Table of Contents

List of Figures

List of Tables

2 Climatological Factors

2.1 Introduction and Background

The Copper Flat Mine Permit Area (Site) lies within the belt of mid-latitude westerlies where the prevailing wind direction is from the west. Winds at the Truth or Consequences, New Mexico, airport, located about 30 miles northeast of the Site, are generally from the northwest; however, the Black Range and foothills cause local variations in the winds. At Copper Flat, the wind direction is predominantly west to east, and secondarily north to south. Local wind speeds average about 10 to 15 miles per hour, although winds in excess of 50 miles per hour may occur at times. Temperature inversions are rare at Copper Flat, but are more common farther east along the Rio Grande valley, especially during the winter months. Vertical air dilution is generally good because of the area's high surface temperatures, creating strong daytime thermal mixing. Thermal mixing and moderate winds generally tend to suppress occasional nighttime inversions. The presence of higher winds and the lack of inversions contribute to a relatively clean atmosphere at the Site since any pollutants are readily mixed and dispersed (BLM, 1999).

Temperature data for the Site show a wide diurnal and seasonal variability, which is typical of dry climates. The warmest temperatures occur in June and July and the coldest temperatures usually occur in December and January. In spring and fall, daily maximum temperatures are moderate, typically averaging 65 to 85 degrees Fahrenheit (°F). Nights are cooler, with low temperatures averaging 32 to 50°F. Winter temperatures are frequently below freezing at night, but can be above 50°F during the day. During summer, temperatures can approach 100°F during the day. Daily temperature fluctuations of 30°F are common throughout the year (BLM, 1999).

Precipitation at the Site averages about 13 inches per year (ranging from nearly 3 inches in 1956 to over 20 inches in 1986). As much as half of the annual precipitation occurs in the form of intense thunderstorms during July, August, and September, when moist air enters the region from the Gulf of Mexico. Summer thunderstorms can result in heavy rainfall and flash floods. Average monthly precipitation in January through June is typically 0.50 inch or less. Snowfall is possible from October through April, but most likely (greater than 1 inch) between December through February (BLM, 1996).

Evaporation exceeds precipitation in southwestern New Mexico. Pan evaporation data, the most commonly collected data, are correlated with lake evaporation (i.e., free water surface evaporation) to predict evaporation from reservoirs and lakes. Lake evaporation at the Site is estimated to be approximately 58 to 65 inches per year, and pan evaporation is estimated to be approximately 80 to 90 inches per year (SRK, 1995).

Prior to the preparation of this Section, two reports from Alta Gold Company baseline meteorological data were reviewed by a subcontractor on behalf of NMCC to collect baseline meteorological data and conduct PM_{10} ambient air monitoring. These reports were prepared for Alta Gold Company by their air quality subcontractors, Air Sciences Inc. (Air Sciences) and present the meteorological protocols used by Air Sciences, including a letter from the New Mexico Air Quality Bureau approving the protocols. They also present the baseline air conditions for six months of on-site data (collected from August 19 to February 20, 1995), and six months of complimentary Truth or Consequences data (collected from February 21 to August 18, 1964), which was used for air dispersion modeling. On July 9, 2010, NMCC and the subcontractor visited the New Mexico Air Quality Bureau to meet with David Heath of the air modeling group, and Norma Perez and Kathy Primm, Environmental and Permit Specialists, respectively, to describe the air monitoring protocols the subcontractor would use, and to discuss the location of the on-site meteorological tower, which is the same location used by Alta Gold in 1994 and 1995. No objections were noted to either the protocols or the tower location (Air Sciences, 1995a and 1995b).

2.2 Sampling Objectives

2.2.1 Meteorological

The monitoring program will operate as a single station for a minimum of one year. The purpose of the monitoring program will be to collect baseline climatological data representative of the Site that satisfies the criteria of the New Mexico Surface Mining Act and the U.S. Environmental Protection Agency (EPA) on-site meteorological program guidance for dispersion modeling (EPA, 1987). The meteorological data will provide input to characterize the following climatological factors on a quarterly and annual basis:

- Wind direction
- Wind speed
- Temperature
- Precipitation
- Relative humidity
- Barometric pressure
- Net radiation
- Evapotranspiration

Additionally, the meteorological data will support the particulate (PM_{10}) air monitoring program to help determine sources of airborne particulate matter and to aid in the validation of monitored data.

The data capture goal will be 90 percent or greater for each meteorological parameter.

2.2.2 Air Quality – Particulate (PM_{10})

Title 19, Part 6 of the New Mexico Surface Mining Act requires the mine permittee to maintain all environmental permits and to be in compliance with other state or federal laws, regulations, or standards. Other applicable ambient air quality laws, regulations, and standards include those promulgated by the New Mexico Environment Department's Air Quality Bureau and the Environmental Protection Agency.

Federal and New Mexico Ambient Air Quality Standards (NMAAQS) exist for three categories of particulate. The categories and standards are as follows:

- Total suspended particulates (TSP) (20.2.3.109 NMAC)
  - 24-hour average: 150 micrograms per cubic meter (µg/m^3)
  - Annual geometric mean: 60 µg/m^3
- Particulate matter less than 10 micrometers (PM_{10}) (40 CFR 50.6(a))
  - 24-hour average: 150 µg/m^3
- Particulate matter less than 2.5 micrometers ($PM_{2.5}$) (40 CFR 50.7(a))
  - 24-hour average: 35 µg/m^3
  - Annual average: 15 µg/m^3

Fugitive dust from material hauling and conveying, stockpiles, and tailings impoundments may contribute air emissions of particulate matter categorized as PM_{10} and TSP. Currently, no monitored data exists characterizing the local ambient air quality particulate concentrations in the vicinity of the Site. Based on the need to determine current background concentrations and to address potential public concern over future air quality impacts, NMCC recommends PM_{10} monitoring at two locations.

PM_{10} monitoring will demonstrate compliance with the NMAAQS health-based standard and help characterize TSP episodes to address the New Mexico standards for nuisance dust and soiling. The PM_{10} monitoring program will follow EPA guidelines for methodology and quality assurance, and will use samplers with equivalence method designation.

The validated data capture goal is 75 percent based on quarterly and annual report periods.

Surface mining and milling for copper are not considered significant sources for $PM_{2.5}$ emissions. Monitoring for this parameter is not recommended due to potential emissions below significant thresholds.

2.3 Sampling Frequency

2.3.1 Meteorological Station

Meteorological sensors are to be scanned once each second. The data are compiled as averages and totals at hourly and 15-minute intervals.

2.3.2 Air Quality Station

PM_{10} samples will be taken once every 6 days. Each scheduled sample will run for a period of 24 hours from midnight to midnight of the scheduled sample date.

2.4 List of Data to Be Collected

2.4.1 Meteorological

Meteorological data will be output hourly; averages and totals will be output every 15 minutes. See Table 2-1 for the meteorological data that will be collected and the instruments that will be used.

2.4.2 Particulate (PM_{10})

In addition to collecting 24-hour average particulate matter as PM_{10}, the following supporting data will be collected:

- Flow rate in liters per minute
- Fluctuation of flow rate
- Average ambient temperature
- Average ambient pressure
- Total run time in minutes
- Total volume of air sampled

2.5 Methods of Collection

2.5.1 Meteorological Monitoring

Data will be collected and stored on a Campbell Scientific CR1000 datalogger. The datalogger will interface with a digital cellular modem allowing daily data downloads to a remote PC and monitoring of real-time meteorological conditions. The datalogger will have the capacity to store approximately 2 months of data on-site.

2.5.2 Air Quality Monitoring

Each sample filter will be collected manually following the end of the sample period and prior to the next scheduled sample. Filters will be labeled with individual serial numbers and tracked with chain-of-custody forms between the field and laboratory. The laboratory will ship pre-exposed filters to the field in individual glassine envelopes. No later than two days following the end of sample period, a field technician will place the exposed filters into the original glassine envelope and return the filters via express mail.

The designated PM_{10} sampler is a model PQ200 manufactured by BGI corporation. The sampler flow controller will maintain flow rate at 16.7 liters per minute. The processor will output hourly and daily values for average ambient temperature and pressure, flow rate, pressure drop, and error alarms. The data log will be downloaded onto a field PC at the time of each filter change.

2.6 Parameters to be Analyzed

2.6.1 Meteorological Parameters

The meteorological tower will report hourly and 15-minute averages for the following parameters:

- Horizontal wind direction
- Horizontal wind speed
- Sigma theta of the wind direction
- Temperature at 10 meters (T10)
- Temperature at 2 meters (T2)
- Delta temperature as T10 minus T2
- Relative humidity
- Barometric pressure
- Net radiation
- Pan evaporation

In addition, the meteorological tower will report hourly and 15-minute totals for precipitation and evaporation.

2.6.2 Air Quality Parameters

PM_{10} will be calculated as a 24-hour average using standard conditions of temperature and pressure to determine flow rates for each sample. The standardized temperature and pressure will be used in combination with net weight gain on the filter to determine the final PM_{10} concentration in $\mu g/m^3$.

2.7 Maps Showing Proposed Sampling Locations

The map provided in Figure 2-1 plots the locations of the proposed particulate (PM_{10}) and meteorological monitoring stations. The air monitoring stations are designated as Site 1 and Site 2. Site 1 consists of one 10-meter meteorological tower and one PM_{10} monitor. Site 2 consists of a single PM_{10} monitor.

The air monitoring site coordinates are as follows:

- Site 1 – 0264721 meters E; 3650403 meters N; Elevation at 5,402 feet
- Site 2 – 0262618 meters E; 3651000 meters N; Elevation at 5,596 feet
- Mill Site – 0264363 meters E; 3650403 meters N; Elevation at 5,457 feet

All coordinates are expressed as Universal Transverse Mercator (UTM) coordinates in the NAD 83 mode.

2.8 Laboratory and Field Quality Assurance Plans

2.8.1 General

2.8.1.1 Data Validation and Reporting

All data will be reviewed by a senior air quality professional retained by NMCC as it is received from the field. Any problems detected during the data review will be immediately communicated to the field technicians and then to the data reduction specialists. Data reduction specialists will compile the data on a monthly basis and produce monthly engineering units, math reports, and data capture summaries of the validated data. A senior air quality professional will prepare an operations summary for each month. The individual monthly reports and summaries will be compiled into an annual database from which an annual report will be produced. PM_{10} data will be reported monthly and quarterly as specified by EPA guidelines and federal regulations.

All procedures for calculation and reporting of data capture and determination of compliance will be performed in accordance with the following, as appropriate:

- Paragraph 13 of Subsection D of 19.10.6.602 NMAC
- Instruction manual for the PQ200 air sampler version 1.83 (BGI, 2007)
- 40 CFR 50, Appendices H, J, and K to Part 50
- 40 CFR 58, Appendix B to Part 58
- EPA *On-Site Meteorological Program Guidance for Regulatory Modeling Applications, Quality Assurance Handbook for Air Pollution Measurement Systems,* Volume II: Ambient Air Specific Methods (Appendix D); and *Quality Assurance Handbook for Air Pollution Measurement Systems,* Volume IV: Meteorological Measurements (EPA 1987, 2008a, 2008b).

2.8.1.2 Quality Assurance/Quality Control

The quality assurance audits will be conducted with personnel and equipment completely independent from the routine field operators and their chain of supervision. Audits of the particulate samplers will be performed every six months, with a total of two proposed for the first year. Monthly flow checks will be performed by the on-site technician. The tower-based meteorological sensors will be audited every six months, with a total of two audits scheduled for the first year. Problems encountered during the audits will be corrected at the time of the audit or immediately referred to the station operator. All audit results will be summarized in a separate report to be issued following each field visit.

All audit procedures and equipment will conform to the federal regulations and guidelines listed in the previous section.

2.8.2 Quality Assurance Procedures for Meteorological Station

The field quality assurance procedures and schedule for the meteorological tower are provided below:

Procedure	Schedule
Perform general station check/visit	2 times per month
Review data on a real time basis	Daily
Audit meteorological tower instruments	Biannually
Check operation of meteorological sensors	Each visit
Check datalogger output against ambient conditions	Each visit
Ship data to Albuquerque (field logs)	1 time per month
Review data (field)	Each visit
Review data (home office)	Daily
Maintain documentation of all field activities	Each visit

The station operator will document the findings and actions taken during each station check on pre-printed and bound station log forms. A guidance document outlining the procedures and required corrective actions, if applicable to maintain properly functioning instruments will accompany the station logbook.

Below is a summary of the meteorological field audit procedures to be followed by all air quality personnel. Although characterized as a summary, the procedures described follow the intent of the published EPA QA/QC guidelines and satisfy the project monitoring obligations. The general guidelines to follow in preparation for a field performance audit are as follows:

1. List all parameters to be audited. Include calculated parameters (e.g., delta T, temp. lapse, sigma theta).
2. List the model type(s) for all sensors to be audited.
3. Compare the standard procedures below with the parameter/sensor model to be audited and prepare an equipment list and an information list.
   a. The equipment list should include:
      i. Actual test equipment.
      ii. Tools and spare parts.
      iii. A computer interface (lap top, keyboard, etc).
   b. The information list should include (most of the information in the first five items can be found in the field quality assurance binders and reports from previous audits):
      i. Expected sensor output values.
      ii. Calibration factors for tower sensors and audit instrumentation (e.g., net radiation).
      iii. Programs and software (LoggerNet, copies of the datalogger program and channel outputs, an audit assistant spreadsheet, and look-up tables).
      iv. Wiring diagrams for the datalogger and other connections, if available.
      v. General data points and results from the previous audit, if available.

  vi. Instruction manuals, including Campbell Scientific CR1000, Raven modem, and sensor manuals as required.

  vii. A field quality assurance binder.

4. Pack-up, review the checklist, and leave.

Each meteorological sensor is evaluated based on the comparison of performance against EPA guidelines and manufacturer specifications. If any performance values are outside the recommended ranges, the results are immediately reported to field personnel so that any field repair and/or recalibrations can be performed expeditiously. The baseline summary report will include these results for documentation purposes.

Each meteorological sensor is calibrated using procedures specifically designed to test its accuracy of response. General descriptions are given below. These procedures reflect the requirements described in the *Quality Assurance Handbook for Air Pollution Measurement Systems* (EPA, 2008b). Upon arrival at the Site, each variable is observed for reasonableness. Next, the audit manipulations to each sensor are conducted. The datalogger outputs are recorded and compared to the audit input values. If the bias between the audit and Site values exceeds the prescribed limits described below, the appropriate troubleshooting is conducted to determine the cause of the discrepancy. At the conclusion of the audit, the sensors are put back on line and are again checked for reasonableness.

See Table 2-2 for a summary of meteorological audit criteria.

2.8.2.1 Sensor Heights

During the Site visit, the height of each sensor above ground is measured with a standard tape measure or using trigonometric methods and a surveyor's transit. The measured heights are then compared to those stated in the air monitoring program plan.

2.8.2.2 Wind Direction

Vane Calibration. Two factors must be checked to assure the wind vane is accurately measuring the wind direction: the azimuth as stated on the wind vane (orientation) and the ability of the wind vane to measure winds from all directions.

The preferred method for checking the wind vane orientation marker’s stated azimuth is the solar azimuth angle technique, which is used to determine a known direction (solar azimuth). This measurement is made using a surveyor’s transit mounted either on a field tripod or directly onto the wind direction sensor mounting plate. A measurement to a local topographical marker is then taken and the difference between that value and the known solar azimuth is used to determine a calculated azimuth angle for the reference marker. The resultant azimuth for the reference marker is used in a like manner to determine the orientation of the sensor crossarm (ideally set at 180 degrees). The solar azimuth check is normally done only once to establish a known direction for measurement of the orientation of the reference marker. A minimum of three bearings will be taken for this test. If the solar azimuth angle technique cannot be used, the azimuth angles will be measured with compass bearings.

A substitute (and second preference) for using the solar angle method is to measure the reference point azimuths from a topographic map. The sensor outputs, when aligned to the chosen reference points, are compared to the azimuths determined from the topographic map. This methodology requires accurate interpretation of the angles from the topographic map and knowledge that the chosen reference points are visible from the tower site. Additionally, at least one of the reference points needs to be greater than 10 kilometers from the tower site.

Regardless of which azimuth determination technique is used, the following should be adhered to by the field staff:

1. Select reference points with as great a distance possible from the tower site. The preferred approach is to have at least one point that is a minimum of 10 kilometers distant. If points of this distance are not available, extra care must be taken during the visual alignments.
2. Always prepare the basic field data before leaving for the Site (solar angle tables, azimuth to reference points, etc.).
3. Complete all preliminary data on the audit log forms. This data includes calibration constants of all audit instrumentation (as applicable) and expected output values for each test (as applicable).
4. Always run an equipment checklist prior to leaving for the Site. The content of the equipment list depends on the methodologies to be used.

The ability of the wind sensor to measure winds from any direction is tested by visually aligning the sensor with the reference markers established above, recording the output from the datalogger, and comparing the previously determined azimuths. To ensure accuracy, the wind vane is aligned with the crossarm and the corresponding output is recorded.

Sensor Linearity and Overall Accuracy. Sensor linearity is checked by removing the wind vane and replacing it with a protractor and angle fixture. Wind direction readings will be taken at 30 degree intervals for a total of 12 readings. This is the preferred method.

In the event a calibrated protractor is not available for a given type of sensor, the linearity will be checked by approximating 45 or 90 degree turns. A volt or ohm meter may be also be used for the alignments. As with the calibrated protractor, readings will be taken at approximately 30 degree intervals.

Sigma Theta Test. The wind direction sigma theta check is a test of the datalogger sigma theta calculation. Any system errors attributable to the program algorithm and/or the signal from the sensors are detected in the outputs at the datalogger. The theta test is conducted by fixing the wind vane at a given direction for a given period of time and then moving the vane approximately 30 degrees and leaving it at this setting for the same time period. The time interval is selected to correspond to one averaging period of the datalogger. During the selected time interval, the wind speed sensor is held stationary to prevent the vector averaging routine from interfering with the sigma theta audit. Sigma theta, average wind direction, and average wind speed are recorded from the datalogger and compared to the expected values.

The following items are important to ensure the accuracy of this test:

1. Ensure that the theta test corresponds to the averaging interval on the datalogger. Most systems calculate the sigma theta over a sub-interval period of either 10 or 15 minutes. Whenever a sub-interval period is in use, the averaging period of the datalogger (i.e., final output instruction) must be modified to correspond to this interval. Remember to always reset all changes made to the program before proceeding to the next audit parameter.
2. Synchronize the timing for the test to the datalogger clock, not necessarily with the auditor’s watch. Repositioning of the wind vane (for the second half of the averaging interval) must occur as closely as

possible to the midpoint of the time interval. For example, the wind vane will be moved after 5 minutes for a 10-minute test and after 7.5 minutes for a 15-minute test.

3. Always record start and end values for time, wind directions, wind speeds, and protractor settings (when applicable).
4. Perform the sigma theta test on each datalogger within a monitoring network. On towers with multiple levels of sigma theta, perform the test on the level of the most significant interest.

Starting Threshold Torque. The wind vane's starting threshold torque is measured using a National Institute of Standards and Technology (NIST)-calibrated torque gauge. The gauge is applied to the wind vane shaft at the center of rotation and a constant force is applied. The test is repeated six to eight times beginning at different points for a 360-degree rotation. The value recorded is the highest value observed during the test.

If a calibrated torque watch is not available, the Jonard leaf torque gauge must be employed. This method requires a ruler (capable of measuring 10 centimeters [cm]) and a protected area where the sensor can be set up and leveled free from any air disturbance.

A manual, qualified, bearing check is acceptable only in combination with the above procedures for the purpose of a QA audit.

2.8.2.3 Horizontal Wind Speed

Sensor Calibration. The sensor is audited by removing the anemometer cups and applying a constant rate of rotation in the normal direction of spin using synchronous motors. This is done by connecting the motor shaft to the anemometer shaft using a non-rigid, non-slip connector. Using the anemometer specifications, revolutions per minute (rpm) are converted to wind speed and compared to the resulting instantaneous datalogger outputs. The following precautions will be taken during the calibration procedure:

1. Avoid applying excessive pressure to the sensor shaft during the motor test. Excessive pressure will slow the rate of rotation.
2. Be certain all connections between the motor shaft and the sensor shaft are secure. Slippage can cause erroneous readings on the sensor.
3. Always have the expected output values and audit criteria recorded on the audit log.

Starting Threshold Torque. The starting threshold torque measurement of the anemometer shaft follows the same procedure as that described for the horizontal wind vane. Due to the lower resistance, a more sensitive torque watch is used.

2.8.2.4 Temperature

The tower-mounted temperature sensor is audited by collocation at three points with an NIST-traceable thermometer in constant temperature water baths. The field thermometer has a range of at least -1° to 51°C in 0.1°C graduations and will be certified by comparison to an NIST-certified thermometer. The tests are conducted in the following temperature ranges: 0° to 5°C, 20° to 30°C, and 40° to 50°C. The equilibrated thermometer reading is compared to the datalogger output. Finally, the aspirator is checked for proper ventilation by inspecting operation of the fans, if applicable, and checking the air pathway for obstructions.

Occasionally, a water bath test is not possible. In this instance, the temperature probes will be audited by collocation with the NIST thermometer. The field (NIST) thermometer is to be collocated, under ambient conditions, in proximity to the tower sensor. If possible, the temperature probe will be placed inside the aspirator shield. Be certain not to contact any nearby surfaces with the field probe while conducting this test and keep in mind the following considerations:

1. In addition to recording readings from the field thermometer and individual tower probes, record the delta temperature and temperature lapse values, as calculated by the datalogger, simultaneously for each of the three water baths.
2. Note that small temperature differences within the water bath tests can induce large differences in the measured lapse rates. The passing criterion is 0.1°C.

2.8.2.5 Precipitation

The precipitation gauges are audited using a 100–milliliter (ml) graduated buret (within 1 percent accuracy). Two types of tests are conducted: a 10-tip test and a bucket test. The 10-tip test is conducted before disturbing the outer housing of the gauge. To conduct the 10-tip test, the buret is opened to deliver water at the approximate rate of 5 seconds per cubic centimeter (cc) of water and allowed to flow until ten tips are identified. The delivered amount of water is converted to equivalent inches of precipitation and the result compared to the datalogger output. During the 10-tip test, it is important that the bucket does not overflow on the final tip (the tenth tip). Carefully monitor the flow rate following the ninth tip and quickly close the stop cock on the final tip of the bucket. The error introduced at this point can be minimized with careful control of the water flow rate and should not have a significant effect on the 10-tip average.

In the bucket test, water is delivered until the bucket tips one time. The delivered water is compared to the theoretical amount of precipitation needed for 0.01 inch of rain in each bucket. The bucket test is repeated at least three times for each bucket. Following the bucket tip tests, the sensor is checked for level and cleanliness.

2.8.2.6 Barometric Pressure

The barometric pressure sensors will be calibrated according to manufacturer specifications. The sensor output will be checked by collocation with an aneroid or digital portable barometer. The portable barometer will be calibrated to an NIST-traceable mercury barometer immediately before the team leaves for the field. The mercury barometer and documentation of the certifications will be located at the NMCC Albuquerque office.

2.8.2.7 Relative Humidity

The relative humidity sensors are audited by collocation under ambient conditions using an aspirated psychrometer or digital relative humidity (RH) meter. Both thermometers used in the psychrometer are certified using the procedures cited above for temperature. The equilibrated dry bulb and wet bulb thermometer readings and the datalogger output values are recorded. The audit relative humidity value is calculated from formulas contained in the Smithsonian Meteorological Tables, corrected for the measured ambient barometric pressure. The audit relative humidity is compared to the datalogger output and the result is considered satisfactory if the difference between the two is ±3 percent RH or less.

When conducting the relative humidity audit, it is important that the following considerations be observed:

1. Position the tower sensor as close to the inlet to the psychrometer thermometers as possible.
2. Be certain to shield the tower sensor and the psychrometer from direct sunlight.
3. Allow 2 or 3 minutes for the psychrometer to stabilize at the beginning of the test.

4. Perform at least two tests, preferably three.

2.8.2.8 Net Radiation

The net radiation audit is accomplished through collocation of an audit pyranometer with the tower pyranometer. The mounting of the audit sensor should closely match that of the tower sensor, accounting for elevation, sun exposure, and level. The audit sensor should be of nearly identical spectral response as that of the tower sensor.

Readings from the two sensors can either be taken as discrete points over a pre-determined time interval or as an extended time average. Discrete readings should be taken over a minimum period of 2 hours with as many as 15 to 20 values distributed over the time interval. Extended averages can be taken with an independent volt meter (capable of collecting average data) over a minimum period of one hour. The following considerations apply:

1. Ensure that discrete readings of the audit and tower sensors are closely synchronized in time.
2. Start the extended averaging period on the digital volt meter (DVM) at the beginning of the corresponding period on the tower datalogger (hourly, 15 minutes, etc.).

2.8.2.9 Station Locations and Orientation

During the field portion of the audit activities, the integrity of the station reference marker is checked by determining the azimuth angle with respect to true north and comparing that value to the value used by the station operator for the meteorological tower. This is accomplished by field measurement of the solar azimuth using a leveled surveyor's transit. The solar azimuth angle is previously calculated from a computer program and available to the auditor in tables at 5-minute intervals. Once the known azimuth angle of the sun is established, it is used to determine the azimuth of station reference marker(s). These values are compared to values determined by the station operator using other orientation methods.

2.8.2.10 Station Sampling Environs

Part of the system audit is to document instrument fetch and local effects on data. The Site area obstructions, field of view, and local topography are examined. Nearby obstructions are located on the azimuth scale, heights are determined (when possible), and the distance from the tower is measured. All local environs data are evaluated, compared to regulatory guidance, and submitted with the audit report for inclusion in Site documentation files.

Meteorological Data Validation Criteria. The following criteria will be used in preparing the quarterly summaries for the Copper Flat meteorological data for this report:

1. Temperature Summaries (10-m temperature, 2-m temperature, delta temperature, and temperature lapse rate)

   The mean, maximum, and minimum temperatures (in degrees Celsius) are reported for each day in the quarter. The maxima and the minima are based on 1-hour averages. For a 24-hour mean value to be valid, at least 18 hourly values must have been recorded during the 24-hour period. If less than 18 hours of valid data are available, the mean is calculated, but data may not be representative and should be used with care. Similarly, maxima and minima are included for these periods. Even though some data may have been available on these days, the maxima and minima may be misleading if the missing data was for the hottest or coldest part of the day.

For each month in the quarter, the mean temperature for the month is calculated from all of the hourly data, including the data from the days that did not have sufficient data to calculate a 24-hour mean. Monthly averages are calculated for months with less than 4 valid 24-hour means. The monthly maximum and minimum are also reported. Although 4 days of valid data are considered enough to report a mean, means for months with less than 18 days of valid data may not be representative and should be used with care.

A quarterly mean, maximum, and minimum are reported if there is at least one valid month of data in the quarter. However, these values may not be truly representative of the entire quarter if significant amounts of data are missing. The validity of the quarterly values depends on their intended use, and care should be taken with quarters with low data capture.

2. Wind Speed Summary

   The 24-hour mean wind speed and the maximum hourly wind speed are reported for each day of each month (in meters per second). The criterion for a valid 24-hour means is the same as that described above for mean temperatures.

   The monthly mean wind speed and the maximum wind speed are also reported. The criteria for determining the monthly values are the same as those described above for monthly temperature values. Likewise, the mean for the entire quarter and the maximum hourly value in the quarter are reported, using the criteria described above for quarterly temperature values.

3. Wind Data Summary

   The wind data summary report gives a joint frequency distribution (JFD) for wind direction and wind speed. Wind direction is divided into 16 sectors, each representing 22.5 degrees. The north sector covers 348.75 degrees to 11.25 degrees (i.e., its axis of symmetry is zero degrees). Wind speeds are divided into 8 categories. The data in each wind speed/wind direction category are given as a fraction of the total month to the nearest 1 percent. The total fraction for each wind direction sector and each wind speed category is also given.

   A quarterly JFD is printed if at least one valid month of data existed in the quarter. However, the quarterly JFD may not be truly representative of the full quarter if only one month of data is available.

4. Precipitation Summary

   The total daily precipitation in inches is reported for each day in the quarter, along with a running precipitation total beginning on the first day of the quarter. Daily precipitation is reported if at least one hour of data is available during that day.

   The total quarterly precipitation is reported along with the total number of hours during which precipitation occurred. A quarterly precipitation value is reported if there is any valid precipitation data during the quarter. Care must be taken when using quarterly precipitation values if there were significant missing data during the quarter.

5. Relative Humidity Summaries

   The daily mean, maximum, and minimum relative humidity (in percent) are reported for each day in the quarter. The maxima and minima are based on 1-hour averages. For a 24-hour mean value to be valid, at least 18 hourly values must have been recorded during the 24-hour period. If less than 18 hours of valid data are available, the mean is calculated, but data may not be representative and should be used with care. Similarly, maxima and minima are included for these periods. However, the maxima and minima may be misleading if the missing data were for the hottest or coldest part of the day.

The monthly mean relative humidity is calculated from all of the hourly data, including that from the days without sufficient data to calculate a 24-hour mean. Monthly averages are calculated for months with less than 4 valid 24-hour means in the month. The monthly maximum and minimum are also reported. Although 4 valid days are considered sufficient to report a mean, monthly means based on less than 18 days of valid data may not be representative and should be used with care.

A quarterly mean, maximum, and minimum are reported if there is at least one valid month of data in the quarter. However, these values may not be truly representative of the entire quarter if significant amounts of data are missing.

6. Data Capture Summary

The percent of valid data, based on hourly values, is reported for each month and each parameter; the average data capture for the entire month is also reported. In addition, the percent of valid data for the quarter for each parameter and the average data capture for the quarter are provided.

7. Barometric Pressure Summary

Barometric pressure is provided in millibars and represents the actual Site pressures; these data have not been "corrected" to sea level as is typically done with National Weather Service data. The reporting requirements for valid averages, maxima, and minima are the same as those for temperature and relative humidity summaries.

8. Net Radiation Summary

The maximum net radiation in watts per square meter is reported for each day in the quarter. The maxima are based on 1-hour averages.

9. Evaporation Summary

The total, minimum, and maximum evaporation values are reported in inches for each day of the quarter. Minima and maxima are based on 1-hour averages. Positive values indicate evaporation, or loss of water from the evaporation pan, whereas negative values indicate precipitation or addition of water to the evaporation pan for other reasons.

For a 24-hour total value to be valid, at least 18 hourly values must have been recorded during the 24-hour period. If less than 18 hours of valid data are available, the total is calculated, but data may not be representative and should be used with care. Similarly, the maximum and minimum are included for these periods, but may be misleading if the missing data occurred in the hottest or coldest part of the day or during a precipitation event.

The total monthly evaporation is calculated from all the hourly data for each month in the quarter, including the data from days with insufficient data to calculate a 24-hour total. The monthly maximum and minimum are reported as well.

Validated data includes natural precipitation events. Scheduled and manual re-filling events are removed from the reported data set.

2.8.3 Quality Assurance Procedures for Air Quality Station

The field quality assurance procedures and schedule for the air quality station are provided below (EPA, 2008a):

Procedure	Schedule
Change particulate filters	Every 6 days
General station check/visit	At each visit
Flow rate check particulate samplers (PM_{10})	Monthly
Audit flow check of particulate samplers	Every 6 months

During monthly sampler flow checks, the flow rate is adjusted to be within 4 percent of 16.67 liters per minute (l/min) under ambient conditions. Ambient temperature and pressure taken at the time of the flow checks/adjustments are used to calculate a correction factor. The correction factor is used to calculate actual flow rates (Q_{ACT}).

Actual flow rates are converted into standard flow rates (Q_{STD}) at standard temperature (298°K) and pressure (760 mm Hg). The filter weight gain is determined to be the difference between the unexposed filter weight and the exposed filter weight. Both Q_{ACT} and Q_{STD} together with net weight gain are used to determine the 24-hour particulate concentration in micrograms per cubic meter ($\mu g/m^3$).

2.9 Discussion in Support of Proposal

2.9.1 Total Suspended Particulates

Currently no NMAAQS exists for TSP. However, the state of New Mexico retains a TSP ambient air quality standard for nuisance dust and overall welfare type of impacts. Given the lack of residences and restricted public access to the mine areas, NMCC does not anticipate nuisance dust to be a significant problem, at least for the near term of the project. However, the project recognizes potential public concern for TSP impacts. NMCC proposes to use PM_{10} monitoring, as described in the following section, to estimate TSP concentrations based on monitored PM_{10} values.

2.9.2 Particulate Matter Less than 10 Micrometers

In 1987, the EPA adopted PM_{10} as the NMAAQS for particulate matter, replacing TSP. Since that date, PM_{10} has been one of the particulate matter health standards at the federal and state levels. PM_{10} has potential local impacts due to releases from the ground level and elevated stack sources. A review of the New Mexico Energy, Minerals and Natural Resources Department (EMNRD) Mining and Minerals Division (MMD) regulations (Title 19, Part 6) revealed no specific requirement for an air quality monitoring plan to protect the environment. Additionally, a survey of several non-coal mines in New Mexico revealed no requirements for particulate monitoring.

Fugitive dust from material hauling and conveying, stockpiles, and tailings impoundments may contribute air emissions of particulate matter categorized as PM_{10} and TSP. Currently, no monitoring data exists characterizing the local ambient air quality particulate concentrations in the vicinity of the Site. Based on the need to determine current background concentrations and potential public concern of future air quality impacts, NMCC recommends PM_{10} monitoring at two locations.

PM_{10} monitoring will demonstrate compliance with the NMAAQS health-based standard and help characterize TSP episodes to address the New Mexico standards for nuisance dust and soiling. The PM_{10} monitoring program will follow EPA guidelines for methodology and quality assurance, and will use samplers with equivalence method designation.

NMCC proposes using the PQ200 low-volume (16.67 l/min) sampler manufactured by BGI. The sampler uses a 47-mm Teflon filter and is powered by a 100-amp hour gel cell lead acid battery. It uses a photovoltaic panel for charging. The sampler has EPA equivalence method designation for both PM_{10} and $PM_{2.5}$.

2.10 References

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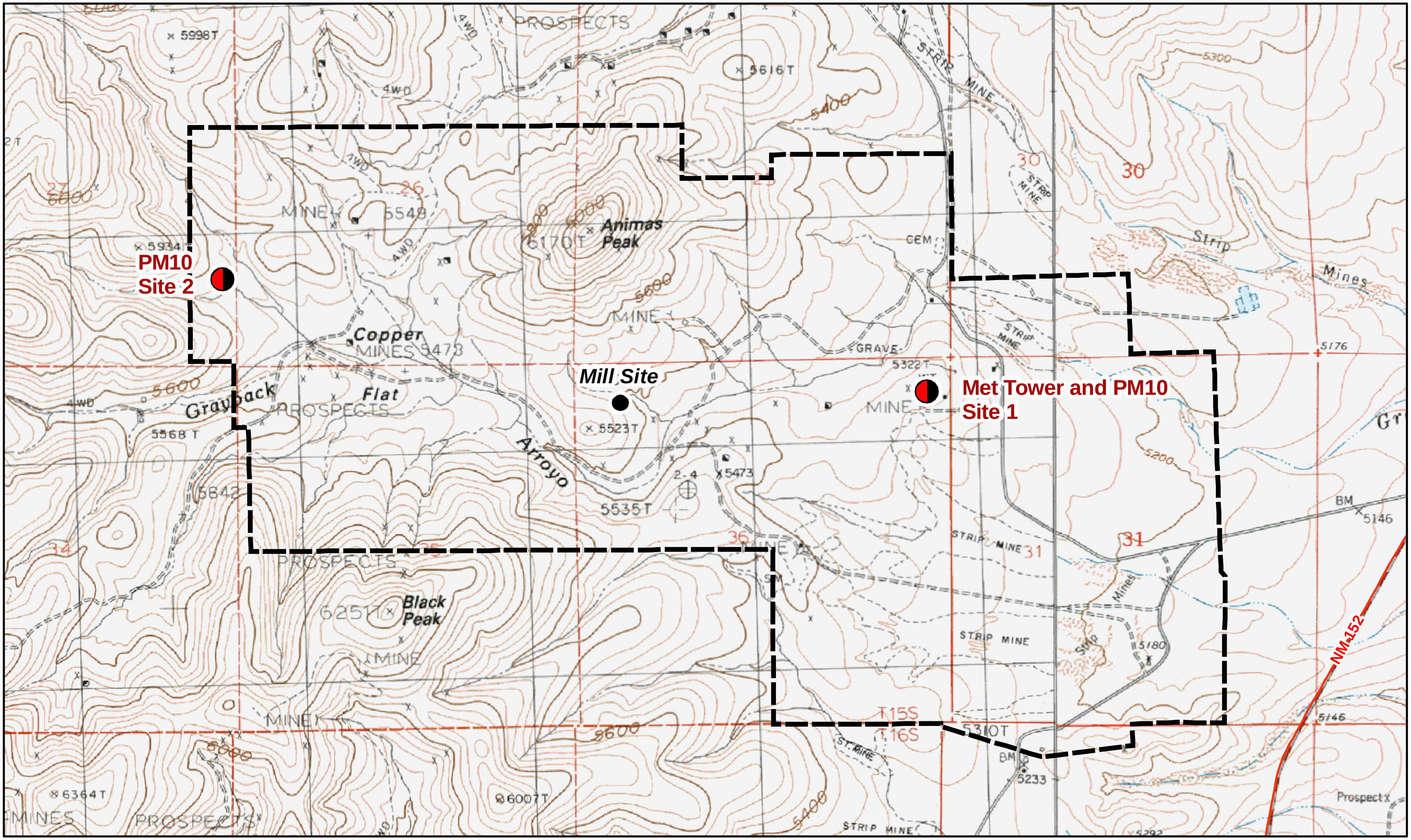
Figure



N W E S

0 1,000 2,000 4,000 6,000

Feet

Sample Locations:
Class One Technical Services
Mine Boundary:
Tom Van Bebber
Imagery Information:
-USGS 7.5-Minutes Quads; Skute
Stone Arroyo & Hillsboro
Projection Information:
-New Mexico State Plane West, NAD 1927

Legend

Proposed Mine Permit Boundary

Figure 2-1
Topographic Map Showing the Locations of the Proposed Particulate (PM_{10}) and Meteorological Monitoring Stations

New Mexico Copper Corporation

Tables

Table 2-1

Meteorological Data to be Collected

Parameter	Tower Level (m above ground surface)			Equipment Manufacturer and Model
	0	2	10	
Horizontal Wind Direction			X	Climatronics F460
Horizontal Wind Speed			X	Climatronics F460
Ambient Temperature		X	X	Climatronics 100093 Motor Aspirated
Temperature Lapse (2–10 m)		X	X	Climatronics 100093 Motor Aspirated
Pan Evaporation	X			NovaLynx
Relative Humidity		X		Climatronics 100098 Motor Aspirated
Net Radiation		X		Kipp and Zonen
Precipitation	X			Climatronics Tipping Bucket
Barometric Pressure		X		Setra

Table 2-2

Summary of Meteorological Audit Criteria

Parameter Tested	Acceptable EPA Deviation or Satisfactory Criteria
Wind Direction	
Vane Orientation	± 5° from reference
Sensor Linearity	±3° at any of the 12 points checked
Starting Torque	See manufacturer specifications
Horizontal Wind Speed	
Sensor Calibration	± 0.25 m/s at speeds < 5 m/s 5% at speeds > 5 m/s (max. error 2.5 m/s)
Starting Torque	See manufacturer specifications
Temperature	± 0.5°C at all 3 points checked
Temp. Lapse	± 0.1°C
Precipitation	± 10% difference
Barometric Pressure	± 10.2 millibars (mb)
Relative Humidity	± 3%
Net Radiation	± 5% difference
Evaporation	± 10% difference