0.105	0.110	0.005	ODEQ
T06-11719	18-hr collection event	147.151	147.151	147.257	147.260	0.106	0.109	0.003	ODEQ
T06-11720	filter blank	148.556	148.558	148.555	148.557	-0.001	-0.001	0.000	ODEQ
T06-11721	filter blank	147.029	147.030	147.028	147.030	-0.001	0.000	0.001	ODEQ
T06-11722	filter blank	146.234	146.234	146.232	146.234	-0.002	0.000	0.002	ODEQ
MW06-11747	metallic transfer weight	191.061	191.061	191.060	191.061	-0.001	0.000	0.001	ODEQ
MW06-11748	metallic transfer weight	96.352	96.353	96.355	96.353	0.003	0.000	-0.003	ODEQ
T06-11723	24-hr collection event	146.800	146.801	146.930	146.933	0.130	0.132	0.002	RTI
T06-11724	48-hr collection event	146.327	146.328	146.605	146.606	0.278	0.278	0.000	RTI
T06-11725	48-hr collection event	145.690	145.688	145.976	145.979	0.286	0.291	0.005	RTI
T06-11726	24-hr collection event	147.493	147.492	147.673	147.676	0.180	0.184	0.004	RTI
T06-11727	24-hr collection event	144.133	144.133	144.314	144.315	0.181	0.182	0.001	RTI
T06-11728	18-hr collection event	148.371	148.374	148.483	148.490	0.112	0.116	0.004	RTI
T06-11729	18-hr collection event	148.248	148.247	148.357	148.362	0.109	0.115	0.006	RTI
T06-11730	filter blank	147.211	147.212	147.215	147.211	0.004	-0.001	-0.005	RTI
T06-11731	filter blank	146.769	146.770	146.773	146.770	0.004	0.000	-0.004	RTI
T06-11732	filter blank	148.624	148.625	148.626	148.625	0.002	0.000	-0.002	RTI
MW06-11749	metallic transfer weight	194.664	194.663	194.661	194.662	-0.003	-0.001	0.002	RTI
MW06-11750	metallic transfer weight	86.250	86.250	86.250	86.250	0.000	0.000	0.000	RTI
T06-11733	24-hr collection event	42.479	42.483	42.595	42.606	0.116	0.123	0.007	UCD
T06-11734	48-hr collection event	42.401	42.404	42.680	42.693	0.279	0.289	0.010	UCD
T06-11735	48-hr collection event	41.628	41.631	41.906	41.919	0.278	0.288	0.010	UCD
T06-11736	24-hr collection event	41.680	41.682	41.853	41.863	0.173	0.181	0.008	UCD

Table 11. Gravimetric Mass PE Results

Sample ID	Sample Description	Tare Mass		Final Mass		Captured $PM_{2.5}$		Inter-Lab Difference* of Captured $PM_{2.5}$ (mg)	Name of the Test Lab
		Test Lab (mg)	NAREL (mg)	Test Lab (mg)	NAREL (mg)	Test Lab (mg)	NAREL (mg)		
T06-11737	24-hr collection event	42.560	42.563	42.732	42.741	0.172	0.178	0.006	UCD
T06-11738	18-hr collection event	41.834	41.838	41.928	41.939	0.094	0.101	0.007	UCD
T06-11739	18-hr collection event	41.964	41.967	42.057	42.068	0.093	0.101	0.008	UCD
T06-11740	filter blank	40.903	40.906	40.901	40.906	-0.002	0.000	0.002	UCD
T06-11741	filter blank	41.363	41.366	41.361	41.366	-0.002	0.000	0.002	UCD
T06-11742	filter blank	41.175	41.179	41.175	41.179	0.000	0.000	0.000	UCD
MW06-11751	metallic transfer weight	41.818	41.819	41.817	41.819	-0.001	0.000	0.001	UCD
MW06-11752	metallic transfer weight	38.534	38.534	38.533	38.534	-0.001	0.000	0.001	UCD

**** Negative values indicate a smaller capture determined by NAREL.***

Table 12. Ion Chromatography PE Results

Sample ID	Filter Medium	Sample Description	Lab	Method	Concentration (µg/filter)						
					Chloride	Nitrate	Nitrite	Sulfate	Ammonium	Potassium	Sodium
N05-11555	Nylon®	159-hr event, 12/08/05	CARB	STN	-----	80.809	-----	157.956	90.372	5.156	2.939
N05-11556	Nylon®	159-hr event, 12/08/05	CARB	STN	-----	80.346	-----	157.960	90.746	5.195	2.818
N05-11557	Nylon®	159-hr event, 12/08/05	DRI	STN	-----	84.132	-----	174.153	-----	-----	-----
N05-11558	Nylon®	159-hr event, 12/08/05	DRI	STN	-----	91.239	-----	175.653	-----	-----	-----
N05-11559	Nylon®	159-hr event, 12/08/05	ODEQ	STN	-----	77.800	-----	148.000	64.700	4.250	<3.6
N05-11560	Nylon®	159-hr event, 12/08/05	ODEQ	STN	-----	79.000	-----	152.000	59.700	4.180	<3.6
N05-11561	Nylon®	159-hr event, 12/08/05	RTI	STN	-----	79.022	-----	157.346	72.727	4.195	1.913
N05-11562	Nylon®	159-hr event, 12/08/05	RTI	STN	-----	85.032	-----	161.301	79.526	4.253	2.038
N05-11563	Nylon®	159-hr event, 12/08/05	NAREL	STN	-----	81.590	-----	155.179	68.920	5.271	1.952
N05-11564	Nylon®	159-hr event, 12/08/05	NAREL	STN	-----	81.371	-----	156.927	68.213	5.067	1.980
N06-11575	Nylon®	144-hr event, 01/09/06	CARB	STN	-----	44.034	-----	121.380	59.503	4.348	5.241
N06-11576	Nylon®	144-hr event, 01/09/06	CARB	STN	-----	45.538	-----	124.428	61.516	4.571	5.319
N06-11577	Nylon®	144-hr event, 01/09/06	DRI	STN	-----	48.243	-----	131.829	-----	-----	-----
N06-11578	Nylon®	144-hr event, 01/09/06	DRI	STN	-----	60.462	-----	136.029	-----	-----	-----
N06-11579	Nylon®	144-hr event, 01/09/06	ODEQ	STN	-----	62.900	-----	127.000	54.300	5.520	6.040
N06-11580	Nylon®	144-hr event, 01/09/06	ODEQ	STN	-----	46.600	-----	116.000	44.300	3.940	4.210
N06-11581	Nylon®	144-hr event, 01/09/06	RTI	STN	-----	53.827	-----	124.861	57.619	3.662	4.131
N06-11582	Nylon®	144-hr event, 01/09/06	RTI	STN	-----	55.205	-----	128.925	59.282	3.741	4.065
N06-11583	Nylon®	144-hr event, 01/09/06	NAREL	STN	-----	53.756	-----	123.286	51.896	4.269	3.931
N06-11584	Nylon®	144-hr event, 01/09/06	NAREL	STN	-----	55.216	-----	124.388	52.447	4.302	3.807
N06-11763	Nylon®	filter blank	CARB	STN	-----	<0.5	-----	<1.75	<0.5	<1.25	<0.75
N06-11764	Nylon®	filter blank	CARB	STN	-----	<0.5	-----	<1.75	<0.5	<1.25	<0.75
N06-11765	Nylon®	filter blank	DRI	STN	-----	<0.5	-----	<0.5	-----	-----	-----
N06-11766	Nylon®	filter blank	DRI	STN	-----	0.744	-----	<0.5	-----	-----	-----
N06-11767	Nylon®	filter blank	ODEQ	STN	-----	<1.4	-----	<1.4	<0.72	<1.1	<3.6
N06-11768	Nylon®	filter blank	ODEQ	STN	-----	<1.4	-----	<1.4	<0.72	<1.1	<3.6
N06-11769	Nylon®	filter blank	RTI	STN	-----	<.107	-----	<0.172	<0.029	<0.030	<0.259
N06-11770	Nylon®	filter blank	RTI	STN	-----	<.107	-----	<0.172	<0.029	<0.030	<0.259
N06-11771	Nylon®	filter blank	NAREL	STN	-----	0.614	-----	<0.2	<0.2	<0.2	<0.4
N06-11772	Nylon®	filter blank	NAREL	STN	-----	<0.2	-----	<0.2	<0.2	<0.2	0.160

Table 12. Ion Chromatography PE Results

Sample ID	Filter Medium	Sample Description	Lab	Method	Concentration (µg/filter)						
					Chloride	Nitrate	Nitrite	Sulfate	Ammonium	Potassium	Sodium
N06-11585	Nylon®	192-hr event, 01/18/06	RTI	IMPROVE	6.054	34.340	1.628	123.581	46.645	-----	-----
N06-11586	Nylon®	192-hr event, 01/18/06	RTI	IMPROVE	6.398	34.996	1.382	124.327	45.892	-----	-----
N06-11587	Nylon®	192-hr event, 01/18/06	NAREL	IMPROVE	6.239	34.108	1.468	115.416	40.203	-----	-----
N06-11588	Nylon®	192-hr event, 01/18/06	NAREL	IMPROVE	6.088	34.934	2.851	119.222	38.761	-----	-----
N06-11593	Nylon®	188-hr event, 01/27/06	RTI	IMPROVE	3.687	34.542	1.326	132.911	47.664	-----	-----
N06-11594	Nylon®	188-hr event, 01/27/06	RTI	IMPROVE	3.707	35.307	1.331	133.773	48.349	-----	-----
N06-11595	Nylon®	188-hr event, 01/27/06	NAREL	IMPROVE	3.572	33.849	1.502	121.542	40.824	-----	-----
N06-11596	Nylon®	188-hr event, 01/27/06	NAREL	IMPROVE	3.492	34.260	1.880	124.493	41.721	-----	-----
N06-11773	Nylon®	filter blank	RTI	IMPROVE	<0.036	<0.086	0.795	<0.138	<0.023	-----	-----
N06-11774	Nylon®	filter blank	RTI	IMPROVE	0.064	<0.086	0.736	<0.138	<0.023	-----	-----
N06-11775	Nylon®	filter blank	NAREL	IMPROVE	<0.2	<0.2	0.735	<0.2	<0.2	-----	-----
N06-11776	Nylon®	filter blank	NAREL	IMPROVE	<0.2	<0.2	0.412	<0.2	<0.2	-----	-----
T06-11589	Teflon®	192-hr event, 01/18/06	DRI	STN	-----	4.361	-----	126.749	40.414	3.905	6.714
T06-11590	Teflon®	192-hr event, 01/18/06	DRI	STN	-----	4.826	-----	125.922	40.643	3.983	6.230
T06-11591	Teflon®	192-hr event, 01/18/06	NAREL	STN	-----	5.131	-----	115.827	36.168	4.666	6.008
T06-11592	Teflon®	192-hr event, 01/18/06	NAREL	STN	-----	6.500	-----	118.994	37.530	4.824	5.914
T06-11597	Teflon®	188-hr event, 01/27/06	DRI	STN	-----	7.420	-----	137.452	45.010	4.455	5.101
T06-11598	Teflon®	188-hr event, 01/27/06	DRI	STN	-----	6.396	-----	136.362	44.874	4.385	5.019
T06-11599	Teflon®	188-hr event, 01/27/06	NAREL	STN	-----	8.888	-----	120.388	39.864	5.036	4.682
T06-11600	Teflon®	188-hr event, 01/27/06	NAREL	STN	-----	7.875	-----	127.087	40.104	5.228	4.640
T06-11777	Teflon®	filter blank	DRI	STN	-----	<0.5	-----	<0.5	<0.017	<0.017	0.121
T06-11778	Teflon®	filter blank	DRI	STN	-----	<0.5	-----	<0.5	0.504	<0.017	0.166
T06-11779	Teflon®	filter blank	NAREL	STN	-----	<0.2	-----	<0.2	<0.2	<0.2	0.229
T06-11780	Teflon®	filter blank	NAREL	STN	-----	0.711	-----	<0.2	<0.2	<0.2	0.235

Table 13. TOA Carbon PE Results

Sample ID	Sample Description	Lab	Instrument (see text)*	Method	Concentration (µg/cm^2)							
					EC	OC	TC	OC1	OC2	OC3	OC4	PyrolC
Q05-11545	260-hr event, 11/01/05	CARB	#1	STN (mod.)	3.30	31.40	34.70	-----	-----	-----	-----	-----
Q05-11546	260-hr event, 11/01/05	CARB	#1	STN (mod.)	3.51	31.39	34.90	-----	-----	-----	-----	-----
Q05-11547	260-hr event, 11/01/05	DRI	8	STN	3.2 ± 0.5	28.3 ± 4.5	31.6 ± 5.1	8.3 ± 1.3	4.5 ± 0.8	2.7 ± 0.2	9.3 ± 1.0	3.5 ± 0.9
Q05-11547	260-hr event, 11/01/05	DRI	10	STN	3.0 ± 0.5	29.9 ± 4.7	33.0 ± 5.3	7.7 ± 1.2	5.7 ± 1.0	2.5 ± 0.2	7.8 ± 0.8	6.1 ± 1.6
Q05-11548	260-hr event, 11/01/05	DRI	9	STN	2.7 ± 0.4	29.3 ± 4.6	31.9 ± 5.1	8.4 ± 1.3	5.2 ± 0.9	2.8 ± 0.2	9.1 ± 0.9	3.6 ± 1.0
Q05-11548	260-hr event, 11/01/05	DRI	10	STN	3.3 ± 0.5	30.4 ± 4.8	33.8 ± 5.4	7.8 ± 1.2	5.9 ± 1.0	2.7 ± 0.2	8.4 ± 0.9	5.6 ± 1.5
Q05-11549	260-hr event, 11/01/05	NAREL	#1	STN	2.8 ± 0.3	29.8 ± 1.7	32.5 ± 1.9	9.45	2.98	1.52	2.76	13.04
Q05-11550	260-hr event, 11/01/05	NAREL	#1	STN	3.4 ± 0.4	29.1 ± 1.7	32.5 ± 1.9	9.20	2.99	1.59	2.73	12.58
Q05-11551	260-hr event, 11/01/05	RTI	R	STN	2.3 ± 0.3	31.1 ± 1.8	33.4 ± 2.0	10.0 ± 0.7	3.7 ± 0.4	3.2 ± 0.5	10.0 ± 1.3	4.2 ± 6.1
Q05-11551	260-hr event, 11/01/05	RTI	S	STN	3.0 ± 0.3	32.5 ± 1.8	35.4 ± 2.1	10.1 ± 0.7	3.6 ± 0.4	2.7 ± 0.4	8.1 ± 1.1	7.9 ± 11.3
Q05-11551	260-hr event, 11/01/05	RTI	T	STN	3.7 ± 0.4	30.1 ± 1.7	33.8 ± 2.0	8.1 ± 0.6	3.9 ± 0.4	4.0 ± 0.5	10.5 ± 1.3	3.7 ± 5.3
Q05-11552	260-hr event, 11/01/05	RTI	R	STN	2.6 ± 0.3	31.1 ± 1.8	33.7 ± 2.0	10.1 ± 0.7	3.6 ± 0.4	3.3 ± 0.5	10.6 ± 1.4	3.5 ± 5.1
Q05-11552	260-hr event, 11/01/05	RTI	S	STN	3.0 ± 0.3	32.0 ± 1.8	34.9 ± 2.0	10.2 ± 0.7	3.4 ± 0.4	2.7 ± 0.4	8.5 ± 1.1	7.2 ± 10.2
Q05-11552	260-hr event, 11/01/05	RTI	T	STN	3.7 ± 0.4	30.4 ± 1.7	34.1 ± 2.0	8.4 ± 0.6	3.8 ± 0.4	4.0 ± 0.5	10.7 ± 1.4	3.6 ± 5.2
Q06-11604	194-hr event, 02/06/05	CARB	#1	STN (mod.)	2.72	28.35	31.07	-----	-----	-----	-----	-----
Q06-11605	194-hr event, 02/06/05	CARB	#1	STN (mod.)	2.39	28.69	31.08	-----	-----	-----	-----	-----
Q06-11606	194-hr event, 02/06/05	DRI	8	STN	1.3 ± 0.2	27.6 ± 4.4	28.9 ± 4.6	5.7 ± 0.9	5.4 ± 0.9	2.5 ± 0.2	7.6 ± 0.8	6.2 ± 1.6
Q06-11606	194-hr event, 02/06/05	DRI	10	STN	1.6 ± 0.3	27.7 ± 4.4	29.3 ± 4.7	5.4 ± 0.9	6.2 ± 1.1	2.5 ± 0.2	7.1 ± 0.7	6.4 ± 1.7
Q06-11607	194-hr event, 02/06/05	DRI	8	STN	1.4 ± 0.2	29.4 ± 4.6	30.8 ± 4.9	6.1 ± 1.0	5.8 ± 1.0	2.7 ± 0.2	8.2 ± 0.9	6.5 ± 1.7
Q06-11607	194-hr event, 02/06/05	DRI	9	STN	1.2 ± 0.2	29.5 ± 4.6	30.6 ± 4.9	6.2 ± 1.0	6.2 ± 1.1	2.7 ± 0.2	7.4 ± 0.8	6.9 ± 1.8
Q06-11608	194-hr event, 02/06/05	NAREL	#1	STN	1.8 ± 0.3	28.0 ± 1.6	29.8 ± 1.8	6.68	3.89	2.25	2.85	12.37
Q06-11609	194-hr event, 02/06/05	NAREL	#1	STN	1.9 ± 0.3	27.1 ± 1.6	29.0 ± 1.8	6.34	3.98	2.07	2.75	11.99
Q06-11610	194-hr event, 02/06/05	RTI	R	STN	1.5 ± 0.3	29.0 ± 1.7	30.5 ± 1.8	7.3 ± 0.6	4.8 ± 0.4	3.9 ± 0.5	11.2 ± 1.4	1.8 ± 2.7
Q06-11610	194-hr event, 02/06/05	RTI	S	STN	1.8 ± 0.3	29.0 ± 1.6	30.8 ± 1.8	6.9 ± 0.5	4.3 ± 0.4	3.3 ± 0.5	8.0 ± 1.1	6.5 ± 9.3
Q06-11610	194-hr event, 02/06/05	RTI	T	STN	2.2 ± 0.3	28.0 ± 1.6	30.2 ± 1.8	5.6 ± 0.5	4.2 ± 0.4	4.6 ± 0.5	10.9 ± 1.4	2.8 ± 4.1
Q06-11611	194-hr event, 02/06/05	RTI	R	STN	1.6 ± 0.3	29.5 ± 1.7	31.1 ± 1.9	7.8 ± 0.6	4.6 ± 0.4	4.0 ± 0.5	11.6 ± 1.5	1.5 ± 2.3
Q06-11611	194-hr event, 02/06/05	RTI	S	STN	1.9 ± 0.3	30.6 ± 1.7	32.4 ± 1.9	7.4 ± 0.6	4.5 ± 0.4	3.4 ± 0.5	8.8 ± 1.2	6.4 ± 9.2
Q06-11611	194-hr event, 02/06/05	RTI	T	STN	2.3 ± 0.3	28.7 ± 1.6	31.0 ± 1.9	5.8 ± 0.5	4.4 ± 0.4	4.8 ± 0.5	11.4 ± 1.4	2.3 ± 3.4
Q06-11753	filter blank	CARB	#1	STN (mod.)	<0.8	<0.8	<0.8	-----	-----	-----	-----	-----
Q06-11754	filter blank	CARB	#1	STN (mod.)	<0.8	<0.8	<0.8	-----	-----	-----	-----	-----

Table 13. TOA Carbon PE Results

Sample ID	Sample Description	Lab	Instrument (see text)*	Method	Concentration (µg/cm^2)							
					EC	OC	TC	OC1	OC2	OC3	OC4	PyrolC
Q06-11755	filter blank	DRI	9	STN	0.0 ± 0.1	0.5 ± 0.3	0.5 ± 0.3	0.1 ± 0.0	0.3 ± 0.1	0.1 ± 0.2	0.0 ± 0.1	0.0 ± 0.1
Q06-11755	filter blank	DRI	12	STN	0.0 ± 0.1	0.2 ± 0.3	0.2 ± 0.3	0.1 ± 0.0	0.1 ± 0.1	0.0 ± 0.2	0.0 ± 0.1	0.0 ± 0.1
Q06-11756	filter blank	DRI	8	STN	0.0 ± 0.1	0.2 ± 0.3	0.2 ± 0.3	0.1 ± 0.0	0.2 ± 0.1	0.0 ± 0.2	0.0 ± 0.1	0.0 ± 0.1
Q06-11756	filter blank	DRI	9	STN	0.0 ± 0.1	0.3 ± 0.3	0.3 ± 0.3	0.0 ± 0.0	0.2 ± 0.1	0.0 ± 0.2	0.0 ± 0.1	0.0 ± 0.1
Q06-11757	filter blank	NAREL	#1	STN	0.0 ± 0.2	0.1 ± 0.2	0.1 ± 0.3	0.03	0.04	0.03	0.05	-0.01
Q06-11758	filter blank	NAREL	#1	STN	0.0 ± 0.2	0.1 ± 0.2	0.1 ± 0.3	0.02	0.03	0.02	0.02	0.01
Q06-11759	filter blank	RTI	R	STN	0.0 ± 0.2	0.2 ± 0.2	0.2 ± 0.3	0.0 ± 0.2	0.1 ± 0.2	0.0 ± 0.3	0.0 ± 0.3	0.0 ± 0.2
Q06-11759	filter blank	RTI	S	STN	0.0 ± 0.2	0.0 ± 0.2	0.0 ± 0.3	0.0 ± 0.2	0.0 ± 0.2	0.0 ± 0.3	0.0 ± 0.3	0.0 ± 0.2
Q06-11759	filter blank	RTI	T	STN	0.0 ± 0.2	0.1 ± 0.2	0.1 ± 0.3	0.0 ± 0.2	0.0 ± 0.2	0.0 ± 0.3	0.0 ± 0.3	0.0 ± 0.2
Q06-11760	filter blank	RTI	R	STN	0.0 ± 0.2	0.1 ± 0.2	0.1 ± 0.3	0.0 ± 0.2	0.1 ± 0.2	0.0 ± 0.3	0.0 ± 0.3	0.0 ± 0.2
Q06-11760	filter blank	RTI	S	STN	0.0 ± 0.2	0.2 ± 0.2	0.2 ± 0.3	0.0 ± 0.2	0.1 ± 0.2	0.1 ± 0.3	0.0 ± 0.3	0.0 ± 0.2
Q06-11760	filter blank	RTI	T	STN	0.0 ± 0.2	0.1 ± 0.2	0.1 ± 0.3	0.0 ± 0.2	0.0 ± 0.2	0.0 ± 0.3	0.0 ± 0.3	0.0 ± 0.2
Q05-11545	260-hr event, 11/01/05	CARB	#1	IMPROVE_A	8.15	26.36	34.51	0.36	7.76	7.54	4.96	5.74
Q05-11546	260-hr event, 11/01/05	CARB	#1	IMPROVE_A	8.31	27.22	35.53	0.32	8.51	7.53	5.68	5.18
Q05-11547	260-hr event, 11/01/05	DRI	10	IMPROVE_A	8.9 ± 0.6	22.8 ± 2.1	31.7 ± 2.7	0.6 ± 0.3	8.3 ± 1.7	5.7 ± 0.7	4.8 ± 0.8	3.3 ± 1.1
Q05-11547	260-hr event, 11/01/05	DRI	6	IMPROVE_A	9.6 ± 0.7	23.1 ± 2.1	32.6 ± 2.8	2.3 ± 1.4	6.2 ± 1.3	6.0 ± 0.7	4.6 ± 0.7	4.0 ± 1.3
Q05-11548	260-hr event, 11/01/05	DRI	11	IMPROVE_A	8.3 ± 0.6	25.8 ± 2.4	34.1 ± 2.9	1.8 ± 1.1	7.0 ± 1.4	6.6 ± 0.8	4.8 ± 0.8	5.7 ± 1.8
Q05-11548	260-hr event, 11/01/05	DRI	14	IMPROVE_A	9.9 ± 0.7	24.3 ± 2.2	34.2 ± 2.9	3.9 ± 2.4	5.7 ± 1.2	6.2 ± 0.7	7.1 ± 1.1	1.3 ± 0.4
Q05-11549	260-hr event, 11/01/05	NAREL	#2	IMPROVE_A	8.6 ± 0.6	22.9 ± 1.3	31.5 ± 1.9	2.63	7.96	4.48	4.13	3.70
Q05-11550	260-hr event, 11/01/05	NAREL	#2	IMPROVE_A	8.7 ± 0.6	23.0 ± 1.4	31.7 ± 1.9	2.49	7.98	4.58	4.16	3.83
Q05-11551	260-hr event, 11/01/05	RTI	F	IMPROVE_A	10.4 ± 2.1	23.8 ± 2.0	34.2 ± 2.6	0.1 ± 0.2	9.8 ± 1.7	4.8 ± 1.0	3.5 ± 1.4	5.5 ± 5.6
Q05-11551	260-hr event, 11/01/05	RTI	#5	IMPROVE_A	4.2 ± 1.1	30.9 ± 2.3	35.1 ± 2.7	2.8 ± 0.8	7.0 ± 1.3	6.8 ± 1.3	4.9 ± 1.9	9.4 ± 9.5
Q05-11552	260-hr event, 11/01/05	RTI	F	IMPROVE_A	10.3 ± 2.0	24.5 ± 2.0	34.7 ± 2.6	0.1 ± 0.2	10.1 ± 1.7	4.9 ± 1.0	3.5 ± 1.4	5.9 ± 6.0
Q05-11552	260-hr event, 11/01/05	RTI	#5	IMPROVE_A	5.3 ± 1.3	32.9 ± 2.4	38.2 ± 2.8	3.2 ± 0.8	7.5 ± 1.3	7.1 ± 1.4	5.3 ± 2.0	9.8 ± 9.9
Q06-11604	194-hr event, 02/06/05	CARB	#1	IMPROVE_A	6.69	25.46	32.15	0.34	6.2	7.85	6.72	4.35
Q06-11605	194-hr event, 02/06/05	CARB	#1	IMPROVE_A	6.28	25.17	31.45	0.39	5.92	7.64	6.2	5.02
Q06-11606	194-hr event, 02/06/05	DRI	14	IMPROVE_A	7.4 ± 0.5	21.9 ± 2.0	29.3 ± 2.5	2.1 ± 1.3	4.6 ± 0.9	6.8 ± 0.8	6.7 ± 1.1	1.7 ± 0.5
Q06-11606	194-hr event, 02/06/05	DRI	10	IMPROVE_A	7.4 ± 0.5	22.0 ± 2.0	29.3 ± 2.5	0.4 ± 0.3	6.0 ± 1.2	6.8 ± 0.8	6.0 ± 1.0	2.7 ± 0.9
Q06-11607	194-hr event, 02/06/05	DRI	14	IMPROVE_A	8.1 ± 0.6	23.4 ± 2.2	31.5 ± 2.7	2.7 ± 1.7	4.7 ± 1.0	6.9 ± 0.8	6.8 ± 1.1	2.2 ± 0.7
Q06-11607	194-hr event, 02/06/05	DRI	6	IMPROVE_A	7.9 ± 0.5	23.4 ± 2.2	31.3 ± 2.7	1.7 ± 1.0	5.1 ± 1.0	7.3 ± 0.9	6.4 ± 1.0	3.0 ± 1.0
Q06-11608	194-hr event, 02/06/05	NAREL	#2	IMPROVE_A	7.3 ± 0.6	22.1 ± 1.3	29.4 ± 1.8	2.24	6.36	6.22	4.55	2.70

Table 13. TOA Carbon PE Results

Sample ID	Sample Description	Lab	Instrument (see text)*	Method	Concentration (µg/cm^2)							
					EC	OC	TC	OC1	OC2	OC3	OC4	PyrolC
Q06-11609	194-hr event, 02/06/05	NAREL	#2	IMPROVE_A	7.5 ± 0.6	21.1 ± 1.3	28.6 ± 1.7	2.07	6.02	5.65	3.52	3.83
Q06-11610	194-hr event, 02/06/05	RTI	F	IMPROVE_A	8.8 ± 1.8	21.7 ± 1.9	30.5 ± 2.4	0.1 ± 0.2	6.7 ± 1.2	6.0 ± 1.2	4.0 ± 1.6	4.8 ± 4.9
Q06-11610	194-hr event, 02/06/05	RTI	#5	IMPROVE_A	3.9 ± 1.1	29.4 ± 2.3	33.3 ± 2.6	2.4 ± 0.7	5.3 ± 1.0	7.7 ± 1.5	5.6 ± 2.1	8.4 ± 8.5
Q06-11611	194-hr event, 02/06/05	RTI	F	IMPROVE_A	9.4 ± 1.9	23.9 ± 2.0	33.4 ± 2.6	0.1 ± 0.2	7.2 ± 1.3	6.8 ± 1.3	4.3 ± 1.7	5.4 ± 5.5
Q06-11611	194-hr event, 02/06/05	RTI	#5	IMPROVE_A	4.6 ± 1.2	31.6 ± 2.4	36.1 ± 2.7	2.9 ± 0.8	5.6 ± 1.0	8.3 ± 1.5	6.1 ± 2.3	8.7 ± 8.8
Q06-11753	filter blank	CARB	#1	IMPROVE_A	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Q06-11754	filter blank	CARB	#1	IMPROVE_A	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Q06-11755	filter blank	DRI	6	IMPROVE_A	0.0 ± 0.1	0.1 ± 0.3	0.1 ± 0.3	0.0 ± 0.0	0.0 ± 0.1	0.1 ± 0.2	0.0 ± 0.1	0.0 ± 0.1
Q06-11755	filter blank	DRI	14	IMPROVE_A	0.0 ± 0.1	0.1 ± 0.3	0.1 ± 0.3	0.0 ± 0.0	0.0 ± 0.1	0.1 ± 0.2	0.0 ± 0.1	0.0 ± 0.1
Q06-11756	filter blank	DRI	6	IMPROVE_A	0.0 ± 0.1	0.2 ± 0.3	0.2 ± 0.3	0.0 ± 0.0	0.0 ± 0.1	0.2 ± 0.2	0.0 ± 0.1	0.0 ± 0.1
Q06-11756	filter blank	DRI	7	IMPROVE_A	0.0 ± 0.1	0.1 ± 0.3	0.1 ± 0.3	0.0 ± 0.0	0.0 ± 0.1	0.1 ± 0.2	0.0 ± 0.1	0.0 ± 0.1
Q06-11757	filter blank	NAREL	#2	IMPROVE_A	0.0 ± 0.2	0.1 ± 0.2	0.1 ± 0.3	0.01	0.02	0.04	0.00	0.02
Q06-11758	filter blank	NAREL	#2	IMPROVE_A	0.0 ± 0.2	0.1 ± 0.2	0.1 ± 0.3	0.00	0.00	0.03	0.00	0.05
Q06-11759	filter blank	RTI	F	IMPROVE_A	0.0 ± 0.5	0.1 ± 0.8	0.1 ± 0.9	0.0 ± 0.2	0.0 ± 0.2	0.1 ± 0.3	0.0 ± 0.2	0.0 ± 0.1
Q06-11759	filter blank	RTI	#5	IMPROVE_A	1.0 ± 0.7	1.6 ± 0.9	2.6 ± 1.0	0.4 ± 0.3	0.4 ± 0.3	0.5 ± 0.4	0.4 ± 0.3	0.0 ± 0.1
Q06-11760	filter blank	RTI	F	IMPROVE_A	0.0 ± 0.5	0.3 ± 0.8	0.3 ± 0.9	0.0 ± 0.2	0.0 ± 0.2	0.2 ± 0.3	0.1 ± 0.2	0.1 ± 0.2
Q06-11760	filter blank	RTI	#5	IMPROVE_A	0.1 ± 0.5	0.5 ± 0.8	0.7 ± 0.9	0.1 ± 0.2	0.2 ± 0.2	0.3 ± 0.3	0.1 ± 0.2	0.0 ± 0.1

**** Instruments identified as DRI #6, #7, #8, #9, #10, #11, #12 ,#14, CARB #1, and RTI #5 are DRI/Model 2001 instruments capable of the TOR and the TOT analysis. RTI instruments identified as R, S, T, and NAREL #1 are early model Sunset instruments set up for the TOT analysis. The instruments identified as RTI F and NAREL #2 are newer Sunset Dual Mode instruments capable of the TOR and the TOT analysis.***

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Na	11	205-hr event	T05-11565	CARB	not reported	not reported	-----
Mg	12	205-hr event	T05-11565	CARB	not reported	not reported	-----
Al	13	205-hr event	T05-11565	CARB	2.037 ± 0.061	1.933 ± 0.995	-----
Si	14	205-hr event	T05-11565	CARB	7.855 ± 0.042	7.376 ± 0.506	7.270
P	15	205-hr event	T05-11565	CARB	0.332 ± 0.022	0.203 ± 0.294	-----
S	16	205-hr event	T05-11565	CARB	63.695 ± 0.106	55.608 ± 1.224	59.941
Cl	17	205-hr event	T05-11565	CARB	0.605 ± 0.022	0.147 ± 0.115	-----
K	19	205-hr event	T05-11565	CARB	9.489 ± 0.066	7.808 ± 0.234	8.403
Ca	20	205-hr event	T05-11565	CARB	3.488 ± 0.035	3.306 ± 0.110	3.009
Sc	21	205-hr event	T05-11565	CARB	not reported	-0.036 ± 0.046	-----
Ti	22	205-hr event	T05-11565	CARB	0.175 ± 0.014	0.180 ± 0.051	-----
V	23	205-hr event	T05-11565	CARB	0.051 ± 0.013	0.031 ± 0.022	-----
Cr	24	205-hr event	T05-11565	CARB	0.019 ± 0.009	0.006 ± 0.014	-----
Mn	25	205-hr event	T05-11565	CARB	0.153 ± 0.012	0.150 ± 0.020	0.164
Fe	26	205-hr event	T05-11565	CARB	3.802 ± 0.044	3.510 ± 0.117	3.669
Co	27	205-hr event	T05-11565	CARB	0.000 ± 0.020	0.047 ± 0.031	-----
Ni	28	205-hr event	T05-11565	CARB	0.569 ± 0.018	0.616 ± 0.035	-----
Cu	29	205-hr event	T05-11565	CARB	0.148 ± 0.007	0.207 ± 0.024	0.187
Zn	30	205-hr event	T05-11565	CARB	1.093 ± 0.013	1.055 ± 0.040	1.088
Ga	31	205-hr event	T05-11565	CARB	not reported	0.016 ± 0.014	-----
As	33	205-hr event	T05-11565	CARB	0.070 ± 0.010	0.111 ± 0.023	0.091
Se	34	205-hr event	T05-11565	CARB	0.101 ± 0.006	0.111 ± 0.016	0.096
Br	35	205-hr event	T05-11565	CARB	0.290 ± 0.005	0.339 ± 0.020	0.298
Rb	37	205-hr event	T05-11565	CARB	0.044 ± 0.004	0.013 ± 0.013	-----
Sr	38	205-hr event	T05-11565	CARB	0.035 ± 0.006	0.049 ± 0.015	-----
Y	39	205-hr event	T05-11565	CARB	0.000 ± 0.009	0.060 ± 0.054	-----
Zr	40	205-hr event	T05-11565	CARB	not reported	0.102 ± 0.047	-----
Nb	41	205-hr event	T05-11565	CARB	not reported	-0.041 ± 0.047	-----
Mo	42	205-hr event	T05-11565	CARB	0.000 ± 0.023	-0.016 ± 0.052	-----
Ag	47	205-hr event	T05-11565	CARB	not reported	-0.051 ± 0.046	-----
Cd	48	205-hr event	T05-11565	CARB	not reported	-0.050 ± 0.053	-----
In	49	205-hr event	T05-11565	CARB	not reported	0.089 ± 0.062	-----
Sn	50	205-hr event	T05-11565	CARB	0.047 ± 0.046	0.042 ± 0.075	-----
Sb	51	205-hr event	T05-11565	CARB	0.087 ± 0.062	0.084 ± 0.085	-----
Cs	55	205-hr event	T05-11565	CARB	not reported	0.122 ± 0.154	-----
Ba	56	205-hr event	T05-11565	CARB	0.353 ± 0.035	0.740 ± 0.179	-----
La	57	205-hr event	T05-11565	CARB	not reported	-0.023 ± 0.051	-----
Ce	58	205-hr event	T05-11565	CARB	not reported	0.068 ± 0.060	-----
Sm	62	205-hr event	T05-11565	CARB	not reported	not reported	-----
Eu	63	205-hr event	T05-11565	CARB	not reported	not reported	-----
Tb	65	205-hr event	T05-11565	CARB	not reported	not reported	-----
Hf	72	205-hr event	T05-11565	CARB	not reported	not reported	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Ta	73	205-hr event	T05-11565	CARB	not reported	not reported	-----
W	74	205-hr event	T05-11565	CARB	not reported	-0.002 ± 0.041	-----
Ir	77	205-hr event	T05-11565	CARB	not reported	not reported	-----
Au	79	205-hr event	T05-11565	CARB	not reported	0.018 ± 0.029	-----
Hg	80	205-hr event	T05-11565	CARB	0.000 ± 0.012	-0.044 ± 0.031	-----
Pb	82	205-hr event	T05-11565	CARB	0.264 ± 0.019	0.223 ± 0.038	0.239
Na	11	205-hr event	T05-11566	CARB	not reported	not reported	-----
Mg	12	205-hr event	T05-11566	CARB	not reported	not reported	-----
Al	13	205-hr event	T05-11566	CARB	2.947 ± 0.062	4.494 ± 1.018	-----
Si	14	205-hr event	T05-11566	CARB	7.638 ± 0.041	7.645 ± 0.502	7.270
P	15	205-hr event	T05-11566	CARB	0.353 ± 0.021	0.650 ± 0.296	-----
S	16	205-hr event	T05-11566	CARB	64.041 ± 0.103	58.572 ± 1.285	59.941
Cl	17	205-hr event	T05-11566	CARB	0.605 ± 0.022	0.539 ± 0.116	-----
K	19	205-hr event	T05-11566	CARB	9.810 ± 0.065	8.451 ± 0.243	8.403
Ca	20	205-hr event	T05-11566	CARB	3.304 ± 0.033	2.920 ± 0.104	3.009
Sc	21	205-hr event	T05-11566	CARB	not reported	-0.059 ± 0.045	-----
Ti	22	205-hr event	T05-11566	CARB	0.215 ± 0.014	0.165 ± 0.051	-----
V	23	205-hr event	T05-11566	CARB	0.061 ± 0.013	0.071 ± 0.022	-----
Cr	24	205-hr event	T05-11566	CARB	0.593 ± 0.015	0.064 ± 0.014	-----
Mn	25	205-hr event	T05-11566	CARB	0.193 ± 0.013	0.164 ± 0.019	0.164
Fe	26	205-hr event	T05-11566	CARB	5.607 ± 0.051	4.472 ± 0.138	3.669
Co	27	205-hr event	T05-11566	CARB	0.000 ± 0.022	0.027 ± 0.031	-----
Ni	28	205-hr event	T05-11566	CARB	0.388 ± 0.015	0.263 ± 0.026	-----
Cu	29	205-hr event	T05-11566	CARB	0.265 ± 0.009	0.236 ± 0.025	0.187
Zn	30	205-hr event	T05-11566	CARB	1.157 ± 0.013	1.103 ± 0.042	1.088
Ga	31	205-hr event	T05-11566	CARB	not reported	0.004 ± 0.013	-----
As	33	205-hr event	T05-11566	CARB	0.055 ± 0.010	0.100 ± 0.023	0.091
Se	34	205-hr event	T05-11566	CARB	0.099 ± 0.006	0.119 ± 0.015	0.096
Br	35	205-hr event	T05-11566	CARB	0.307 ± 0.005	0.323 ± 0.019	0.298
Rb	37	205-hr event	T05-11566	CARB	0.042 ± 0.004	0.018 ± 0.013	-----
Sr	38	205-hr event	T05-11566	CARB	0.050 ± 0.006	0.025 ± 0.014	-----
Y	39	205-hr event	T05-11566	CARB	0.000 ± 0.007	0.040 ± 0.050	-----
Zr	40	205-hr event	T05-11566	CARB	not reported	0.079 ± 0.045	-----
Nb	41	205-hr event	T05-11566	CARB	not reported	-0.034 ± 0.047	-----
Mo	42	205-hr event	T05-11566	CARB	0.000 ± 0.023	0.051 ± 0.053	-----
Ag	47	205-hr event	T05-11566	CARB	not reported	-0.049 ± 0.045	-----
Cd	48	205-hr event	T05-11566	CARB	not reported	-0.030 ± 0.052	-----
In	49	205-hr event	T05-11566	CARB	not reported	0.004 ± 0.060	-----
Sn	50	205-hr event	T05-11566	CARB	0.100 ± 0.045	0.139 ± 0.075	-----
Sb	51	205-hr event	T05-11566	CARB	0.101 ± 0.062	0.199 ± 0.085	-----
Cs	55	205-hr event	T05-11566	CARB	not reported	0.291 ± 0.153	-----
Ba	56	205-hr event	T05-11566	CARB	0.292 ± 0.036	0.593 ± 0.176	-----
La	57	205-hr event	T05-11566	CARB	not reported	0.005 ± 0.051	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Ce	58	205-hr event	T05-11566	CARB	not reported	0.071 ± 0.060	-----
Sm	62	205-hr event	T05-11566	CARB	not reported	not reported	-----
Eu	63	205-hr event	T05-11566	CARB	not reported	not reported	-----
Tb	65	205-hr event	T05-11566	CARB	not reported	not reported	-----
Hf	72	205-hr event	T05-11566	CARB	not reported	not reported	-----
Ta	73	205-hr event	T05-11566	CARB	not reported	not reported	-----
W	74	205-hr event	T05-11566	CARB	not reported	0.035 ± 0.040	-----
Ir	77	205-hr event	T05-11566	CARB	not reported	not reported	-----
Au	79	205-hr event	T05-11566	CARB	not reported	0.006 ± 0.029	-----
Hg	80	205-hr event	T05-11566	CARB	0.000 ± 0.012	-0.006 ± 0.030	-----
Pb	82	205-hr event	T05-11566	CARB	0.288 ± 0.019	0.288 ± 0.038	0.239
Na	11	205-hr event	T05-11567	DRI	6.047 ± 2.595	not reported	-----
Mg	12	205-hr event	T05-11567	DRI	0.919 ± 0.744	not reported	-----
Al	13	205-hr event	T05-11567	DRI	2.499 ± 0.301	3.222 ± 1.023	-----
Si	14	205-hr event	T05-11567	DRI	7.611 ± 0.268	6.839 ± 0.496	7.270
P	15	205-hr event	T05-11567	DRI	2.650 ± 0.084	0.099 ± 0.295	-----
S	16	205-hr event	T05-11567	DRI	65.619 ± 0.420	58.179 ± 1.275	59.941
Cl	17	205-hr event	T05-11567	DRI	0.268 ± 0.031	0.029 ± 0.114	-----
K	19	205-hr event	T05-11567	DRI	7.923 ± 0.045	7.816 ± 0.234	8.403
Ca	20	205-hr event	T05-11567	DRI	3.145 ± 0.049	3.156 ± 0.107	3.009
Sc	21	205-hr event	T05-11567	DRI	0.038 ± 0.120	0.045 ± 0.046	-----
Ti	22	205-hr event	T05-11567	DRI	0.309 ± 0.021	0.134 ± 0.049	-----
V	23	205-hr event	T05-11567	DRI	0.006 ± 0.004	0.044 ± 0.021	-----
Cr	24	205-hr event	T05-11567	DRI	0.027 ± 0.023	0.005 ± 0.013	-----
Mn	25	205-hr event	T05-11567	DRI	0.126 ± 0.053	0.144 ± 0.019	0.164
Fe	26	205-hr event	T05-11567	DRI	3.842 ± 0.054	3.926 ± 0.127	3.669
Co	27	205-hr event	T05-11567	DRI	0.000 ± 0.003	-0.001 ± 0.029	-----
Ni	28	205-hr event	T05-11567	DRI	0.370 ± 0.009	0.408 ± 0.030	-----
Cu	29	205-hr event	T05-11567	DRI	0.210 ± 0.028	0.237 ± 0.025	0.187
Zn	30	205-hr event	T05-11567	DRI	1.082 ± 0.025	1.066 ± 0.041	1.088
Ga	31	205-hr event	T05-11567	DRI	0.018 ± 0.080	-0.002 ± 0.013	-----
As	33	205-hr event	T05-11567	DRI	0.124 ± 0.009	0.084 ± 0.022	0.091
Se	34	205-hr event	T05-11567	DRI	0.106 ± 0.018	0.126 ± 0.016	0.096
Br	35	205-hr event	T05-11567	DRI	0.205 ± 0.025	0.338 ± 0.019	0.298
Rb	37	205-hr event	T05-11567	DRI	0.002 ± 0.016	0.010 ± 0.013	-----
Sr	38	205-hr event	T05-11567	DRI	0.011 ± 0.039	0.014 ± 0.014	-----
Y	39	205-hr event	T05-11567	DRI	0.000 ± 0.023	-0.089 ± 0.045	-----
Zr	40	205-hr event	T05-11567	DRI	0.000 ± 0.064	0.035 ± 0.044	-----
Nb	41	205-hr event	T05-11567	DRI	0.011 ± 0.041	-0.004 ± 0.049	-----
Mo	42	205-hr event	T05-11567	DRI	0.056 ± 0.039	0.018 ± 0.053	-----
Ag	47	205-hr event	T05-11567	DRI	0.000 ± 0.091	-0.078 ± 0.044	-----
Cd	48	205-hr event	T05-11567	DRI	0.000 ± 0.072	0.092 ± 0.057	-----
In	49	205-hr event	T05-11567	DRI	0.000 ± 0.079	0.124 ± 0.064	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Sn	50	205-hr event	T05-11567	DRI	0.122 ± 0.085	0.114 ± 0.076	-----
Sb	51	205-hr event	T05-11567	DRI	0.051 ± 0.131	0.192 ± 0.087	-----
Cs	55	205-hr event	T05-11567	DRI	0.000 ± 0.037	0.258 ± 0.155	-----
Ba	56	205-hr event	T05-11567	DRI	0.013 ± 0.039	0.592 ± 0.179	-----
La	57	205-hr event	T05-11567	DRI	0.000 ± 0.027	0.028 ± 0.049	-----
Ce	58	205-hr event	T05-11567	DRI	0.056 ± 0.025	0.002 ± 0.058	-----
Sm	62	205-hr event	T05-11567	DRI	0.038 ± 0.054	not reported	-----
Eu	63	205-hr event	T05-11567	DRI	0.004 ± 0.083	not reported	-----
Tb	65	205-hr event	T05-11567	DRI	0.051 ± 0.061	not reported	-----
Hf	72	205-hr event	T05-11567	DRI	0.000 ± 0.249	not reported	-----
Ta	73	205-hr event	T05-11567	DRI	0.000 ± 0.160	not reported	-----
W	74	205-hr event	T05-11567	DRI	0.027 ± 0.267	0.002 ± 0.040	-----
Ir	77	205-hr event	T05-11567	DRI	0.000 ± 0.074	not reported	-----
Au	79	205-hr event	T05-11567	DRI	0.081 ± 0.123	-0.033 ± 0.028	-----
Hg	80	205-hr event	T05-11567	DRI	0.000 ± 0.061	-0.022 ± 0.030	-----
Pb	82	205-hr event	T05-11567	DRI	0.106 ± 0.058	0.223 ± 0.037	0.239
Na	11	205-hr event	T05-11568	DRI	6.906 ± 2.612	not reported	-----
Mg	12	205-hr event	T05-11568	DRI	0.795 ± 0.744	not reported	-----
Al	13	205-hr event	T05-11568	DRI	2.680 ± 0.301	1.413 ± 1.021	-----
Si	14	205-hr event	T05-11568	DRI	7.555 ± 0.268	7.086 ± 0.509	7.270
P	15	205-hr event	T05-11568	DRI	2.899 ± 0.085	0.122 ± 0.300	-----
S	16	205-hr event	T05-11568	DRI	69.619 ± 0.444	59.449 ± 1.301	59.941
Cl	17	205-hr event	T05-11568	DRI	0.381 ± 0.031	0.120 ± 0.116	-----
K	19	205-hr event	T05-11568	DRI	8.499 ± 0.046	8.477 ± 0.247	8.403
Ca	20	205-hr event	T05-11568	DRI	3.304 ± 0.049	3.148 ± 0.108	3.009
Sc	21	205-hr event	T05-11568	DRI	0.027 ± 0.120	-0.070 ± 0.046	-----
Ti	22	205-hr event	T05-11568	DRI	0.185 ± 0.021	0.164 ± 0.050	-----
V	23	205-hr event	T05-11568	DRI	0.063 ± 0.004	0.024 ± 0.021	-----
Cr	24	205-hr event	T05-11568	DRI	0.015 ± 0.023	0.005 ± 0.014	-----
Mn	25	205-hr event	T05-11568	DRI	0.171 ± 0.053	0.145 ± 0.020	0.164
Fe	26	205-hr event	T05-11568	DRI	3.887 ± 0.054	3.665 ± 0.121	3.669
Co	27	205-hr event	T05-11568	DRI	0.000 ± 0.003	0.030 ± 0.030	-----
Ni	28	205-hr event	T05-11568	DRI	0.009 ± 0.007	0.037 ± 0.020	-----
Cu	29	205-hr event	T05-11568	DRI	0.198 ± 0.028	0.182 ± 0.024	0.187
Zn	30	205-hr event	T05-11568	DRI	1.127 ± 0.025	1.137 ± 0.043	1.088
Ga	31	205-hr event	T05-11568	DRI	0.006 ± 0.080	0.019 ± 0.014	-----
As	33	205-hr event	T05-11568	DRI	0.079 ± 0.009	0.104 ± 0.023	0.091
Se	34	205-hr event	T05-11568	DRI	0.061 ± 0.018	0.126 ± 0.016	0.096
Br	35	205-hr event	T05-11568	DRI	0.216 ± 0.025	0.367 ± 0.020	0.298
Rb	37	205-hr event	T05-11568	DRI	0.002 ± 0.016	0.018 ± 0.013	-----
Sr	38	205-hr event	T05-11568	DRI	0.045 ± 0.039	0.021 ± 0.015	-----
Y	39	205-hr event	T05-11568	DRI	0.000 ± 0.023	-0.110 ± 0.048	-----
Zr	40	205-hr event	T05-11568	DRI	0.000 ± 0.064	0.039 ± 0.044	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Nb	41	205-hr event	T05-11568	DRI	0.022 ± 0.041	-0.038 ± 0.048	-----
Mo	42	205-hr event	T05-11568	DRI	0.045 ± 0.039	0.095 ± 0.056	-----
Ag	47	205-hr event	T05-11568	DRI	0.083 ± 0.092	0.052 ± 0.047	-----
Cd	48	205-hr event	T05-11568	DRI	0.287 ± 0.072	0.032 ± 0.056	-----
In	49	205-hr event	T05-11568	DRI	0.000 ± 0.079	-0.015 ± 0.061	-----
Sn	50	205-hr event	T05-11568	DRI	0.099 ± 0.085	0.130 ± 0.076	-----
Sb	51	205-hr event	T05-11568	DRI	0.176 ± 0.131	-0.086 ± 0.082	-----
Cs	55	205-hr event	T05-11568	DRI	0.000 ± 0.037	0.292 ± 0.156	-----
Ba	56	205-hr event	T05-11568	DRI	0.171 ± 0.039	0.662 ± 0.179	-----
La	57	205-hr event	T05-11568	DRI	0.000 ± 0.027	-0.063 ± 0.050	-----
Ce	58	205-hr event	T05-11568	DRI	0.022 ± 0.025	-0.037 ± 0.059	-----
Sm	62	205-hr event	T05-11568	DRI	0.004 ± 0.054	not reported	-----
Eu	63	205-hr event	T05-11568	DRI	0.027 ± 0.083	not reported	-----
Tb	65	205-hr event	T05-11568	DRI	0.232 ± 0.061	not reported	-----
Hf	72	205-hr event	T05-11568	DRI	0.137 ± 0.249	not reported	-----
Ta	73	205-hr event	T05-11568	DRI	0.291 ± 0.163	not reported	-----
W	74	205-hr event	T05-11568	DRI	0.015 ± 0.267	0.061 ± 0.041	-----
Ir	77	205-hr event	T05-11568	DRI	0.000 ± 0.074	not reported	-----
Au	79	205-hr event	T05-11568	DRI	0.000 ± 0.122	0.070 ± 0.030	-----
Hg	80	205-hr event	T05-11568	DRI	0.000 ± 0.061	-0.037 ± 0.030	-----
Pb	82	205-hr event	T05-11568	DRI	0.298 ± 0.059	0.238 ± 0.038	0.239
Na	11	205-hr event	T05-11569	ODEQ	not reported	not reported	-----
Mg	12	205-hr event	T05-11569	ODEQ	not reported	not reported	-----
Al	13	205-hr event	T05-11569	ODEQ	0.688 ± 0.117	3.633 ± 1.038	-----
Si	14	205-hr event	T05-11569	ODEQ	8.269 ± 0.724	6.210 ± 0.486	7.270
P	15	205-hr event	T05-11569	ODEQ	-0.415 ± 0.156	0.284 ± 0.299	-----
S	16	205-hr event	T05-11569	ODEQ	60.284 ± 4.848	60.622 ± 1.322	59.941
Cl	17	205-hr event	T05-11569	ODEQ	-0.477 ± 0.444	0.340 ± 0.117	-----
K	19	205-hr event	T05-11569	ODEQ	8.420 ± 0.679	8.385 ± 0.244	8.403
Ca	20	205-hr event	T05-11569	ODEQ	3.093 ± 0.256	2.924 ± 0.105	3.009
Sc	21	205-hr event	T05-11569	ODEQ	-0.062 ± 0.037	-0.077 ± 0.045	-----
Ti	22	205-hr event	T05-11569	ODEQ	0.190 ± 0.052	0.311 ± 0.050	-----
V	23	205-hr event	T05-11569	ODEQ	0.040 ± 0.020	0.023 ± 0.021	-----
Cr	24	205-hr event	T05-11569	ODEQ	0.017 ± 0.010	-0.014 ± 0.013	-----
Mn	25	205-hr event	T05-11569	ODEQ	0.141 ± 0.018	0.153 ± 0.019	0.164
Fe	26	205-hr event	T05-11569	ODEQ	3.511 ± 0.283	3.898 ± 0.126	3.669
Co	27	205-hr event	T05-11569	ODEQ	-0.027 ± 0.019	0.021 ± 0.031	-----
Ni	28	205-hr event	T05-11569	ODEQ	0.034 ± 0.011	0.027 ± 0.020	-----
Cu	29	205-hr event	T05-11569	ODEQ	0.172 ± 0.018	0.174 ± 0.024	0.187
Zn	30	205-hr event	T05-11569	ODEQ	1.050 ± 0.085	1.125 ± 0.042	1.088
Ga	31	205-hr event	T05-11569	ODEQ	0.000 ± 0.050	-0.004 ± 0.013	-----
As	33	205-hr event	T05-11569	ODEQ	0.087 ± 0.018	0.075 ± 0.023	0.091
Se	34	205-hr event	T05-11569	ODEQ	0.089 ± 0.012	0.083 ± 0.015	0.096

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Br	35	205-hr event	T05-11569	ODEQ	0.274 ± 0.024	0.344 ± 0.019	0.298
Rb	37	205-hr event	T05-11569	ODEQ	0.024 ± 0.010	-0.007 ± 0.013	-----
Sr	38	205-hr event	T05-11569	ODEQ	0.017 ± 0.010	0.021 ± 0.014	-----
Y	39	205-hr event	T05-11569	ODEQ	-0.022 ± 0.011	0.025 ± 0.052	-----
Zr	40	205-hr event	T05-11569	ODEQ	0.007 ± 0.013	-0.014 ± 0.043	-----
Nb	41	205-hr event	T05-11569	ODEQ	0.010 ± 0.015	0.017 ± 0.050	-----
Mo	42	205-hr event	T05-11569	ODEQ	0.007 ± 0.018	0.036 ± 0.054	-----
Ag	47	205-hr event	T05-11569	ODEQ	0.012 ± 0.049	0.044 ± 0.048	-----
Cd	48	205-hr event	T05-11569	ODEQ	0.010 ± 0.045	0.037 ± 0.055	-----
In	49	205-hr event	T05-11569	ODEQ	0.033 ± 0.045	0.008 ± 0.061	-----
Sn	50	205-hr event	T05-11569	ODEQ	0.042 ± 0.051	0.053 ± 0.075	-----
Sb	51	205-hr event	T05-11569	ODEQ	0.022 ± 0.062	0.146 ± 0.086	-----
Cs	55	205-hr event	T05-11569	ODEQ	-0.099 ± 0.094	0.629 ± 0.160	-----
Ba	56	205-hr event	T05-11569	ODEQ	0.071 ± 0.206	0.439 ± 0.176	-----
La	57	205-hr event	T05-11569	ODEQ	-0.041 ± 0.170	0.008 ± 0.050	-----
Ce	58	205-hr event	T05-11569	ODEQ	-0.083 ± 0.207	0.224 ± 0.059	-----
Sm	62	205-hr event	T05-11569	ODEQ	-0.971 ± 0.767	not reported	-----
Eu	63	205-hr event	T05-11569	ODEQ	-1.179 ± 1.222	not reported	-----
Tb	65	205-hr event	T05-11569	ODEQ	-1.233 ± 2.710	not reported	-----
Hf	72	205-hr event	T05-11569	ODEQ	0.170 ± 0.287	not reported	-----
Ta	73	205-hr event	T05-11569	ODEQ	-0.063 ± 0.264	not reported	-----
W	74	205-hr event	T05-11569	ODEQ	0.033 ± 0.062	0.031 ± 0.039	-----
Ir	77	205-hr event	T05-11569	ODEQ	0.043 ± 0.032	not reported	-----
Au	79	205-hr event	T05-11569	ODEQ	0.017 ± 0.027	-0.008 ± 0.029	-----
Hg	80	205-hr event	T05-11569	ODEQ	0.017 ± 0.021	-0.023 ± 0.031	-----
Pb	82	205-hr event	T05-11569	ODEQ	0.187 ± 0.033	0.287 ± 0.039	0.239
Na	11	205-hr event	T05-11570	ODEQ	not reported	not reported	-----
Mg	12	205-hr event	T05-11570	ODEQ	not reported	not reported	-----
Al	13	205-hr event	T05-11570	ODEQ	1.248 ± 0.149	1.551 ± 1.020	-----
Si	14	205-hr event	T05-11570	ODEQ	8.504 ± 0.745	5.994 ± 0.485	7.270
P	15	205-hr event	T05-11570	ODEQ	-0.429 ± 0.160	0.082 ± 0.297	-----
S	16	205-hr event	T05-11570	ODEQ	62.015 ± 4.987	56.549 ± 1.246	59.941
Cl	17	205-hr event	T05-11570	ODEQ	-0.519 ± 0.457	0.204 ± 0.114	-----
K	19	205-hr event	T05-11570	ODEQ	8.688 ± 0.700	8.079 ± 0.238	8.403
Ca	20	205-hr event	T05-11570	ODEQ	3.313 ± 0.274	2.849 ± 0.103	3.009
Sc	21	205-hr event	T05-11570	ODEQ	-0.064 ± 0.038	0.004 ± 0.045	-----
Ti	22	205-hr event	T05-11570	ODEQ	0.250 ± 0.053	0.189 ± 0.049	-----
V	23	205-hr event	T05-11570	ODEQ	0.052 ± 0.020	0.053 ± 0.021	-----
Cr	24	205-hr event	T05-11570	ODEQ	0.142 ± 0.016	0.049 ± 0.014	-----
Mn	25	205-hr event	T05-11570	ODEQ	0.162 ± 0.020	0.182 ± 0.019	0.164
Fe	26	205-hr event	T05-11570	ODEQ	4.172 ± 0.335	3.927 ± 0.126	3.669
Co	27	205-hr event	T05-11570	ODEQ	-0.020 ± 0.022	0.004 ± 0.029	-----
Ni	28	205-hr event	T05-11570	ODEQ	0.249 ± 0.023	0.226 ± 0.025	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Cu	29	205-hr event	T05-11570	ODEQ	0.190 ± 0.020	0.203 ± 0.024	0.187
Zn	30	205-hr event	T05-11570	ODEQ	1.064 ± 0.086	1.145 ± 0.042	1.088
Ga	31	205-hr event	T05-11570	ODEQ	-0.006 ± 0.050	-0.005 ± 0.013	-----
As	33	205-hr event	T05-11570	ODEQ	0.056 ± 0.019	0.097 ± 0.022	0.091
Se	34	205-hr event	T05-11570	ODEQ	0.092 ± 0.012	0.085 ± 0.015	0.096
Br	35	205-hr event	T05-11570	ODEQ	0.275 ± 0.024	0.282 ± 0.018	0.298
Rb	37	205-hr event	T05-11570	ODEQ	0.022 ± 0.009	0.032 ± 0.013	-----
Sr	38	205-hr event	T05-11570	ODEQ	0.020 ± 0.010	0.033 ± 0.014	-----
Y	39	205-hr event	T05-11570	ODEQ	-0.019 ± 0.011	0.081 ± 0.053	-----
Zr	40	205-hr event	T05-11570	ODEQ	0.010 ± 0.013	0.080 ± 0.045	-----
Nb	41	205-hr event	T05-11570	ODEQ	-0.001 ± 0.015	0.002 ± 0.049	-----
Mo	42	205-hr event	T05-11570	ODEQ	0.018 ± 0.018	0.137 ± 0.056	-----
Ag	47	205-hr event	T05-11570	ODEQ	-0.013 ± 0.049	-0.014 ± 0.045	-----
Cd	48	205-hr event	T05-11570	ODEQ	-0.001 ± 0.045	0.040 ± 0.054	-----
In	49	205-hr event	T05-11570	ODEQ	0.029 ± 0.045	0.019 ± 0.060	-----
Sn	50	205-hr event	T05-11570	ODEQ	-0.013 ± 0.051	0.222 ± 0.077	-----
Sb	51	205-hr event	T05-11570	ODEQ	0.024 ± 0.062	0.124 ± 0.084	-----
Cs	55	205-hr event	T05-11570	ODEQ	0.028 ± 0.093	0.212 ± 0.153	-----
Ba	56	205-hr event	T05-11570	ODEQ	0.020 ± 0.205	0.344 ± 0.173	-----
La	57	205-hr event	T05-11570	ODEQ	-0.004 ± 0.168	-0.073 ± 0.049	-----
Ce	58	205-hr event	T05-11570	ODEQ	-0.069 ± 0.204	0.068 ± 0.058	-----
Sm	62	205-hr event	T05-11570	ODEQ	-0.078 ± 0.754	not reported	-----
Eu	63	205-hr event	T05-11570	ODEQ	-1.136 ± 1.211	not reported	-----
Tb	65	205-hr event	T05-11570	ODEQ	-0.356 ± 2.680	not reported	-----
Hf	72	205-hr event	T05-11570	ODEQ	0.104 ± 0.287	not reported	-----
Ta	73	205-hr event	T05-11570	ODEQ	-0.177 ± 0.264	not reported	-----
W	74	205-hr event	T05-11570	ODEQ	-0.052 ± 0.062	-0.006 ± 0.038	-----
Ir	77	205-hr event	T05-11570	ODEQ	-0.000 ± 0.032	not reported	-----
Au	79	205-hr event	T05-11570	ODEQ	-0.006 ± 0.027	0.048 ± 0.028	-----
Hg	80	205-hr event	T05-11570	ODEQ	0.004 ± 0.020	0.004 ± 0.030	-----
Pb	82	205-hr event	T05-11570	ODEQ	0.234 ± 0.034	0.234 ± 0.037	0.239
Na	11	205-hr event	T05-11571	RTI	3.356 ± 0.349	not reported	-----
Mg	12	205-hr event	T05-11571	RTI	0.647 ± 0.079	not reported	-----
Al	13	205-hr event	T05-11571	RTI	1.830 ± 0.218	2.155 ± 0.991	-----
Si	14	205-hr event	T05-11571	RTI	7.051 ± 0.477	5.873 ± 0.472	7.270
P	15	205-hr event	T05-11571	RTI	0.000 ± 0.092	0.298 ± 0.293	-----
S	16	205-hr event	T05-11571	RTI	56.782 ± 2.844	54.936 ± 1.210	59.941
Cl	17	205-hr event	T05-11571	RTI	1.212 ± 0.066	0.075 ± 0.115	-----
K	19	205-hr event	T05-11571	RTI	8.094 ± 0.406	7.671 ± 0.231	8.403
Ca	20	205-hr event	T05-11571	RTI	2.691 ± 0.137	2.853 ± 0.102	3.009
Sc	21	205-hr event	T05-11571	RTI	0.000 ± 0.025	-0.023 ± 0.043	-----
Ti	22	205-hr event	T05-11571	RTI	0.074 ± 0.017	0.166 ± 0.050	-----
V	23	205-hr event	T05-11571	RTI	0.222 ± 0.015	0.059 ± 0.022	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Cr	24	205-hr event	T05-11571	RTI	0.000 ± 0.007	0.000 ± 0.013	-----
Mn	25	205-hr event	T05-11571	RTI	0.149 ± 0.010	0.155 ± 0.020	0.164
Fe	26	205-hr event	T05-11571	RTI	3.279 ± 0.165	3.356 ± 0.114	3.669
Co	27	205-hr event	T05-11571	RTI	0.000 ± 0.006	-0.014 ± 0.029	-----
Ni	28	205-hr event	T05-11571	RTI	0.016 ± 0.004	0.032 ± 0.020	-----
Cu	29	205-hr event	T05-11571	RTI	0.161 ± 0.009	0.163 ± 0.023	0.187
Zn	30	205-hr event	T05-11571	RTI	0.940 ± 0.047	1.026 ± 0.040	1.088
Ga	31	205-hr event	T05-11571	RTI	0.000 ± 0.007	-0.000 ± 0.013	-----
As	33	205-hr event	T05-11571	RTI	0.097 ± 0.012	0.111 ± 0.022	0.091
Se	34	205-hr event	T05-11571	RTI	0.091 ± 0.009	0.143 ± 0.016	0.096
Br	35	205-hr event	T05-11571	RTI	0.270 ± 0.016	0.315 ± 0.019	0.298
Rb	37	205-hr event	T05-11571	RTI	0.012 ± 0.008	0.026 ± 0.013	-----
Sr	38	205-hr event	T05-11571	RTI	0.021 ± 0.008	0.012 ± 0.014	-----
Y	39	205-hr event	T05-11571	RTI	0.005 ± 0.009	-0.034 ± 0.051	-----
Zr	40	205-hr event	T05-11571	RTI	0.000 ± 0.012	0.064 ± 0.046	-----
Nb	41	205-hr event	T05-11571	RTI	0.000 ± 0.011	-0.058 ± 0.048	-----
Mo	42	205-hr event	T05-11571	RTI	0.000 ± 0.014	0.140 ± 0.058	-----
Ag	47	205-hr event	T05-11571	RTI	0.000 ± 0.038	-0.046 ± 0.046	-----
Cd	48	205-hr event	T05-11571	RTI	0.000 ± 0.041	-0.019 ± 0.054	-----
In	49	205-hr event	T05-11571	RTI	0.000 ± 0.043	-0.037 ± 0.061	-----
Sn	50	205-hr event	T05-11571	RTI	0.000 ± 0.089	0.201 ± 0.079	-----
Sb	51	205-hr event	T05-11571	RTI	0.214 ± 0.136	0.150 ± 0.087	-----
Cs	55	205-hr event	T05-11571	RTI	0.000 ± 0.070	0.622 ± 0.162	-----
Ba	56	205-hr event	T05-11571	RTI	0.074 ± 0.036	0.426 ± 0.179	-----
La	57	205-hr event	T05-11571	RTI	0.000 ± 0.037	-0.049 ± 0.050	-----
Ce	58	205-hr event	T05-11571	RTI	0.000 ± 0.024	0.006 ± 0.059	-----
Sm	62	205-hr event	T05-11571	RTI	0.000 ± 0.016	not reported	-----
Eu	63	205-hr event	T05-11571	RTI	0.000 ± 0.023	not reported	-----
Tb	65	205-hr event	T05-11571	RTI	0.036 ± 0.048	not reported	-----
Hf	72	205-hr event	T05-11571	RTI	0.006 ± 0.016	not reported	-----
Ta	73	205-hr event	T05-11571	RTI	0.000 ± 0.039	not reported	-----
W	74	205-hr event	T05-11571	RTI	0.000 ± 0.028	-0.007 ± 0.038	-----
Ir	77	205-hr event	T05-11571	RTI	0.000 ± 0.021	not reported	-----
Au	79	205-hr event	T05-11571	RTI	0.000 ± 0.017	-0.031 ± 0.029	-----
Hg	80	205-hr event	T05-11571	RTI	0.000 ± 0.024	0.003 ± 0.032	-----
Pb	82	205-hr event	T05-11571	RTI	0.242 ± 0.027	0.193 ± 0.037	0.239
Na	11	205-hr event	T05-11572	RTI	3.277 ± 0.344	not reported	-----
Mg	12	205-hr event	T05-11572	RTI	0.574 ± 0.078	not reported	-----
Al	13	205-hr event	T05-11572	RTI	1.853 ± 0.228	3.417 ± 1.027	-----
Si	14	205-hr event	T05-11572	RTI	7.164 ± 0.484	6.461 ± 0.488	7.270
P	15	205-hr event	T05-11572	RTI	0.057 ± 0.097	0.404 ± 0.298	-----
S	16	205-hr event	T05-11572	RTI	56.601 ± 2.836	58.780 ± 1.288	59.941
Cl	17	205-hr event	T05-11572	RTI	1.259 ± 0.069	0.233 ± 0.117	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
K	19	205-hr event	T05-11572	RTI	8.548 ± 0.428	8.615 ± 0.246	8.403
Ca	20	205-hr event	T05-11572	RTI	2.627 ± 0.133	2.575 ± 0.099	3.009
Sc	21	205-hr event	T05-11572	RTI	0.000 ± 0.024	-0.028 ± 0.044	-----
Ti	22	205-hr event	T05-11572	RTI	0.062 ± 0.017	0.125 ± 0.050	-----
V	23	205-hr event	T05-11572	RTI	0.223 ± 0.015	0.067 ± 0.022	-----
Cr	24	205-hr event	T05-11572	RTI	0.000 ± 0.007	0.015 ± 0.014	-----
Mn	25	205-hr event	T05-11572	RTI	0.138 ± 0.010	0.166 ± 0.020	0.164
Fe	26	205-hr event	T05-11572	RTI	3.325 ± 0.167	3.556 ± 0.118	3.669
Co	27	205-hr event	T05-11572	RTI	0.000 ± 0.006	-0.008 ± 0.029	-----
Ni	28	205-hr event	T05-11572	RTI	0.016 ± 0.004	0.013 ± 0.019	-----
Cu	29	205-hr event	T05-11572	RTI	0.144 ± 0.009	0.196 ± 0.024	0.187
Zn	30	205-hr event	T05-11572	RTI	0.973 ± 0.049	1.133 ± 0.042	1.088
Ga	31	205-hr event	T05-11572	RTI	0.012 ± 0.009	0.002 ± 0.013	-----
As	33	205-hr event	T05-11572	RTI	0.100 ± 0.012	0.080 ± 0.022	0.091
Se	34	205-hr event	T05-11572	RTI	0.089 ± 0.009	0.074 ± 0.015	0.096
Br	35	205-hr event	T05-11572	RTI	0.275 ± 0.017	0.305 ± 0.019	0.298
Rb	37	205-hr event	T05-11572	RTI	0.008 ± 0.008	0.037 ± 0.013	-----
Sr	38	205-hr event	T05-11572	RTI	0.033 ± 0.008	0.043 ± 0.015	-----
Y	39	205-hr event	T05-11572	RTI	0.000 ± 0.007	0.058 ± 0.053	-----
Zr	40	205-hr event	T05-11572	RTI	0.000 ± 0.011	0.026 ± 0.044	-----
Nb	41	205-hr event	T05-11572	RTI	0.000 ± 0.012	0.008 ± 0.049	-----
Mo	42	205-hr event	T05-11572	RTI	0.000 ± 0.014	0.027 ± 0.054	-----
Ag	47	205-hr event	T05-11572	RTI	0.000 ± 0.038	0.000 ± 0.046	-----
Cd	48	205-hr event	T05-11572	RTI	0.051 ± 0.056	-0.016 ± 0.054	-----
In	49	205-hr event	T05-11572	RTI	0.000 ± 0.059	0.145 ± 0.064	-----
Sn	50	205-hr event	T05-11572	RTI	0.000 ± 0.073	0.048 ± 0.075	-----
Sb	51	205-hr event	T05-11572	RTI	0.203 ± 0.147	0.248 ± 0.088	-----
Cs	55	205-hr event	T05-11572	RTI	0.000 ± 0.069	0.369 ± 0.157	-----
Ba	56	205-hr event	T05-11572	RTI	0.027 ± 0.037	0.658 ± 0.181	-----
La	57	205-hr event	T05-11572	RTI	0.000 ± 0.037	0.000 ± 0.051	-----
Ce	58	205-hr event	T05-11572	RTI	0.000 ± 0.024	0.010 ± 0.057	-----
Sm	62	205-hr event	T05-11572	RTI	0.000 ± 0.016	not reported	-----
Eu	63	205-hr event	T05-11572	RTI	0.000 ± 0.023	not reported	-----
Tb	65	205-hr event	T05-11572	RTI	0.028 ± 0.049	not reported	-----
Hf	72	205-hr event	T05-11572	RTI	0.019 ± 0.016	not reported	-----
Ta	73	205-hr event	T05-11572	RTI	0.000 ± 0.039	not reported	-----
W	74	205-hr event	T05-11572	RTI	0.000 ± 0.028	0.066 ± 0.040	-----
Ir	77	205-hr event	T05-11572	RTI	0.000 ± 0.021	not reported	-----
Au	79	205-hr event	T05-11572	RTI	0.003 ± 0.022	0.032 ± 0.030	-----
Hg	80	205-hr event	T05-11572	RTI	0.042 ± 0.030	0.036 ± 0.032	-----
Pb	82	205-hr event	T05-11572	RTI	0.249 ± 0.027	0.239 ± 0.038	0.239
Na	11	205-hr event	T05-11573	UCD	1.098 ± 0.542	not reported	-----
Mg	12	205-hr event	T05-11573	UCD	0.670 ± 0.257	not reported	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Al	13	205-hr event	T05-11573	UCD	0.603 ± 0.091	1.182 ± 0.985	-----
Si	14	205-hr event	T05-11573	UCD	7.499 ± 0.436	6.650 ± 0.493	7.270
P	15	205-hr event	T05-11573	UCD	0.000 ± 0.000	0.336 ± 0.299	-----
S	16	205-hr event	T05-11573	UCD	60.457 ± 3.049	62.683 ± 1.365	59.941
Cl	17	205-hr event	T05-11573	UCD	0.000 ± 0.000	0.266 ± 0.116	-----
K	19	205-hr event	T05-11573	UCD	7.987 ± 0.408	8.955 ± 0.253	8.403
Ca	20	205-hr event	T05-11573	UCD	2.904 ± 0.154	2.766 ± 0.101	3.009
Sc	21	205-hr event	T05-11573	UCD	not reported	-0.008 ± 0.044	-----
Ti	22	205-hr event	T05-11573	UCD	0.158 ± 0.011	0.185 ± 0.048	-----
V	23	205-hr event	T05-11573	UCD	0.050 ± 0.007	0.066 ± 0.021	-----
Cr	24	205-hr event	T05-11573	UCD	0.013 ± 0.002	0.006 ± 0.013	-----
Mn	25	205-hr event	T05-11573	UCD	0.120 ± 0.008	0.154 ± 0.019	0.164
Fe	26	205-hr event	T05-11573	UCD	3.029 ± 0.154	3.640 ± 0.119	3.669
Co	27	205-hr event	T05-11573	UCD	not reported	0.086 ± 0.030	-----
Ni	28	205-hr event	T05-11573	UCD	0.006 ± 0.002	-0.006 ± 0.018	-----
Cu	29	205-hr event	T05-11573	UCD	0.146 ± 0.009	0.239 ± 0.024	0.187
Zn	30	205-hr event	T05-11573	UCD	0.938 ± 0.048	1.191 ± 0.043	1.088
Ga	31	205-hr event	T05-11573	UCD	0.000 ± 0.000	0.005 ± 0.013	-----
As	33	205-hr event	T05-11573	UCD	0.033 ± 0.006	0.093 ± 0.022	0.091
Se	34	205-hr event	T05-11573	UCD	0.079 ± 0.005	0.119 ± 0.015	0.096
Br	35	205-hr event	T05-11573	UCD	0.237 ± 0.013	0.341 ± 0.019	0.298
Rb	37	205-hr event	T05-11573	UCD	0.018 ± 0.004	0.045 ± 0.013	-----
Sr	38	205-hr event	T05-11573	UCD	0.016 ± 0.003	-0.001 ± 0.013	-----
Y	39	205-hr event	T05-11573	UCD	not reported	-0.072 ± 0.046	-----
Zr	40	205-hr event	T05-11573	UCD	not reported	0.010 ± 0.041	-----
Nb	41	205-hr event	T05-11573	UCD	not reported	0.052 ± 0.047	-----
Mo	42	205-hr event	T05-11573	UCD	not reported	0.043 ± 0.051	-----
Ag	47	205-hr event	T05-11573	UCD	not reported	-0.029 ± 0.042	-----
Cd	48	205-hr event	T05-11573	UCD	not reported	0.027 ± 0.051	-----
In	49	205-hr event	T05-11573	UCD	not reported	0.097 ± 0.060	-----
Sn	50	205-hr event	T05-11573	UCD	not reported	0.222 ± 0.073	-----
Sb	51	205-hr event	T05-11573	UCD	not reported	0.175 ± 0.082	-----
Cs	55	205-hr event	T05-11573	UCD	not reported	0.103 ± 0.144	-----
Ba	56	205-hr event	T05-11573	UCD	not reported	0.498 ± 0.167	-----
La	57	205-hr event	T05-11573	UCD	not reported	-0.014 ± 0.048	-----
Ce	58	205-hr event	T05-11573	UCD	not reported	0.051 ± 0.056	-----
Sm	62	205-hr event	T05-11573	UCD	not reported	not reported	-----
Eu	63	205-hr event	T05-11573	UCD	not reported	not reported	-----
Tb	65	205-hr event	T05-11573	UCD	not reported	not reported	-----
Hf	72	205-hr event	T05-11573	UCD	not reported	not reported	-----
Ta	73	205-hr event	T05-11573	UCD	not reported	not reported	-----
W	74	205-hr event	T05-11573	UCD	not reported	0.053 ± 0.038	-----
Ir	77	205-hr event	T05-11573	UCD	not reported	not reported	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Au	79	205-hr event	T05-11573	UCD	not reported	-0.030 ± 0.027	-----
Hg	80	205-hr event	T05-11573	UCD	not reported	0.021 ± 0.030	-----
Pb	82	205-hr event	T05-11573	UCD	0.217 ± 0.019	0.237 ± 0.036	0.239
Na	11	205-hr event	T05-11574	UCD	3.474 ± 0.791	not reported	-----
Mg	12	205-hr event	T05-11574	UCD	0.000 ± 0.000	not reported	-----
Al	13	205-hr event	T05-11574	UCD	1.377 ± 0.217	2.616 ± 0.995	-----
Si	14	205-hr event	T05-11574	UCD	7.882 ± 0.451	6.607 ± 0.488	7.270
P	15	205-hr event	T05-11574	UCD	0.000 ± 0.000	0.796 ± 0.300	-----
S	16	205-hr event	T05-11574	UCD	61.748 ± 3.114	59.598 ± 1.305	59.941
Cl	17	205-hr event	T05-11574	UCD	0.000 ± 0.000	0.306 ± 0.113	-----
K	19	205-hr event	T05-11574	UCD	8.063 ± 0.412	7.794 ± 0.234	8.403
Ca	20	205-hr event	T05-11574	UCD	3.148 ± 0.166	2.798 ± 0.100	3.009
Sc	21	205-hr event	T05-11574	UCD	not reported	-0.062 ± 0.044	-----
Ti	22	205-hr event	T05-11574	UCD	0.180 ± 0.012	0.158 ± 0.050	-----
V	23	205-hr event	T05-11574	UCD	0.064 ± 0.008	0.093 ± 0.022	-----
Cr	24	205-hr event	T05-11574	UCD	0.017 ± 0.003	-0.003 ± 0.013	-----
Mn	25	205-hr event	T05-11574	UCD	0.123 ± 0.008	0.135 ± 0.018	0.164
Fe	26	205-hr event	T05-11574	UCD	3.175 ± 0.161	3.671 ± 0.120	3.669
Co	27	205-hr event	T05-11574	UCD	not reported	-0.004 ± 0.028	-----
Ni	28	205-hr event	T05-11574	UCD	0.000 ± 0.000	0.030 ± 0.019	-----
Cu	29	205-hr event	T05-11574	UCD	0.150 ± 0.009	0.153 ± 0.022	0.187
Zn	30	205-hr event	T05-11574	UCD	0.955 ± 0.049	1.096 ± 0.041	1.088
Ga	31	205-hr event	T05-11574	UCD	0.000 ± 0.000	0.002 ± 0.012	-----
As	33	205-hr event	T05-11574	UCD	0.031 ± 0.006	0.111 ± 0.022	0.091
Se	34	205-hr event	T05-11574	UCD	0.082 ± 0.005	0.114 ± 0.015	0.096
Br	35	205-hr event	T05-11574	UCD	0.249 ± 0.013	0.340 ± 0.019	0.298
Rb	37	205-hr event	T05-11574	UCD	0.017 ± 0.004	0.018 ± 0.012	-----
Sr	38	205-hr event	T05-11574	UCD	0.008 ± 0.001	0.004 ± 0.013	-----
Y	39	205-hr event	T05-11574	UCD	not reported	0.036 ± 0.051	-----
Zr	40	205-hr event	T05-11574	UCD	not reported	0.096 ± 0.044	-----
Nb	41	205-hr event	T05-11574	UCD	not reported	0.106 ± 0.050	-----
Mo	42	205-hr event	T05-11574	UCD	not reported	0.077 ± 0.052	-----
Ag	47	205-hr event	T05-11574	UCD	not reported	0.035 ± 0.044	-----
Cd	48	205-hr event	T05-11574	UCD	not reported	0.115 ± 0.054	-----
In	49	205-hr event	T05-11574	UCD	not reported	-0.009 ± 0.058	-----
Sn	50	205-hr event	T05-11574	UCD	not reported	0.100 ± 0.072	-----
Sb	51	205-hr event	T05-11574	UCD	not reported	0.142 ± 0.082	-----
Cs	55	205-hr event	T05-11574	UCD	not reported	0.215 ± 0.147	-----
Ba	56	205-hr event	T05-11574	UCD	not reported	0.480 ± 0.168	-----
La	57	205-hr event	T05-11574	UCD	not reported	-0.016 ± 0.049	-----
Ce	58	205-hr event	T05-11574	UCD	not reported	-0.054 ± 0.056	-----
Sm	62	205-hr event	T05-11574	UCD	not reported	not reported	-----
Eu	63	205-hr event	T05-11574	UCD	not reported	not reported	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Tb	65	205-hr event	T05-11574	UCD	not reported	not reported	-----
Hf	72	205-hr event	T05-11574	UCD	not reported	not reported	-----
Ta	73	205-hr event	T05-11574	UCD	not reported	not reported	-----
W	74	205-hr event	T05-11574	UCD	not reported	-0.000 ± 0.037	-----
Ir	77	205-hr event	T05-11574	UCD	not reported	not reported	-----
Au	79	205-hr event	T05-11574	UCD	not reported	0.007 ± 0.027	-----
Hg	80	205-hr event	T05-11574	UCD	not reported	-0.011 ± 0.029	-----
Pb	82	205-hr event	T05-11574	UCD	0.225 ± 0.019	0.222 ± 0.035	0.239
Na	11	231-hr event	T06-11614	CARB	not reported	not reported	-----
Mg	12	231-hr event	T06-11614	CARB	not reported	not reported	-----
Al	13	231-hr event	T06-11614	CARB	2.053 ± 0.058	3.642 ± 1.011	-----
Si	14	231-hr event	T06-11614	CARB	6.861 ± 0.041	6.612 ± 0.494	6.865
P	15	231-hr event	T06-11614	CARB	0.306 ± 0.022	0.104 ± 0.307	-----
S	16	231-hr event	T06-11614	CARB	73.844 ± 0.115	74.584 ± 1.599	74.689
Cl	17	231-hr event	T06-11614	CARB	0.494 ± 0.023	0.356 ± 0.116	-----
K	19	231-hr event	T06-11614	CARB	4.479 ± 0.049	4.292 ± 0.162	4.241
Ca	20	231-hr event	T06-11614	CARB	2.436 ± 0.030	2.485 ± 0.092	2.399
Sc	21	231-hr event	T06-11614	CARB	not reported	0.061 ± 0.042	-----
Ti	22	231-hr event	T06-11614	CARB	0.152 ± 0.013	0.182 ± 0.048	-----
V	23	231-hr event	T06-11614	CARB	0.039 ± 0.012	0.040 ± 0.020	-----
Cr	24	231-hr event	T06-11614	CARB	0.020 ± 0.007	0.025 ± 0.013	-----
Mn	25	231-hr event	T06-11614	CARB	0.110 ± 0.011	0.103 ± 0.018	-----
Fe	26	231-hr event	T06-11614	CARB	2.676 ± 0.038	2.909 ± 0.103	2.882
Co	27	231-hr event	T06-11614	CARB	0.000 ± 0.018	0.004 ± 0.028	-----
Ni	28	231-hr event	T06-11614	CARB	0.294 ± 0.014	0.315 ± 0.027	-----
Cu	29	231-hr event	T06-11614	CARB	0.106 ± 0.006	0.083 ± 0.021	0.099
Zn	30	231-hr event	T06-11614	CARB	0.857 ± 0.012	0.948 ± 0.038	0.912
Ga	31	231-hr event	T06-11614	CARB	not reported	0.026 ± 0.013	-----
As	33	231-hr event	T06-11614	CARB	0.054 ± 0.009	0.083 ± 0.021	0.080
Se	34	231-hr event	T06-11614	CARB	0.070 ± 0.005	0.099 ± 0.014	0.082
Br	35	231-hr event	T06-11614	CARB	0.284 ± 0.004	0.326 ± 0.019	0.310
Rb	37	231-hr event	T06-11614	CARB	0.011 ± 0.004	0.022 ± 0.012	-----
Sr	38	231-hr event	T06-11614	CARB	0.019 ± 0.006	0.011 ± 0.014	-----
Y	39	231-hr event	T06-11614	CARB	0.000 ± 0.009	-0.033 ± 0.048	-----
Zr	40	231-hr event	T06-11614	CARB	not reported	0.019 ± 0.042	-----
Nb	41	231-hr event	T06-11614	CARB	not reported	0.057 ± 0.049	-----
Mo	42	231-hr event	T06-11614	CARB	0.000 ± 0.023	0.050 ± 0.053	-----
Ag	47	231-hr event	T06-11614	CARB	not reported	0.072 ± 0.047	-----
Cd	48	231-hr event	T06-11614	CARB	not reported	0.001 ± 0.052	-----
In	49	231-hr event	T06-11614	CARB	not reported	0.102 ± 0.061	-----
Sn	50	231-hr event	T06-11614	CARB	0.000 ± 0.059	0.246 ± 0.076	-----
Sb	51	231-hr event	T06-11614	CARB	0.000 ± 0.077	0.092 ± 0.082	-----
Cs	55	231-hr event	T06-11614	CARB	not reported	-0.013 ± 0.149	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Ba	56	231-hr event	T06-11614	CARB	0.193 ± 0.032	0.339 ± 0.170	-----
La	57	231-hr event	T06-11614	CARB	not reported	-0.085 ± 0.047	-----
Ce	58	231-hr event	T06-11614	CARB	not reported	0.051 ± 0.056	-----
Sm	62	231-hr event	T06-11614	CARB	not reported	not reported	-----
Eu	63	231-hr event	T06-11614	CARB	not reported	not reported	-----
Tb	65	231-hr event	T06-11614	CARB	not reported	not reported	-----
Hf	72	231-hr event	T06-11614	CARB	not reported	not reported	-----
Ta	73	231-hr event	T06-11614	CARB	not reported	not reported	-----
W	74	231-hr event	T06-11614	CARB	not reported	0.111 ± 0.041	-----
Ir	77	231-hr event	T06-11614	CARB	not reported	not reported	-----
Au	79	231-hr event	T06-11614	CARB	not reported	-0.026 ± 0.028	-----
Hg	80	231-hr event	T06-11614	CARB	0.000 ± 0.012	-0.010 ± 0.029	-----
Pb	82	231-hr event	T06-11614	CARB	0.210 ± 0.018	0.200 ± 0.036	0.212
Na	11	231-hr event	T06-11615	CARB	not reported	not reported	-----
Mg	12	231-hr event	T06-11615	CARB	not reported	not reported	-----
Al	13	231-hr event	T06-11615	CARB	2.041 ± 0.059	3.384 ± 0.990	-----
Si	14	231-hr event	T06-11615	CARB	7.380 ± 0.044	7.645 ± 0.511	6.865
P	15	231-hr event	T06-11615	CARB	0.307 ± 0.023	1.524 ± 0.322	-----
S	16	231-hr event	T06-11615	CARB	77.843 ± 0.120	78.187 ± 1.666	74.689
Cl	17	231-hr event	T06-11615	CARB	0.519 ± 0.024	0.432 ± 0.115	-----
K	19	231-hr event	T06-11615	CARB	4.708 ± 0.050	4.449 ± 0.166	4.241
Ca	20	231-hr event	T06-11615	CARB	2.673 ± 0.031	2.718 ± 0.096	2.399
Sc	21	231-hr event	T06-11615	CARB	not reported	-0.096 ± 0.042	-----
Ti	22	231-hr event	T06-11615	CARB	0.151 ± 0.014	0.232 ± 0.049	-----
V	23	231-hr event	T06-11615	CARB	0.054 ± 0.013	0.071 ± 0.021	-----
Cr	24	231-hr event	T06-11615	CARB	0.021 ± 0.009	0.013 ± 0.013	-----
Mn	25	231-hr event	T06-11615	CARB	0.113 ± 0.011	0.132 ± 0.018	-----
Fe	26	231-hr event	T06-11615	CARB	2.898 ± 0.041	3.217 ± 0.110	2.882
Co	27	231-hr event	T06-11615	CARB	0.000 ± 0.019	-0.018 ± 0.027	-----
Ni	28	231-hr event	T06-11615	CARB	0.197 ± 0.013	0.227 ± 0.025	-----
Cu	29	231-hr event	T06-11615	CARB	0.103 ± 0.006	0.135 ± 0.022	0.099
Zn	30	231-hr event	T06-11615	CARB	0.948 ± 0.012	1.115 ± 0.042	0.912
Ga	31	231-hr event	T06-11615	CARB	not reported	0.000 ± 0.013	-----
As	33	231-hr event	T06-11615	CARB	0.063 ± 0.009	0.083 ± 0.022	0.080
Se	34	231-hr event	T06-11615	CARB	0.079 ± 0.005	0.086 ± 0.014	0.082
Br	35	231-hr event	T06-11615	CARB	0.279 ± 0.005	0.381 ± 0.020	0.310
Rb	37	231-hr event	T06-11615	CARB	0.004 ± 0.004	0.021 ± 0.012	-----
Sr	38	231-hr event	T06-11615	CARB	0.033 ± 0.006	0.019 ± 0.014	-----
Y	39	231-hr event	T06-11615	CARB	0.006 ± 0.006	0.006 ± 0.051	-----
Zr	40	231-hr event	T06-11615	CARB	not reported	0.047 ± 0.042	-----
Nb	41	231-hr event	T06-11615	CARB	not reported	-0.078 ± 0.045	-----
Mo	42	231-hr event	T06-11615	CARB	0.000 ± 0.022	0.063 ± 0.052	-----
Ag	47	231-hr event	T06-11615	CARB	not reported	0.042 ± 0.045	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Cd	48	231-hr event	T06-11615	CARB	not reported	0.059 ± 0.053	-----
In	49	231-hr event	T06-11615	CARB	not reported	0.038 ± 0.059	-----
Sn	50	231-hr event	T06-11615	CARB	0.162 ± 0.044	0.019 ± 0.071	-----
Sb	51	231-hr event	T06-11615	CARB	0.051 ± 0.059	0.048 ± 0.081	-----
Cs	55	231-hr event	T06-11615	CARB	not reported	0.312 ± 0.149	-----
Ba	56	231-hr event	T06-11615	CARB	0.242 ± 0.035	0.452 ± 0.171	-----
La	57	231-hr event	T06-11615	CARB	not reported	0.003 ± 0.049	-----
Ce	58	231-hr event	T06-11615	CARB	not reported	0.101 ± 0.056	-----
Sm	62	231-hr event	T06-11615	CARB	not reported	not reported	-----
Eu	63	231-hr event	T06-11615	CARB	not reported	not reported	-----
Tb	65	231-hr event	T06-11615	CARB	not reported	not reported	-----
Hf	72	231-hr event	T06-11615	CARB	not reported	not reported	-----
Ta	73	231-hr event	T06-11615	CARB	not reported	not reported	-----
W	74	231-hr event	T06-11615	CARB	not reported	0.060 ± 0.039	-----
Ir	77	231-hr event	T06-11615	CARB	not reported	not reported	-----
Au	79	231-hr event	T06-11615	CARB	not reported	-0.064 ± 0.027	-----
Hg	80	231-hr event	T06-11615	CARB	0.000 ± 0.011	-0.042 ± 0.029	-----
Pb	82	231-hr event	T06-11615	CARB	0.214 ± 0.018	0.286 ± 0.037	0.212
Na	11	231-hr event	T06-11616	DRI	6.262 ± 2.599	not reported	-----
Mg	12	231-hr event	T06-11616	DRI	0.682 ± 0.743	not reported	-----
Al	13	231-hr event	T06-11616	DRI	2.567 ± 0.301	1.471 ± 1.006	-----
Si	14	231-hr event	T06-11616	DRI	7.283 ± 0.266	5.958 ± 0.489	6.865
P	15	231-hr event	T06-11616	DRI	3.340 ± 0.088	0.077 ± 0.314	-----
S	16	231-hr event	T06-11616	DRI	79.992 ± 0.506	73.443 ± 1.574	74.689
Cl	17	231-hr event	T06-11616	DRI	0.291 ± 0.031	0.251 ± 0.116	-----
K	19	231-hr event	T06-11616	DRI	4.081 ± 0.036	4.110 ± 0.160	4.241
Ca	20	231-hr event	T06-11616	DRI	2.513 ± 0.048	2.484 ± 0.092	2.399
Sc	21	231-hr event	T06-11616	DRI	0.027 ± 0.120	-0.028 ± 0.041	-----
Ti	22	231-hr event	T06-11616	DRI	0.162 ± 0.021	0.185 ± 0.048	-----
V	23	231-hr event	T06-11616	DRI	0.063 ± 0.004	0.059 ± 0.021	-----
Cr	24	231-hr event	T06-11616	DRI	0.027 ± 0.023	0.008 ± 0.013	-----
Mn	25	231-hr event	T06-11616	DRI	0.115 ± 0.053	0.102 ± 0.018	-----
Fe	26	231-hr event	T06-11616	DRI	2.915 ± 0.051	2.862 ± 0.102	2.882
Co	27	231-hr event	T06-11616	DRI	0.000 ± 0.003	-0.036 ± 0.027	-----
Ni	28	231-hr event	T06-11616	DRI	0.189 ± 0.007	0.269 ± 0.026	-----
Cu	29	231-hr event	T06-11616	DRI	0.085 ± 0.027	0.087 ± 0.021	0.099
Zn	30	231-hr event	T06-11616	DRI	0.867 ± 0.025	0.917 ± 0.037	0.912
Ga	31	231-hr event	T06-11616	DRI	0.018 ± 0.080	-0.013 ± 0.013	-----
As	33	231-hr event	T06-11616	DRI	0.033 ± 0.009	0.056 ± 0.021	0.080
Se	34	231-hr event	T06-11616	DRI	0.049 ± 0.018	0.073 ± 0.014	0.082
Br	35	231-hr event	T06-11616	DRI	0.216 ± 0.025	0.373 ± 0.020	0.310
Rb	37	231-hr event	T06-11616	DRI	0.000 ± 0.016	0.022 ± 0.013	-----
Sr	38	231-hr event	T06-11616	DRI	0.022 ± 0.039	0.041 ± 0.014	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Y	39	231-hr event	T06-11616	DRI	0.000 ± 0.023	0.051 ± 0.055	-----
Zr	40	231-hr event	T06-11616	DRI	0.015 ± 0.064	0.052 ± 0.045	-----
Nb	41	231-hr event	T06-11616	DRI	0.033 ± 0.041	-0.117 ± 0.044	-----
Mo	42	231-hr event	T06-11616	DRI	0.011 ± 0.039	0.111 ± 0.055	-----
Ag	47	231-hr event	T06-11616	DRI	0.000 ± 0.091	0.028 ± 0.046	-----
Cd	48	231-hr event	T06-11616	DRI	0.000 ± 0.072	-0.049 ± 0.052	-----
In	49	231-hr event	T06-11616	DRI	0.000 ± 0.079	-0.000 ± 0.059	-----
Sn	50	231-hr event	T06-11616	DRI	0.054 ± 0.085	0.185 ± 0.075	-----
Sb	51	231-hr event	T06-11616	DRI	0.085 ± 0.131	0.120 ± 0.083	-----
Cs	55	231-hr event	T06-11616	DRI	0.000 ± 0.037	0.261 ± 0.151	-----
Ba	56	231-hr event	T06-11616	DRI	0.002 ± 0.039	0.361 ± 0.171	-----
La	57	231-hr event	T06-11616	DRI	0.015 ± 0.027	0.054 ± 0.048	-----
Ce	58	231-hr event	T06-11616	DRI	0.000 ± 0.025	-0.081 ± 0.055	-----
Sm	62	231-hr event	T06-11616	DRI	0.015 ± 0.054	not reported	-----
Eu	63	231-hr event	T06-11616	DRI	0.072 ± 0.083	not reported	-----
Tb	65	231-hr event	T06-11616	DRI	0.074 ± 0.061	not reported	-----
Hf	72	231-hr event	T06-11616	DRI	0.000 ± 0.248	not reported	-----
Ta	73	231-hr event	T06-11616	DRI	0.009 ± 0.162	not reported	-----
W	74	231-hr event	T06-11616	DRI	0.117 ± 0.267	0.042 ± 0.039	-----
Ir	77	231-hr event	T06-11616	DRI	0.126 ± 0.074	not reported	-----
Au	79	231-hr event	T06-11616	DRI	0.000 ± 0.122	-0.008 ± 0.028	-----
Hg	80	231-hr event	T06-11616	DRI	0.183 ± 0.062	-0.060 ± 0.029	-----
Pb	82	231-hr event	T06-11616	DRI	0.264 ± 0.059	0.235 ± 0.036	0.212
Na	11	231-hr event	T06-11617	DRI	5.799 ± 2.589	not reported	-----
Mg	12	231-hr event	T06-11617	DRI	1.134 ± 0.746	not reported	-----
Al	13	231-hr event	T06-11617	DRI	2.702 ± 0.301	2.643 ± 1.040	-----
Si	14	231-hr event	T06-11617	DRI	7.012 ± 0.266	6.800 ± 0.508	6.865
P	15	231-hr event	T06-11617	DRI	3.396 ± 0.088	-0.328 ± 0.312	-----
S	16	231-hr event	T06-11617	DRI	80.546 ± 0.509	74.014 ± 1.587	74.689
Cl	17	231-hr event	T06-11617	DRI	0.257 ± 0.031	0.292 ± 0.118	-----
K	19	231-hr event	T06-11617	DRI	3.945 ± 0.036	4.245 ± 0.161	4.241
Ca	20	231-hr event	T06-11617	DRI	2.524 ± 0.048	2.390 ± 0.091	2.399
Sc	21	231-hr event	T06-11617	DRI	0.049 ± 0.120	-0.026 ± 0.042	-----
Ti	22	231-hr event	T06-11617	DRI	0.196 ± 0.021	0.178 ± 0.049	-----
V	23	231-hr event	T06-11617	DRI	0.029 ± 0.004	0.068 ± 0.022	-----
Cr	24	231-hr event	T06-11617	DRI	0.038 ± 0.023	0.022 ± 0.013	-----
Mn	25	231-hr event	T06-11617	DRI	0.103 ± 0.053	0.118 ± 0.019	-----
Fe	26	231-hr event	T06-11617	DRI	2.892 ± 0.051	3.012 ± 0.106	2.882
Co	27	231-hr event	T06-11617	DRI	0.000 ± 0.003	0.061 ± 0.030	-----
Ni	28	231-hr event	T06-11617	DRI	0.000 ± 0.007	0.015 ± 0.019	-----
Cu	29	231-hr event	T06-11617	DRI	0.097 ± 0.027	0.100 ± 0.021	0.099
Zn	30	231-hr event	T06-11617	DRI	0.901 ± 0.025	0.985 ± 0.039	0.912
Ga	31	231-hr event	T06-11617	DRI	0.000 ± 0.080	-0.007 ± 0.012	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
As	33	231-hr event	T06-11617	DRI	0.045 ± 0.009	0.083 ± 0.022	0.080
Se	34	231-hr event	T06-11617	DRI	0.083 ± 0.018	0.083 ± 0.015	0.082
Br	35	231-hr event	T06-11617	DRI	0.318 ± 0.025	0.328 ± 0.019	0.310
Rb	37	231-hr event	T06-11617	DRI	0.000 ± 0.016	0.014 ± 0.013	-----
Sr	38	231-hr event	T06-11617	DRI	0.000 ± 0.039	0.023 ± 0.014	-----
Y	39	231-hr event	T06-11617	DRI	0.000 ± 0.023	-0.043 ± 0.050	-----
Zr	40	231-hr event	T06-11617	DRI	0.004 ± 0.064	0.095 ± 0.046	-----
Nb	41	231-hr event	T06-11617	DRI	0.000 ± 0.041	-0.035 ± 0.047	-----
Mo	42	231-hr event	T06-11617	DRI	0.033 ± 0.039	0.011 ± 0.053	-----
Ag	47	231-hr event	T06-11617	DRI	0.027 ± 0.092	0.019 ± 0.047	-----
Cd	48	231-hr event	T06-11617	DRI	0.174 ± 0.072	0.012 ± 0.054	-----
In	49	231-hr event	T06-11617	DRI	0.000 ± 0.079	0.124 ± 0.063	-----
Sn	50	231-hr event	T06-11617	DRI	0.000 ± 0.085	0.113 ± 0.075	-----
Sb	51	231-hr event	T06-11617	DRI	0.000 ± 0.131	0.301 ± 0.087	-----
Cs	55	231-hr event	T06-11617	DRI	0.000 ± 0.037	0.280 ± 0.154	-----
Ba	56	231-hr event	T06-11617	DRI	0.047 ± 0.039	0.787 ± 0.178	-----
La	57	231-hr event	T06-11617	DRI	0.000 ± 0.027	0.025 ± 0.049	-----
Ce	58	231-hr event	T06-11617	DRI	0.033 ± 0.025	0.001 ± 0.057	-----
Sm	62	231-hr event	T06-11617	DRI	0.049 ± 0.054	not reported	-----
Eu	63	231-hr event	T06-11617	DRI	0.094 ± 0.083	not reported	-----
Tb	65	231-hr event	T06-11617	DRI	0.097 ± 0.061	not reported	-----
Hf	72	231-hr event	T06-11617	DRI	0.160 ± 0.249	not reported	-----
Ta	73	231-hr event	T06-11617	DRI	0.000 ± 0.161	not reported	-----
W	74	231-hr event	T06-11617	DRI	0.332 ± 0.268	0.047 ± 0.038	-----
Ir	77	231-hr event	T06-11617	DRI	0.092 ± 0.074	not reported	-----
Au	79	231-hr event	T06-11617	DRI	0.000 ± 0.122	-0.018 ± 0.028	-----
Hg	80	231-hr event	T06-11617	DRI	0.126 ± 0.061	-0.061 ± 0.031	-----
Pb	82	231-hr event	T06-11617	DRI	0.253 ± 0.059	0.243 ± 0.037	0.212
Na	11	231-hr event	T06-11618	ODEQ	not reported	not reported	-----
Mg	12	231-hr event	T06-11618	ODEQ	not reported	not reported	-----
Al	13	231-hr event	T06-11618	ODEQ	0.787 ± 0.122	2.255 ± 1.000	-----
Si	14	231-hr event	T06-11618	ODEQ	7.817 ± 0.685	5.886 ± 0.485	6.865
P	15	231-hr event	T06-11618	ODEQ	-0.532 ± 0.193	0.376 ± 0.310	-----
S	16	231-hr event	T06-11618	ODEQ	76.043 ± 6.112	71.381 ± 1.537	74.689
Cl	17	231-hr event	T06-11618	ODEQ	-0.943 ± 0.561	0.075 ± 0.113	-----
K	19	231-hr event	T06-11618	ODEQ	4.235 ± 0.344	4.592 ± 0.165	4.241
Ca	20	231-hr event	T06-11618	ODEQ	2.584 ± 0.213	2.262 ± 0.088	2.399
Sc	21	231-hr event	T06-11618	ODEQ	-0.041 ± 0.031	-0.040 ± 0.041	-----
Ti	22	231-hr event	T06-11618	ODEQ	0.150 ± 0.050	0.197 ± 0.048	-----
V	23	231-hr event	T06-11618	ODEQ	0.028 ± 0.020	0.076 ± 0.021	-----
Cr	24	231-hr event	T06-11618	ODEQ	0.014 ± 0.010	-0.012 ± 0.013	-----
Mn	25	231-hr event	T06-11618	ODEQ	0.076 ± 0.015	0.127 ± 0.018	-----
Fe	26	231-hr event	T06-11618	ODEQ	2.773 ± 0.223	2.880 ± 0.103	2.882

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Co	27	231-hr event	T06-11618	ODEQ	-0.009 ± 0.016	0.035 ± 0.029	-----
Ni	28	231-hr event	T06-11618	ODEQ	0.016 ± 0.011	0.020 ± 0.019	-----
Cu	29	231-hr event	T06-11618	ODEQ	0.084 ± 0.014	0.151 ± 0.022	0.099
Zn	30	231-hr event	T06-11618	ODEQ	0.903 ± 0.073	0.958 ± 0.038	0.912
Ga	31	231-hr event	T06-11618	ODEQ	0.000 ± 0.050	0.006 ± 0.013	-----
As	33	231-hr event	T06-11618	ODEQ	0.055 ± 0.017	0.090 ± 0.022	0.080
Se	34	231-hr event	T06-11618	ODEQ	0.075 ± 0.011	0.091 ± 0.014	0.082
Br	35	231-hr event	T06-11618	ODEQ	0.270 ± 0.023	0.340 ± 0.019	0.310
Rb	37	231-hr event	T06-11618	ODEQ	0.001 ± 0.009	0.025 ± 0.013	-----
Sr	38	231-hr event	T06-11618	ODEQ	0.019 ± 0.010	0.051 ± 0.014	-----
Y	39	231-hr event	T06-11618	ODEQ	-0.001 ± 0.011	-0.063 ± 0.048	-----
Zr	40	231-hr event	T06-11618	ODEQ	-0.004 ± 0.013	0.039 ± 0.043	-----
Nb	41	231-hr event	T06-11618	ODEQ	0.019 ± 0.015	-0.044 ± 0.048	-----
Mo	42	231-hr event	T06-11618	ODEQ	0.024 ± 0.018	0.105 ± 0.054	-----
Ag	47	231-hr event	T06-11618	ODEQ	0.029 ± 0.049	-0.097 ± 0.043	-----
Cd	48	231-hr event	T06-11618	ODEQ	0.016 ± 0.044	-0.019 ± 0.052	-----
In	49	231-hr event	T06-11618	ODEQ	0.034 ± 0.044	0.080 ± 0.061	-----
Sn	50	231-hr event	T06-11618	ODEQ	0.017 ± 0.051	-0.013 ± 0.072	-----
Sb	51	231-hr event	T06-11618	ODEQ	0.027 ± 0.062	-0.012 ± 0.082	-----
Cs	55	231-hr event	T06-11618	ODEQ	-0.032 ± 0.092	0.260 ± 0.152	-----
Ba	56	231-hr event	T06-11618	ODEQ	0.091 ± 0.204	0.241 ± 0.170	-----
La	57	231-hr event	T06-11618	ODEQ	-0.082 ± 0.166	-0.069 ± 0.048	-----
Ce	58	231-hr event	T06-11618	ODEQ	0.018 ± 0.202	0.082 ± 0.056	-----
Sm	62	231-hr event	T06-11618	ODEQ	0.362 ± 0.751	not reported	-----
Eu	63	231-hr event	T06-11618	ODEQ	-0.641 ± 1.203	not reported	-----
Tb	65	231-hr event	T06-11618	ODEQ	3.866 ± 2.701	not reported	-----
Hf	72	231-hr event	T06-11618	ODEQ	0.319 ± 0.287	not reported	-----
Ta	73	231-hr event	T06-11618	ODEQ	-0.078 ± 0.263	not reported	-----
W	74	231-hr event	T06-11618	ODEQ	-0.001 ± 0.058	0.015 ± 0.038	-----
Ir	77	231-hr event	T06-11618	ODEQ	0.040 ± 0.031	not reported	-----
Au	79	231-hr event	T06-11618	ODEQ	0.013 ± 0.025	0.001 ± 0.028	-----
Hg	80	231-hr event	T06-11618	ODEQ	0.008 ± 0.020	0.026 ± 0.030	-----
Pb	82	231-hr event	T06-11618	ODEQ	0.172 ± 0.032	0.224 ± 0.036	0.212
Na	11	231-hr event	T06-11619	ODEQ	not reported	not reported	-----
Mg	12	231-hr event	T06-11619	ODEQ	not reported	not reported	-----
Al	13	231-hr event	T06-11619	ODEQ	0.799 ± 0.122	0.922 ± 0.990	-----
Si	14	231-hr event	T06-11619	ODEQ	8.134 ± 0.712	6.293 ± 0.488	6.865
P	15	231-hr event	T06-11619	ODEQ	-0.579 ± 0.195	0.101 ± 0.309	-----
S	16	231-hr event	T06-11619	ODEQ	76.540 ± 6.152	73.214 ± 1.573	74.689
Cl	17	231-hr event	T06-11619	ODEQ	-0.929 ± 0.564	0.063 ± 0.112	-----
K	19	231-hr event	T06-11619	ODEQ	4.272 ± 0.346	4.315 ± 0.162	4.241
Ca	20	231-hr event	T06-11619	ODEQ	2.766 ± 0.227	2.408 ± 0.091	2.399
Sc	21	231-hr event	T06-11619	ODEQ	-0.016 ± 0.032	0.033 ± 0.042	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Ti	22	231-hr event	T06-11619	ODEQ	0.227 ± 0.051	0.126 ± 0.047	-----
V	23	231-hr event	T06-11619	ODEQ	0.060 ± 0.020	0.046 ± 0.020	-----
Cr	24	231-hr event	T06-11619	ODEQ	0.012 ± 0.010	-0.012 ± 0.012	-----
Mn	25	231-hr event	T06-11619	ODEQ	0.102 ± 0.016	0.131 ± 0.018	-----
Fe	26	231-hr event	T06-11619	ODEQ	2.939 ± 0.237	3.302 ± 0.111	2.882
Co	27	231-hr event	T06-11619	ODEQ	-0.012 ± 0.017	-0.057 ± 0.026	-----
Ni	28	231-hr event	T06-11619	ODEQ	0.217 ± 0.021	0.196 ± 0.024	-----
Cu	29	231-hr event	T06-11619	ODEQ	0.072 ± 0.013	0.136 ± 0.022	0.099
Zn	30	231-hr event	T06-11619	ODEQ	0.906 ± 0.074	0.969 ± 0.038	0.912
Ga	31	231-hr event	T06-11619	ODEQ	0.009 ± 0.050	0.010 ± 0.013	-----
As	33	231-hr event	T06-11619	ODEQ	0.057 ± 0.016	0.095 ± 0.021	0.080
Se	34	231-hr event	T06-11619	ODEQ	0.069 ± 0.011	0.080 ± 0.014	0.082
Br	35	231-hr event	T06-11619	ODEQ	0.269 ± 0.023	0.333 ± 0.019	0.310
Rb	37	231-hr event	T06-11619	ODEQ	0.003 ± 0.009	0.000 ± 0.012	-----
Sr	38	231-hr event	T06-11619	ODEQ	0.035 ± 0.010	0.003 ± 0.013	-----
Y	39	231-hr event	T06-11619	ODEQ	-0.000 ± 0.011	0.073 ± 0.052	-----
Zr	40	231-hr event	T06-11619	ODEQ	0.000 ± 0.012	0.073 ± 0.043	-----
Nb	41	231-hr event	T06-11619	ODEQ	0.003 ± 0.014	0.004 ± 0.046	-----
Mo	42	231-hr event	T06-11619	ODEQ	0.007 ± 0.017	0.100 ± 0.053	-----
Ag	47	231-hr event	T06-11619	ODEQ	0.040 ± 0.048	-0.043 ± 0.043	-----
Cd	48	231-hr event	T06-11619	ODEQ	0.072 ± 0.045	0.002 ± 0.051	-----
In	49	231-hr event	T06-11619	ODEQ	0.029 ± 0.045	0.048 ± 0.059	-----
Sn	50	231-hr event	T06-11619	ODEQ	0.103 ± 0.052	0.223 ± 0.074	-----
Sb	51	231-hr event	T06-11619	ODEQ	0.053 ± 0.061	0.038 ± 0.080	-----
Cs	55	231-hr event	T06-11619	ODEQ	0.045 ± 0.091	0.518 ± 0.151	-----
Ba	56	231-hr event	T06-11619	ODEQ	-0.036 ± 0.202	0.437 ± 0.168	-----
La	57	231-hr event	T06-11619	ODEQ	-0.063 ± 0.163	0.005 ± 0.048	-----
Ce	58	231-hr event	T06-11619	ODEQ	0.141 ± 0.200	0.075 ± 0.055	-----
Sm	62	231-hr event	T06-11619	ODEQ	0.086 ± 0.741	not reported	-----
Eu	63	231-hr event	T06-11619	ODEQ	-0.032 ± 1.182	not reported	-----
Tb	65	231-hr event	T06-11619	ODEQ	-0.314 ± 2.636	not reported	-----
Hf	72	231-hr event	T06-11619	ODEQ	0.199 ± 0.286	not reported	-----
Ta	73	231-hr event	T06-11619	ODEQ	-0.130 ± 0.263	not reported	-----
W	74	231-hr event	T06-11619	ODEQ	0.073 ± 0.058	0.014 ± 0.037	-----
Ir	77	231-hr event	T06-11619	ODEQ	0.024 ± 0.031	not reported	-----
Au	79	231-hr event	T06-11619	ODEQ	0.038 ± 0.025	0.010 ± 0.027	-----
Hg	80	231-hr event	T06-11619	ODEQ	0.019 ± 0.020	-0.024 ± 0.029	-----
Pb	82	231-hr event	T06-11628	ODEQ	0.164 ± 0.031	0.196 ± 0.035	0.212
Na	11	231-hr event	T06-11620	RTI	3.435 ± 0.361	not reported	-----
Mg	12	231-hr event	T06-11620	RTI	0.676 ± 0.083	not reported	-----
Al	13	231-hr event	T06-11620	RTI	1.706 ± 0.223	1.483 ± 0.990	-----
Si	14	231-hr event	T06-11620	RTI	6.960 ± 0.471	5.380 ± 0.470	6.865
P	15	231-hr event	T06-11620	RTI	0.001 ± 0.100	0.222 ± 0.306	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
S	16	231-hr event	T06-11620	RTI	71.065 ± 3.559	67.996 ± 1.471	74.689
Cl	17	231-hr event	T06-11620	RTI	1.501 ± 0.079	0.098 ± 0.114	-----
K	19	231-hr event	T06-11620	RTI	4.185 ± 0.210	3.754 ± 0.153	4.241
Ca	20	231-hr event	T06-11620	RTI	2.204 ± 0.112	2.138 ± 0.086	2.399
Sc	21	231-hr event	T06-11620	RTI	0.000 ± 0.023	-0.022 ± 0.042	-----
Ti	22	231-hr event	T06-11620	RTI	0.097 ± 0.015	0.159 ± 0.048	-----
V	23	231-hr event	T06-11620	RTI	0.159 ± 0.013	0.045 ± 0.021	-----
Cr	24	231-hr event	T06-11620	RTI	0.021 ± 0.001	0.007 ± 0.013	-----
Mn	25	231-hr event	T06-11620	RTI	0.100 ± 0.008	0.087 ± 0.018	-----
Fe	26	231-hr event	T06-11620	RTI	2.663 ± 0.134	2.831 ± 0.101	2.882
Co	27	231-hr event	T06-11620	RTI	0.000 ± 0.006	0.014 ± 0.028	-----
Ni	28	231-hr event	T06-11620	RTI	0.010 ± 0.003	0.036 ± 0.019	-----
Cu	29	231-hr event	T06-11620	RTI	0.107 ± 0.007	0.106 ± 0.021	0.099
Zn	30	231-hr event	T06-11620	RTI	0.829 ± 0.042	0.901 ± 0.036	0.912
Ga	31	231-hr event	T06-11620	RTI	0.013 ± 0.008	-0.009 ± 0.012	-----
As	33	231-hr event	T06-11620	RTI	0.082 ± 0.010	0.044 ± 0.021	0.080
Se	34	231-hr event	T06-11620	RTI	0.085 ± 0.008	0.082 ± 0.015	0.082
Br	35	231-hr event	T06-11620	RTI	0.252 ± 0.016	0.302 ± 0.018	0.310
Rb	37	231-hr event	T06-11620	RTI	0.018 ± 0.007	0.023 ± 0.013	-----
Sr	38	231-hr event	T06-11620	RTI	0.018 ± 0.007	0.017 ± 0.014	-----
Y	39	231-hr event	T06-11620	RTI	0.001 ± 0.009	0.063 ± 0.052	-----
Zr	40	231-hr event	T06-11620	RTI	0.000 ± 0.011	0.118 ± 0.046	-----
Nb	41	231-hr event	T06-11620	RTI	0.000 ± 0.011	-0.067 ± 0.046	-----
Mo	42	231-hr event	T06-11620	RTI	0.000 ± 0.014	0.008 ± 0.052	-----
Ag	47	231-hr event	T06-11620	RTI	0.000 ± 0.038	-0.033 ± 0.044	-----
Cd	48	231-hr event	T06-11620	RTI	0.000 ± 0.041	-0.128 ± 0.051	-----
In	49	231-hr event	T06-11620	RTI	0.000 ± 0.059	0.009 ± 0.059	-----
Sn	50	231-hr event	T06-11620	RTI	0.000 ± 0.073	0.178 ± 0.075	-----
Sb	51	231-hr event	T06-11620	RTI	0.000 ± 0.098	0.041 ± 0.082	-----
Cs	55	231-hr event	T06-11620	RTI	0.000 ± 0.066	0.170 ± 0.152	-----
Ba	56	231-hr event	T06-11620	RTI	0.000 ± 0.024	0.335 ± 0.172	-----
La	57	231-hr event	T06-11620	RTI	0.000 ± 0.032	-0.033 ± 0.048	-----
Ce	58	231-hr event	T06-11620	RTI	0.000 ± 0.017	0.049 ± 0.056	-----
Sm	62	231-hr event	T06-11620	RTI	0.000 ± 0.016	not reported	-----
Eu	63	231-hr event	T06-11620	RTI	0.000 ± 0.020	not reported	-----
Tb	65	231-hr event	T06-11620	RTI	0.014 ± 0.044	not reported	-----
Hf	72	231-hr event	T06-11620	RTI	0.027 ± 0.015	not reported	-----
Ta	73	231-hr event	T06-11620	RTI	0.000 ± 0.039	not reported	-----
W	74	231-hr event	T06-11620	RTI	0.000 ± 0.028	-0.002 ± 0.036	-----
Ir	77	231-hr event	T06-11620	RTI	0.000 ± 0.021	not reported	-----
Au	79	231-hr event	T06-11620	RTI	0.000 ± 0.017	0.003 ± 0.027	-----
Hg	80	231-hr event	T06-11620	RTI	0.013 ± 0.028	-0.030 ± 0.029	-----
Pb	82	231-hr event	T06-11620	RTI	0.160 ± 0.023	0.237 ± 0.036	0.212

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Na	11	231-hr event	T06-11621	RTI	3.356 ± 0.356	not reported	-----
Mg	12	231-hr event	T06-11621	RTI	0.689 ± 0.084	not reported	-----
Al	13	231-hr event	T06-11621	RTI	1.796 ± 0.226	3.419 ± 1.011	-----
Si	14	231-hr event	T06-11621	RTI	6.825 ± 0.463	6.698 ± 0.497	6.865
P	15	231-hr event	T06-11621	RTI	0.000 ± 0.098	0.220 ± 0.311	-----
S	16	231-hr event	T06-11621	RTI	70.523 ± 3.532	78.721 ± 1.676	74.689
Cl	17	231-hr event	T06-11621	RTI	1.510 ± 0.079	0.351 ± 0.115	-----
K	19	231-hr event	T06-11621	RTI	4.199 ± 0.211	4.504 ± 0.167	4.241
Ca	20	231-hr event	T06-11621	RTI	2.123 ± 0.108	2.285 ± 0.089	2.399
Sc	21	231-hr event	T06-11621	RTI	0.000 ± 0.022	0.044 ± 0.043	-----
Ti	22	231-hr event	T06-11621	RTI	0.075 ± 0.015	0.181 ± 0.047	-----
V	23	231-hr event	T06-11621	RTI	0.162 ± 0.012	0.073 ± 0.021	-----
Cr	24	231-hr event	T06-11621	RTI	0.023 ± 0.007	0.012 ± 0.013	-----
Mn	25	231-hr event	T06-11621	RTI	0.096 ± 0.008	0.148 ± 0.018	-----
Fe	26	231-hr event	T06-11621	RTI	2.641 ± 0.133	2.967 ± 0.104	2.882
Co	27	231-hr event	T06-11621	RTI	0.000 ± 0.006	-0.010 ± 0.028	-----
Ni	28	231-hr event	T06-11621	RTI	0.014 ± 0.003	0.041 ± 0.020	-----
Cu	29	231-hr event	T06-11621	RTI	0.102 ± 0.007	0.092 ± 0.021	0.099
Zn	30	231-hr event	T06-11621	RTI	0.829 ± 0.042	1.047 ± 0.040	0.912
Ga	31	231-hr event	T06-11621	RTI	0.009 ± 0.008	-0.009 ± 0.013	-----
As	33	231-hr event	T06-11621	RTI	0.088 ± 0.011	0.087 ± 0.022	0.080
Se	34	231-hr event	T06-11621	RTI	0.093 ± 0.009	0.096 ± 0.015	0.082
Br	35	231-hr event	T06-11621	RTI	0.263 ± 0.016	0.346 ± 0.019	0.310
Rb	37	231-hr event	T06-11621	RTI	0.016 ± 0.007	0.015 ± 0.013	-----
Sr	38	231-hr event	T06-11621	RTI	0.031 ± 0.007	0.033 ± 0.014	-----
Y	39	231-hr event	T06-11621	RTI	0.000 ± 0.006	-0.033 ± 0.048	-----
Zr	40	231-hr event	T06-11621	RTI	0.000 ± 0.010	0.101 ± 0.045	-----
Nb	41	231-hr event	T06-11621	RTI	0.000 ± 0.011	0.012 ± 0.047	-----
Mo	42	231-hr event	T06-11621	RTI	0.000 ± 0.014	0.148 ± 0.055	-----
Ag	47	231-hr event	T06-11621	RTI	0.000 ± 0.038	-0.029 ± 0.044	-----
Cd	48	231-hr event	T06-11621	RTI	0.000 ± 0.041	-0.071 ± 0.050	-----
In	49	231-hr event	T06-11621	RTI	0.000 ± 0.043	0.104 ± 0.061	-----
Sn	50	231-hr event	T06-11621	RTI	0.000 ± 0.073	0.120 ± 0.073	-----
Sb	51	231-hr event	T06-11621	RTI	0.090 ± 0.124	0.202 ± 0.084	-----
Cs	55	231-hr event	T06-11621	RTI	0.000 ± 0.062	0.572 ± 0.153	-----
Ba	56	231-hr event	T06-11621	RTI	0.000 ± 0.024	0.510 ± 0.170	-----
La	57	231-hr event	T06-11621	RTI	0.000 ± 0.032	-0.080 ± 0.047	-----
Ce	58	231-hr event	T06-11621	RTI	0.000 ± 0.017	0.042 ± 0.055	-----
Sm	62	231-hr event	T06-11621	RTI	0.000 ± 0.016	not reported	-----
Eu	63	231-hr event	T06-11621	RTI	0.000 ± 0.020	not reported	-----
Tb	65	231-hr event	T06-11621	RTI	0.018 ± 0.042	not reported	-----
Hf	72	231-hr event	T06-11621	RTI	0.028 ± 0.014	not reported	-----
Ta	73	231-hr event	T06-11621	RTI	0.000 ± 0.028	not reported	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
W	74	231-hr event	T06-11621	RTI	0.000 ± 0.020	0.024 ± 0.039	-----
Ir	77	231-hr event	T06-11621	RTI	0.000 ± 0.021	not reported	-----
Au	79	231-hr event	T06-11621	RTI	0.000 ± 0.017	-0.037 ± 0.027	-----
Hg	80	231-hr event	T06-11621	RTI	0.007 ± 0.027	-0.034 ± 0.028	-----
Pb	82	231-hr event	T06-11621	RTI	0.163 ± 0.024	0.255 ± 0.037	0.212
Na	11	231-hr event	T06-11622	UCD	8.309 ± 1.764	not reported	-----
Mg	12	231-hr event	T06-11622	UCD	0.414 ± 0.134	not reported	-----
Al	13	231-hr event	T06-11622	UCD	0.511 ± 0.083	2.377 ± 1.012	-----
Si	14	231-hr event	T06-11622	UCD	7.506 ± 0.432	5.831 ± 0.482	6.865
P	15	231-hr event	T06-11622	UCD	0.000 ± 0.000	0.384 ± 0.310	-----
S	16	231-hr event	T06-11622	UCD	76.397 ± 3.846	70.986 ± 1.530	74.689
Cl	17	231-hr event	T06-11622	UCD	0.000 ± 0.000	0.035 ± 0.114	-----
K	19	231-hr event	T06-11622	UCD	4.062 ± 0.212	3.987 ± 0.158	4.241
Ca	20	231-hr event	T06-11622	UCD	2.227 ± 0.118	1.960 ± 0.084	2.399
Sc	21	231-hr event	T06-11622	UCD	not reported	-0.036 ± 0.040	-----
Ti	22	231-hr event	T06-11622	UCD	0.148 ± 0.011	0.216 ± 0.047	-----
V	23	231-hr event	T06-11622	UCD	0.050 ± 0.006	0.072 ± 0.020	-----
Cr	24	231-hr event	T06-11622	UCD	0.009 ± 0.002	-0.001 ± 0.013	-----
Mn	25	231-hr event	T06-11622	UCD	0.090 ± 0.007	0.106 ± 0.018	-----
Fe	26	231-hr event	T06-11622	UCD	2.445 ± 0.124	2.794 ± 0.100	2.882
Co	27	231-hr event	T06-11622	UCD	not reported	0.080 ± 0.029	-----
Ni	28	231-hr event	T06-11622	UCD	0.004 ± 0.000	0.011 ± 0.018	-----
Cu	29	231-hr event	T06-11622	UCD	0.087 ± 0.006	0.096 ± 0.020	0.099
Zn	30	231-hr event	T06-11622	UCD	0.803 ± 0.042	0.945 ± 0.037	0.912
Ga	31	231-hr event	T06-11622	UCD	0.000 ± 0.000	-0.000 ± 0.013	-----
As	33	231-hr event	T06-11622	UCD	0.033 ± 0.005	0.079 ± 0.021	0.080
Se	34	231-hr event	T06-11622	UCD	0.062 ± 0.004	0.092 ± 0.014	0.082
Br	35	231-hr event	T06-11622	UCD	0.240 ± 0.013	0.325 ± 0.019	0.310
Rb	37	231-hr event	T06-11622	UCD	0.005 ± 0.001	0.002 ± 0.012	-----
Sr	38	231-hr event	T06-11622	UCD	0.005 ± 0.001	0.016 ± 0.013	-----
Y	39	231-hr event	T06-11622	UCD	not reported	0.037 ± 0.049	-----
Zr	40	231-hr event	T06-11622	UCD	not reported	0.028 ± 0.041	-----
Nb	41	231-hr event	T06-11622	UCD	not reported	-0.022 ± 0.045	-----
Mo	42	231-hr event	T06-11622	UCD	not reported	0.050 ± 0.051	-----
Ag	47	231-hr event	T06-11622	UCD	not reported	0.013 ± 0.044	-----
Cd	48	231-hr event	T06-11622	UCD	not reported	0.032 ± 0.052	-----
In	49	231-hr event	T06-11622	UCD	not reported	0.017 ± 0.057	-----
Sn	50	231-hr event	T06-11622	UCD	not reported	0.266 ± 0.074	-----
Sb	51	231-hr event	T06-11622	UCD	not reported	0.026 ± 0.080	-----
Cs	55	231-hr event	T06-11622	UCD	not reported	0.239 ± 0.147	-----
Ba	56	231-hr event	T06-11622	UCD	not reported	0.621 ± 0.170	-----
La	57	231-hr event	T06-11622	UCD	not reported	-0.047 ± 0.047	-----
Ce	58	231-hr event	T06-11622	UCD	not reported	0.106 ± 0.056	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Sm	62	231-hr event	T06-11622	UCD	not reported	not reported	-----
Eu	63	231-hr event	T06-11622	UCD	not reported	not reported	-----
Tb	65	231-hr event	T06-11622	UCD	not reported	not reported	-----
Hf	72	231-hr event	T06-11622	UCD	not reported	not reported	-----
Ta	73	231-hr event	T06-11622	UCD	not reported	not reported	-----
W	74	231-hr event	T06-11622	UCD	not reported	0.019 ± 0.036	-----
Ir	77	231-hr event	T06-11622	UCD	not reported	not reported	-----
Au	79	231-hr event	T06-11622	UCD	not reported	-0.002 ± 0.027	-----
Hg	80	231-hr event	T06-11622	UCD	not reported	-0.012 ± 0.028	-----
Pb	82	231-hr event	T06-11622	UCD	0.184 ± 0.016	0.215 ± 0.035	0.212
Na	11	231-hr event	T06-11623	UCD	4.734 ± 1.108	not reported	-----
Mg	12	231-hr event	T06-11623	UCD	0.331 ± 0.128	not reported	-----
Al	13	231-hr event	T06-11623	UCD	1.529 ± 0.245	1.276 ± 0.974	-----
Si	14	231-hr event	T06-11623	UCD	7.643 ± 0.432	6.869 ± 0.498	6.865
P	15	231-hr event	T06-11623	UCD	0.000 ± 0.000	0.422 ± 0.311	-----
S	16	231-hr event	T06-11623	UCD	75.704 ± 3.812	74.793 ± 1.604	74.689
Cl	17	231-hr event	T06-11623	UCD	0.000 ± 0.000	0.055 ± 0.113	-----
K	19	231-hr event	T06-11623	UCD	4.025 ± 0.210	4.278 ± 0.161	4.241
Ca	20	231-hr event	T06-11623	UCD	2.198 ± 0.116	2.150 ± 0.087	2.399
Sc	21	231-hr event	T06-11623	UCD	not reported	0.009 ± 0.042	-----
Ti	22	231-hr event	T06-11623	UCD	0.149 ± 0.011	0.157 ± 0.046	-----
V	23	231-hr event	T06-11623	UCD	0.055 ± 0.008	0.072 ± 0.021	-----
Cr	24	231-hr event	T06-11623	UCD	0.013 ± 0.003	0.000 ± 0.012	-----
Mn	25	231-hr event	T06-11623	UCD	0.085 ± 0.006	0.125 ± 0.018	-----
Fe	26	231-hr event	T06-11623	UCD	2.401 ± 0.122	2.884 ± 0.102	2.882
Co	27	231-hr event	T06-11623	UCD	not reported	0.013 ± 0.027	-----
Ni	28	231-hr event	T06-11623	UCD	0.002 ± 0.000	0.030 ± 0.018	-----
Cu	29	231-hr event	T06-11623	UCD	0.087 ± 0.006	0.124 ± 0.021	0.099
Zn	30	231-hr event	T06-11623	UCD	0.788 ± 0.041	1.026 ± 0.039	0.912
Ga	31	231-hr event	T06-11623	UCD	0.000 ± 0.000	0.014 ± 0.013	-----
As	33	231-hr event	T06-11623	UCD	0.030 ± 0.005	0.076 ± 0.021	0.080
Se	34	231-hr event	T06-11623	UCD	0.062 ± 0.004	0.057 ± 0.014	0.082
Br	35	231-hr event	T06-11623	UCD	0.227 ± 0.012	0.316 ± 0.019	0.310
Rb	37	231-hr event	T06-11623	UCD	0.012 ± 0.003	0.008 ± 0.012	-----
Sr	38	231-hr event	T06-11623	UCD	0.006 ± 0.001	0.041 ± 0.014	-----
Y	39	231-hr event	T06-11623	UCD	not reported	-0.033 ± 0.049	-----
Zr	40	231-hr event	T06-11623	UCD	not reported	-0.006 ± 0.040	-----
Nb	41	231-hr event	T06-11623	UCD	not reported	-0.064 ± 0.044	-----
Mo	42	231-hr event	T06-11623	UCD	not reported	-0.009 ± 0.050	-----
Ag	47	231-hr event	T06-11623	UCD	not reported	0.039 ± 0.044	-----
Cd	48	231-hr event	T06-11623	UCD	not reported	0.051 ± 0.052	-----
In	49	231-hr event	T06-11623	UCD	not reported	0.138 ± 0.061	-----
Sn	50	231-hr event	T06-11623	UCD	not reported	0.337 ± 0.075	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Sb	51	231-hr event	T06-11623	UCD	not reported	0.027 ± 0.080	-----
Cs	55	231-hr event	T06-11623	UCD	not reported	0.159 ± 0.147	-----
Ba	56	231-hr event	T06-11623	UCD	not reported	0.459 ± 0.168	-----
La	57	231-hr event	T06-11623	UCD	not reported	-0.039 ± 0.048	-----
Ce	58	231-hr event	T06-11623	UCD	not reported	0.099 ± 0.055	-----
Sm	62	231-hr event	T06-11623	UCD	not reported	not reported	-----
Eu	63	231-hr event	T06-11623	UCD	not reported	not reported	-----
Tb	65	231-hr event	T06-11623	UCD	not reported	not reported	-----
Hf	72	231-hr event	T06-11623	UCD	not reported	not reported	-----
Ta	73	231-hr event	T06-11623	UCD	not reported	not reported	-----
W	74	231-hr event	T06-11623	UCD	not reported	0.089 ± 0.038	-----
Ir	77	231-hr event	T06-11623	UCD	not reported	not reported	-----
Au	79	231-hr event	T06-11623	UCD	not reported	0.022 ± 0.028	-----
Hg	80	231-hr event	T06-11623	UCD	not reported	-0.006 ± 0.029	-----
Pb	82	231-hr event	T06-11623	UCD	0.182 ± 0.017	0.201 ± 0.035	0.212
Na	11	filter blank	T06-11624	CARB	not reported	not reported	-----
Mg	12	filter blank	T06-11624	CARB	not reported	not reported	-----
Al	13	filter blank	T06-11624	CARB	0.002 ± 0.039	1.002 ± 0.757	-----
Si	14	filter blank	T06-11624	CARB	0.056 ± 0.019	-0.097 ± 0.272	-----
P	15	filter blank	T06-11624	CARB	0.000 ± 0.015	0.017 ± 0.180	-----
S	16	filter blank	T06-11624	CARB	0.000 ± 0.018	0.167 ± 0.125	-----
Cl	17	filter blank	T06-11624	CARB	0.032 ± 0.012	0.109 ± 0.081	-----
K	19	filter blank	T06-11624	CARB	0.059 ± 0.025	-0.021 ± 0.067	-----
Ca	20	filter blank	T06-11624	CARB	0.028 ± 0.022	-0.006 ± 0.040	-----
Sc	21	filter blank	T06-11624	CARB	not reported	-0.044 ± 0.028	-----
Ti	22	filter blank	T06-11624	CARB	0.011 ± 0.011	0.001 ± 0.039	-----
V	23	filter blank	T06-11624	CARB	0.000 ± 0.013	0.022 ± 0.018	-----
Cr	24	filter blank	T06-11624	CARB	0.002 ± 0.007	-0.009 ± 0.012	-----
Mn	25	filter blank	T06-11624	CARB	0.000 ± 0.007	-0.001 ± 0.016	-----
Fe	26	filter blank	T06-11624	CARB	0.019 ± 0.009	0.003 ± 0.036	-----
Co	27	filter blank	T06-11624	CARB	0.003 ± 0.009	-0.009 ± 0.022	-----
Ni	28	filter blank	T06-11624	CARB	0.000 ± 0.012	-0.015 ± 0.017	-----
Cu	29	filter blank	T06-11624	CARB	0.023 ± 0.005	-0.016 ± 0.017	-----
Zn	30	filter blank	T06-11624	CARB	0.000 ± 0.006	0.019 ± 0.014	-----
Ga	31	filter blank	T06-11624	CARB	not reported	-0.018 ± 0.011	-----
As	33	filter blank	T06-11624	CARB	0.000 ± 0.006	-0.018 ± 0.016	-----
Se	34	filter blank	T06-11624	CARB	0.000 ± 0.005	0.000 ± 0.011	-----
Br	35	filter blank	T06-11624	CARB	0.000 ± 0.003	-0.024 ± 0.012	-----
Rb	37	filter blank	T06-11624	CARB	0.000 ± 0.004	0.011 ± 0.011	-----
Sr	38	filter blank	T06-11624	CARB	0.003 ± 0.006	0.005 ± 0.013	-----
Y	39	filter blank	T06-11624	CARB	0.000 ± 0.009	-0.025 ± 0.047	-----
Zr	40	filter blank	T06-11624	CARB	not reported	0.090 ± 0.044	-----
Nb	41	filter blank	T06-11624	CARB	not reported	0.061 ± 0.048	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Mo	42	filter blank	T06-11624	CARB	0.000 ± 0.022	0.024 ± 0.051	-----
Ag	47	filter blank	T06-11624	CARB	not reported	-0.039 ± 0.043	-----
Cd	48	filter blank	T06-11624	CARB	not reported	-0.009 ± 0.051	-----
In	49	filter blank	T06-11624	CARB	not reported	0.088 ± 0.060	-----
Sn	50	filter blank	T06-11624	CARB	0.000 ± 0.057	0.107 ± 0.072	-----
Sb	51	filter blank	T06-11624	CARB	0.000 ± 0.074	0.110 ± 0.081	-----
Cs	55	filter blank	T06-11624	CARB	not reported	0.375 ± 0.149	-----
Ba	56	filter blank	T06-11624	CARB	0.071 ± 0.024	0.329 ± 0.165	-----
La	57	filter blank	T06-11624	CARB	not reported	-0.027 ± 0.042	-----
Ce	58	filter blank	T06-11624	CARB	not reported	-0.024 ± 0.047	-----
Sm	62	filter blank	T06-11624	CARB	not reported	not reported	-----
Eu	63	filter blank	T06-11624	CARB	not reported	not reported	-----
Tb	65	filter blank	T06-11624	CARB	not reported	not reported	-----
Hf	72	filter blank	T06-11624	CARB	not reported	not reported	-----
Ta	73	filter blank	T06-11624	CARB	not reported	not reported	-----
W	74	filter blank	T06-11624	CARB	not reported	-0.006 ± 0.031	-----
Ir	77	filter blank	T06-11624	CARB	not reported	not reported	-----
Au	79	filter blank	T06-11624	CARB	not reported	-0.000 ± 0.025	-----
Hg	80	filter blank	T06-11624	CARB	0.000 ± 0.011	0.031 ± 0.028	-----
Pb	82	filter blank	T06-11624	CARB	0.000 ± 0.009	0.027 ± 0.030	-----
Na	11	filter blank	T06-11625	CARB	not reported	not reported	-----
Mg	12	filter blank	T06-11625	CARB	not reported	not reported	-----
Al	13	filter blank	T06-11625	CARB	0.011 ± 0.039	0.286 ± 0.768	-----
Si	14	filter blank	T06-11625	CARB	0.041 ± 0.020	-0.242 ± 0.277	-----
P	15	filter blank	T06-11625	CARB	0.000 ± 0.015	-0.009 ± 0.184	-----
S	16	filter blank	T06-11625	CARB	0.000 ± 0.019	0.092 ± 0.126	-----
Cl	17	filter blank	T06-11625	CARB	0.020 ± 0.012	-0.056 ± 0.080	-----
K	19	filter blank	T06-11625	CARB	0.048 ± 0.025	-0.002 ± 0.067	-----
Ca	20	filter blank	T06-11625	CARB	0.037 ± 0.022	-0.020 ± 0.040	-----
Sc	21	filter blank	T06-11625	CARB	not reported	-0.028 ± 0.029	-----
Ti	22	filter blank	T06-11625	CARB	0.000 ± 0.013	0.017 ± 0.039	-----
V	23	filter blank	T06-11625	CARB	0.000 ± 0.013	-0.007 ± 0.018	-----
Cr	24	filter blank	T06-11625	CARB	0.006 ± 0.007	-0.002 ± 0.012	-----
Mn	25	filter blank	T06-11625	CARB	0.000 ± 0.011	-0.002 ± 0.016	-----
Fe	26	filter blank	T06-11625	CARB	0.011 ± 0.009	-0.020 ± 0.036	-----
Co	27	filter blank	T06-11625	CARB	0.000 ± 0.012	0.001 ± 0.023	-----
Ni	28	filter blank	T06-11625	CARB	0.005 ± 0.010	0.034 ± 0.018	-----
Cu	29	filter blank	T06-11625	CARB	0.027 ± 0.005	0.013 ± 0.017	-----
Zn	30	filter blank	T06-11625	CARB	0.010 ± 0.004	0.000 ± 0.013	-----
Ga	31	filter blank	T06-11625	CARB	not reported	-0.001 ± 0.011	-----
As	33	filter blank	T06-11625	CARB	0.000 ± 0.006	-0.007 ± 0.016	-----
Se	34	filter blank	T06-11625	CARB	0.000 ± 0.006	0.005 ± 0.011	-----
Br	35	filter blank	T06-11625	CARB	0.003 ± 0.002	0.000 ± 0.011	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Rb	37	filter blank	T06-11625	CARB	0.000 ± 0.004	-0.001 ± 0.011	-----
Sr	38	filter blank	T06-11625	CARB	0.019 ± 0.005	0.021 ± 0.013	-----
Y	39	filter blank	T06-11625	CARB	0.000 ± 0.009	0.000 ± 0.051	-----
Zr	40	filter blank	T06-11625	CARB	not reported	0.032 ± 0.042	-----
Nb	41	filter blank	T06-11625	CARB	not reported	-0.072 ± 0.044	-----
Mo	42	filter blank	T06-11625	CARB	0.000 ± 0.022	0.038 ± 0.051	-----
Ag	47	filter blank	T06-11625	CARB	not reported	0.061 ± 0.045	-----
Cd	48	filter blank	T06-11625	CARB	not reported	0.053 ± 0.052	-----
In	49	filter blank	T06-11625	CARB	not reported	0.107 ± 0.060	-----
Sn	50	filter blank	T06-11625	CARB	0.065 ± 0.044	0.047 ± 0.070	-----
Sb	51	filter blank	T06-11625	CARB	0.000 ± 0.076	0.030 ± 0.080	-----
Cs	55	filter blank	T06-11625	CARB	not reported	0.257 ± 0.147	-----
Ba	56	filter blank	T06-11625	CARB	0.098 ± 0.023	-0.053 ± 0.162	-----
La	57	filter blank	T06-11625	CARB	not reported	-0.052 ± 0.043	-----
Ce	58	filter blank	T06-11625	CARB	not reported	0.036 ± 0.049	-----
Sm	62	filter blank	T06-11625	CARB	not reported	not reported	-----
Eu	63	filter blank	T06-11625	CARB	not reported	not reported	-----
Tb	65	filter blank	T06-11625	CARB	not reported	not reported	-----
Hf	72	filter blank	T06-11625	CARB	not reported	not reported	-----
Ta	73	filter blank	T06-11625	CARB	not reported	not reported	-----
W	74	filter blank	T06-11625	CARB	not reported	0.063 ± 0.033	-----
Ir	77	filter blank	T06-11625	CARB	not reported	not reported	-----
Au	79	filter blank	T06-11625	CARB	not reported	-0.001 ± 0.025	-----
Hg	80	filter blank	T06-11625	CARB	0.000 ± 0.011	-0.026 ± 0.026	-----
Pb	82	filter blank	T06-11625	CARB	0.003 ± 0.009	0.010 ± 0.030	-----
Na	11	filter blank	T06-11626	DRI	1.572 ± 2.504	not reported	-----
Mg	12	filter blank	T06-11626	DRI	0.433 ± 0.741	not reported	-----
Al	13	filter blank	T06-11626	DRI	0.058 ± 0.289	1.667 ± 0.775	-----
Si	14	filter blank	T06-11626	DRI	0.040 ± 0.231	0.446 ± 0.279	-----
P	15	filter blank	T06-11626	DRI	0.040 ± 0.074	0.042 ± 0.182	-----
S	16	filter blank	T06-11626	DRI	0.000 ± 0.031	0.046 ± 0.127	-----
Cl	17	filter blank	T06-11626	DRI	0.000 ± 0.030	-0.101 ± 0.080	-----
K	19	filter blank	T06-11626	DRI	0.024 ± 0.028	-0.058 ± 0.066	-----
Ca	20	filter blank	T06-11626	DRI	0.038 ± 0.045	-0.020 ± 0.040	-----
Sc	21	filter blank	T06-11626	DRI	0.038 ± 0.120	-0.040 ± 0.029	-----
Ti	22	filter blank	T06-11626	DRI	0.000 ± 0.020	0.066 ± 0.040	-----
V	23	filter blank	T06-11626	DRI	0.000 ± 0.004	0.000 ± 0.018	-----
Cr	24	filter blank	T06-11626	DRI	0.004 ± 0.023	-0.006 ± 0.012	-----
Mn	25	filter blank	T06-11626	DRI	0.024 ± 0.053	-0.017 ± 0.016	-----
Fe	26	filter blank	T06-11626	DRI	0.022 ± 0.047	0.015 ± 0.036	-----
Co	27	filter blank	T06-11626	DRI	0.015 ± 0.003	0.015 ± 0.024	-----
Ni	28	filter blank	T06-11626	DRI	0.000 ± 0.007	-0.000 ± 0.017	-----
Cu	29	filter blank	T06-11626	DRI	0.018 ± 0.027	0.014 ± 0.017	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Zn	30	filter blank	T06-11626	DRI	0.020 ± 0.023	0.013 ± 0.014	-----
Ga	31	filter blank	T06-11626	DRI	0.040 ± 0.080	-0.016 ± 0.011	-----
As	33	filter blank	T06-11626	DRI	0.000 ± 0.009	-0.000 ± 0.016	-----
Se	34	filter blank	T06-11626	DRI	0.000 ± 0.018	-0.006 ± 0.011	-----
Br	35	filter blank	T06-11626	DRI	0.013 ± 0.025	-0.022 ± 0.011	-----
Rb	37	filter blank	T06-11626	DRI	0.000 ± 0.016	0.017 ± 0.012	-----
Sr	38	filter blank	T06-11626	DRI	0.000 ± 0.039	-0.016 ± 0.013	-----
Y	39	filter blank	T06-11626	DRI	0.000 ± 0.023	0.082 ± 0.051	-----
Zr	40	filter blank	T06-11626	DRI	0.000 ± 0.063	0.032 ± 0.043	-----
Nb	41	filter blank	T06-11626	DRI	0.000 ± 0.041	-0.010 ± 0.047	-----
Mo	42	filter blank	T06-11626	DRI	0.000 ± 0.039	0.066 ± 0.052	-----
Ag	47	filter blank	T06-11626	DRI	0.000 ± 0.091	-0.045 ± 0.043	-----
Cd	48	filter blank	T06-11626	DRI	0.000 ± 0.072	0.055 ± 0.052	-----
In	49	filter blank	T06-11626	DRI	0.000 ± 0.079	0.034 ± 0.059	-----
Sn	50	filter blank	T06-11626	DRI	0.000 ± 0.085	-0.009 ± 0.070	-----
Sb	51	filter blank	T06-11626	DRI	0.000 ± 0.131	0.068 ± 0.081	-----
Cs	55	filter blank	T06-11626	DRI	0.000 ± 0.037	0.046 ± 0.146	-----
Ba	56	filter blank	T06-11626	DRI	0.000 ± 0.039	0.028 ± 0.164	-----
La	57	filter blank	T06-11626	DRI	0.049 ± 0.027	-0.011 ± 0.043	-----
Ce	58	filter blank	T06-11626	DRI	0.056 ± 0.025	0.029 ± 0.048	-----
Sm	62	filter blank	T06-11626	DRI	0.004 ± 0.054	not reported	-----
Eu	63	filter blank	T06-11626	DRI	0.000 ± 0.083	not reported	-----
Tb	65	filter blank	T06-11626	DRI	0.000 ± 0.061	not reported	-----
Hf	72	filter blank	T06-11626	DRI	0.000 ± 0.249	not reported	-----
Ta	73	filter blank	T06-11626	DRI	0.000 ± 0.161	not reported	-----
W	74	filter blank	T06-11626	DRI	0.083 ± 0.267	-0.000 ± 0.032	-----
Ir	77	filter blank	T06-11626	DRI	0.081 ± 0.074	not reported	-----
Au	79	filter blank	T06-11626	DRI	0.036 ± 0.123	0.000 ± 0.025	-----
Hg	80	filter blank	T06-11626	DRI	0.070 ± 0.061	-0.000 ± 0.027	-----
Pb	82	filter blank	T06-11626	DRI	0.000 ± 0.058	-0.002 ± 0.030	-----
Na	11	filter blank	T06-11627	DRI	0.000 ± 2.469	not reported	-----
Mg	12	filter blank	T06-11627	DRI	0.106 ± 0.739	not reported	-----
Al	13	filter blank	T06-11627	DRI	0.000 ± 0.288	1.583 ± 0.780	-----
Si	14	filter blank	T06-11627	DRI	0.266 ± 0.231	0.449 ± 0.282	-----
P	15	filter blank	T06-11627	DRI	0.000 ± 0.073	0.337 ± 0.187	-----
S	16	filter blank	T06-11627	DRI	0.000 ± 0.031	0.227 ± 0.129	-----
Cl	17	filter blank	T06-11627	DRI	0.000 ± 0.030	0.063 ± 0.082	-----
K	19	filter blank	T06-11627	DRI	0.000 ± 0.028	-0.053 ± 0.068	-----
Ca	20	filter blank	T06-11627	DRI	0.015 ± 0.045	-0.033 ± 0.040	-----
Sc	21	filter blank	T06-11627	DRI	0.061 ± 0.120	-0.010 ± 0.029	-----
Ti	22	filter blank	T06-11627	DRI	0.000 ± 0.020	-0.013 ± 0.040	-----
V	23	filter blank	T06-11627	DRI	0.000 ± 0.004	-0.029 ± 0.018	-----
Cr	24	filter blank	T06-11627	DRI	0.027 ± 0.023	-0.026 ± 0.012	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Mn	25	filter blank	T06-11627	DRI	0.036 ± 0.053	-0.018 ± 0.016	-----
Fe	26	filter blank	T06-11627	DRI	0.022 ± 0.047	-0.016 ± 0.035	-----
Co	27	filter blank	T06-11627	DRI	0.000 ± 0.003	0.054 ± 0.025	-----
Ni	28	filter blank	T06-11627	DRI	0.000 ± 0.007	-0.027 ± 0.017	-----
Cu	29	filter blank	T06-11627	DRI	0.006 ± 0.027	0.010 ± 0.018	-----
Zn	30	filter blank	T06-11627	DRI	0.031 ± 0.023	-0.004 ± 0.013	-----
Ga	31	filter blank	T06-11627	DRI	0.000 ± 0.080	-0.006 ± 0.012	-----
As	33	filter blank	T06-11627	DRI	0.000 ± 0.009	0.003 ± 0.016	-----
Se	34	filter blank	T06-11627	DRI	0.038 ± 0.018	-0.010 ± 0.011	-----
Br	35	filter blank	T06-11627	DRI	0.000 ± 0.025	-0.012 ± 0.012	-----
Rb	37	filter blank	T06-11627	DRI	0.000 ± 0.016	0.004 ± 0.011	-----
Sr	38	filter blank	T06-11627	DRI	0.000 ± 0.039	0.002 ± 0.013	-----
Y	39	filter blank	T06-11627	DRI	0.000 ± 0.023	0.056 ± 0.050	-----
Zr	40	filter blank	T06-11627	DRI	0.000 ± 0.064	-0.010 ± 0.040	-----
Nb	41	filter blank	T06-11627	DRI	0.033 ± 0.041	-0.027 ± 0.047	-----
Mo	42	filter blank	T06-11627	DRI	0.000 ± 0.039	0.049 ± 0.052	-----
Ag	47	filter blank	T06-11627	DRI	0.000 ± 0.091	-0.060 ± 0.043	-----
Cd	48	filter blank	T06-11627	DRI	0.000 ± 0.072	0.001 ± 0.051	-----
In	49	filter blank	T06-11627	DRI	0.000 ± 0.079	-0.002 ± 0.058	-----
Sn	50	filter blank	T06-11627	DRI	0.000 ± 0.085	0.073 ± 0.072	-----
Sb	51	filter blank	T06-11627	DRI	0.085 ± 0.131	0.188 ± 0.083	-----
Cs	55	filter blank	T06-11627	DRI	0.000 ± 0.037	0.166 ± 0.148	-----
Ba	56	filter blank	T06-11627	DRI	0.024 ± 0.039	0.108 ± 0.165	-----
La	57	filter blank	T06-11627	DRI	0.049 ± 0.027	-0.057 ± 0.043	-----
Ce	58	filter blank	T06-11627	DRI	0.000 ± 0.025	0.053 ± 0.050	-----
Sm	62	filter blank	T06-11627	DRI	0.000 ± 0.054	not reported	-----
Eu	63	filter blank	T06-11627	DRI	0.072 ± 0.083	not reported	-----
Tb	65	filter blank	T06-11627	DRI	0.006 ± 0.061	not reported	-----
Hf	72	filter blank	T06-11627	DRI	0.000 ± 0.249	not reported	-----
Ta	73	filter blank	T06-11627	DRI	0.054 ± 0.162	not reported	-----
W	74	filter blank	T06-11627	DRI	0.072 ± 0.267	0.010 ± 0.031	-----
Ir	77	filter blank	T06-11627	DRI	0.000 ± 0.074	not reported	-----
Au	79	filter blank	T06-11627	DRI	0.000 ± 0.122	-0.015 ± 0.025	-----
Hg	80	filter blank	T06-11627	DRI	0.000 ± 0.061	-0.016 ± 0.028	-----
Pb	82	filter blank	T06-11627	DRI	0.000 ± 0.058	-0.011 ± 0.029	-----
Na	11	filter blank	T06-11628	ODEQ	not reported	not reported	-----
Mg	12	filter blank	T06-11628	ODEQ	not reported	not reported	-----
Al	13	filter blank	T06-11628	ODEQ	-0.008 ± 0.086	2.344 ± 0.772	-----
Si	14	filter blank	T06-11628	ODEQ	-0.013 ± 0.051	0.214 ± 0.274	-----
P	15	filter blank	T06-11628	ODEQ	0.023 ± 0.050	0.335 ± 0.183	-----
S	16	filter blank	T06-11628	ODEQ	-0.011 ± 0.058	0.265 ± 0.128	-----
Cl	17	filter blank	T06-11628	ODEQ	-0.036 ± 0.043	0.092 ± 0.082	-----
K	19	filter blank	T06-11628	ODEQ	-0.024 ± 0.023	-0.126 ± 0.067	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Ca	20	filter blank	T06-11628	ODEQ	-0.016 ± 0.018	-0.040 ± 0.039	-----
Sc	21	filter blank	T06-11628	ODEQ	0.023 ± 0.019	0.030 ± 0.030	-----
Ti	22	filter blank	T06-11628	ODEQ	0.019 ± 0.046	-0.002 ± 0.038	-----
V	23	filter blank	T06-11628	ODEQ	0.000 ± 0.018	0.013 ± 0.018	-----
Cr	24	filter blank	T06-11628	ODEQ	-0.005 ± 0.010	-0.003 ± 0.012	-----
Mn	25	filter blank	T06-11628	ODEQ	-0.000 ± 0.013	-0.003 ± 0.016	-----
Fe	26	filter blank	T06-11628	ODEQ	-0.013 ± 0.013	0.039 ± 0.036	-----
Co	27	filter blank	T06-11628	ODEQ	-0.003 ± 0.009	0.028 ± 0.024	-----
Ni	28	filter blank	T06-11628	ODEQ	-0.003 ± 0.010	0.004 ± 0.017	-----
Cu	29	filter blank	T06-11628	ODEQ	-0.008 ± 0.011	-0.007 ± 0.017	-----
Zn	30	filter blank	T06-11628	ODEQ	-0.001 ± 0.008	0.017 ± 0.013	-----
Ga	31	filter blank	T06-11628	ODEQ	0.001 ± 0.050	0.013 ± 0.012	-----
As	33	filter blank	T06-11628	ODEQ	-0.000 ± 0.011	-0.010 ± 0.016	-----
Se	34	filter blank	T06-11628	ODEQ	0.002 ± 0.009	-0.010 ± 0.011	-----
Br	35	filter blank	T06-11628	ODEQ	-0.001 ± 0.008	0.001 ± 0.011	-----
Rb	37	filter blank	T06-11628	ODEQ	0.000 ± 0.008	-0.002 ± 0.011	-----
Sr	38	filter blank	T06-11628	ODEQ	0.002 ± 0.009	-0.005 ± 0.013	-----
Y	39	filter blank	T06-11628	ODEQ	0.000 ± 0.010	-0.082 ± 0.044	-----
Zr	40	filter blank	T06-11628	ODEQ	0.001 ± 0.012	-0.033 ± 0.038	-----
Nb	41	filter blank	T06-11628	ODEQ	-0.011 ± 0.014	0.034 ± 0.047	-----
Mo	42	filter blank	T06-11628	ODEQ	-0.007 ± 0.017	0.026 ± 0.050	-----
Ag	47	filter blank	T06-11628	ODEQ	0.026 ± 0.048	0.068 ± 0.045	-----
Cd	48	filter blank	T06-11628	ODEQ	0.004 ± 0.044	-0.001 ± 0.051	-----
In	49	filter blank	T06-11628	ODEQ	0.068 ± 0.044	-0.001 ± 0.057	-----
Sn	50	filter blank	T06-11628	ODEQ	0.025 ± 0.050	-0.068 ± 0.068	-----
Sb	51	filter blank	T06-11628	ODEQ	0.010 ± 0.060	0.143 ± 0.081	-----
Cs	55	filter blank	T06-11628	ODEQ	-0.092 ± 0.089	0.378 ± 0.148	-----
Ba	56	filter blank	T06-11628	ODEQ	-0.049 ± 0.201	0.353 ± 0.165	-----
La	57	filter blank	T06-11628	ODEQ	-0.136 ± 0.162	0.006 ± 0.042	-----
Ce	58	filter blank	T06-11628	ODEQ	-0.074 ± 0.197	0.019 ± 0.049	-----
Sm	62	filter blank	T06-11628	ODEQ	0.142 ± 0.734	not reported	-----
Eu	63	filter blank	T06-11628	ODEQ	0.120 ± 1.181	not reported	-----
Tb	65	filter blank	T06-11628	ODEQ	1.873 ± 2.637	not reported	-----
Hf	72	filter blank	T06-11628	ODEQ	0.093 ± 0.286	not reported	-----
Ta	73	filter blank	T06-11628	ODEQ	-0.054 ± 0.263	not reported	-----
W	74	filter blank	T06-11628	ODEQ	0.052 ± 0.048	0.085 ± 0.034	-----
Ir	77	filter blank	T06-11628	ODEQ	0.016 ± 0.031	not reported	-----
Au	79	filter blank	T06-11628	ODEQ	0.030 ± 0.023	-0.002 ± 0.026	-----
Hg	80	filter blank	T06-11628	ODEQ	0.006 ± 0.020	-0.026 ± 0.027	-----
Pb	82	filter blank	T06-11628	ODEQ	-0.014 ± 0.027	-0.004 ± 0.030	-----
Na	11	filter blank	T06-11629	ODEQ	not reported	not reported	-----
Mg	12	filter blank	T06-11629	ODEQ	not reported	not reported	-----
Al	13	filter blank	T06-11629	ODEQ	0.005 ± 0.086	2.418 ± 0.781	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Si	14	filter blank	T06-11629	ODEQ	-0.005 ± 0.051	0.065 ± 0.276	-----
P	15	filter blank	T06-11629	ODEQ	0.010 ± 0.050	0.259 ± 0.183	-----
S	16	filter blank	T06-11629	ODEQ	-0.038 ± 0.057	0.144 ± 0.129	-----
Cl	17	filter blank	T06-11629	ODEQ	-0.005 ± 0.042	-0.006 ± 0.081	-----
K	19	filter blank	T06-11629	ODEQ	-0.032 ± 0.023	0.041 ± 0.068	-----
Ca	20	filter blank	T06-11629	ODEQ	-0.006 ± 0.017	-0.106 ± 0.040	-----
Sc	21	filter blank	T06-11629	ODEQ	0.016 ± 0.019	-0.007 ± 0.029	-----
Ti	22	filter blank	T06-11629	ODEQ	0.021 ± 0.046	0.011 ± 0.039	-----
V	23	filter blank	T06-11629	ODEQ	0.007 ± 0.018	0.002 ± 0.018	-----
Cr	24	filter blank	T06-11629	ODEQ	0.003 ± 0.009	-0.004 ± 0.012	-----
Mn	25	filter blank	T06-11629	ODEQ	0.012 ± 0.013	-0.014 ± 0.016	-----
Fe	26	filter blank	T06-11629	ODEQ	0.009 ± 0.013	0.019 ± 0.036	-----
Co	27	filter blank	T06-11629	ODEQ	0.008 ± 0.009	0.026 ± 0.024	-----
Ni	28	filter blank	T06-11629	ODEQ	-0.005 ± 0.010	-0.009 ± 0.017	-----
Cu	29	filter blank	T06-11629	ODEQ	0.003 ± 0.011	0.034 ± 0.018	-----
Zn	30	filter blank	T06-11629	ODEQ	0.001 ± 0.008	0.007 ± 0.013	-----
Ga	31	filter blank	T06-11629	ODEQ	-0.016 ± 0.050	-0.000 ± 0.012	-----
As	33	filter blank	T06-11629	ODEQ	-0.008 ± 0.012	-0.004 ± 0.016	-----
Se	34	filter blank	T06-11629	ODEQ	-0.001 ± 0.009	-0.029 ± 0.011	-----
Br	35	filter blank	T06-11629	ODEQ	0.003 ± 0.008	-0.001 ± 0.012	-----
Rb	37	filter blank	T06-11629	ODEQ	0.011 ± 0.008	0.008 ± 0.011	-----
Sr	38	filter blank	T06-11629	ODEQ	0.004 ± 0.009	0.004 ± 0.013	-----
Y	39	filter blank	T06-11629	ODEQ	0.002 ± 0.010	0.057 ± 0.050	-----
Zr	40	filter blank	T06-11629	ODEQ	0.005 ± 0.012	0.011 ± 0.041	-----
Nb	41	filter blank	T06-11629	ODEQ	0.003 ± 0.014	-0.051 ± 0.045	-----
Mo	42	filter blank	T06-11629	ODEQ	0.023 ± 0.017	0.006 ± 0.050	-----
Ag	47	filter blank	T06-11629	ODEQ	-0.005 ± 0.048	0.093 ± 0.047	-----
Cd	48	filter blank	T06-11629	ODEQ	0.037 ± 0.043	0.081 ± 0.053	-----
In	49	filter blank	T06-11629	ODEQ	0.014 ± 0.044	0.147 ± 0.061	-----
Sn	50	filter blank	T06-11629	ODEQ	-0.022 ± 0.049	0.040 ± 0.071	-----
Sb	51	filter blank	T06-11629	ODEQ	0.001 ± 0.060	-0.089 ± 0.079	-----
Cs	55	filter blank	T06-11629	ODEQ	0.023 ± 0.089	0.140 ± 0.147	-----
Ba	56	filter blank	T06-11629	ODEQ	-0.049 ± 0.199	0.125 ± 0.164	-----
La	57	filter blank	T06-11629	ODEQ	0.018 ± 0.160	0.008 ± 0.043	-----
Ce	58	filter blank	T06-11629	ODEQ	0.036 ± 0.196	0.029 ± 0.049	-----
Sm	62	filter blank	T06-11629	ODEQ	0.228 ± 0.730	not reported	-----
Eu	63	filter blank	T06-11629	ODEQ	-1.684 ± 1.169	not reported	-----
Tb	65	filter blank	T06-11629	ODEQ	-1.159 ± 2.600	not reported	-----
Hf	72	filter blank	T06-11629	ODEQ	0.022 ± 0.284	not reported	-----
Ta	73	filter blank	T06-11629	ODEQ	-0.116 ± 0.261	not reported	-----
W	74	filter blank	T06-11629	ODEQ	-0.016 ± 0.048	-0.028 ± 0.030	-----
Ir	77	filter blank	T06-11629	ODEQ	-0.015 ± 0.031	not reported	-----
Au	79	filter blank	T06-11629	ODEQ	0.004 ± 0.023	-0.003 ± 0.025	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Hg	80	filter blank	T06-11629	ODEQ	0.000 ± 0.020	-0.026 ± 0.027	-----
Pb	82	filter blank	T06-11629	ODEQ	0.013 ± 0.027	-0.034 ± 0.030	-----
Na	11	filter blank	T06-11630	RTI	0.000 ± 0.134	not reported	-----
Mg	12	filter blank	T06-11630	RTI	0.000 ± 0.038	not reported	-----
Al	13	filter blank	T06-11630	RTI	0.000 ± 0.087	1.242 ± 0.755	-----
Si	14	filter blank	T06-11630	RTI	0.013 ± 0.044	0.361 ± 0.275	-----
P	15	filter blank	T06-11630	RTI	0.000 ± 0.040	0.150 ± 0.183	-----
S	16	filter blank	T06-11630	RTI	0.000 ± 0.024	-0.060 ± 0.126	-----
Cl	17	filter blank	T06-11630	RTI	0.000 ± 0.018	0.144 ± 0.082	-----
K	19	filter blank	T06-11630	RTI	0.011 ± 0.012	-0.063 ± 0.067	-----
Ca	20	filter blank	T06-11630	RTI	0.009 ± 0.015	0.024 ± 0.041	-----
Sc	21	filter blank	T06-11630	RTI	0.000 ± 0.022	0.026 ± 0.030	-----
Ti	22	filter blank	T06-11630	RTI	0.000 ± 0.014	-0.030 ± 0.039	-----
V	23	filter blank	T06-11630	RTI	0.003 ± 0.009	0.012 ± 0.018	-----
Cr	24	filter blank	T06-11630	RTI	0.000 ± 0.007	0.007 ± 0.012	-----
Mn	25	filter blank	T06-11630	RTI	0.012 ± 0.005	0.010 ± 0.016	-----
Fe	26	filter blank	T06-11630	RTI	0.008 ± 0.004	0.098 ± 0.038	-----
Co	27	filter blank	T06-11630	RTI	0.004 ± 0.003	0.022 ± 0.023	-----
Ni	28	filter blank	T06-11630	RTI	0.004 ± 0.003	0.014 ± 0.017	-----
Cu	29	filter blank	T06-11630	RTI	0.000 ± 0.003	0.070 ± 0.019	-----
Zn	30	filter blank	T06-11630	RTI	0.003 ± 0.005	0.019 ± 0.014	-----
Ga	31	filter blank	T06-11630	RTI	0.007 ± 0.007	0.001 ± 0.011	-----
As	33	filter blank	T06-11630	RTI	0.000 ± 0.005	-0.025 ± 0.017	-----
Se	34	filter blank	T06-11630	RTI	0.002 ± 0.006	-0.013 ± 0.011	-----
Br	35	filter blank	T06-11630	RTI	0.000 ± 0.004	0.010 ± 0.012	-----
Rb	37	filter blank	T06-11630	RTI	0.000 ± 0.004	0.003 ± 0.011	-----
Sr	38	filter blank	T06-11630	RTI	0.000 ± 0.005	0.003 ± 0.013	-----
Y	39	filter blank	T06-11630	RTI	0.000 ± 0.006	-0.060 ± 0.047	-----
Zr	40	filter blank	T06-11630	RTI	0.000 ± 0.009	0.018 ± 0.042	-----
Nb	41	filter blank	T06-11630	RTI	0.000 ± 0.011	0.004 ± 0.047	-----
Mo	42	filter blank	T06-11630	RTI	0.000 ± 0.014	0.016 ± 0.051	-----
Ag	47	filter blank	T06-11630	RTI	0.011 ± 0.047	-0.076 ± 0.043	-----
Cd	48	filter blank	T06-11630	RTI	0.000 ± 0.041	0.028 ± 0.052	-----
In	49	filter blank	T06-11630	RTI	0.000 ± 0.059	0.057 ± 0.059	-----
Sn	50	filter blank	T06-11630	RTI	0.000 ± 0.073	0.088 ± 0.072	-----
Sb	51	filter blank	T06-11630	RTI	0.000 ± 0.080	0.070 ± 0.081	-----
Cs	55	filter blank	T06-11630	RTI	0.000 ± 0.064	0.449 ± 0.151	-----
Ba	56	filter blank	T06-11630	RTI	0.000 ± 0.033	0.434 ± 0.167	-----
La	57	filter blank	T06-11630	RTI	0.000 ± 0.027	0.021 ± 0.044	-----
Ce	58	filter blank	T06-11630	RTI	0.000 ± 0.024	-0.015 ± 0.049	-----
Sm	62	filter blank	T06-11630	RTI	0.000 ± 0.016	not reported	-----
Eu	63	filter blank	T06-11630	RTI	0.000 ± 0.016	not reported	-----
Tb	65	filter blank	T06-11630	RTI	0.000 ± 0.011	not reported	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Hf	72	filter blank	T06-11630	RTI	0.000 ± 0.012	not reported	-----
Ta	73	filter blank	T06-11630	RTI	0.000 ± 0.028	not reported	-----
W	74	filter blank	T06-11630	RTI	0.000 ± 0.020	0.010 ± 0.032	-----
Ir	77	filter blank	T06-11630	RTI	0.000 ± 0.021	not reported	-----
Au	79	filter blank	T06-11630	RTI	0.000 ± 0.013	0.025 ± 0.025	-----
Hg	80	filter blank	T06-11630	RTI	0.000 ± 0.024	-0.047 ± 0.027	-----
Pb	82	filter blank	T06-11630	RTI	0.000 ± 0.013	0.053 ± 0.031	-----
Na	11	filter blank	T06-11631	RTI	0.000 ± 0.139	not reported	-----
Mg	12	filter blank	T06-11631	RTI	0.000 ± 0.039	not reported	-----
Al	13	filter blank	T06-11631	RTI	0.015 ± 0.096	0.156 ± 0.765	-----
Si	14	filter blank	T06-11631	RTI	0.000 ± 0.047	-0.039 ± 0.279	-----
P	15	filter blank	T06-11631	RTI	0.000 ± 0.040	0.039 ± 0.188	-----
S	16	filter blank	T06-11631	RTI	0.000 ± 0.024	0.055 ± 0.129	-----
Cl	17	filter blank	T06-11631	RTI	0.000 ± 0.018	-0.038 ± 0.083	-----
K	19	filter blank	T06-11631	RTI	0.015 ± 0.012	0.028 ± 0.069	-----
Ca	20	filter blank	T06-11631	RTI	0.000 ± 0.016	-0.019 ± 0.041	-----
Sc	21	filter blank	T06-11631	RTI	0.000 ± 0.022	-0.017 ± 0.029	-----
Ti	22	filter blank	T06-11631	RTI	0.000 ± 0.014	0.018 ± 0.040	-----
V	23	filter blank	T06-11631	RTI	0.000 ± 0.010	0.001 ± 0.019	-----
Cr	24	filter blank	T06-11631	RTI	0.003 ± 0.007	-0.012 ± 0.012	-----
Mn	25	filter blank	T06-11631	RTI	0.000 ± 0.005	0.004 ± 0.016	-----
Fe	26	filter blank	T06-11631	RTI	0.011 ± 0.005	0.074 ± 0.038	-----
Co	27	filter blank	T06-11631	RTI	0.001 ± 0.003	-0.015 ± 0.023	-----
Ni	28	filter blank	T06-11631	RTI	0.010 ± 0.003	-0.016 ± 0.018	-----
Cu	29	filter blank	T06-11631	RTI	0.000 ± 0.003	0.014 ± 0.018	-----
Zn	30	filter blank	T06-11631	RTI	0.008 ± 0.005	0.026 ± 0.014	-----
Ga	31	filter blank	T06-11631	RTI	0.000 ± 0.007	0.004 ± 0.012	-----
As	33	filter blank	T06-11631	RTI	0.000 ± 0.005	0.021 ± 0.017	-----
Se	34	filter blank	T06-11631	RTI	0.007 ± 0.005	-0.003 ± 0.012	-----
Br	35	filter blank	T06-11631	RTI	0.000 ± 0.004	-0.022 ± 0.012	-----
Rb	37	filter blank	T06-11631	RTI	0.002 ± 0.006	0.021 ± 0.012	-----
Sr	38	filter blank	T06-11631	RTI	0.002 ± 0.007	0.004 ± 0.014	-----
Y	39	filter blank	T06-11631	RTI	0.000 ± 0.006	-0.070 ± 0.048	-----
Zr	40	filter blank	T06-11631	RTI	0.003 ± 0.014	0.002 ± 0.041	-----
Nb	41	filter blank	T06-11631	RTI	0.007 ± 0.015	0.090 ± 0.050	-----
Mo	42	filter blank	T06-11631	RTI	0.000 ± 0.014	-0.001 ± 0.052	-----
Ag	47	filter blank	T06-11631	RTI	0.000 ± 0.038	-0.024 ± 0.044	-----
Cd	48	filter blank	T06-11631	RTI	0.000 ± 0.041	0.028 ± 0.054	-----
In	49	filter blank	T06-11631	RTI	0.000 ± 0.043	0.078 ± 0.061	-----
Sn	50	filter blank	T06-11631	RTI	0.000 ± 0.073	0.050 ± 0.073	-----
Sb	51	filter blank	T06-11631	RTI	0.000 ± 0.098	0.088 ± 0.084	-----
Cs	55	filter blank	T06-11631	RTI	0.000 ± 0.066	0.165 ± 0.151	-----
Ba	56	filter blank	T06-11631	RTI	0.000 ± 0.033	-0.100 ± 0.167	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
La	57	filter blank	T06-11631	RTI	0.000 ± 0.019	-0.080 ± 0.044	-----
Ce	58	filter blank	T06-11631	RTI	0.000 ± 0.024	0.001 ± 0.050	-----
Sm	62	filter blank	T06-11631	RTI	0.000 ± 0.016	not reported	-----
Eu	63	filter blank	T06-11631	RTI	0.000 ± 0.016	not reported	-----
Tb	65	filter blank	T06-11631	RTI	0.000 ± 0.011	not reported	-----
Hf	72	filter blank	T06-11631	RTI	0.000 ± 0.012	not reported	-----
Ta	73	filter blank	T06-11631	RTI	0.000 ± 0.028	not reported	-----
W	74	filter blank	T06-11631	RTI	0.000 ± 0.020	0.009 ± 0.032	-----
Ir	77	filter blank	T06-11631	RTI	0.004 ± 0.024	not reported	-----
Au	79	filter blank	T06-11631	RTI	0.000 ± 0.013	-0.008 ± 0.026	-----
Hg	80	filter blank	T06-11631	RTI	0.000 ± 0.024	0.014 ± 0.028	-----
Pb	82	filter blank	T06-11631	RTI	0.007 ± 0.015	-0.027 ± 0.031	-----
Na	11	filter blank	T06-11632	UCD	0.791 ± 0.271	not reported	-----
Mg	12	filter blank	T06-11632	UCD	0.000 ± 0.000	not reported	-----
Al	13	filter blank	T06-11632	UCD	0.304 ± 0.111	1.237 ± 0.763	-----
Si	14	filter blank	T06-11632	UCD	0.080 ± 0.019	-0.176 ± 0.272	-----
P	15	filter blank	T06-11632	UCD	0.064 ± 0.014	0.266 ± 0.184	-----
S	16	filter blank	T06-11632	UCD	0.035 ± 0.007	0.187 ± 0.128	-----
Cl	17	filter blank	T06-11632	UCD	0.053 ± 0.013	0.022 ± 0.083	-----
K	19	filter blank	T06-11632	UCD	0.058 ± 0.010	-0.020 ± 0.068	-----
Ca	20	filter blank	T06-11632	UCD	0.008 ± 0.001	-0.059 ± 0.041	-----
Sc	21	filter blank	T06-11632	UCD	not reported	-0.009 ± 0.030	-----
Ti	22	filter blank	T06-11632	UCD	0.000 ± 0.000	-0.041 ± 0.039	-----
V	23	filter blank	T06-11632	UCD	0.001 ± 0.000	-0.009 ± 0.018	-----
Cr	24	filter blank	T06-11632	UCD	0.004 ± 0.001	-0.014 ± 0.012	-----
Mn	25	filter blank	T06-11632	UCD	0.005 ± 0.002	0.008 ± 0.016	-----
Fe	26	filter blank	T06-11632	UCD	0.000 ± 0.000	0.061 ± 0.038	-----
Co	27	filter blank	T06-11632	UCD	not reported	0.012 ± 0.024	-----
Ni	28	filter blank	T06-11632	UCD	0.000 ± 0.000	0.036 ± 0.019	-----
Cu	29	filter blank	T06-11632	UCD	0.006 ± 0.001	0.022 ± 0.018	-----
Zn	30	filter blank	T06-11632	UCD	0.011 ± 0.001	-0.018 ± 0.013	-----
Ga	31	filter blank	T06-11632	UCD	0.000 ± 0.000	-0.013 ± 0.011	-----
As	33	filter blank	T06-11632	UCD	0.000 ± 0.000	0.009 ± 0.017	-----
Se	34	filter blank	T06-11632	UCD	0.000 ± 0.000	-0.028 ± 0.011	-----
Br	35	filter blank	T06-11632	UCD	0.000 ± 0.000	-0.007 ± 0.012	-----
Rb	37	filter blank	T06-11632	UCD	0.001 ± 0.000	0.004 ± 0.011	-----
Sr	38	filter blank	T06-11632	UCD	0.000 ± 0.000	0.001 ± 0.013	-----
Y	39	filter blank	T06-11632	UCD	not reported	0.074 ± 0.051	-----
Zr	40	filter blank	T06-11632	UCD	not reported	0.056 ± 0.042	-----
Nb	41	filter blank	T06-11632	UCD	not reported	-0.010 ± 0.046	-----
Mo	42	filter blank	T06-11632	UCD	not reported	0.044 ± 0.051	-----
Ag	47	filter blank	T06-11632	UCD	not reported	-0.080 ± 0.042	-----
Cd	48	filter blank	T06-11632	UCD	not reported	0.050 ± 0.052	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
In	49	filter blank	T06-11632	UCD	not reported	0.100 ± 0.061	-----
Sn	50	filter blank	T06-11632	UCD	not reported	-0.050 ± 0.069	-----
Sb	51	filter blank	T06-11632	UCD	not reported	0.109 ± 0.082	-----
Cs	55	filter blank	T06-11632	UCD	not reported	0.029 ± 0.147	-----
Ba	56	filter blank	T06-11632	UCD	not reported	0.435 ± 0.169	-----
La	57	filter blank	T06-11632	UCD	not reported	0.039 ± 0.043	-----
Ce	58	filter blank	T06-11632	UCD	not reported	-0.052 ± 0.050	-----
Sm	62	filter blank	T06-11632	UCD	not reported	not reported	-----
Eu	63	filter blank	T06-11632	UCD	not reported	not reported	-----
Tb	65	filter blank	T06-11632	UCD	not reported	not reported	-----
Hf	72	filter blank	T06-11632	UCD	not reported	not reported	-----
Ta	73	filter blank	T06-11632	UCD	not reported	not reported	-----
W	74	filter blank	T06-11632	UCD	not reported	0.039 ± 0.033	-----
Ir	77	filter blank	T06-11632	UCD	not reported	not reported	-----
Au	79	filter blank	T06-11632	UCD	not reported	-0.024 ± 0.025	-----
Hg	80	filter blank	T06-11632	UCD	not reported	-0.012 ± 0.028	-----
Pb	82	filter blank	T06-11632	UCD	0.010 ± 0.002	-0.006 ± 0.030	-----
Na	11	filter blank	T06-11633	UCD	0.533 ± 0.191	not reported	-----
Mg	12	filter blank	T06-11633	UCD	0.318 ± 0.112	not reported	-----
Al	13	filter blank	T06-11633	UCD	0.373 ± 0.110	1.339 ± 0.769	-----
Si	14	filter blank	T06-11633	UCD	0.184 ± 0.063	0.101 ± 0.278	-----
P	15	filter blank	T06-11633	UCD	0.094 ± 0.024	0.025 ± 0.182	-----
S	16	filter blank	T06-11633	UCD	0.158 ± 0.065	0.045 ± 0.128	-----
Cl	17	filter blank	T06-11633	UCD	0.031 ± 0.006	0.084 ± 0.082	-----
K	19	filter blank	T06-11633	UCD	0.046 ± 0.021	-0.185 ± 0.066	-----
Ca	20	filter blank	T06-11633	UCD	0.000 ± 0.000	0.006 ± 0.039	-----
Sc	21	filter blank	T06-11633	UCD	not reported	0.022 ± 0.028	-----
Ti	22	filter blank	T06-11633	UCD	0.000 ± 0.000	-0.013 ± 0.039	-----
V	23	filter blank	T06-11633	UCD	0.008 ± 0.002	0.039 ± 0.018	-----
Cr	24	filter blank	T06-11633	UCD	0.002 ± 0.000	-0.001 ± 0.012	-----
Mn	25	filter blank	T06-11633	UCD	0.009 ± 0.002	0.003 ± 0.015	-----
Fe	26	filter blank	T06-11633	UCD	0.000 ± 0.000	0.015 ± 0.036	-----
Co	27	filter blank	T06-11633	UCD	not reported	-0.034 ± 0.021	-----
Ni	28	filter blank	T06-11633	UCD	0.000 ± 0.000	-0.032 ± 0.016	-----
Cu	29	filter blank	T06-11633	UCD	0.000 ± 0.000	0.020 ± 0.018	-----
Zn	30	filter blank	T06-11633	UCD	0.017 ± 0.002	-0.005 ± 0.013	-----
Ga	31	filter blank	T06-11633	UCD	0.004 ± 0.001	0.009 ± 0.012	-----
As	33	filter blank	T06-11633	UCD	0.000 ± 0.000	-0.005 ± 0.016	-----
Se	34	filter blank	T06-11633	UCD	0.000 ± 0.000	0.009 ± 0.011	-----
Br	35	filter blank	T06-11633	UCD	0.000 ± 0.000	-0.010 ± 0.012	-----
Rb	37	filter blank	T06-11633	UCD	0.000 ± 0.000	0.005 ± 0.011	-----
Sr	38	filter blank	T06-11633	UCD	0.004 ± 0.001	0.004 ± 0.013	-----
Y	39	filter blank	T06-11633	UCD	not reported	-0.044 ± 0.046	-----

Table 14. XRF PE Results

Element	Z	Sample Description	Sample ID	Test Lab	Test Lab Result (µg/filter)	NERL Result (µg/filter)	Median* (µg/filter)
Zr	40	filter blank	T06-11633	UCD	not reported	0.108 ± 0.045	-----
Nb	41	filter blank	T06-11633	UCD	not reported	0.002 ± 0.046	-----
Mo	42	filter blank	T06-11633	UCD	not reported	0.082 ± 0.052	-----
Ag	47	filter blank	T06-11633	UCD	not reported	-0.005 ± 0.044	-----
Cd	48	filter blank	T06-11633	UCD	not reported	0.036 ± 0.052	-----
In	49	filter blank	T06-11633	UCD	not reported	0.023 ± 0.058	-----
Sn	50	filter blank	T06-11633	UCD	not reported	0.084 ± 0.071	-----
Sb	51	filter blank	T06-11633	UCD	not reported	0.055 ± 0.080	-----
Cs	55	filter blank	T06-11633	UCD	not reported	0.282 ± 0.148	-----
Ba	56	filter blank	T06-11633	UCD	not reported	0.327 ± 0.165	-----
La	57	filter blank	T06-11633	UCD	not reported	0.059 ± 0.043	-----
Ce	58	filter blank	T06-11633	UCD	not reported	0.000 ± 0.048	-----
Sm	62	filter blank	T06-11633	UCD	not reported	not reported	-----
Eu	63	filter blank	T06-11633	UCD	not reported	not reported	-----
Tb	65	filter blank	T06-11633	UCD	not reported	not reported	-----
Hf	72	filter blank	T06-11633	UCD	not reported	not reported	-----
Ta	73	filter blank	T06-11633	UCD	not reported	not reported	-----
W	74	filter blank	T06-11633	UCD	not reported	0.062 ± 0.032	-----
Ir	77	filter blank	T06-11633	UCD	not reported	not reported	-----
Au	79	filter blank	T06-11633	UCD	not reported	-0.014 ± 0.024	-----
Hg	80	filter blank	T06-11633	UCD	not reported	0.053 ± 0.027	-----
Pb	82	filter blank	T06-11633	UCD	0.016 ± 0.005	-0.003 ± 0.030	-----

**** Median was calculated only when the result from all reporting labs was greater than three times the uncertainty.***

Table 15. XRF Analysis at the CARB Laboratory

Instrument: Thermo QuanX EC Software: WinTrace 3.0.2

Parameter	Instrument Conditions for Routine Sample Analysis					
	#1	#2	#3	#4	#5	#6
X-ray tube parameters: Tube voltage (kV)	10	30	50	50		
Tube current (mA)	1.98	1.66	1.00	1.00		
Tube anode material	Rhodium	Rhodium	Rhodium	Rhodium		
Direct excitation of sample: Filter material	Cellulose	Palladium	Palladium	Copper		
Filter thickness (mm)	unknown	0.025 mm	0.125 mm	0.377 mm		
Secondary excitation of sample: Secondary fluorescor	none	none	none	none		
Filter material						
Filter thickness (mm)						
Acquisition time (seconds)	800	400	400	800		
Energy range acquired (keV)	0-10	0-20	0-40	0-40		

Number of [MCA] channels	512	1024	2048	2048		
Sample rotation (yes/no)	yes	yes	yes	yes		
Beam spot size, diameter (mm)	unknown	unknown	unknown	unknown		
Atmosphere (vacuum, He, air)	vacuum	vacuum	vacuum	vacuum		
Elements Reported	Al Si P S Cl K Ca	Ti V Cr Mn Fe Co Ni Ba	Cu Zn As Se Br Rb Sr Y Mo Hg Pb	Sn Sb		

Table 16. XRF Analysis at the DRI Laboratory						
Instrument: PanAnalytical Epsilon 5 Software: E5 Version 1.0B						
Parameter	Instrument Conditions for Routine Sample Analysis					
	#1	#2	#3	#4	#5	#6
X-ray tube parameters: Tube voltage (kV)	40	40	75	100	100	100
Tube current (mA)	15	15	8	6	6	6
Tube anode material	Gd	Gd	Gd	Gd	Gd	Gd
Direct excitation of sample: Filter material						
Filter thickness (mm)						
Secondary excitation of sample: Secondary fluorescor	Ti	Fe	Ge	Zr	Mo	Ag
Filter material						
Filter thickness (mm)						
Acquisition time (seconds)	200	200	200	200	200	200
Energy range acquired (keV)	0-20	0-20	0-20	0-20	0-20	0-40
Number of [MCA] channels	2048	2048	2048	2048	2048	4096
Sample rotation (yes/no)	yes	yes	yes	yes	yes	yes
Beam spot size, diameter (mm)	20	20	20	20	20	20
Atmosphere (vacuum, He, air)	vacuum	vacuum	vacuum	vacuum	vacuum	vacuum
Elements Reported	Na Mg Al Si P S Cl K Ca Sc	Ti V Cr	Mn Fe Co Ni Cu Zn	Ga As Se Br Rb	Sr Y	Zr Nb Mo
Parameter (repeated)	#7	#8	#9	#10	#11	#12
X-ray tube parameters: Tube voltage (kV)	100	100	100	100		
Tube current (mA)	6	6	6	6		
Tube anode material	Gd	Gd	Gd	Gd		
Direct excitation of sample: Filter material						
Filter thickness (mm)						
Secondary excitation of sample: Secondary fluorescor	BaF_2	Fe	Ge	Zr		
Filter material						
Filter thickness (mm)						
Acquisition time (seconds)	200	200	200	200		
Energy range acquired (keV)	0-80	0-20	0-20	0-20		
Number of [MCA] channels	8192	2048	2048	2048		
Sample rotation (yes/no)	yes	yes	yes	yes		
Beam spot size, diameter (mm)	20	20	20	20		
Atmosphere (vacuum, He, air)	vacuum	vacuum	vacuum	vacuum		
Elements Reported	Pd Ag Cd In Sn Sb	Cs Ba La Ce	Sm Eu Tb	Hf Ta W Ir Au Hg Tl Pb		

Table 17. XRF Analysis at the ODEQ Laboratory						
Instrument: Kevex771 Software: WinXRF V2.41						
Parameter	Instrument Conditions for Routine Sample Analysis					
	#1	#2	#3	#4	#5	#6
X-ray tube parameters: Tube voltage (kV)	7.5	35	40	45	40	58
Tube current (mA)	0.9	2.1	2.1	2.1	0.9	1.5
Tube anode material	Rh	Rh	Rh	Rh	Rh	Rh
Direct excitation of sample: Filter material	Whatman 41	na	na	na	Rh	W
Filter thickness (mm)	1 layer	na	na	na	0.1	0.1
Secondary excitation of sample: Secondary fluorescor	none	Ti	Fe	Ge	none	none
Filter material	na	none	none	none	na	na
Filter thickness (mm)	na	na	na	na	na	na
Acquisition time (seconds)	400	400	400	400	400	400
Energy range acquired (keV)	10	10	10	10	20	40
Number of [MCA] channels	1024	1024	1024	1024	2048	4096
Sample rotation (yes/no)	no	no	no	no	no	no
Beam spot size, diameter (mm)	unknown	unknown	unknown	unknown	unknown	unknown
Atmosphere (vacuum, He, air)	vacuum	vacuum	vacuum	vacuum	vacuum	vacuum
Elements Reported	Na Mg Al Si P	S Cl K Ca	Sc Ti V Cr	Mn Fe Co Ni Cu Zn	Ga As Se Br Rb Sr Y Zr Nb Mo Hf Ta W Ir Au Hg Pb	Ag Cd In Sn Sb Cs Ba La Ce Sm Eu Tb

Table 18. XRF Analysis at the RTI Laboratory						
Instrument: ThermoNoran QuanX EC Software: Wintrace 3.0 Build 31						
Parameter	Instrument Conditions for Routine Sample Analysis					
	#1	#2	#3	#4	#5	#6
X-ray tube parameters: Tube voltage (kV)	5	10	30	50	50	
Tube current (mA)	1.98	1.98	1.66	1.00	1.00	
Tube anode material	Rh	Rh	Rh	Rh	Rh	
Direct excitation of sample: Filter material	No filter	Graphite	Pd Thin	Pd Thick	Cu Thin	
Filter thickness (g/cm^2)	na	0.06	0.03	0.09	0.338	
Secondary excitation of sample: Secondary fluorescor	na	na	na	na	na	
Filter material	na	na	na	na	na	
Filter thickness (mm)	na	na	na	na	na	
Acquisition time (seconds)	300	300	300	300	300	
Energy range acquired (keV)	0-10	0-10	0-20	0-40	0-40	
Number of [MCA] channels						
Sample rotation (yes/no)	no	no	no	no	no	
Beam spot size, diameter (mm)	10 x 12mm elipse	10 x 12mm elipse	10 x 12mm elipse	10 x 12mm elipse	10 x 12mm elipse	
Atmosphere (vacuum, He, air)	vacuum	vacuum	vacuum	vacuum	vacuum	
Elements Reported	Na Mg	Al Si P S Cl K Ca Sc	Ti V Cr Mn Fe Co Ni Cu Zn Cs Ba La Sm Eu Tb Hf	Ga As Se Br Rb Sr Y Zr Nb Mo Ta W Ir Au Hg Pb	Ag Cd In Sn Sb	

Table 19. XRF Analysis at the RTI Laboratory						
Instrument: ThermoNoran QuanX EC Software: Wintrace 3.0 Build 31						
Parameter	Instrument Conditions for Routine Sample Analysis					
	#1	#2	#3	#4	#5	#6
X-ray tube parameters: Tube voltage (kV)	5	10	12	30	50	50
Tube current (mA)	1.20	1.98	1.98	1.66	1.00	1.00
Tube anode material	Rh	Rh	Rh	Rh	Rh	Rh
Direct excitation of sample: Filter material	No filter	Graphite	Aluminum	Pd Thin	Pd Thick	Cu Thin
Filter thickness (**g/cm^2**)	na	0.06	0.034	0.03	0.15	0.338
Secondary excitation of sample: Secondary fluorescor	na	na	na	na	na	
Filter material	na	na	na	na	na	
Filter thickness (mm)	na	na	na	na	na	
Acquisition time (seconds)	300	300	250	250	200	200
Energy range acquired (keV)	0-10	0-10	0-10	0-20	0-40	0-40
Number of [MCA] channels	20eV per channel	20eV per channel	20eV per channel	20eV per channel	20eV per channel	20eV per channel
Sample rotation (yes/no)	no	no	no	no	no	
Beam spot size, diameter (mm)	9.5 x 11mm elipse	9.5 x 11mm elipse	9.5 x 11mm elipse	9.5 x 11mm elipse	9.5 x 11mm elipse	9.5 x 11mm elipse
Atmosphere (vacuum, He, air)	vacuum	vacuum	vacuum	vacuum	vacuum	
Elements Reported	Na Mg	Al Si P S Cl K Ca Sc Cs	Ti	V Cr Mn Fe Co Ni Cu Zn Ga Ba La Ce Sm Eu Tb Hf	As Se Br Rb Sr Y Zr Nb Mo Ta W Ir Au Hg Tl Pb	Pd Ag Cd In Sn Sb

Table 20. XRF Analysis at the UCD Laboratory						
Instrument: UCD design and build Software: RACE (Rapid Analysis of Composition by Elements)						
Parameter	Instrument Conditions for Routine Sample Analysis					
	#1	#2	#3	#4	#5	#6
X-ray tube parameters: Tube voltage (kV)	35	20				
Tube current (mA)	16	5				
Tube anode material	Molybdenum	Copper				
Direct excitation of sample: Filter material	yes	yes				
Filter thickness (mm^2)		0.051 mm thick integrated Cu collimator				
Secondary excitation of sample: Secondary fluorescor	na	na				
Filter material	na	na				
Filter thickness (mm)	na	na				
Acquisition time (seconds)	1400	2000				
Energy range acquired (keV)	2-16	1-8				
Number of [MCA] channels	512	512				
Sample rotation (yes/no)	no	no				
Beam spot size, diameter (mm)	~0.7 cm^2	~0.785 cm^2				
Atmosphere (vacuum, He, air)	air	vacuum				
Elements Reported	Ni Cu Zn Ga As Se Br Rb Sr Pb	Na Mg Al Si P S Cl K Ca Ti V Cr Mn Fe				

Table 21. XRF Analysis at EPA's NERL						
Instrument: LBL (1984)			Software: XRF2000 V3.1-2006A			
	Instrument Conditions for Routine Sample Analysis					
Parameter	#1	#2	#3	#4	#5	#6
X-ray tube parameters:						
Tube voltage (kV)	40	40	55	68		
Tube current (mA)	0.60	0.60	0.80	0.60		
Tube anode material	W	W	W	W		
Direct excitation of sample:						
Filter material	na	na	na	na		
Filter thickness (mm)						
Secondary excitation of sample:						
Secondary fluorescor	Ti	Co	Mo	Sm		
Filter material	na	na	na	na		
Filter thickness (mm)						
Acquisition time (seconds)	90	86	76	92		
Energy range acquired (keV)	32	32	32	32		
Number of [MCA] channels	1024	1024	1024	1024		
Sample rotation (yes/no)	no	no	no	no		
Beam spot size, diameter (mm)	20	20	20	20		
Atmosphere (vacuum, He, air)	He	He	He	He		
Elements Reported	Al Si P S Cl K Ca	S Cl K Ca Sc Ti V Cr Mn La Ce	Mn Fe Co Ni Ca Zn Ga Ge As Se Br Rb Sr W Pt Au Hg Tl Pb	Rb Sr Y Zr Nb Mo Rh Pd Ag Cd In Sn Sb Tc I Cs Ba		