SOP-10
PM_{10} High Volume Air Sampling

Yerington Mine Site
Standard Operating Procedure

Revision 0
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SOP-10
PM_{10} HIGH VOLUME AIR SAMPLING

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1.0 OBJECTIVE

The objective of this document is to establish a standard operating procedure (SOP) for high volume sampling of PM_{10} in ambient air.

2.0 DEFINITIONS

High Volume Air Sampler. Air sampling equipment capable of sampling high volumes of air (typically 57,000 ft^3 or 1,600 m^3) at high flow rates (typically 1.13 m^3/min or 40 ft^3/min) over an extended sampling duration (typically 24 hrs).

NAAQS. National Ambient Air Quality Standard as specified in the Clean Air Act Amendments of 1990. The U.S. EPA provides NAAQS for six criteria air pollutants: carbon monoxide, lead, nitrogen dioxide, particulate matter as PM_{10} and $PM_{2.5}$, ozone, and sulfur dioxides. The current primary standard for PM_{10} is 50 $\mu g/m^3$ averaged over a year at each monitoring location. Each location may have no more than one measurement per year above 150 $\mu g/m^3$ averaged over 24 hrs.

Particulate Matter. Material suspended in the air in the form of solid particles or liquid droplets (i.e., aerosols).

$PM_{2.5}$. Fine particulate matter with an aerodynamic diameter of 2.5 µm or less. $PM_{2.5}$ is a subset of TSP that can lodge deeply into the lungs and are believed to post the largest health risks. Sources of fine particles include all types of combustion (motor vehicles, power plants, wood burning, etc.) and some industrial processes. In 1997, EPA established a NAAQS for $PM_{2.5}$ for the first time as well as a revised NAAQS for PM_{10}.

PM_{10}. Particulate matter with an aerodynamic diameter of 10 µm or less. PM_{10} is a subset of TSP (typically 40 to 50%) that can be inhaled and accumulate in the respiratory system. Particles with diameters between 2.5 and 10 µm are referred to as "coarse." Sources of coarse particles include crushing or grinding operations, and dust from paved or unpaved roads.

Real Time Air Sampler. Air sampling equipment that provides instantaneous measurements. The equipment is often mobile, battery-operated, and passive. Passive sampling devices are not equipped with an air pump and are typically used for indoor applications. Active sampling is more appropriate for ambient applications since a low flow (i.e., flow rates in liters per minute) air pump constantly draws air into the detector. Most real time particulate air samplers measure a subset of TSP (e.g., PM_{10} or $PM_{2.5}$).

TSP. Total suspended particulates. Prior to 1987, the NAAQS for particulate matter was measured as TSP.

Units. The following units are used in this SOP:

- **ft^3** = cubic feet (volume)
- **ft^3/min** = cubic feet per minute (flow rate)

- **m^3** = cubic meters (volume)
- **m^3/min** = cubic meters per minute (flow rate)
- **µg** = micrograms (mass)
- **µg/m^3** = micrograms per cubic meter (concentration)
- **µm** = micrometers or "microns" (length)

3.0 APPLICABILITY

This SOP applies to monitoring air quality for ambient (i.e., outdoor) applications such as environmental remedial actions and general construction activities. This SOP may also be used to help estimate fugitive dust emissions from a mine, agricultural area, or industrial operation. This SOP does not apply to low volume, low flow rate, or real-time air sampling techniques typically used to evaluate worker exposure in an indoor workplace. This procedure represents general minimum standards and may be modified or supplemented as needed for a specific project by site-specific documents such as a quality assurance project plan (QAPP), work plan, field sampling plan, or health and safety plan.

4.0 RESPONSIBILITY

The *Project Manager*, or designee, will have the responsibility to oversee and ensure that the air sampling is implemented according to this SOP and any site-specific documents.

The *field personnel* will be responsible for understanding and implementing this SOP and related SOPs during field activities, as well as obtaining the appropriate field logbooks, forms and records necessary to complete the field activities.

5.0 REQUIRED MATERIALS

The following equipment and supplies are required for implementation of this SOP. Note that this SOP is based on the use of a PM10 high volume air sampler manufactured by Tisch Environmental, Inc. (Tisch). A PM10 high volume air sampler from another manufacturer may be substituted; however, you must ensure that it has been approved by the U.S. EPA and has received a Federal Reference Method Number. Although the majority of the information in this SOP applies to all PM10 high volume air samplers, consult the manufacturer and modify procedures accordingly.

- Tisch TE-6070D PM_{10} High Volume Air Sampler (Federal Reference Method Number RFPS-0202-141) or equivalent with the following specifications:
  - Size selective, vertically symmetric inlet
  - Flow rates between 1.02 to 1.24 m^3/min (36 to 44 ft^3/min)
  - Mass flow controlled

  - Continuous flow recorder (e.g., Dickson chart recorder)
  - Digital timer/elapsed time indicator
  - Cassette holder and cover for loading and transporting filters
- Tisch TE-5028 Variable Resistance Calibration Kit or equivalent with the following specifications:
  - Variable resistance orifice with NIST-traceable calibration certificate
  - Adapter plate and rubber vacuum tubing
  - Slack tube water manometer
- Electrical power supply rated at 110 V, 60 Hz, 5 A (12 A to start)
- For temporary monitoring locations only:
  - Electrical generator that provides the required power supply
  - Fuel for electrical generator (adequate for a duration of 24 hrs)
  - Electrical power extension cord rated at 15 A (preferably 20 A and limit total length to 100 feet)
- 8 in by 10 in quartz fiber PM10 filters supplied by the laboratory (usually in protective manila folder)
- Dickson charts and spare ink pen for continuous flow recorder
- Clean, lint-free cloths and Dow Corning Silicone #316 for cleaning and re-greasing shim plates
- Chronograph (digital watch), thermometer, and barometric pressure gauge (required for calibration and sample volume calculation)
- Wind sock for approximating wind speed and wind direction (required for data interpretation)
- Meteorological station (optional, but highly recommended) that provides 15-minute measurements of temperature, barometric pressure, wind speed, and wind direction
- Miscellaneous tools: flat-head screwdriver (for adjusting continuous flow controller and mass flow controller set screw) and Phillips screwdriver/ratchet set/wrenches (for assembly/disassembly of high volume air samplers)
- Gloves (latex or nitrile) for handling filters
- Large Zip-lock bags (to hold filter/manila folder)
- Small Fed-Ex box for shipping samples
- Field notebook, Field Data Sheet, Total Volume Calculation Sheet, and indelible pen
- First-aid kit and fire extinguisher

- Personnel Protective Equipment (PPE) as specified in the site-specific health and safety plan

6.0 METHODS

PM10 sampling will be conducted in accordance with 40 CFR 50, Appendix J Reference Method for the Determination of Particulate Matter as PM-10 in the Atmosphere (U.S. EPA, 1998). The sampling will involve collecting an integrated (i.e., continuous) 24-hour air sample from midnight to midnight on the target day. The table below provides targeted values and allowable variances for sample duration, flow rate, and volume.

PM_{10} Sample Specifications

Parameter		PM_{10}
Sample Duration	Target	24 hrs (1,440 min)
	Allowable variance	23-25 hrs (1,380-1,500 min)
Sample Flow Rate	Target	1.13 m^3/min (40 ft^3/min)
	Allowable variance	1.02–1.24 m^3/min (36–44 ft^3/min)
Sample Volume	Target	1,630 m^3 (57,600 ft^3)

Although the sampling equipment has a digital timer and mass flow controller, actual sample durations and flow rates may differ from targeted values. The actual laboratory detection limits achieved are dependent upon the laboratory instrument detection limit and sample volume obtained in the field. Note that sample volumes less than targeted values may result in higher than targeted detection limits.

The following sections describe methods for: pre-sampling activities; calibration, operation, and maintenance of the high volume air samplers; and other aspects of the sampling such as collecting quality control samples.

6.1 Pre-Sampling Activities

The following activities will be conducted prior to sampling:

- Procure equipment from manufacturer or supplier (may require up to 5 business days and can be costly if not shipped by ground);
- Assemble high volume air samplers and become familiar with operation;
- Calibrate high volume air samplers and enter calibration data into Sample Volume Calculation Sheet;
- Determine predominant wind direction (optional, but highly recommended);
- Establish monitoring locations (e.g., upwind, downwind, or near sensitive receptors) by reviewing data from the nearest meteorological station or by using dispersion modeling;
- Construct permanent monitoring locations or procure electrical generators; and

- Procure sample filters from laboratory.

6.2 Calibration of High Volume Air Samplers

The high volume air sampler will be calibrated according to the following schedule:

- Upon installation or first use;
- After any major maintenance (e.g., motor or mass flow controller replacement);
- Once every quarter (3 months); and
- After 360 sampling hours.

The following calibration criteria must be met:

- Minimum of 5 calibration points (7 points highly recommended);
- Minimum of 3 calibration points within the allowable variance range of 1.02–1.24 m3/min (36–44 ft3/min); and
- Correlation coefficient greater or equal to 0.990.

The following calibration procedure will be used to determine the calibration flow rates and resulting slope and intercept for the high volume air sampler. Enter calibration data in the Calibration Data Sheet provided as Attachment A. Use a variable resistance orifice or equivalent for calibration.

- IMPORTANT: disconnect the motor from the mass flow controller and connect the motor to a stable electrical power source (an electrical generator is not recommended).
- Mount the calibrator orifice and top loading adapter plate to the sampler. A sampling filter is generally not used during this procedure. Tighten the top loading adapter hold-down nuts securely for this procedure and ensure that no air leaks are present.
- Allow the motor to warm up to normal operating temperature.
- Conduct a leak test by covering the hole on top of the calibrator orifice and pressure tap on the side of the orifice with your hands. Listen for a high-pitched squealing sound made by escaping air. If this sound is heard, a leak is present and the top loading adapter hold-down knobs need to be re-tightened. CAUTION: avoid running the sampler for longer than 30 seconds at a time with the orifice blocked. This will reduce the chance of the motor overheating. CAUTION: never try this leak test procedure with a manometer connected to the side tap on the calibrator orifice or the blower motor. Water from the manometer could be drawn into the system and cause motor damage.
- Connect a rubber vacuum tube from one valve of the manometer to the pressure tap on the side of the calibrator orifice. Leave the other manometer valve open to the atmosphere. Both valves on the manometer have to be open for the liquid to flow freely.

Ensure that the manometer is vertical and there are no kinks in the tubing. The fluid level in each tube must be at the same level prior to use. Adjust the graduated tape so that the zero reading is exactly at the fluid level. When under a vacuum, the fluid level on one side of the "U" tube goes up and the other fluid level goes down. To read a manometer, add the distances both fluid levels travel from zero (units = in H2O). Be consistent on reading the fluid levels (e.g., always read from the bottom of the meniscus).

- To begin calibration, turn black knob on top of calibrator office counter clock-wise, opening the four holes on the bottom wide open. Then carefully turn the knob clock-wise to obtain 5 different calibration points (7 points highly recommended). Typical calibrator orifice readings are between 3-4 in H2O. Record the manometer reading from the calibrator orifice and the continuous flow recorder reading from the sampler on the Calibration Data Sheet. The manometer must remain vertical to ensure accurate readings. Tapping the back of the continuous flow recorder will help to center the pen and give accurate readings.
- Disconnect the motor from the electrical power source and remove the orifice and top loading adapter plate. Re-connect the motor to the mass flow controller.
- Record the following information on the Calibration Data Sheet:
  - Current date, start time of calibration, and monitoring location;
  - Current ambient air temperature and uncorrected barometric pressure (measure or determine values from the nearest meteorological station being mindful of the effect altitude has on barometric pressure);
  - Seasonal temperature and uncorrected barometric pressure (monthly average is better, daily average is best); and
  - Sampler serial number, the calibrator orifice serial number, and the calibrator orifice slope and intercept with date last certified.
- The Calibration Data Sheet will calculate a Sampler Set Point (SSP) which is the continuous flow recorder reading that corresponds to the target operating flow rate of 1.13 m3/min (40 ft3/min). The final step in the calibration is to adjust the mass flow controller to the SSP. IMPORTANT: the final step is done while the mass flow controller is in use. Load the sampler with a filter and allow the motor to warm up to its normal operating temperature. Adjust the mass flow controller set screw (Flow Adj.) with a screwdriver until the continuous flow recorder reads at the SSP.

6.3 Operation of High Volume Air Samplers

The following procedure will be used to operate the high volume air sampler.

- Open inlet and wipe any dirt accumulation with a clean, lint-free cloth.
- Install filter cassette holder and remove filter holder frame.
- Don clean gloves and carefully center a new filter, rougher side up, on the supporting screen. If the laboratory printed a number on the filter, it should be face up. Properly

align the filter on the screen so that when the frame is in position the gasket will form an airtight seal on the outer edges of the filter.

- Secure the filter with the frame, brass bolts, and washers with sufficient pressure to avoid air leakage at the edges (make sure that the plastic washers are on top of the frame). IMPORTANT: make sure the filter cassette cover is removed.
- Close inlet carefully and secure with all hooks and catches.
- Open instrument panel door and program the digital timer if necessary (refer to the following section). Ensure that the digital timer is functioning properly (i.e., look for the flashing delta in the display and ensure that the power failure light is not illuminated). If the power failure light is illuminated, you will need to re-program the digital timer (refer to the following section).
- Install a new Dickson chart in the continuous flow recorder. Ensure that the ink pen is lowered and touching the chart. Rotate the recorder clockwise with a screwdriver so that the chart is reading the current time
- Make sure all electrical cords are plugged into their appropriate receptacles and that the black vacuum tubing is connected to the motor and to the continuous flow recorder. Be careful not to pinch tubing when closing instrument panel door.
- When sampling is complete, don new gloves and remove the frame to expose the filter
- Carefully remove the exposed filter from the supporting screen by holding it gently at the ends (not at the corners).
- Fold the filter lengthwise so that the particulate matter is contained inside.
- Place the folded filter in the protective manila folder.
- Apply a sample label to the manila folder. CAUTION: do not write on the filter or attach a sample label.
- Place the filter/manila folder in a large Zip-lock bag. Keep filters out of sunlight and maintain at room temperature. CAUTION: do not chill samples.
- Fill out the chain-of-custody and place in a small Fed-Ex box with the samples. Include any field quality control samples as necessary. It is critical to ship the samples in a rigid container such as a cardboard Fed-Ex box for protection. The box should not be so large that the samples move around. Add padding as necessary.
- Typical sample hold times prior to laboratory analysis are 6 months for gravimetric PM10 and most metals (mercury analysis is 28 days).
- Remove the Dickson chart from the continuous flow recorder. Write the monitoring location, sampling date, and monitoring event number on the perimeter of the chart and retain with other field records.

6.3.1 Operation of Digital Timer

The following procedures will be used to program the digital timer. It is customary to set the clock on standard time throughout the year (i.e., DO NOT adjust clock for daylight savings time).

- To begin programming, toggle the Sampler Switch (Timed/Off/On) to the "Off" position. If you need to test the motor or adjust the SSP, toggle the Sampler Switch to "On". When done with adjusting, toggle it back to "Off".
- To set the sampling start day, frequency, and duration, rotate the 3 dials to the desired positions.
  - Sample After Days Dial: sets the starting day of the sampling. The current day is "0", tomorrow is "1", the day after tomorrow is "2", etc. EXAMPLE: if today is Friday and you want the first monitoring event to begin on Sunday, set to position "2".
  - Sample After Days Dial: sets the frequency of sampling in days. Typically set to position "6" for the NAAQS 6-day schedule. For weekly sampling, set to position "7".
  - Sample For Hours Dial: sets the duration of sampling in hours. Typically set to position "24" for 24-hour sampling. For 8-hr workday sampling, set to position "8".
- To set the starting time of sampling, toggle the Display Switch (Start Time/Time of Day) to the "Start Time" position. Use the Set Switch (Hour/Minute) to enter the starting time of sampling in hours and minutes in military time (e.g., 01:30 = 1:30 a.m. and 14:00 = 2:00 p.m.).
- To set the current time, toggle the Display Switch to the "Time of Day" position. Use the Set Switch to enter the current in military time.
- Now press and release the Reset Switch toward "Timer". A small triangle on the digital display will start blinking to indicate the timer is running.
- Final step in programming is to toggle the Sampler Switch to the "Timed" position.
- OPTIONAL: these procedures can be followed as necessary. You will probably need to re-program the digital timer afterwards.
  - Reset Hour Meter: can be reset following motor or mass flow controller replacement. Press and release the Reset Switch toward "Hour Meter".
  - Reset Power Failure Light: indicates electrical power interruption. Toggle Display Switch to "Start Time" if it is in the "Time of Day" position or vice versa. The red light will reset upon the next sampling.

6.3.2 Sample Volume Calculation

Sampling contaminants in a gaseous medium can be quite different from sampling in soil and groundwater media because the contaminants are separated from their original matrix (e.g., ambient air). High volume air sampling concentrates contaminants on a filter which is

subsequently analyzed by a laboratory. Results are typically provided in mass (µg) of contaminant (PM10 or a metal) detected on the filter. To determine the original concentration (µg/m3) of the contaminant in air, a sample volume (m3) must be calculated. If the sample volume is provided to the laboratory, a concentration can be reported; however, the sample volume is not typically available at the time the chain-of-custody is prepared and samples are shipped. A Microsoft Excel spreadsheet is provided as Attachment B to facilitate the calculation of sample volume.

Record the following information on the Total Volume Calculation Sheet:

- Average daily temperature and uncorrected barometric pressure;
- Sampling date and monitoring locations;
- Sampling durations (difference of elapsed time indicator stop and start readings – typically 24 hrs);
- Average Dickson chart responses (typically a circle in red ink near 40 ft3/min); and
- Calibration dates, slopes, and intercepts (refer to section on calibration);

The spreadsheet will calculate the actual flow rates and total volumes. Divide the laboratory mass results by the calculated total volumes to determine concentrations (µg/m3). Note that field blanks and trip blanks do not have associated volumes.

6.4 Maintenance of High Volume Air Samplers

Maintenance of the high volume air samplers consists of routine maintenance, motor brush replacement, and troubleshooting/corrective action.

6.4.1 Routine Maintenance

The following routine maintenance activities will be conducted during the monitoring program.

- Inspect all gaskets (including motor cushion) to ensure they are in good condition and that they seal properly. For the PM10 inlet to seal properly, all gaskets must function properly and retain their resilience. Replace gaskets as necessary.
- Inspect electrical power cords periodically for good connections and for cracks (replace if necessary). CAUTION: Do not allow power cord or outlets to be immersed in water.
- Inspect the filter screen and remove any foreign deposits each monitoring event.
- Inspect the filter cassette holder frame gasket each monitoring event. This gasket must make an airtight seal.
- Ensure the elapsed time indicator is operating by observing under power.

- Ensure the continuous flow recorder pen is making contact with the chart and depositing ink each monitoring event. Be sure the door is sealed completely. Tubing should be inspected for crimps or cracks and replaced as necessary.
- Be certain the alignment pins are aligning properly. The upper and lower tubs must have an airtight seal. Be careful not to bend any parts of inlet out of their original aerodynamic shape, mainly the hood, acceleration nozzle plate, nozzles and vent tubes.

Shim Plate Cleaning/Re-Greasing Schedule		
Average TSP at Site ($\mu g/m^3$)	**Quantity of Sampling Days**	**Frequency Assuming Sampling Every 6 Days**
40	50	10 months
75	25	5 months
150	13	3 months
200	10	2 months

Note: PM_{10} is typically 40-50% of TSP.

- Clean shim plate and re-grease according to the above schedule because excess dirt will cause false readings and bounce heavier particulates.
  - Shim plate is located on top of the 1st stage plate of the inlet and can be seen by opening the body of the inlet. Cleaning of the shim plate is done after removal from the inlet. Two shim plate clips located on the right and left sides should be rotated 90° to release the fastening pressure on the shim. The shim plate should be handled by the edges and slowly lifted vertically to clear the height of the vent tubes and pulled out forward toward the operator. A clean, lint-free cloth is used to wipe the soiled grease from the shim plate. Acetone or any commercially available solvent can be used to clean the shim plate to its original state.
  - Clean the interior surfaces of the inlet using a clean, lint-free cloth.
  - Place shim plate on a clean flat surface away from the rest of the inlet assembly and spray the shim plate with a coating of Dow Corning Silicone #316. Apply a generous amount of the silicone after shaking the aerosol can. Spray holding the can 8–10 in away. Spray is necessary in the areas which are below the acceleration nozzles. Allow 3 minutes for the solvent in the spray to evaporate leaving the final greased shim plate tacky, but not slippery. After drying, a cloudy film is visible, with a film thickness at least twice the diameter of the particles to be captured. Over-spraying with the silicone will not hurt the performance of the inlet, so when in doubt, apply more silicone spray. Reverse the removal steps.

6.4.2 Motor Brush Replacement

Check or replace the motor brushes every 300–500 hrs of operation. If the motor has exhausted brush changes (limit to 3), then replace motor. The following procedure will be followed to replace motor brushes.

- CAUTION: Disconnect the high volume air sampler from electrical power prior to any servicing of the blower motor assembly. Verify power is disconnected with a voltage meter.
- Remove blower motor flange by removing four bolts. This will expose motor cushion gasket and motor.
- Rotate assembly on its side and loosen cord retainer. Then push cord into housing and at the same time let motor slide out exposing the brushes.
- Looking down at motor, there are 2 brushes, one on each side. Carefully pry brass tabs (the tabs are pushed into end of brush) away from expended brushes and toward armature. Pry tabs until they dislodge from brushes.
- With a screwdriver, loosen and remove brush holder clamps and release brushes. Carefully, pull tabs from expended brushes.
- Slide tabs into tab slot of new brush.
- Push brush carbon against armature until brush housing falls into brush slot on motor.
- Put brush holder clamps back onto brushes.
- Make sure tabs are firmly seated into tab slot. Check field wires for good connections.
- Insert motor by placing housing over while pulling power cord out of housing. Be certain not to pinch motor wires with motor spacer ring.
- Secure power cord with cord retainer cap.
- Replace blower motor flange on top of motor making sure to center gasket.
- Seat new brushes by applying 50% voltage for 10 to 15 minutes.

6.4.3 Troubleshooting/Corrective Action

The following is a list of possible problems and associated corrective actions.

- Shelter: There is nothing on the anodized aluminum shelter that can wear out. In the event a system is dropped or blown over, some shelter parts may become bent. Simply re-shape the bent components or replace them as necessary.
- Motor: If the motor does not function, perform the following test. Unplug the motor from the mass flow controller. Plug the motor directly into electrical power source. If motor does not operate, replace with new motor. If motor operates, then check electrical connections. If motor still does not work, refer to section of digital timer operation.

- Continuous Flow Recorder: If not inking properly, replace pen. If pen arm is bent or pen arm lifter is damaged, thereby not allowing pen point to contact chart, replace the pen arm or pen arm lifter as necessary. A tight door seal is necessary to prevent drying of pen; replace seal if necessary. If pen does not respond properly to pressure/flow signal, one of two solutions are available. (1) No rotation of chart indicates a defective chart drive. Replace as necessary. (2) Out of adjustment flow indications may exist if one adjusts the mass flow controller set screw beyond its range. This condition allows the bellows to make contact with the chart drive thereby making the bellow movement inaccurate. Factory re-adjustment is necessary.
- Filter Cassette Holder: Two gaskets make contact with the filter holder. The 8 in by 10 in gasket seals between the shelter base pan and the flange of the filter holder. If this seal is compromised, replace the gasket. The lower section of the filter holder is sealed against the blower with a round neoprene rubber gasket. This gasket should be replaced if any leakage is evident.
- Filter Media Holder: The filter media holder uses the 8 in by 10 in gasket to seal between it and the filter holder. Another 8 in by 10 in gasket is also used on the filter media holder to seal between the filter hold-down frame and the filter media itself. If leakage is evident, inspect the gasket for foreign objects and replace as necessary.
- Digital Timer: If the timer does not activate the system at the desired time, check for proper electrical power connections and review section on operation of digital timer.
- Inlet: If inlet does not fit onto shelter, check that inlet is installed in a vertical path onto the shelter. It may take two people to gently lower the inlet onto the shelter. If the holes in the sides of the shelter do not exactly line up with holes in inlet shelter pan, it may be necessary to gently file away a small amount of material to align the holes. Most often the inlet holes will align by simply moving the inlet relative to the shelter until aligned. If the inlet hood does not fit onto acceleration plate, be sure that the spacers are not tightened until all of the washers, screws and spacers are loosely assembled. If inlet does not open properly, be sure the strut is in correct position and strut slot is aligned with shoulder bolt. If the top tub and bottom tub do not seal together, be sure alignment pin in top tub goes into alignment pin "hole" in bottom tub. It is also necessary that the alignment pins on 1st stage plate are aligned with the alignment pin "holes" on bottom tub. Adjustment hooks are provided to assure a seal between the top and bottom tube. To adjust, loosen nut with 3/8 in wrench, adjust hook length until a tight seal develops, then tighten nut. Shim plate clips are provided to assure the shim plate rests tightly against the first stage plate. Six adjustment screws and catches are provided to insure the seal between the inlet top section and the shelter base pan. Adjust catches by loosening the nuts with 3/8 in wrench, adjust catch length until it seals then tighten. Do this for all 6 catches. A shelter base pan gasket 16 in by 16 in is provided to seal between the shelter base pan and inlet base pan. If a leak develops, replace this gasket. All gaskets should be inspected for age or misuse. Replace as necessary.

6.5 Other Aspects

Other aspects of air monitoring are included in this section and consist of collecting field quality control samples and addressing sampling irregularities.

6.5.1 Field Quality Control Samples

Field quality control samples may be prescribed in site-specific documents such as the QAPP or work plan. These documents will specify the type of field quality control samples (e.g., duplicate samples, trip blanks, and field blanks) and quantity to collect.

- Duplicate Sample. A true duplicate sample is difficult to collect with many types of high volume air sampling. A co-located sample may be collected by co-locating a second high volume air sampler with the primary sampler.
- Field Blank. A quality control sample collected by loading a laboratory-supplied filter in the high volume air sampler, but not operating the sampler. The filter is then replaced into the protective sleeve and returned to the laboratory with the primary samples. May also be referred to as an equipment blank.
- Trip Blank. A quality control sample consisting of a laboratory-supplied filter that accompanies the primary samples at all times for a selected monitoring event. The filter is not removed from the protective sleeve and is returned to the laboratory with the primary samples.

6.5.2 Sampling Irregularities

Two types of sampling irregularities may occur: electrical power interruption/failure and irregular flow rate.

- Electrical Power Interruption/Failure: can be determined from one or all of 3 methods. (1) Elapsed time indicator less than 24 hrs (2) Power Failure red light is on. (3) Red ink trace on Dickson chart is not a complete circle. Power failure will cause the ink pen to fall near 0 ft^3/min. The method allows sample durations between 23-25 hrs. Common causes of power interruption/failure are: power outage, circuit overload causing a breaker to trip, or running out of fuel if using a generator.
- Irregular Flow Rate: can be determined by red ink marks on Dickson chart that look like seismograph readings (rapid/irregular vertical marks). If the problem is severe, a flow rate will be difficult to determine and a total volume cannot be calculated. Check the stability of the electrical power. If electrical power is stable, the mass flow controller is most likely defective and will require replacement.

7.0 REFERENCES

Tisch Environmental, Inc., 1999. Operations Manual PM10 High Volume Air Sampler. February 1.

U.S. Environmental Protection Agency, 1998. Reference Method for the Determination of Particulate Matter as PM-10 in the Atmosphere. 40 CFR, Chapter I, Appendix J to Part 50. July 1.

8.0 ATTACHMENTS

ATTACHMENT A Calibration Data Sheet

ATTACHMENT B Total Volume Calculation Sheet

ATTACHMENT A

Calibration Data Sheet

Calibration Data Sheet

PM10 High Volume Air Sampling

General Information

Calibration Date: _____ Location: _____

Ambient Conditions	Field Equipment Units		Calculation Required Units
Actual Pressure (P_a):	in Hg	751.3	mm Hg
Actual Temperature (T_a):	°F	298.6	°K
Seasonal Pressure (P_s):	in Hg	759.5	mm Hg
Seasonal Temp. (T_s):	°F	295.4	°K

High Volume Sampler Information

Type:	PM-10	
Make/Model:	Tisch Environmental TE-6070D	
Serial #:	Blower 1013	Inlet 0613

Calibration Orifice

Type:	Variable Resistance Orifice	
Make/Model:	Tisch Environmental TE-5028A	
Rootsmeter Serial #:	9833620	
Orifice Serial #:	0835	
Calibrator Slope (m_c):		based on actual flow rate (Q_a)
Calibrator Intercept (b_c):		based on actual flow rate (Q_a)
Date Certified:	11/19/04	

Calibration Measurements and Calculations

	Manometer (in H_2O)	Q_a (m^3/min)	I (chart)	IC (corrected)
Point #1		1.436		34.04
Point #2		1.281		31.52
Point #3		1.200		30.26
Point #4		1.183		29.63
Point #5		1.095		28.37

Sampler Slope (m_s):	16.7296
Sampler Intercept (b_s):	10.0332
Correlation Coefficient (R):	0.9982
Sampler Flow Rate Set Point (SFR):	1.155
Sampler Chart Set Point (SSP):	46.56

Equations

$Q_a = 1/m_c*(Sqrt(Manometer*T_a/P_a)-b_c)$

$IC = I*Sqrt(T_a/P_a)$

$SFR = 1.13*P_s/P_a*T_a/T_s$

$SSP = (m_s*SFR+b_s)*Sqrt(P_a/T_a)$

X	**Brown and Caldwell**	
Field Technician Signature	**Company**	**Date**

Notes

Highlighted items are required information.

Minimum 5 calibration points required and 3 must be within 1.02 to 1.24 m^3/min.

Correlation coefficient must be greater than 0.990.

All temperatures & pressures are station values (uncorrected to sea level).

Seasonal temp. & press. are average values (monthly average is better, daily average is best).

ATTACHMENT B

Total Volume Calculation Sheet

Total Volume Calculation Sheet

PM10 High VolumeAir Sampling

Ambient Conditions		**Field Equipment Units**		**Calculation Required Units**	**Sampling Date**
Average Daily Pressure (P_{avg}):		in Hg	756.9	mm Hg	
Avg. Daily Temperature (T_{avg}):		°F	291.2	°K	

Location	**t Sample Duration (hrs)**	**I Avg Chart Response**	**Sampler Calibration (date)**	**m_s Sampler Slope**	**b_s Sampler Intercept**	**Q_a Actual Flow Rate (m^3/min)**	**V Total Volume (m^3)**
						1.11	1,578
						1.11	1,598
	24.0		***Target***			1.13	1,630
	23.0 - 25.0		***Allowable Variance***			1.02 - 1.24	

Equations

$Q_a = 1/m_s*(I*Sqrt(T_{avg}/P_{avg})-b_s)$

$V = Q_a*t*60$

X	**Brown and Caldwell**	
Field Technician Signature	**Company**	**Date**

Notes:

Elapsed time refers to readings on the TE-300-312 Elapsed Time Indicator.

Chart response refers to readings on the TE-5009 Continuous Flow/Pressure Recorder.

All temperatures & pressures are station values (uncorrected to sea level).

Field Data Sheet

Air Monitoring for 2010 Removal Actions
Yerington Mine, Yerington Nevada

Location	Filter Removal		Sample			Elapsed Time		Chart Response		Comment
	Date	Time (24 hr)	Filter Serial #	Type	Date	Start	End	Min	Max	
Primary Samples										
AM-1-PM10				Primary						
AM-2-PM10				Primary						
AM-3-PM10				Primary						
AM-4-PM10				Primary						
AM-5-PM10				Primary						
AM-6-PM10				Primary						
Field Quality Control Samples										
AM-1-PM10-DUP				Duplicate						
AM-				Trip Blank		N/A	N/A	N/A	N/A	
AM-				Field Blank		N/A	N/A	N/A	N/A	

Ambient Conditions

□ Clear □ Rainy □ Hazy □ Windy
□ Cloudy □ Snowy □ Foggy □ Other (explain): _____

Event # _____

X _____ *Brown and Caldwell* _____

Field Technician Signature **Company** **Date**

Notes:

Elapsed time refers to readings on the TE-300-312 Elapsed Time Indicator.
Indicate any filter damage or mishandling under filter condition.

Chart response refers to readings on the TE-5009 Continuous Flow/Pressure Recorder.