APPENDIX H

PM_{10} Federal Reference Method (FRM) Sampler SOP

Standard Operating Procedure
for a
PM_{10} Federal Reference Method (FRM) Sampler

1.0 INTRODUCTION

This procedure applies to the Thermo Fisher Scientific Partisol FRM Model 2000 single filter PM_{10} samplers, which will be used to monitor the preoperational and operational concentrations of particulate matter (PM) at two sites in the vicinity of the proposed Energy Fuels Resources Corporation (EFR) Uranium Mill. The sites for these monitors were chosen according to guidance outlined in Nuclear Regulatory Commission (NRC) Regulatory Guides 3.63 Onsite Meteorological Measurement Program for Uranium Recovery Facilities – Data Acquisition and Reporting (NRC 3.63); 4.14 Radiological Effluent and Environmental Monitoring at Uranium Mills (NRC 4.14); and Environmental Protection Agency (EPA) Meteorological Monitoring Guidance for Regulatory Modeling Applications (MMGRMA) (EPA-454/R-99-005).

Data from the FRM PM_{10} samplers will be collected at two air monitoring sites located on the northern and eastern boundaries of the proposed Energy Fuels Piñon Ridge Uranium Mill site in order to obtain a representative set of data for the assessment. Samples will be collected at both sites following the EPA Ambient Particulate Monitoring Sample Day Schedule (Appendix A) for 1-in-6-day sampling during preoperational monitoring and 1-in-3-day sampling when the mill becomes operational. Filters for sample collection will be prepared by the laboratory following procedures set forth in the manufacturer's operating manual.

2.0 SAMPLER INSTALLATION

This section describes the menus, or screens, and the process for editing within screens that will be used for sampler installation and operation.

2.1 Sampler Assembly

Samplers will be assembled and prepared for operation with assistance from Inter-Mountain Laboratories (IML) according to the procedure in the manufacturer's operating manual. IML will also carryout the initial calibration of the instruments.

2.2 Screen Descriptions

1. After the sampler is plugged in, the first screen will be the **Title Screen**. The Title Screen displays summary information on the sampling program currently defined by the user, the current operating mode, the existence of any status conditions, as well as certain operational information. For procedures on changing the hardware and software please see the operating manual.

2. The **Main Screen** (Figure 1) will automatically appear, unless the operator determines that the instrument's initial software or hardware is incorrect.

```
Stat:Ok        Main Screen       Mode:SAMP
      Current Time: 19.36 96/11/07
      Sample Start:  0.00 96/11/07
      Sample Stop:   0.00 96/11/08
 Amb Temp: 23.2 C  Flow Rate: 16.7 l/min
Filt Temp: 23.6 C     Volume: 19.6 m^3
 Amb Pres: 760 mmHg SampTime:  19.36
FiltSet | Stats | Data | Run/Stp | Setup |
```

Figure 1: Main Screen

Stat - The value of the status code in the upper left-hand corner of the Main Screen indicates whether or not the hardware is operating properly. A value of "Ok" indicates that all functions are proceeding normally.

2.2.1 Status Codes

The sampler displays operational status codes in the upper left-hand corner of the Main Screen next to "Stat," as well as on several other screens. The hardware resets the status to "Ok" (no current conditions) after the user presses <F4:Run/Stp> from the Main Screen to return the unit to the Stop Mode.

With the occurrence of any status conditions, the sampler displays the single-letter abbreviation for each flag that applies. In the case of multiple status conditions, the sampler displays the single-letter abbreviation of all applicable flags in the status field of the Main Screen and other screens with a status condition field. For example, the sampler would display "FV" in the case of simultaneous flow rate and power outage conditions. The hardware stores all status conditions that apply to each exposed filter in the filter data storage buffer (Section 11.0).

The following list details the system's status codes and definitions:
Ok - No current status conditions.

F - The measured sample flow rate deviates by more than 5% from its set point for more than 30 seconds.

X - The measured sample flow rate deviates by more than 10% from its set point for more than 60 sec.

S - The ambient temperature sensor is not plugged in or is indicating an invalid value (less than -150 °C or greater than 60 °C).

P - The ambient pressure sensor is not installed correctly or is indicating an invalid value (less than 300 mm Hg or greater than 900 mm Hg).

T - The measured filter temperature exceeds the measured ambient temperature by more than 5 °C for more than ten consecutive minutes during sampling or post-sampling periods of operation.

I - The temperature of the instrument electronics is outside of its usual operating range (less than -5 °C or greater than 60 °C).

V - A power outage of greater than 60 seconds occurred during sample collection.

E - The elapsed time of the sample was less than 23 hours or greater than 25 hours.

C - The coefficient of variation of the sample flow rate, expressed as a percentage, was greater than 4 (4%) during the sampling interval.

Mode - Current operating mode is located in the upper right-hand corner of the Main Screen. Press <F4: Run/Stp> to switch among the Stop, Wait, Sampling, and Done Operating Modes.

Current Time - The local time and date. These variables should be set to their proper values in the Setup Screen before commencing operation of the sampler. The Partisol-FRM Sampler expresses time as “hh.mm” and dates as “yy/mm/dd” in accordance with U.S. EPA requirements.

Sample Start - Indicates the time and date at which the sampler is currently programmed to begin sample collection. Press <F1: FiltSet> from the Main Screen to enter the Filter Setup Screen. With the device in the Stop Operating Mode (Stop Mode), the user can change the sampling program from this screen.

Sample Stop - Indicates the time and date at which the sampler is currently programmed to stop sample collection. Press <F1: FiltSet> from the Main Screen to enter the Filter Setup Screen. With the device in the Stop Mode, the user can change the sampling program from the Filter Setup Screen.

Amb Temp - The current ambient temperature (°C), as measured by the temperature probe mounted on the down tube.

Filt Temp - The current filter temperature (°C), as measured by a temperature sensor located within 1 cm of the sample filter’s center.

Amb Pres - The current ambient pressure (absolute mm Hg), as measured by a pressure sensor located within the instrument enclosure.

Flow Rate - The current sample flow rate (volumetric liters per minute or l/min). The value of this field is “0” if the sample flow is currently turned off.

Volume - The total volume sampled (volumetric m^3). This field is reset to 0 whenever the user advances from the Done to the Stop Mode by pressing <F4: Run/Stp>. The user may view stored data by entering <F3: Data> from the Main Screen (Section 10.0).

SampTime: The total elapsed sampling time (hh.mm). This field is reset to “0” whenever the user advances from the Done to the Stop Mode by pressing <F4: Run/Stp>. The user may view stored data by entering <F3: Data> from the Main Screen (Section 10.0).

Note: Pressing **<ESC>** will take you back one previous screen (i.e. if <ESC> is pressed while at the Setup Screen you will be taken back to the Main Screen).

3. The **<SHIFT>** key is important for accessing certain functions. In any screen a “>” or “<” indicator on the rightmost position of the bottom line indicates that the menu for that screen is two lines long. <SHIFT> can be pressed to toggle between the lines of that menu. This is the case in the Setup Screen for both the Browse Mode and Edit Mode.

   For Example: If the <SHIFT> key is pressed while in the Setup Screen (Figure 2) and in the Browse Mode, the second line containing Passwd will appear the first time <SHIFT> is pressed, and the original Edit, Calib, Diag, RS232, Audit line will appear if <SHIFT> is hit a second time.

4. The **Setup Screen** (Figure 2) can be accessed from the Main Screen by pressing <F5: Setup>.

```
Stat:Ok       Setup     Mode:SAMP
 Cur Time: 19.36.37   Def Start:  0.00
 Cur Date: 96/11/07   Def Dur:  24.00
 Set Flow: 16.7 l/min Std Temp:  99.9
                     Std Press:  99.9
FTS Const M: 0.0000   Soft Ver:  1.202
FTS Const B: 0.0000   Ser Num:   1001
```

Edit	Calib	Diag	RS232	Audit	>
Function Keys in Browse Mode					
Edit	Calib	Diag	RS232	Audit	>
Passwd					<
Function Keys in Edit Mode					
- -	-	+	++	Bksp	>
+/-					<

Figure 2: Setup Screen

Cur Time - Current local time (or other standard time selected by the user) expressed as hh.mm.ss. When editing this parameter, treat each part of the time as a separate field.

Cur Date - Current local date expressed as yy/mm/dd. When editing this parameter, treat each part of the date as a separate field.

Set Flow - The Set Flow parameter defines the flow rate (volumetric l/min) at which the device draws a sample when it is in the Sampling Operating Mode. This is identical to the Set Flow field in the Filter Setup Screen (Section 3.3).

Def Start - Sets the default start time (hh.mm) of samples collected by the unit. The sampler uses this parameter to simplify sample programming in the Filter Setup Screen (Section 3.3). The default value of 0 causes sampling to begin at midnight by default.

Def Dur - Establishes the default sampling duration (hh.mm) of samples collected by the Partisol unit. The sampler uses this parameter to simplify sample programming in the Filter Setup Screen (Section 3.3). The default value of 24 causes the sampling duration to be 24 hours by default.

FTS Const M – The Streamline Flow Transfer Standard "m" calibration constant. The Streamline FTS can be used for verifying and calibrating the Partisol-FRM sampler flow. The sampler uses this constant to convert flow from inches H_2O into l/min.

FTS Const B – The Streamline Flow Transfer Standard “b” calibration constant. The Streamline FTS can be used for verifying and calibrating the Partisol- FRM sampler flow. The sampler uses this constant to convert flow from inches H_2O into l/min.

Soft Ver - The software version number when it issues new releases of the Partisol-FRM operating software. Refer to the Operating Manual: Appendix E for instructions to upgrade the system software.
This field is not editable.

Ser Num - Contains a shortened version of the sampler’s serial number or other identifying information.

2.3 Edit Mode

From the Setup Screen enter Edit Mode by pressing <F1: Edit>.

Note: If the sampler is not in Stop Mode the sampler will beep to indicate that Edit Mode is inoperable. To enter Edit Mode return to the Main Screen and press <F4: Run/Stp>, before entering into Edit Mode in the desired screen.

1. Numeric keys or the <-->, <->, <++>, and <+> keys can be used to decrease or increase default or entered values of, for example, flow rate or time.

2. Times expressed as “hh:mm” or “hh:mm:ss” are edited as two or three separate sections.

3. Use the Arrow keys to move from one field to another.

4. To edit multiple parameters while remaining in the Edit Mode, use the arrow keys after making changes to move to other areas in the screen that need to be edited.

5. **To exit Edit Mode either <u>press <Enter> to save changes</u>** made, **or** press **<ESC> to exit Edit Mode without saving changes**.

3.0 FILTER EXCHANGE PROCEDURE AND SAMPLER OPERATIONS

Please enter date, time, technician name, name of any visitors, and purpose of visit in Site Notebook for any visit to the site.

It is also important to note in the Site Notebook and on the Partisol PM_{10} Field Form any unusual events that could influence particulate matter levels. These include forest fire smoke, high winds, local construction activity, etc.

3.1 Necessary Equipment

Clean Sample Filter loaded into a cassette and placed in Anti-static Protective Bag
Exposed Sample Filter Anti-static Protective Bag
Chain of Custody Form
Field Container
Daily/Weekly Checklist for Partisol FRM
Partisol FRM Field Form
Site Notebook
Writing Instrument

If this is the **First Run Go To Step 13 in Section 3.2**

3.2 Filter Exchange Procedure

1. Determine from the Main Screen whether the sampler is still in Sampling Mode (SAMP will appear in the upper right-hand corner of the screen if the sampler is still sampling.). The sampling must be completed before attempting to exchange the filter.

2. If the sampler is in the Done or Error Mode Press <F4: Run/Stp> on the sampler while in the Main Screen to return the sampler to Stop Mode.

   Note: Do not exchange filter cassettes if the sampler is not in Stop Mode. Return to the Stop Mode before exchanging the collection media.

   Note: If the sampler is in Error Mode note the status code (Section 2.2.1) on the Partisol FRM Field Form, Time Section of Filter Bag Label and Remarks section of Chain of Custody. For the Filter Bag Label note the total time from the sampler then the status code, i.e. 22:01 - F

3. Record the requested information, on the Partisol PM10 FRM Field Form (Figure 3), the chain of custody form (Figure 4), and the protective bag label (Figure 5) associated with the filter being retrieved.

   a. For the filter bag label this would usually include the volume sampled (Vol), the flow rate coefficient of variation (%CV), the total sampling time (Tot), the largest difference between the ambient and filter temperatures (TempDiff), and the status code (Stat).

4. Press <F3: Data> in the Main Screen to view the data for the removed filter in the Filter Data Screen (Section 10.0). Press <F2: ->, if necessary, to view the appropriate record of filter data.

5. When in the Filter Data Screen the power outage and filter ID information is available. The Power Outage data is also available in the Power Outages Screen (Section 11.2).

   NOTE: The information contained in the Filter Data Screen, Power Outages Screen and Interval Data Screen may be downloaded electronically into a laptop personal computer (PC) using software and a cable provided with the Partisol-FRM Sampler (Section 12.0).

6. Pull the handle of the filter exchange mechanism out to expose the filter.

7. Remove the filter and cassette by grasping the cassette. **Do not touch the filter!**

   Note: The filter must be removed from the sampler according to the filter exchange schedule prepared by Kleinfelder West, Inc.; this schedule is located in the site binder.

8. Assure that the cassette identification (ID) number corresponds to the cassette ID on the bag label and place the filter and cassette into the protective bag.

9. Place the bag containing the sample into a field container.

10. Fill out the appropriate sections on the Chain of Custody Form (Figure 4).

11. If a field blank is scheduled, perform the Field Blank procedure described in Section 4.0 of this document.

12. Perform daily/weekly/monthly checks and any other required maintenance, performance verification tests, calibrations, etc. before continuing to Step 12.

13. Assure the sampler is in Stop Mode. Remove a clean filter (in its associated cassette) from its protective bag and install in the filter exchange mechanism. Grasp only the cassette; the filter must never be touched.

14. Carefully close the filter exchange mechanism; do not slam.

15. Program the sampler following the instructions in Section 3.3.

16. Press <F4: Run/Stp> to place the sampler into the Wait Mode. The system resides in the Wait Mode until the user-defined starting time/date is achieved. At that time, the device will automatically enter the Sampling Mode and begins sample collection. If <F4: Run/Stp> is pressed in the Main Screen with the hardware in this mode the sampler will return to the Stop Mode. In order for sampling to begin as scheduled be sure the sampler is in the Wait Mode.

17. Close the sampler door and collect all sampling equipment.

18. In a secure location, place the exposed samples (in their associated protective bags) into the designated shipping container and store the shipping container in a safe place until shipped to the laboratory.

19. According to the schedule arranged with the laboratory, prepare the samples for shipment to the laboratory (Section 6.0). This includes carefully packing the samples in the shipping container. Once loaded, arrange for shipment of the container to the laboratory. Be sure a chain of custody form (Figure 4) is filled out and placed in the shipping container.

Partisol PM_{10} FRM Field Form

Site Name: _____ Filter ID: _____

Sampler ID #: _____ Sample Run Date: _____

Sample Setup

Technician Name: _____

Sample Setup Date: _____ Current Instrument Date: _____

Sample Setup Time: _____ Current Instrument Time: _____

Current Weather Conditions: _____

Notes: _____

Sample Retrieval

Technician Name: _____

Sample Retrieval Date: _____ Current Instrument Date: _____

Sample Retrieval Time: _____ Current Instrument Time: _____

Status Code (Stat): _____ Average Temperature (AmbT Ave): _____

Total Sampling Time (Tot): _____ Average Pressure (Pres Ave): _____

Volume Sampled (Vol): _____ Flow Rate Coefficient of Variation (%CV): _____

Current Weather Conditions: _____

Notes: _____

Field Blank

Note: Field Blank information should be recorded on Field Form for Retrieved Filter.

Field Blank procedure should be performed once a month at one site.

Filter ID: _____

Current Instrument Date: _____

Current Instrument Time: _____

Notes: _____

Figure 3: Example Field Form

Inter-Mountain Laboratories, Inc.
Sheridan, WY and Gillette, WY

- CHAIN OF CUSTODY RECORD -

This is a LEGAL DOCUMENT. All shaded fields must be completed. # 119067

Client Name	Project Identification	Sampler (Signature/Printed)	Telephone #

Report Address	Contact Name and Email	ANALYSES / PARAMETERS
	Voice	
Invoice Address	FAX	
	Purchase Order # / Quote #	

ITEM	LAB ID (Lab Use Only)	DATE SAMPLED	TIME	SAMPLE IDENTIFICATION	Matrix	# of Containers								REMARKS
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														

LAB COMMENTS	Relinquished By (Signature/Printed)	DATE	TIME	Received By (Signature/Printed)	DATE	TIME

SHIPPING INFO	MATRIX CODES		TURN AROUND TIMES	COMPLIANCE INFORMATION		ADDITIONAL REMARKS
☐ UPS	Water	WT	Check desired service	Compliance Monitoring ?	Y / N	
☐ Fed Express	Soil	SL	☐ Standard turnaround	Program (SDWA, NPDES, ...)		
☐ US Mail	Solid	SD	☐ RUSH - 5 Working Days	PWSID / Permit #		
☐ Hand Carried	Trip Blank	TB	☐ URGENT - < 2 Working Days	Chlorinated?	Y / N	
☐ Other_____	Other	OT	*Rush & Urgent Surcharges will be applied*	Sample Disposal: Lab ____	Client ____	

INTER-MOUNTAIN LABORATORIES, INC. *Rev 4.3*

Figure 4: Example of Inter-Mountain Laboratories Chain of Custody Form

Facility: **Pinon Ridge TMF**

Sampler ID: _____

Sample Date: _____ Std. Vol: _____

Valid Time: _____ Act. Vol: _____

Avg.Temp: _____ Avg.Press: _____

Filter ID: _____

Figure 5: Example of Inter-Mountain Laboratories Filter Bag Label

3.3 Programming the Sampler for a Run Day

1. If the sampler is still sampling, allow completion of the sampling period. If the sampling was completed successfully the sampler will be in Done Mode.

   If an error occurred during sampling the sampler will be in Error Mode.

   If the sampler is not in the Stop Mode, press <F4: Run/Stp> in the Main Screen to enter the Stop Mode.

   Upon entering Stop Mode from one of its operational modes (Wait, Sampling, Done, and Error) the information for each exposed filter is recorded in the filter storage buffer.

2. Press the <ESC> key to return to the Main Screen, then <F1: FiltSet> to enter the **Filter Setup Screen** (Figure 6).

```
Stat:Ok        Filter Setup      Mode:SAMP
      Current Time: 19.36 96/11/07
Start Time:  0.00      End Time:  0.00
Start Date: 96/11/07  End Date: 96/11/08
  Set Flow: 16.7 l/min
ID1: "96                                "
ID2: "00154                             "
```

Edit	Next Hr	NextDay	+ Day	Set Def	
Function Keys in Browse Mode					
Edit	Next Hr	NextDay	+ Day	Set Def	
Function Keys in Edit Mode					
--	-	+	++	Bksp	>
		<--	-->	Bksp	<

Figure 6: Filter Setup Screen

Set-up for the First Run Day:

3. The necessary parameters to change would be the Current Time, Current Date, Start Time, End Time, Start Date, End Date, Set Flow, ID1, and ID2.

4. To change the parameters press <F1: Edit> while in the Filter Setup Screen (Figure 6).

5. Then, Press <SHIFT> and use the <F1: <-- > and <F2: --> > keys to move the editing cursor to make changes to the necessary parameters.

6. **Note:** New numbers entered by the user overwrite any character that already resides in the current cursor position.

7. **Note:** Time is hh.mm, with 0 representing midnight, and date is yy/mm/dd

8. **Note:** To sample for an entire 24-hour period starting at midnight, enter 0 for both the Start Time and End Time parameters, and successive days for Start Date and End Date.

   For example, to sample during the entire day of 13 March 2008, enter 08/03/13 as the Start Date and 08/03/14 as for the End Date. Both the Start Time and End Time settings would be 0 in this case.

9. Press <ENTER> to save changes.

10. Press <ESC> to return to the Main Screen. Then press <F4: Run/Stp> to put the sampler in Wait Mode. Sampling will begin at the Start Time defined by the user.

    After the very first sample has been collected and the operator is setting the instrument up for subsequent samples the following steps simplify the programming for subsequent run days.

Setup for the Next Run Day:

11. Press <F3: Next Day>, while in the Filter Setup Screen to change the Start Time, Start Date, End Time and End Date parameters to match the sampling period according to the Def Start and Def Dur parameters in the Setup Screen (Section 2.2 Step 4).

12. This will only advance the Start Date and End Date by one day. In order to reach the appropriate Start Date and End Date Press <F4: +Day> this will increment the Start Date and End Date by one day, continue to press <F4: +Day> until the sampler arrives at the desired Start Date/End Date.

13. Press <ESC> to return to the Main Screen. Then press <F4: Run/Stp> to put the sampler in Wait Mode. Sampling will begin at the Start Time defined by the user.

4.0 FIELD BLANK

4.1 Necessary Equipment

Clean filter loaded into a cassette and placed in anti-static protective bag
Chain of Custody Form
Field Container
Partisol FRM Field Form
Site Notebook
Writing Instrument

4.2 Frequency

Inter-Mountain Laboratories will send one extra filter per month to be used for a Field Blank for quality control purposes. This will allow for one Field Blank per month, three Field Blanks per quarter. The Field Blank procedure should alternate each month between the samplers following a specified schedule, provided on the filter exchange calendar, located in the site binder.

4.3 Field Blank Procedure

1. Remove a clean filter from its protective bag, grasping only the cassette. **Do Not Touch the Filter!**

2. Place the filter and cassette into the filter exchange mechanism and close.

3. Record the sample date and sampler serial number on the protective bag label, plainly write “Field Blank” on the bag label.

4. Record requested information for the Field Blank in the “Field Blank” section on Partisol PM_{10} Field Form for the Retrieved Filter.

5. Open the filter exchange mechanism and remove the filter, grasping only the cassette.

6. Place the filter and cassette into its original protective bag.

7. Return the Field Blank to the laboratory following the same procedure as used for sample filters.

8. Fill out the appropriate sections on the Chain of Custody Form (Figure 4).

5.0 SHIPPING AND RECEIVING

Follow these steps for shipping and receiving of filters for the Partisol PM_{10} samplers:

5.1 Receiving

Shipments will be sent from Inter-Mountain Laboratories during the first week of the month preceding each calendar quarter. For example, the June - July - August quarter filters will be shipped to EFR during the first week of May.

1. Check the Chain of Custody Sheet included with the shipment to be sure that the appropriate filters have been received and shipment is intact.

2. Place shipping container in a secure location until filters are needed for field deployment.

5.2 Field Sheet Tracking

Copies of Field Sheets for Kleinfelder may be scanned and saved as PDF documents, and e-mailed to the appropriate Kleinfelder personnel instead of creating a hard copy.

1. **Partisol PM_{10} Field Form:** Two copies should be made of the Partisol PM_{10} Field Form associated with the filters to be shipped. One copy should be shipped with the filters, and one copy sent to the appropriate Kleinfelder personnel. The originals should be filed at the EFR site office.

2. **Chain of Custody Form** Two copies should be made of the IML Chain of Custody Form. One copy should be filed at the EFR site office, and one copy

should be sent to the appropriate Kleinfelder personnel. The original Chain of Custody Form should be shipped to IML with the PM_{10} filters.

3. **Checklists and Maintenance and Calibration Forms:** One copy should be made of all Checklists, Maintenance, and Calibration Forms. These copies should be sent to the appropriate Kleinfelder personnel. The originals should be filed at the EFR site office.

5.3 Shipping

Shipments will be made by EFR to Inter-Mountain Laboratories following the last sample of each month. For example, for the month of May 2008, samples should be prepared for shipment following the retrieval of the May 30, 2008 sample.

1. Check Filter Bag Labels for completeness.

2. Be sure that the Chain of Custody Sheet is filled out with necessary information.

3. Check shipping container to be sure all filters that are on the Chain of Custody Sheet are in the shipping container.

4. Prior to shipping, follow the Field Sheet Tracking Procedure (Section 5.2).

5. Place Chain of Custody Sheet and copies of field forms in shipping container.

6. Seal shipping container.

7. Complete shipping label and affix to shipping container.

8. Contact appropriate shipping company for pick up.

6.0 DAILY/WEEKLY INSTRUMENT CHECKS

Daily Instrument Checks for the Partisol PM_{10} Sampler are only required if operating the Partisol PM_{10} Sampler on a daily basis. For 1-in-6-day operations, these checks should be completed on the run day and also with the weekly procedures, or on a volunteer basis if daily checks are more frequent.

6.1 Necessary Equipment

Timepiece
Daily/Weekly Checklist for Partisol FRM
Site Notebook
Writing Instrument

6.2 Daily Check Procedure

1. Record all information requested on the Daily/Weekly Checklist for Partisol FRM (Figure 7).

2. Confirm that the correct time, date and set flow rate are displayed on the Setup Screen. If the correct time, date and set flow rate are not displayed, reset the sampler by pressing <F1: Edit>, then enter the correct data using the keypad. Press <ENTER> to Save changes.

   Note: The Set Flow Rate should be: 16.7 L/min.

3. Perform a visual inspection of the instrument, and note any damages that may affect sampler operation. If needed contact appropriate personnel for next steps; the contact list is located in the site binder.

Daily - Weekly Checklist for Partisol PM_{10} Sampler

Site Name:
Sampler ID #:
Sampler Serial #:
Sample Run Date:

Filter Information
Filter #:
Sample Setup Date:
Sample Retrieval Date:

Daily Instrument Checks

Daily Instrument Checks for the Partisol PM_{10} Sampler are only required if operating the Partisol PM_{10} Sampler on a daily basis. For 1/6 day operations, these checks should be completed on the run day and also with the weekly procedures or on a volunteer basis if daily checks are more frequent.

Sampler Operation

Date														
Time														
Technician Name														
Is sampler running?	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
If No, is filter exchange required?	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
If Yes, filter exchange is required - Go To Visual Check of Sampler then proceed to Weekly Filter Exchange														
If No, filter exchange is not required, continue with visual sampler checks, then other site activities.														
If No, sampler is not running - is this a sample run day?	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
If Yes, this is a run day and sampler is not running, check instrument for power outage information & contact appropriate personnel for next steps; see contact list in site binder.														

Visual Check of Sampler

Is sampler level and securely mounted?	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Any visible damage to sampler?	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
If Yes, the sampler is damaged, contact appropriate personnel; see contact list in site binder.														

Weekly Instrument Checks and Filter Exchange

Date: Time: Technician Name:

Perform Daily Check Procedure		
Filter Exchange Day?	Yes	No
Is rain catch intact?	Yes	No
Is rain catch empty?	Yes	No

→ If No, detach from sampler and empty.

If Yes --	Remove exposed filter cartridge from sampler	
	Place sample in protective bag	
	Place sample in field container	
	Record requested information from sampler on Partisol Field Form & Filter Bag Label	

If No - - Finish other site activities

Before placing clean sample filter

Is a Monthly Check scheduled?	Yes	No
If Yes - Perform Monthly Check Procedure		
If No - Continue with Filter Exchange Procedure		

Is Field Blank Scheduled?	Yes	No
If Yes - Perform Field Blank Procedure		
If No - Continue with filter exchange procedure		

Prepare for next run --	Remove new filter cartridge from field container	
	Remove filter cartridge from protective bag	
	Install filter cartridge in sampler	
	Program sampler for next run day	
	Record requested information on Partisol Field Form, Filter Bag Label, & COC	

Notes: Please note any unusual events that could influence particulate matter levels. These include forest fire smoke, high winds, local construction activity, etc.

Figure 7: Example Daily/Weekly Checklist for Partisol Sampler.

6.3 Weekly Check Procedure

1. Perform Daily Check Procedure.

2. After retrieving the exposed filter (Filter Exchange Procedure 3.2), check that the rain catch is intact and emptied. If the jar contains water, loosen and empty (Figure 8).

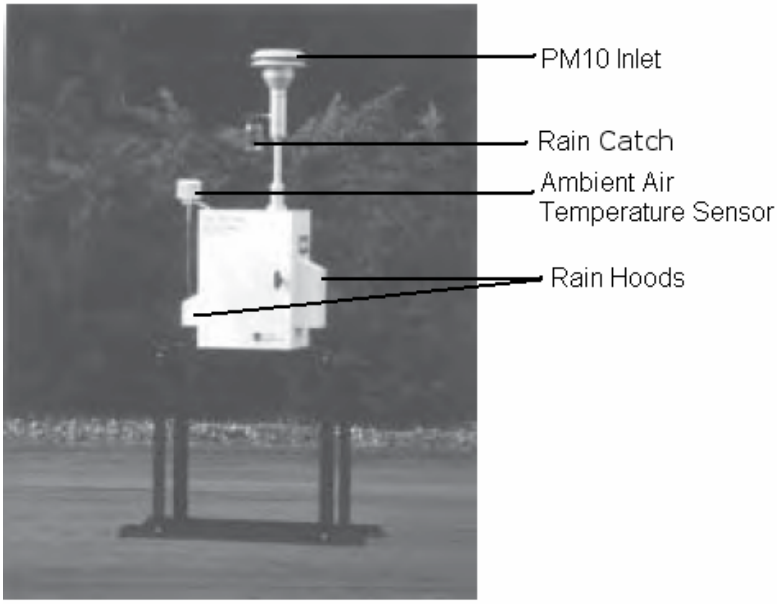

Figure 8: Diagram of Partisol FRM Sampler.

3. Return to Filter Exchange Procedure (Section 3.2) to setup for next run day.

7.0 MONTHLY VERIFICATION OF SAMPLER TEMPERATURE, PRESSURE AND FLOW RATE

7.1 Necessary Equipment

Streamline Pro MultiCal System
Insulating cover for Streamline Pro MultiCal System
2 filter cassettes, one loaded with a filter, one loaded with a solid disk
Timepiece
Field Container
Site Notebook
Inspection and Maintenance Checklist for Partisol FRM
Partisol FRM Monthly Verification/Maintenance Form
Writing Instrument
Calculator
Spare Batteries – AA

7.2 Verification Specifications

1. Verification Specifications are as follows:

Ambient Temperature	± 2°C
Filter Temperature	± 2°C
Barometric Pressure	± 10 mmHg
Flow Rate	± 4% (0.66 L/min)

2. If a sensor fails to meet verification specifications, a calibration is performed (Section 10.0)

3. The verification procedure includes external and internal leak tests, and is often performed in conjunction with sampler inspection and maintenance (Section 8.0).

7.3 Performance Verification

This is best performed after collecting the sample, but before setting the instrument for the following sample day. While performing the monthly sampler inspection and maintenance, make sure to record all information requested.

1. Record all information requested on both the Partisol PM_{10} FRM Monthly Verification/Maintenance Form (Figure 9) and the Inspection and Maintenance Checklist Form (Figure 10). Be sure to record the sampler ID, date and time, technician, serial numbers of standards, and instrument calibration values on the Partisol FRM Monthly Verification/Maintenance Form (Figure 9).

2. Check the date and time displayed by the sampler on the Main Screen against the timepiece. The instrument time will be in Mountain Standard Time year round.

3. Place instrument in Stop Mode by pressing <F4: Run/Stop>, while in the Main Screen.

4. Carefully remove the sample filter from the instrument (Filter Exchange procedure Section 3.2) and place it in the Field Container.

5. Install a filter cassette loaded with a clean filter. **Do not use a filter that has been prepared for a sample.**

Partisol PM_{10} FRM Monthly Verification/Maintenance

Site Name:
Date:
Time:
Technician Name:
Sampler ID #:
Streamline Pro cal. expires:
Streamline Pro Control Unit S/N:
Streamline Pro Measurement Unit S/N:

As-Found Calibration Values

Parameter	Offset	Span
A/I		
Amb. T		
Filter T		
Pressure		
Flow		

Condition of Instrument:

Sensors Verification

Sensor	Indicated	Actual	Difference	Specification
Amb. T				+/- ˚C verification, +/- 2 ˚C audit
Filter T				+/- ˚C verification, +/- 2 ˚C audit
Pressure				+/- 10 mmHG
Flow				16.7 L/min +/- 4.0% (+/- 0.66 l/min)

Pressure Conversion: multiply atm value from Streamline Pro Multical by 760.0 mmHg

External Leak Check: Pass / Fail

Internal Leak Check: Pass / Fail

Initial Vacuum {inches Hg}	Final Vacuum {inches Hg}

(< 8.5" Hg / 30 sec.)

Maintenance

Maintenance procedures can be found in Section 9.0 of the SOP.

Inspect & clean 1st Stage inlet:	Yes	No
Inspect seals on PM_{10} Inlet	Yes	No
Replace inlet seal?	Yes	No

Inspect cassette seals, any replaced?	Yes	No
If Yes, please circle	**Upper**	**Lower**

Other monthly checks can be found on the Partisol PM_{10} Inspection and Maintenance Checklist.

If any seals, fittings, or other flow-related parts were replaced, verify that the sampler is leak tight and operating at 16.7 liters/min.

External Leak Check: Pass / Fail

Internal Leak Check: Pass / Fail

Initial Vacuum {inches Hg}	Final Vacuum {inches Hg}

(< 8.5" Hg / 30 sec.)

	indicated	actual
post-service flow check		

Notes:

Figure 9: Partisol PM_{10} FRM Monthly Verification/Maintenance Form

Inspection and Maintenance Checklist for Partisol PM_{10} Sampler

Site Name: _____
Date: _____
Time: _____
Technician Name: _____
Sampler ID #: _____
Sampler Serial #: _____

Monthly Instrument Checks and Verification

Perform Daily and/or Weekly Checks

Time and Date on sampler correct?	Yes	No	Inspect seals on PM_{10} Inlet			Inspect cassette seals		
Disassemble PM_{10} Inlet			Replace inlet seal?	Yes	No	Replace cassette seals?	Yes	No
Wipe out impaction area with clean cloth			Clean -OR- Replace air screens located under sampler rain hoods					

Follow SOP procedures to perform the following verifications for the sampler.

If any of the sensors fails verification calibrate failed sensor following SOP for calibrations and perform verification procedure.

Verify Ambient Temperature		Verify Filter Temperature		Verify Barometric Pressure	
Verify Sampler Flow Rate		External Leak Check		Internal Leak Check	

Semi-Annual

Note: Semi-Annual is once every six months.

Perform Monthly Checks

The following inspections will be performed every other quarter along with calibration procedures performed by Inter-Mountain Laboratories.

Inspect inline filter (and replace as needed or once a year)			Inspect tubing and connections		
Replace inline filter?	Yes	No	Replace tubing or connections?	Yes	No
Check voltage of battery on control board					

Notes: _____

Figure 10: Example Inspection and Maintenance Checklist Form for Partisol PM_{10} Sampler

6. Remove the PM_{10} inlet from the end of the sample tube following the steps in Section 9.0, and set aside.

7. Using the provided cord connect the Streamline Pro MultiCal System Control Unit to the Measurement Unit.

8. Place the insulating cover around the Measurement Unit.

9. Turn the Streamline Pro MultiCal System On.

10. Place the Measurement Unit for the Streamline Pro MultiCal System onto the end of the inlet tube on the sampler.

Figure 11: Streamline Pro MultiCal System Installed on Inlet Tube, without insulating cover.

11. Access the **Audit Screen** (Figure 12) on the sampler's display by going into the Setup Screen. This is done by hitting <F5: Setup> while in the Main Screen, then <F5: Audit> from the Setup Screen to enter the Audit Screen.

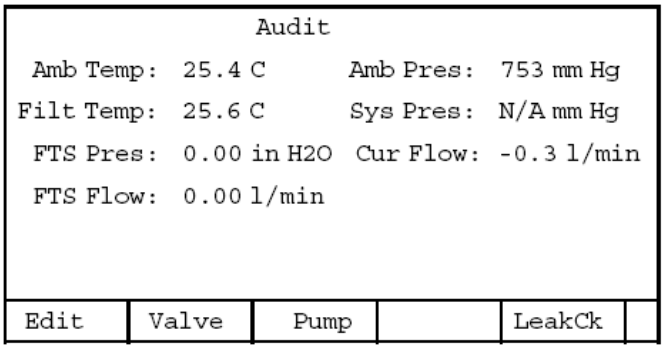

Figure 12: Audit Screen

12. Perform sensor verification procedures for Ambient Temperature (Section 7.3.1), Filter Temperature (Section 7.3.2), Barometric Pressure (Section 7.3.3), and Flow Rate (Section 7.3.4).

13. If any component is replaced during the maintenance procedure, perform External and Internal Leak Checks (Sections 8.4 and 8.5 respectively) and record the results. Also re-perform flow rate verification (Section 7.3.4). External and Internal Leak Checks are also a monthly maintenance requirement, however, it is important to perform these checks after any component is replaced.

14. Restore the sampler to operational condition after performing all three of the verification procedures, and perform the monthly (and if needed the semi-annual) inspection and maintenance procedure (Section 8.0).

7.3.1 Ambient Temperature Verification Procedure

1. Record the Remote Temp reading from the Streamline Pro MultiCal System in the Actual Column for AmbT of the Partisol PM_{10} FRM Monthly Verification/Maintenance Form.

2. Record the ambient temperature (Amb Temp) indicated by the sampler on the Audit Screen in the Indicated column for AmbT of the Partisol PM_{10} FRM Monthly Verification/Maintenance Form.

3. Compute the difference of the two readings and record. If the difference is greater than ± 2°C, perform a calibration of the ambient temperature sensor (Section 10.2.1) following the completion of the entire verification procedure.

7.3.2 Filter Temperature Verification Procedure

1. Record the Tflow reading from the Streamline Pro MultiCal System in the Actual Column for Filter T of the Partisol PM_{10} FRM Monthly Verification/Maintenance Form.

2. Record the ambient temperature (Filt Temp) indicated by the sampler on the Audit Screen in the Indicated column for Filter T of the Partisol PM_{10} FRM Monthly Verification/Maintenance Form.

3. Compute the difference of the two readings and record. If the difference is greater than ± 2°C, perform a calibration of the filter temperature sensor (Section 10.2.1) following the completion of the entire verification procedure.

7.3.3 Barometric Pressure Verification Procedure

1. Make note of the barometric pressure (Amb Pres) from the Streamline Pro MultiCal System and use calculator to convert to mm Hg by multiplying by 760. Record the pressure in mmHg in the Actual Column for Pressure on the Partisol PM_{10} FRM Monthly Verification/Maintenance Form.

2. Record the pressure (Amb Pres) reading indicated by the sampler on the Audit Screen in the Indicated column for Pressure on the Partisol PM_{10} FRM Monthly Verification/Maintenance Form.

3. Compute the difference of the two readings and record. If the difference is greater than ± 10 mmHg, perform a calibration of the barometric pressure sensor (Section 10.2.2) following the completion of the entire verification procedure.

7.3.4 Flow Rate Verification Procedure

1. Establish flow by pressing <F3: Pump> and <F2: Valve> as indicated on the Audit Screen. Allow the flow rate indication on the sampler and the pressure drop indication on the Streamline Pro MultiCal System to stabilize.

2. The Flow reading from the Streamline Pro MultiCal System will be in Actual conditions; however, because the sampler is set to log in standard

conditions the flow rate from the Streamline Pro Multical system will need to be converted using the following method.

Determine the actual flow in units of liters per minute (l/min) using the external flow device.

The Partisol FRM 2000 is capable of logging the flow rate in either standard or actual conditions. The FRM 2000 will be set to log data in standard conditions. Conversions from both actual to standard and standard to actual are listed below.

Converting from standard to actual flow is performed as follows:

$$Qa = Qstd \times \frac{760}{Pa} \times \frac{Ta}{298.15}$$

Converting from actual to standard flow is performed as follows:

$$Qstd = Qa \times \frac{298.15}{Ta} \times \frac{Pa}{760}$$

Where:

Qa = Actual flow
Qstd = Standard flow
Ta = Ambient temperature in °K. The sampler will give temperature in °C; to convert use the following formula: Ta {°K} = T {°C} +273.15
Pa = Ambient barometric pressure in mmHg

3. Record the converted flow rate from the Streamline Pro MultiCal System in the Actual column for Flow on the Partisol PM_{10} FRM Monthly Verification/Maintenance Form.

4. Record the flow rate (Cur Flow) indicated by the sampler in the Indicated column of the Partisol PM_{10} FRM Monthly Verification/Maintenance Form.

5. Compute the difference between the indicated and actual flow rates and record on the verification form. If the difference is greater than ±4%, perform a calibration of the flow rate measurement system following the completion of the entire verification procedure.

6. Return to the Main Screen by pressing the <ESC> key twice.

7. Remove the flow metering hardware.

8. Install the PM_{10} inlet onto the end of the sample tube.

9. Return the sampler to operation condition.

8.0 ROUTINE INSPECTION AND MAINTENANCE

8.1 Necessary Equipment

Timepiece
Paper Towels or Wipes
Isopropyl Alcohol
Inspection and Maintenance Checklist for Partisol FRM
Partisol FRM Monthly Verification/Maintenance Form
Leak Check Valve
Digital Multimeter
Extra Inline Filter
Non-sample Filter
Leak Check Disk
Site Notebook
Writing instrument

8.2 Monthly Sampler Inspection and Maintenance Procedure

While performing any monthly sampler inspection and maintenance procedures, record all information requested on the Inspection and Maintenance Checklist for Partisol PM_{10} FRM (Figure 10) and the Partisol PM_{10} FRM Monthly Verification/Maintenance Form (Figure 9).

1. Ensure the instrument is in Stop Mode (Press <F4: Run/Stp> in the Main Screen).

2. Check the date and time displayed on the sampler against the time piece.

3. Carefully remove the sample filter from the instrument and place in its protective container (Filter Exchange Procedure in Section 3.2).

4. Disassemble the PM_{10} inlet (Section 9.0), wipe out the impaction area, and empty any water from the rain catch.

5. Inspect seals on the PM_{10} inlet and the cassette seals. Replace any O-rings that show signs of wear or degradation.

6. If any component is replaced, perform external leak check (Section 8.4) and internal leak check (Section 8.5) and record the results. Also perform flow rate verification (Section 7.3.4).

7. When finished, restore the sampler to operational mode.

8.3 Semi-Annual Sampler Inspection and Maintenance Procedure

1. Place the instrument in Stop Mode (Press <F4: Run/Stp> in the Main Screen).

2. Check the date and time displayed by the sampler on the Main Screen against the timepiece.

3. Carefully remove the sample filter from the instrument and place in its protective container (Filter Exchange Procedure in Section 3.2).

4. Inspect the in-line filter. Replace if it is showing signs of excessive loading or if the in-line filter if it hasn't been replaced within the previous twelve months.

5. Inspect all tubing, connectors, and seals. Repair or replace any components that appear loose or damaged.

6. Check the voltage of the battery on the control board with a multimeter.

   a. Measure the voltage across the ground ("GND") test point in the center of the interface board and the top surface of the round battery on the computer board. This voltage should be at least 2.5 VDC.

   Note: If the voltage is less than 2.5V, replace the battery.

7. Clean or replace the air screens located under the sampler's rain hoods.

8. Thoroughly clean the filter exchange mechanism and chamber with a damp cloth or wipes.

9. Turn the pump on and off several times, listening for signs of bearing wear or other potential problems. Replace or repair the pump as needed.

10. If any component is replaced, perform external leak check (Section 8.4) and internal leak check (Section 8.5) and record the results. Also perform flow rate verification (Section 7.3.4).

11. When finished, restore the sampler to operational condition.

8.4 Performing an External Leak Check

1. Place the instrument in Stop Mode (Press <F4: Run/Stp> in the Main Screen).

2. Carefully remove the sample filter from the instrument and place in its protective bag (Filter Exchange Procedure in Section 3.2).

3. When in the Setup Screen press <F5: Audit> to display the Audit Screen.

4. Remove the PM_{10} inlet from the sampler following procedures in Section 9.0.

5. Install a filter cassette containing a clean filter. **Do not use a filter that has been prepared for a sample.**

6. Install the leak check valve onto the end of the sample tube of the sampler. Ensure that the valve is in the open position.

7. Press <F5: LeakCK> function key.

8. Press the <ENTER> key.

9. Turn the valve to its closed position.

10. Press the <ENTER> key.

11. Shut off the flow to the flow controller assembly by turning the manual shut-off valve that is attached to the large air filter on the left-hand side of the manifold in the hub. Note: This valve is found on the upper left-hand side of the hub and is labeled A in Figure 13.

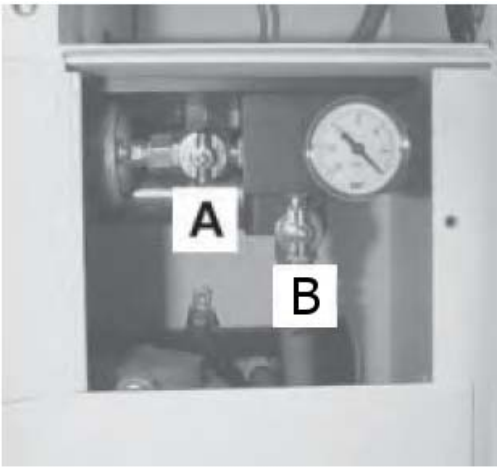

Figure 13: Manual Shut-off Valves: where “A” is the flow controller assembly valve and “B” is the pump manual valve.

12. Press the <ENTER> key. The system will now pull a vacuum and begin a 30 second leak check cycle. At the end of the cycle, a “Leak Check Pass” or “Leak Check Fail” message will display on the screen. If the check fails, the unit will display the actual measure of vacuum loss, Go to Step 13. If the leak check passes go to step 15.

13. Record the leak check information on the form provided.

14. Replace the filter cassette with a new filter and repeat the leak check procedure.

15. Open the flow controller manual valve.

16. Slowly open the leak check valve.

17. Proceed to Section 8.5 Performing an Internal Leak Check.

8.5 Performing an Internal Leak Check

1. Clean a filter cassette with a clean cloth and isopropyl alcohol to remove any oil or other material.

2. Insert a leak check disk into the filter cassette.

3. Install the filter cassette into the sampler and push on the handle to move the filter cassette into the sampling position.

4. When in the Setup Screen, press <F5: Audit> to display Audit Screen.

5. Press <F2: Valve>

6. Press <F3: Pump>

7. Shut off the flow to the flow controller assembly by turning the manual shut-off valve that is attached to the large air filter on the left-hand side of the hub; this corresponds to location “A” in Figure 13.

8. Record the initial reading from the vacuum gauge on the Partisol FRM Monthly Verification/Maintenance form.

9. Shut off the flow to the pump by turning the other manual shut-off valve (pump manual valve) located on the bottom of the manifold in the hub; this corresponds to location “B” in Figure 13.

10. Press <F3: Pump>

11. After 30 seconds record the reading on the vacuum gauge (final reading) on the Partisol FRM Monthly Verification/Maintenance form.

    Note: This reading should not drop by more than 8.5 inches Hg during this 30 second period. This corresponds to a leak of 80 ml/min. If the reading does drop by more than 8.5 inches Hg during this 30 second period, trace the internal flow paths to identify problems in tubing or connections.

12. Press <F2: Valve>

13. Open the flow controller manual valve and pump manual valve that you previously closed.

14. Slowly open the valve of the flow audit adapter (Figure 14).

Figure 14: Flow Audit Adapter

15. Remove the leak check valve from the end of the sample tube.

16. Install the PM_{10} inlet onto the end of the sample tube.

17. Remove the leak check disk/filter cassette assembly.

10. Return to the Main Screen by pressing the <ESC> key twice.

9.0 INLET MAINTENANCE

This section contains the maintenance procedures for the PM_{10} inlet.

9.1 Necessary Equipment

Recommended Supplies for Maintenance:

- Isopropyl Alcohol or ammonia-based, general-purpose cleaner
- Cotton swabs
- Small soft-bristle brush
- Paper towels
- Distilled water
- Silicone-based, stopcock grease
- Writing Instrument

Recommended Tools for Maintenance:

- Small Philips-blade screwdriver
- Small crescent wrench
- Pocket knife

Maintenance Frequency

Inlet Cleaning will be performed monthly.

9.2 Removing the PM_{10} Inlet

Follow these steps to remove the PM_{10} inlet (Figure 15) from the sampler:

1. Lift the PM_{10} inlet upward off the aluminum sample inlet tube.

2. Disassemble the upper and lower inlet halves by unscrewing counterclockwise the top acceleration assembly from the lower collector assembly.

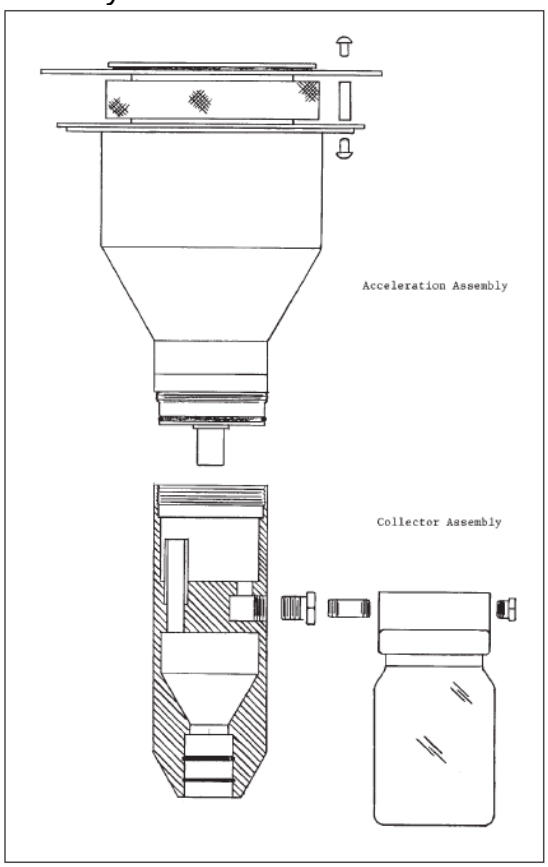

Figure 15: PM_{10} Inlet

9.3 Maintaining the Acceleration Assembly

Follow these steps to maintain the top acceleration assembly (Figure 15):

1. Mark the top plate deflector cone and lower plate with a pencil scribe to indicate proper orientation for easier reassembly after cleaning and maintenance.

2. Using a Philips-blade screwdriver, remove the four pan head screws from the top of the top plate, and lift the top plate off the four threaded spacer standoffs and set aside.

3. Inspect the insect screen for contamination and clean by lifting the screen off the lower plate rain deflector and brush or rinse with water until clean. Dry and reinstall.

4. Using a general-purpose cleaner and paper towel, clean the top plate deflector cone and internal wall surface of the acceleration assembly.

Note: Be sure that after cleaning the acceleration nozzle is clean. If not, use a cotton swab and cleaner to remove contamination.

5. Inspect the large diameter impactor nozzle O-ring for wear. Replace, if necessary, or using a light coating of silicone grease, apply a thin film on the O-

ring itself, and likewise a light coating on the aluminum threads of the acceleration assembly.

6. After reinstalling the insect screen, align the top plate markings with the lower plate markings. The four holes in the top plate should align with the four spacer standoffs. Insert and securely tighten the four pan-head screws.

9.4 Maintaining the Lower Collector Assembly

Follow these steps to maintain the lower collector assembly (Figure 15):

Note: Most of the contamination in the inlet generally will be found on the collector plate.

1. Using a general-purpose cleaner with a paper towel, clean the collector assembly walls and three vent tubes. You may need to use a cotton swab to clean the vent tubes.

2. Clean the bottom side of the collector assembly.

3. Using a cotton swab, clean the weep hole in the collector plate where the moisture runs into the rain catch.

4. Remove the rain catch jar and clean it.

5. Inspect the brass nipple fitting on the rain catch to ensure tightness and non-blockage.

6. Place a light coating of silicone grease on the cork gasket inside the cap of the rain catch.

7. Reinstall the rain catch jar onto the lower collector assembly.

8. Inspect the two inlet-to-inlet tube sealing O-rings for wear. Replace if necessary.

9. Place a light coating of silicone grease on the two inlet-to-inlet tube sealing O-rings to ensure that a proper seal is made when the PM_{10} inlet is reinstalled on the sample inlet tube.

10. Clean the threads on the top and bottom inlet assemblies.

11. Reassemble the top and bottom inlet assemblies until the threads tighten. Hand-tighten only.

12. Place the PM_{10} inlet back on top of the sample inlet tube. Take care not to damage the internal O-rings.

    Note: For further information or parts, please contact Kleinfelder personnel.

10.0 CALIBRATION PROCEDURES

10.1 Necessary Equipment

Temperature standard with current NIST traceable certification (Streamline Pro MultiCal System)
Barometric pressure standard (altimeter) with current NIST traceable certification (Streamline Pro MultiCal System)
Flow transfer standard (FTS) with current NIST traceable certification manometer with at least 10 inches of water range (Streamline Pro MultiCal System)
Flow audit adaptor or other inlet-sealing device
2 filter cassettes, one loaded with a filter, one loaded with solid disk
Partisol FRM Multi-Point Verification/Calibration Form
Digital Multimeter with 4 Digit Resolution
Analog Input Calibration Plug
Writing instrument

10.2 Sampler Calibration Procedure

While performing any of the following Calibrations record all information requested on the Partisol FRM Multi-point Verification/Calibration Form (Figure 16).

1. Place the instrument in Stop Mode.

2. Carefully remove the sample filter from the instrument (Filter Exchange Procedure 3.2).

3. Access the Calibration Screen. From the Main Screen, press <F5: Setup> and then <F2: Calib> to display the Calibration Screen.

4. Remove the PM_{10} inlet from the end of the sample tube (Section 9.0).

5. Calibrate the temperature sensors, ambient pressure, flow rate, the interface board, and the analog input, as prescribed, per the procedures outlined in Sections 10.2.1 through 10.2.6.

6. After completing calibration procedures install PM_{10} inlet onto end of the sample tube.

7. Restore the sampler to operational condition after performing procedures.

Partisol FRM Multi- Point Verification/Calibration

Site Name: _____

Date: _____

Time: _____

Technician Name: _____

Streamline FTS ID: _____

Streamline FTS cal. expires: _____

Streamline FTS "m": _____

Streamline FTS "b": _____

Sampler ID #: _____

As-Found Calibration Values

Parameter	Offset	Span
A/I		
Amb. T		
Filter T		
Pressure		
Flow		

Notes Instrument As Found: _____

Calibration

(before calibrating, be sure all sampler maintenance is completed, sampler is leak tight)

Perform calibrations, record raw sampler calibration values.

If any parameters require hardware calibration, perform those first, then re-calibrate ALL sensors.

Post Calibration Values

Parameter	Offset	Span
A/I		
Amb. T		
Filter T		
Pressure		
Flow		

Perform a post-calibration flow rate check

	indicated	actual
post-service flow check		

Notes: _____

Figure 16: Multi-point verification and calibration form

10.2.1 Temperature Sensors Calibration

1. The sampler must be in Stop Operating Mode to perform an ambient and filter temperature calibration.

2. When in the Main Screen, press <F5: Setup> and <F2: Calib> to display the Calibration Screen.

3. Determine the current temperature at the ambient temperature sensor using an external thermometer.

4. Press <F1: Edit> to enter the Edit Mode, and move the cursor to the row labeled “AmbT” under the “Act” (actual) column.

5. Enter the current ambient temperature and press the <ENTER> key. If necessary, use the <F6: +/-> key to enter negative temperatures when in the Edit Mode.

6. Upon receiving the actual temperature, the sampler’s microprocessor automatically computes the “Span” value for the ambient temperature. Record the new “Span” value.

7. Determine the current temperature at the location of the sample filter using an external thermometer.

8. Press <F1: Edit> to enter the Edit Mode, and move the cursor to the row labeled “FltT” under the “Act” (actual) column.

9. Enter the current filter temperature and press the <ENTER> key. If necessary, use the <F6: +/-> key to enter negative temperatures when in the Edit Mode.

10. Upon receiving the actual temperature, the sampler’s microprocessor automatically computes the “Span” value for the filter temperature. Record the new “Span” value.

10.2.2 Ambient Pressure Calibration

1. When in the Main Screen, press <F5: Setup> and <F2: Calib> to display the Calibration Screen. The sampler must be the Stop Mode to perform an ambient pressure calibration.

2. Determine the current ambient pressure in mm Hg.

3. Press <F1: Edit> to enter the Edit Mode, and move the cursor to the row labeled “Pres” under the “Act” (actual) column.

4. Enter the current ambient pressure and press the <ENTER> key.

5. Upon receiving the actual pressure, the sampler's microprocessor automatically computes the "Span" value for the ambient pressure. Record the new "Span" value.

10.2.3 Five Point Flow Rate Calibration

1. At the Main Screen make sure the sampler is in the Stop Mode before continuing with the calibration.

2. Remove PM_{10} inlet from the sampler (Section 9.0), and install the flow audit adapter (FTS).

3. Install calibration filter cassette. This filter should be discarded following the completion of this flow calibration.

4. Press the <F5: Setup> button, the <F2: Calib> button, and then the <F2: FlowCal> button to display the Flow Calibration Screen.

5. Press <ESC> to display the Setup Screen.

6. Press <F1: Edit>.

7. Press the arrow keys to scroll down to the "FTS CONST" field.

8. Enter the "m" constant from the FTS Calibration sheet.

9. Enter the "b" constant from the FTS Calibration sheet.

10. Press the <ENTER> key.

11. Press <F2:Calib> to return to the Calibration Screen.

12. Attach the Streamline FTS to the sample tube. Other flow meters may require the use of the flow audit adapter, which should be installed with its valve open.

13. Press <F2: Start> to begin the five-point flow calibration routine.

14. With the pump turned off, the sampler first computes the flow offset value before automatically starting the span calibration using five flow rates around the default sample flow rate of 16.7 l/min.

    Note: Follow the instructions displayed by the sampler at the bottom of the Flow Calibration Screen.

15. Determine the flow in actual l/min using the external flow meter.

16. Press <F1:Edit>.

17. Enter the pressure (inches H_2O) in the “FTS Pres” field, then press the <ENTER> key. The sampler will now calculate the volumetric flow in l/min.

18. When in the flow Calibration Screen, wait for the “Current Flow” value to stabilize at each of these flow values (16.7, 17.5, 15.8, 18.3, and 15.0 l/min).

19. The sampler will automatically enter the calculated flow into the “ACT” field and compute “Span” value, which is the span offset for the mass flow controller. Record the new “Span” values.

20. Return to the Main Screen by pressing the <ESC> key three times.

21. Restore the sampling hardware to its original state by removing the flow metering hardware and reinstalling the PM_{10} inlet on the sample tube. Remove the filter cassette from the sampler, and discard the installed filter.

10.2.4 Single Point Flow Rate Calibration

1. At the Main Screen make sure the sampler is in the Stop Mode before continuing on through calibration.

2. Remove PM_{10} inlet from the sampler.

3. Install calibration filter cassette.

4. Press the <F5: Setup> button, and then the <F2: Calib> button to display the Calibration Screen.

5. Press the <ESC> key to display the Setup Screen.

6. Press <F1: Edit>.

7. Press the arrow keys to scroll down to the “FTS CONST” field.

8. Enter the “m” constant from the FTS Calibration sheet.

9. Enter the “b” constant from the FTS Calibration sheet.

10. Press the <ENTER> key.

11. Press <F2:Calib> to return to the Calibration Screen.

12. Attach the Streamline FTS device to the sample tube.

13. Leave the pump turned off. If it is currently on, press <SHIFT> then <F2: Flow> to turn it off.

14. Press <F1: Edit> to enter the Edit Mode, and move the cursor to the row labeled “Flow” under the “Act” (actual) column.

15. Enter “0” in this position and press the <ENTER> key. This causes the microprocessor to compute the “Offset” value, which is the zero offset value for the mass flow controller. Record this value for future reference.

16. Turn on the pump by pressing <SHIFT> then <F2: Flow>.

17. Press <SHIFT> then <F3: DecrFlow> to continuously decrease the flow, <F4: HoldFlow> to maintain the current flow rate, and <F5: IncrFlow> to continuously increase the flow, until the flow rate displayed in the “Calc” column of the Calibration Screen is approximately 16.7 l/min.

18. Determine the flow in actual l/min using the external flow meter.

19. Enter the pressure (inches H_2O) in the “FTS Pres” field by pressing <F1:Edit>, entering the value using the keypad, then pressing the <ENTER> key. The sampler will calculate the volumetric flow in l/min.

20. While using the Streamline FTS, the sampler will automatically display the calculated flow in the “ACT” field and compute the “Span” value. The “Span” value is the span offset value for the mass flow controller. Record this value for future reference.

21. Return to the Main Screen by pressing the <ESC> key twice.

22. Restore the sampling hardware to its original state by removing the flow metering hardware and reinstalling the PM_{10} inlet on the sample tube. Remove the filter cassette from the sampler, and discard the installed filter.

10.2.5 Interface Board Calibration

1. Locate the interface board on the bottom panel of the sampler’s electronics compartment.

2. Locate the test point labeled “+6V” in the front section of the interface board, and the “+2.5V” and “+10V” test points in the back of the interface board. All three test points are red.

3. Locate the black ground test point labeled “GND” in the front portion of the interface board.

4. Ensure that the sampler is turned on and that the display backlight is on. The backlight must be on during the +6V calibration. If the backlight is off, press any key on the keypad to turn it on.

5. Place the positive lead of a multimeter on the +6V test point.

6. Place the ground lead on the ground test point.

7. Locate R21 on the rear section of the interface board. R21 is a horizontal pot, and its designation “R21” is silk-screened on the board.

8. Adjust R21 until the multimeter reads 6.00 VDC +/- 0.05 V.

9. Place the positive lead on the +2.5V test point.

10. Locate R53 on the rear section of the interface board. R53 is a blue vertical pot, and its R53 designation is silk-screened on the board.

11. Adjust R53 until the multimeter reads 2.500 VDC +/- 0.002 V.

12. Place the positive lead of the multimeter on the +10V test point.

13. Locate R44 on the rear section of the interface board. R44 is a blue vertical pot, and its designation “R44” is silk-screened on the board.

14. Adjust R44 until the multimeter reads10.000 VDC +/- 0.002 V.

10.2.6 Analog Input Calibration

1. Return the sampler to the Main Screen.

2. The sampler must be in the Stop Mode to perform an analog input calibration.

3. When in the Main Screen, press <F5: Setup> and then <F2: Calib> to display the Calibration Screen.

4. Locate connector P18 in the back section of the interface board (right-hand side of interface board, gray plug with black and white wires). **Note: Be sure to turn off the sampler before unplugging anything.** Unplug the cable connected to P18.

5. Insert the analog input calibration plug into the P18 port. Turn the sampler back on.

6. Attach the positive lead from a multimeter with four-digit resolution to the green test point labeled “PWM1” on the interface board. Attach the ground lead to the ground test point.

7. When in the Calibration Screen, press the arrow key to position the cursor so that it is in the “A/O” field.

8. Press <F1: Edit> to enter the Edit Mode. Enter a number between 0.050 and 0.150 volts and press the <ENTER> key.

9. Watch the value displayed in the row labeled “A/I” under the column labeled “Calc.” Ensure that this value does not vary by more than +/- 0.005 volts after watching it for 5 seconds. If this number is not stable, choose a new number for “A/O” between 0.050 and 0.150 volts.

10. Read the voltage displayed on the multimeter.

11. Using the arrow keys, position the cursor so that it is in the row labeled “A/I” under the column labeled “Act.”

12. Press <F1: Edit> to enter the Edit Mode. Enter the voltage reading from the multimeter (to three digit accuracy, i.e., 0.xxx) in this position and press the <ENTER> key. The sampler will now calculate the “Offset” value.

13. Ensure that the value now displayed in the row labeled “A/I” under the column labeled “Calc” matches the value displayed on the multimeter, within +/- 0.005 volts.

14. Using the arrow key, position the cursor so that it is in the “A/O” field.

15. Press <F1: Edit> to enter the Edit Mode. Enter a number between 4.800 and 4.900 volts and press the <ENTER> key.

16. Observe the value displayed in the row labeled “A/I” under the column labeled “Calc.” Ensure that this value does not vary by more than +/- 0.005 volts after watching it for 5 seconds. If this number is not stable, choose a new number for “A/O” between 4.800 and 4.900 volts.

17. Read the voltage displayed on the multimeter.

18. Using the arrow keys, position the cursor so that it is in the row labeled “A/I” under the column labeled “Act.”

19. Press <F1: Edit> to enter the Edit Mode. Enter the voltage reading from the multimeter (to three digit accuracy, i.e., 0.xxx) in this position and press the <ENTER> key. The sampler will now calculate the “Span” value.

20. Ensure that the value now displayed in the row labeled “A/I” under the column labeled “Calc” matches the value displayed on the multimeter within +/- 0.005 volts.

21. Remove the multimeter leads from the interface board. **Note: Be sure to turn off the sampler before unplugging anything.** Remove the analog input calibration plug from the P18 port and insert the original cable.

22. After the user has performed the analog input calibration, they must now perform the temperature, pressure and flow calibrations.

11.0 FILTER DATA PROCEDURES

Data for each filter used in the sampler are stored as a separate record of filter data. The sampler splits the display of filter data records between two screens:

- The Filter Data Screen (Section 11.1), and
- The Power Outages Screen (Section 11.2).

Press <F4> in either the Filter Data Screen or the Power Outages Screen to toggle between the two screens while remaining in the same filter data record.

11.1 Filter Data Screen

The sampler displays the following filter data fields in the Filter Data Screen (Figure 17):

```
Stat:Ok        Filter Data      Rec: 937
 Set: 0.00 96/11/05        Min  Ave  Max
Strt: 0.00 96/11/05 AmbT: 11.5 16.8 21.9
Stop: 0.00 96/11/06 FltT: 11.6 17.0 22.4
 Tot: 24.00         Pres:  759  760  761
TempDiff:  0.8   AveFlow: 16.7 Vol: 24.0
14.07 96/11/05                 %CV:  0.1
|        |  -  |  +  | PwrDat | IntvDat | > |
Function Keys in Browse Mode
|        |  -  |  +  | PwrDat | IntvDat | > |
| First  |     |     |  Last  | Output  | < |
```

Figure 17: Filter Data Screen

Stat - In the upper left-hand corner of the screen shows the status conditions encountered during and after the exposure of the sample filter. A value of “Ok” indicates that the sampler did not encounter any status conditions, and Section 10.3 contains a listing of the single-letter status codes that may be displayed in this field.

Rec - The number of the current record is displayed in the upper right-hand corner of the screen.

Set - Displays the starting time/date (hh.mm yy/mm/dd) entered by the user.

Strt - Shows the actual starting time/date (hh.mm yy/mm/dd) at which the unit began sampling.

Stop - Indicates the actual ending time/date ((hh.mm yy/mm/dd) at which the system stopped sampling.

Tot - Displays the elapsed sampling time (hh.mm) in the Tot field.

TempDiff - The fields to the right and below the “TempDiff” title show the maximum difference (°C) between the filter and ambient temperatures during and after sample collection, as well as time/date (hh.mm yy/mm/dd) at which the sampler recorded

the deviation. The sampler writes the final information to these fields when the user presses <F4: Run/Stp> in the Main Screen to return to the Stop Mode.

AmbT - Displays the minimum, average and maximum ambient temperatures (°C) encountered during sampling in the line labeled “AmbT.”

FltT - Shows the minimum, average and maximum filter temperatures (°C) encountered during sampling in the line labeled “FltT.”

Pres - Indicates the minimum, average and maximum ambient pressures (mm Hg) encountered during sampling in the line labeled “Pres.”

AveFlow - Shows the average volumetric flow rate (l/min) during the sampling period in the AveFlow field.

Vol - Displays the total volume (m^3 at ambient conditions) sampled through the collection filter.

%CV - The coefficient of variation is equal to the standard deviation of the five-minute flow rate averages divided by the average flow rate (16.7 l/min by default). This value is then divided by 100 to yield the %CV value shown in the Filter Data Screen. If this value is greater than 4 (4%), the sampler displays the “C” status code (Section 2.2.1).

11.2 Power Outages Screen

The Power Outages Screen (Figure 18) contains the following additional information for each record of filter data:

```
            Power Outages/Misc   Rec: 937
  9.53   xx.xx   xx.xx   xx.xx   xx.xx
 xx.xx   xx.xx   xx.xx   xx.xx   xx.xx

ID1: "96                                "
ID2: "00154                             "
```

	-	+	FiltDat	IntvDat	>

Function Keys in Browse Mode

	-	+	FiltDat	IntvDat	>
First			Last		<

Figure 18: Power Outages Screen

Rec - The number of the current record is displayed in the upper right-hand corner of the screen.

Times - The screen contains up to ten time fields (hh.mm) that indicate the starting time of all power outages longer than 60 sec that occur during sampling.

ID1, ID2 - The ID1 and ID2 fields display the user-defined information entered prior to sampling in the Filter Setup Screen (Section 3.3).

The soft keys of the Filter Data Screen and Power Outages Screen have the following effects upon the location of the viewing pointer:

<SHIFT> then <F1: First> First Record
<F2: -> One record to the “left.”
<F3: +> One record to the “right.”
<SHIFT> then <F4: Last> Last record.

Pressing <SHIFT> then <F5: Output> when in the Filter Data Screen allows the user to download records from the current position of the viewing pointer to the last record of the database through the RS232 port of the Partisol-FRM Sampler. Press <SHIFT> then <F5: Output> again to interrupt the downloading of information before reaching the last record.

Refer to the Operating Manual for a detailed discussion of this downloading feature.

11.3 Operation After Power Failure

The Partisol-FRM Sampler performs the following actions upon resumption of power if the power failure occurs while the sampler is in its Sampling Mode:

- If the power outage is longer than 60 sec, the hardware registers a “V” status condition (Section 2.2.1) and stores the starting time of the power failure in “hh.mm” format in the current record of filter data (Section 11.1).

- If the ending time/date is not yet reached upon resumption of the power supply, the sampler continues its sampling program in the Sampling Operating Mode. Otherwise, it enters either the Done or Error Operating Modes, depending upon the existence of any status conditions.

If the hardware is not in the Sampling Mode at the time of the power failure, the unit resumes operation in its pre-outage operating mode upon restoration of power.

12.0 DATA EXTRACTION

12.1 Necessary Equipment

Portable computer (palm top, laptop, etc.) with appropriate data transmittal software.
9-pin serial data cable

12.2 Data Extraction Procedure

1. Connect the female end of the serial cable to your portable computer, noting the COM port being used.

2. Connect the male end of the serial cable to the Sampler’s RS232 connector that is located on the front of the Sampler.

3. On the Sampler, ensure that the Baud Rate, Config and XON/XOff Cont RS232 parameters displayed in the RS232 Setup screen (Section 12.3) are appropriately defined for the software being employed. Thermo default values are recommended.

4. State the data extraction program (RPComm).

5. In the menu of the Thermo Communicator Main screen Select “File” pull down menu and choose “Open Group,” highlight the desired connection “sampler” to be connected to.

6. Select the Connection icon “phone” on the tool bar. This will display the 2000-FRM Main Screen. If the connection is successful, the instrument’s serial number will be displayed at the top of the screen.

7. Download all previously uncollected filter data records using the filter data button at the top of the FRM Main Screen. Collect interval and power data only when needed for troubleshooting.

8. Store the data to a file by using the “Disk” button at the top of the FRM Main Screen. The file is then saved to the portable computer in a comma-delimited ASCII format.

9. Transfer the data file to a diskette or attach to an e-mail, and deliver to the contract laboratory.

12.3 Configuring the RS232 Port

The settings in the RS232 Setup Screen define the hardware and software configuration of the system’s RS232 port. When in the Main Screen, press <F5: Setup> and then <F4: RS232> to display the RS232 Setup Screen. The fields of this screen are editable in any of the unit’s operating modes.

The RS232 Setup Screen (Figure 19) contains the following user-definable fields.

```
              RS232 Setup
       Baud Rate:   9600
          Config:  8-N-1
   XOn/XOff Cont:    OFF
      AK Station:     52   "4"
      AK Channel:  75048  "K0"
       AK Append:  13010
```

Edit					

Function Keys in Browse Mode					
Edit					

Function Keys in Edit Mode					
--	-	+	++	Bksp	

Figure 19: RS232 Setup Screen

Baud Rate - Data transmission rate (baud, bits per second). Use the <F2: -> and <F3:+> keys to select the appropriate baud rate when in the Edit Mode. The default setting of this parameter is 9600.

Config - Data transfer format (data bits-parity-stop bits). Use the <F2: -> and <F3: +> keys to select between “8-N-1” and “7-E-1”when in the Edit Mode. The default setting of this parameter is “8-N-1” (8 stop bits, no parity, 1 stop bit).

XOn/XOff Cont - The user may turn software data flow control on or off by pressing the <F2: -> and <F3: +> keys when in the Edit Mode. The default setting of this parameter is “OFF.”

AK Station - ASCII code for the one-digit Station Number used by the AK Protocol (Appendix D in the Operating Manual). The default value of this parameter in the sampler and AKCOMM software is 52, which is the ASCII representation for “4.” This parameter is not used when performing the data downloading described in Section 13.2.

AK Channel - ASCII code representation of the two-digit Channel number used by the AK Protocol (Appendix D of Operating Manual). The default value of this parameter in the sampler and AKCOMM software is 75048, which is the ASCII representation for “K0” (the capital letter “K” and the number “0”). This parameter is not used when performing the data downloading described in Section 13.2.

AK Append - ASCII code representation of characters added between response lines from the sampler when using the AK Protocol (Appendix D in the Operating Manual). This parameter is optional, and should have a value of 0 if nothing is to be appended. The default value of this parameter is 13010, which represents CR (carriage return) and LF (line feed). This parameter is not used when performing the data downloading described in Section 12.2.

13.0 AUDIT PROCEDURE

Independent auditing will be performed on a quarterly basis by VSI Environmental Monitoring Service. A plan outlining audit procedures and instruments to be used for auditing is provided in the appendices of the Energy Fuels Resources Corporation Uranium Mill Licensing Support Ambient Air Monitoring Plan for the Piñon Ridge Mill Site.

References:

1. 40 CFR 50, Appendix J: Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere
2. Quality Assurance Handbook for Air Pollution Measurements Systems, vol. II, Part 2, USEPA, Environmental Monitoring Systems Laboratory.
3. Operating Manual: Partisol FRM Model 2000 PM2.5 Sampler, Thermo Fisher Scientific, Inc., 2004
4. Energy Fuels Resources Corporation Uranium Mill Licensing Support Ambient Air Monitoring Plan Piñon Ridge Mill Site, 2008.

Appendix A:

EPA Ambient Particulate Monitoring Sample Day Schedule

Year 2008 U.S. EPA Ambient Particulate Monitoring

Sample-Day Schedule

Legend: = 1-in-6 day sample schedule = 1-in-3 day sample schedule

1st Quarter (includes 16 6-day sample days, 31 3-day sample days)

January

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

February

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	

March

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

2nd Quarter (includes 15 6-day sample days, 30 3-day sample days)

April

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

May

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

June

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

3rd Quarter (includes 15 6-day sample days, 31 3-day sample days)

July

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

August

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

September

Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

4th Quarter (includes 15 6-day sample days, 30 3-day sample days)

October

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

November

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

December

Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			