



DENVER · PORTLAND

Baseline Meteorological and Air Quality Data Annual Report Resolution Copper Mining Project April 1, 2012 - March 31, 2013

PREPARED FOR: Resolution Copper A Member of Rio Tinto Group

CONFIDENTIAL AND PRIVILEGED ATTORNEY WORK PRODUCT AND/OR ATTORNEY-CLIENT COMMUNICATION

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Appendices

Appendix A thorugh K: Enclosed as a CD

1.0 INTRODUCTION

This annual report summarizes the meteorological, nitrogen dioxide (NO₂), sulfur dioxide (SO₂), ozone (O₃), and particulate matter (PM) data collected at the Resolution Copper Project near Superior, Arizona for the first complete year of monitoring, April 1, 2012 – March 31, 2013. Monitoring was performed in accordance with the *Resolution Copper Mining Monitoring Plan, November 2011* (approved by the Pinal County Air Quality Control District [PCAQCD] on November 15, 2011). A more detailed description of the sites, the quality control, and parameters collected can be found in the four quarterly data reports which were issued throughout this year of monitoring.

Resolution Copper Mining LLC (RCML) has implemented a meteorological and air quality monitoring program to support several efforts during the pre-feasibility and other mine development phases: environmental assessments, impact analyses, and documents required by the National Environmental Policy Act (NEPA); meteorological and air quality data to be processed and used as input for AERMOD (American Meteorological Society/Environmental Protection Agency Regulatory Model) dispersion modeling; and air quality baseline data and AERMOD analyses to be used to support RCML's application to the PCAQCD for air permit(s).

1.1 Location

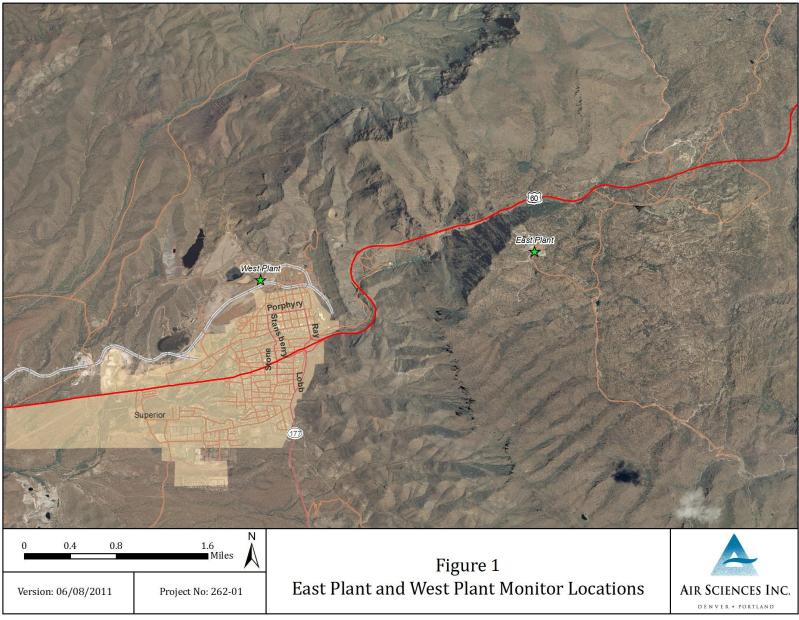
The Resolution Copper Project is located near Superior, Arizona. Currently there are two meteorological and air quality stations. The East Plant station is located at the main project site, east of Superior. The West Plant station is located at RCML's facilities directly north of Superior, Arizona. The topography ranges from hilly to mountainous.

The monitoring station locations are shown in Figure 1 and listed by coordinates in Table 1.

Station	Location	Latitude (Deg)	Longitude (Deg)	Elevation (ft)	Method of Determination	
West Plant	01S12E35NWSE	33.2994	-111.1021	2,949	GPS	
East Plant	01S13E32SWNW	33.3030	-111.0676	4,199	GPS	

Table 1. Monitoring Station Locations

Figure 1. Resolution Monitoring Stations Locations



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1.2 Monitoring Program Description 1.2.1 Meteorological Data

Meteorological sensors and air quality instrumentation at the East Plant and West Plant stations are mounted on 10-meter, open-lattice towers or housed in climate-controlled insulated shelters, and are listed by height, from ground level, in Table 2.

		Height (m)	West Plant	East Plant
	Horizontal wind speed (meters per second [m/s])	10	~	~
a	Horizontal wind direction (degrees [°])	10	\checkmark	\checkmark
l Dat	Horizontal wind direction standard deviation (sigma theta)	10	\checkmark	\checkmark
gica	Air temperature (degrees Celsius [°C])	2	~	\checkmark
orolc	Vertical temperature difference (ΔT, Delta T, [°C])	2,10	~	\checkmark
Aete	Relative humidity (percent [%])	2	~	\checkmark
AERMOD Meteorological Data	Solar radiation (watts per square meter [W/m²])	2	~	\checkmark
RMG	Barometric pressure (millimeters of mercury [mmHg])	1	~	\checkmark
AE	Precipitation (inches [in])	Ground	~	\checkmark
a	FEM* Particulate matter less than 10 microns (PM_{10})	2,3	~	~
r Daf	FEM* Particulate matter less than 2.5 microns (PM _{2.5})	2,3	~	~
nt Ai	Sulfur dioxide (SO ₂)	3		~
Ambient Air Data	Ozone (O ₃)	3		\checkmark
An	Nitrogen dioxide (NO2)	3		\checkmark

Table 2. Sensors and Heights

*Federal Equivalent Method

1.2.2 NO₂ Data

NO₂ is measured at the East Plant using the Teledyne T200 Chemiluminescence NO₂ Analyzer, which holds an Environmental Protection Agency (EPA) equivalency designation as a Reference Method (RFNA-1194-099). This instrument is designed to measure oxides of nitrogen (NO_X) (with nitrogen dioxide, NO₂, as an indicator) at trace levels in ambient air. The instrument is operated continuously to collect hourly NO, NO₂, and NO_X concentrations. Appendix E lists hourly NO₂ data for the East Plant from April 1, 2012 through March 31, 2013.

1.2.3 SO₂ Data

SO₂ is measured at the East Plant using the Teledyne T100 UV Fluorescence SO₂ Analyzer, which holds an EPA designation as an Automated Equivalent Method (EQSA-0495-100). The instrument is operated continuously to collect hourly SO₂ concentrations. Appendix E lists hourly SO₂ data for the East Plant from April 1, 2012 through March 31, 2013.

1.2.4 O3 Data

O₃ is measured at the East Plant using the Teledyne T400 UV Absorption O₃ Analyzer, which holds an EPA designation as an Automated Equivalent Method (EQOA-0992-087). The instrument is operated continuously to collect hourly O₃ concentrations. Appendix E lists hourly and rolling 8-hour average O₃ data for the East Plant from April 1, 2012 through March 31, 2013.

1.2.5 PM Data

 PM_{10} and $PM_{2.5}$ are measured at both the East Plant and West Plant using Met One Instruments' Beta Attenuation Monitors (BAM). At each site, one BAM is configured as a $PM_{2.5}$ Federal Equivalent Method (FEM), which holds the EPA designation (EQPM-0308-170), and the other BAM is configured as a $PM_{2.5}$ FEM, but is set to monitor PM_{10} . The instruments are operated continuously to collect hourly $PM_{2.5}$ and PM_{10} concentrations. Appendix D lists hourly $PM_{2.5}$ and PM_{10} data from April 1, 2012 through March 31, 2013.

2.0 DATA RECOVERY RATES

Data recovery rates for all parameters are presented by quarter in Table 3. Meteorological data recoveries are calculated by dividing the amount of valid hourly averages by the available hourly periods in the quarter. Air quality and particulate data recoveries are calculated by dividing the amount of valid 24-hour averages (for PM₁₀, PM_{2.5}), valid 24-hour maximum value (for SO₂, NO₂), or valid daily rolling 8-hour maximum (O₃) values by the number of days in the quarter. Particulate and air quality 24-hour averages or maximums are valid if greater than 75 percent of the hourly readings are valid for that day (at least 18 out of 24 hours). A more detailed description of data loss and explanations can be found in the four quarterly data reports which were issued throughout this year of monitoring.

All data recoveries for quarterly data collected from April 1, 2012 through March 31, 2013 exceeded the required data recovery quality objectives of 75% for air quality and particulate data and 90% for meteorological data.

	2Q 2012		3Q 2	2012	4Q 2	2012	1Q 2013		
Parameter*	East West Plant Plant					East Plant	West Plant	East Wes Plant Plan	
Meteorological									
Wind speed (10 m)	100	100	99.9	99.9	100	100	99.9	99.7	
Wind direction (10 m)	100	100	99.9	99.9	100	100	99.9	99.7	
Temperature (2 m)	100	100	99.9	99.9	100	100	99.9	99.8	
Delta temperature	100	100	99.9	99.9	100	100	99.9	99.8	
Relative humidity	100	100	99.9	99.9	100	100	99.9	99.8	
Barometric pressure	100	100	99.9	99.9	100	100	99.9	99.8	
Precipitation	100	100	100	100	100	100	99.9	99.9	
Solar radiation	100	100	99.9	99.9	100	100	99.9	99.8	
NO ₂	100		91.3		88.0		95.6		
O ₃	93.4		92.4		95.7		84.4		
SO ₂	100		93.5		91.3		87.8		
PM10	96.7	93.4	100	100	100	100	100	98.9	
PM _{2.5}	93.4	90.1	100	97.8	97.8	91.3	100	97.8	

Table 3. Data Recovery Rates, East Plant and West Plant April 1, 2012 – March 31, 2013 (percent)

*Meteorological parameters are observed hourly.

NO₂, O₃, SO₂, and PM parameters are observed every 24 hours.

2.1 Quality Control

Quality assurance, equipment calibration, and audit procedures are conducted in accordance with the following documents:

- Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Quality Monitoring Program (EPA-454/B-08-003, December 2008)
- Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements (EPA-454/B-08-002, March 2008)
- Transfer Standards for the Calibration of Ambient Air Monitoring Analyzers for Ozone (EPA-454/B-10-001, November 2010)
- Code of Federal Regulations (40 CFR Parts 50 and 58)
- Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD) (EPA-450/4-87-007, May 1987)
- Meteorological Monitoring Guidance for Regulatory Modeling Applications (EPA-454/R-99-005, February 2000)

Details of the audits and/or calibrations of meteorological and air quality instrumentation can be found in the four quarterly data reports which were issued throughout this year of monitoring. Copies of the audit/calibration report, flow verifications, and site check forms can be found in Appendices F-K.

3.0 METEOROLOGICAL DATA SUMMARY AND DISCUSSION

3.1 Meteorological Data Summary

Meteorological data from the first quarter have been compiled and summarized in graphical and tabular form. A schematic of meteorology summary sheets is shown in Figure 2. Meteorological summary sheets (Figure 3 and Figure 4) are comprised of the following:

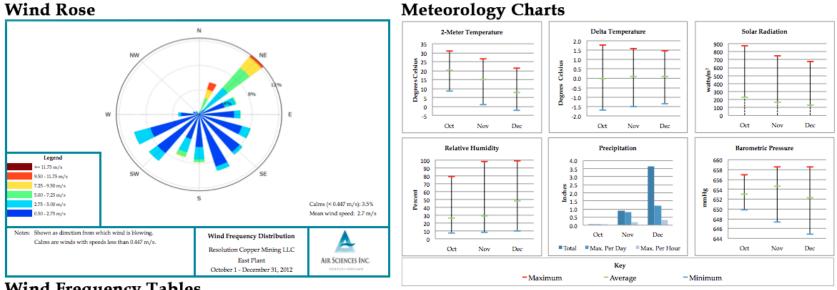
Wind Rose – Graphically depicts the percentage of winds that come from each of the 16 directions for the reported period. Wind speeds are divided into six subcategories ranging from less than 0.5 m/s (the measurement threshold of the instrument) to greater than 11.75 m/s.

Wind Frequency Table – A two-part table. The left part of the Wind Frequency Table shows the percentage of occurrence of winds for each of the 16 directions that occur in each of the six Wind Speed Class Intervals. The right part shows the percentage of occurrence of winds for each of the 16 directions that occur in each of the six Stability Classes.

Meteorology Charts – Graphically summarize recorded hourly meteorological parameters by month. Chart types include stock-ticker charts (with high, low, and average hourly values for each month) and bar charts.

Instantaneous Wind Frequency and Maximum Chart – Graphically summarizes instantaneous (twosecond) wind speeds as a percentage of occurrences for each of the nine wind speed intervals and the magnitude, date, and time of the maximum instantaneous wind speed for each month.

Figure 2. Schematic of Meteorological Data Sheets



Meteorology Charts

Wind Frequency Tables

	Speed Class Intervals (m/s) (percent of occurrence)							Mean			St	ability Cl	ass		
Direction	0.5<1.5	1.5 <3	3<5	5<7	7 <10	>=10	All	Speed	A	в	С	D	E	F	All
N	0.2	0.2	0.0	0.0	0.0	0.0	0.5	1.9	0.0	0.1	0.1	0.1	0.0	0.2	0.5
NNE	0.0	0.2	0.5	1.8	2.1	0.9	5.5	7.4	0.0	0.2	0.6	4.7	0.0	0.1	5.6
NE	0.3	1.3	3.9	3.7	3.0	0.2	12.5	5.4	0.0	0.2	1.2	10.5	0.4	0.2	12.5
ENE	0.8	3.6	1.3	0.1	0.0	0.0	5.9	2.5	0.0	0.2	0.8	2.2	1.7	1.2	6.1
E	1.9	3.5	0.7	0.1	0.0	0.0	6.3	2.0	0.0	0.4	1.0	1.9	1.1	2.0	6.4
ESE	3.6	3.5	1.0	0.0	0.0	0.0	8.1	1.8	0.0	0.5	1.7	1.8	1.3	3.5	8.8
SE	6.0	2.0	0.4	0.0	0.0	0.0	8.4	1.3	0.0	0.5	0.4	0.8	1.0	6.6	9.3
SSE	7.3	1.7	0.5	0.0	0.0	0.0	9.6	1.2	0.0	0.3	0.5	1.0	0.5	8.0	10.2
s	3.6	1.9	1.7	0.5	0.0	0.0	7.8	2.2	0.1	0.4	1.5	2.0	0.4	3.8	8.3
SSW	1.4	3.4	1.7	0.8	0.1	0.0	7.3	2.8	0.0	1.0	1.5	3.1	0.7	1.0	7.3
sw	1.9	7.0	0.9	0.0	0.0	0.0	9.7	2.1	0.0	2.0	3.9	1.6	0.8	1.5	9.8
WSW	2.3	6.3	1.6	0.0	0.0	0.0	10.2	2.2	0.0	1.4	2.4	3.0	1.3	2.2	10.2
w	0.8	2.0	0.3	0.0	0.0	0.0	3.1	2.0	0.0	0.2	0.5	0.7	0.7	0.9	3.1
WNW	0.5	0.4	0.1	0.0	0.0	0.0	1.0	1.8	0.0	0.1	0.0	0.2	0.1	0.6	1.0
NW	0.2	0.5	0.0	0.0	0.0	0.0	0.7	1.7	0.0	0.1	0.0	0.0	0.2	0.2	0.7
NNW	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.1
All	31.0	37.5	14.5	7.2	5.3	1.0	96.5	2.7	. 0.2	7.7	16.1	33.6	10.2	32.2	100.0

Instantaneous Wind Frequency & Maximum Chart

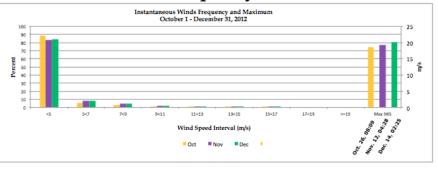
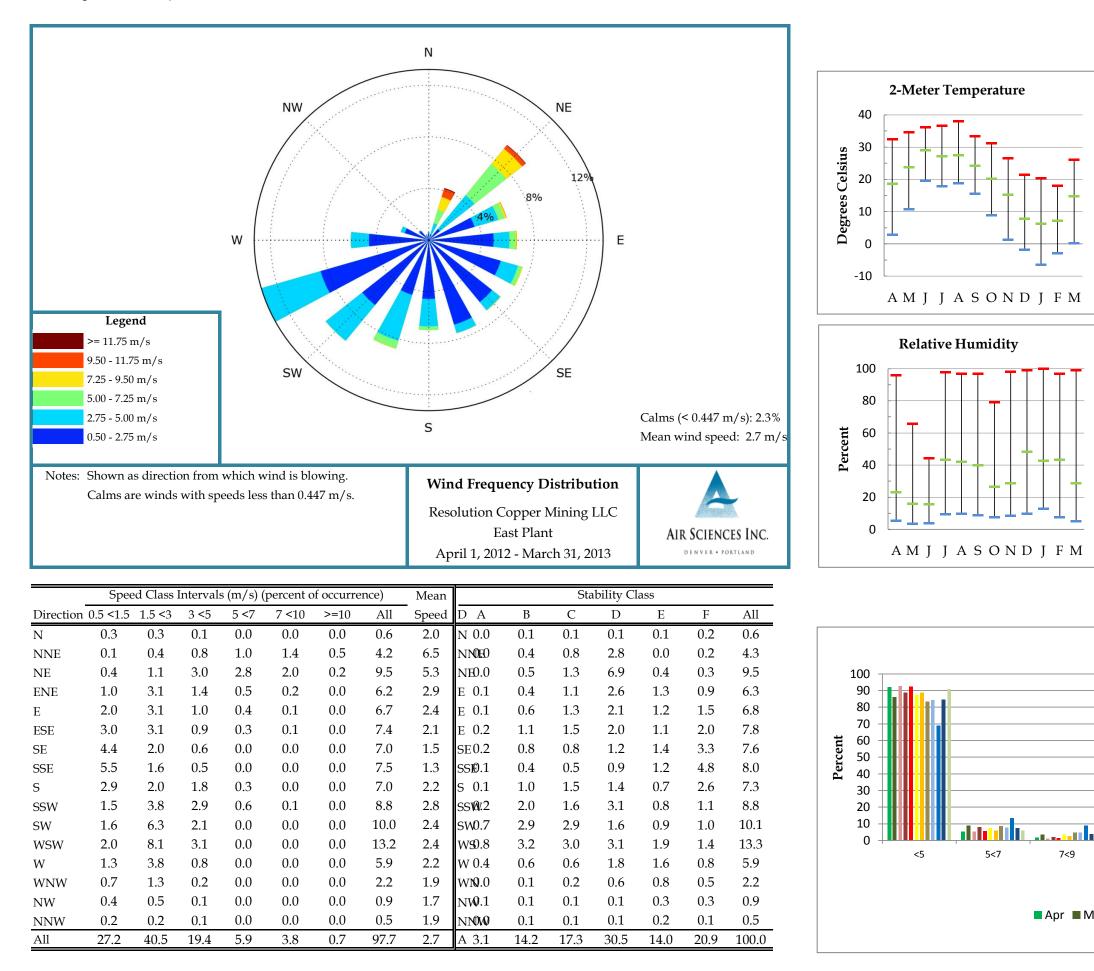
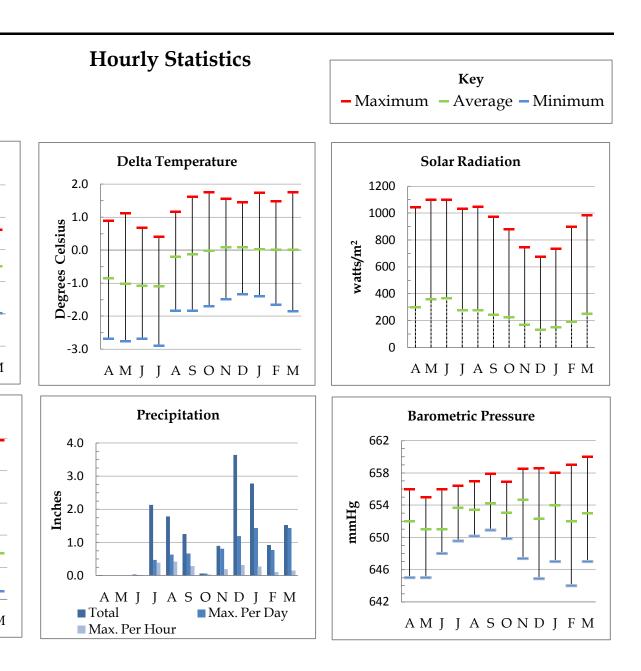


Figure 3: East Plant Meteorological Data Summary

Meteorological Data: April 1, 2012 - March 31, 2013





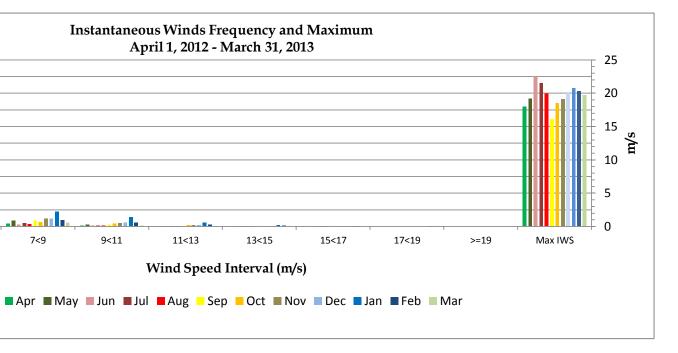
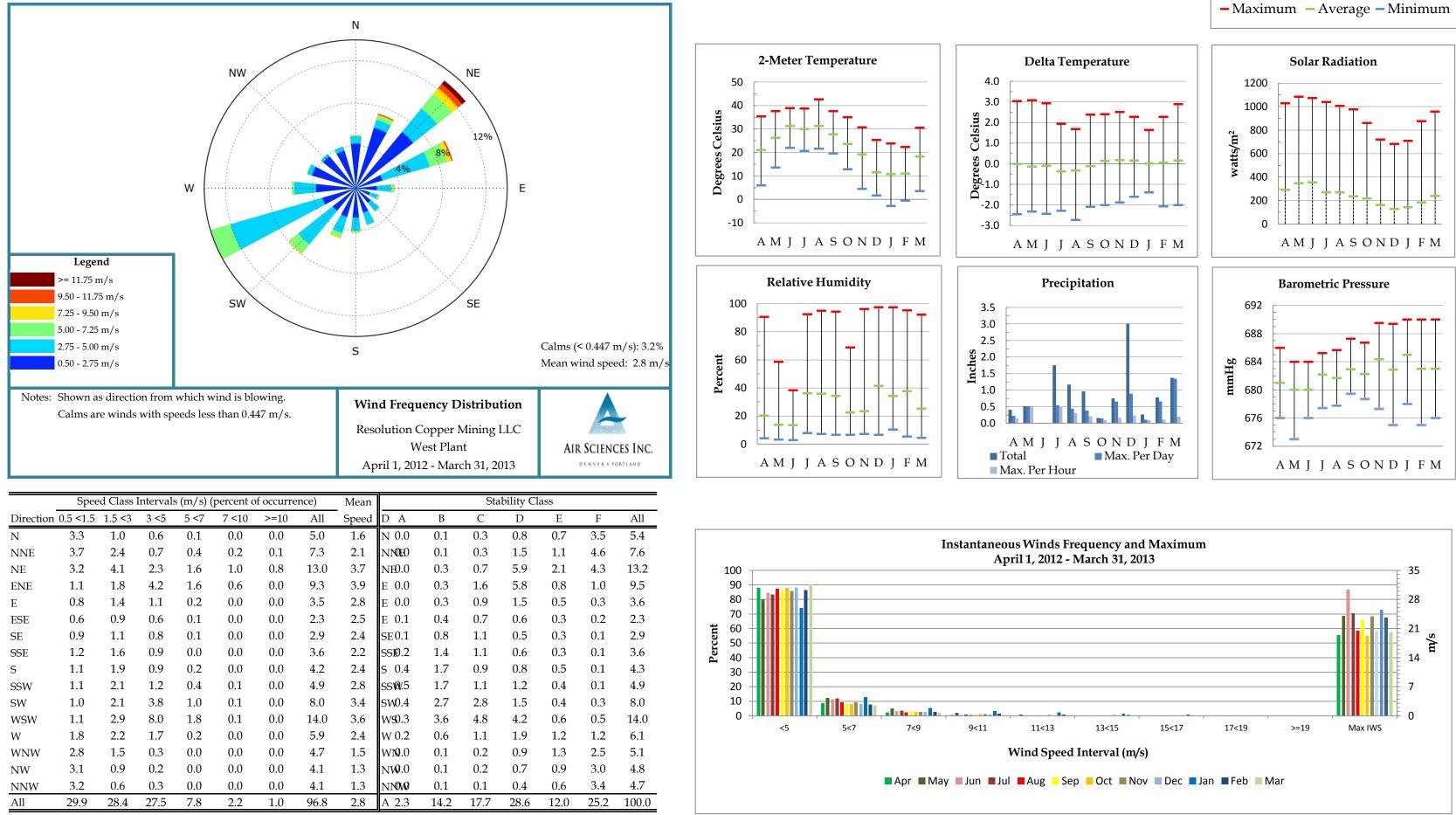
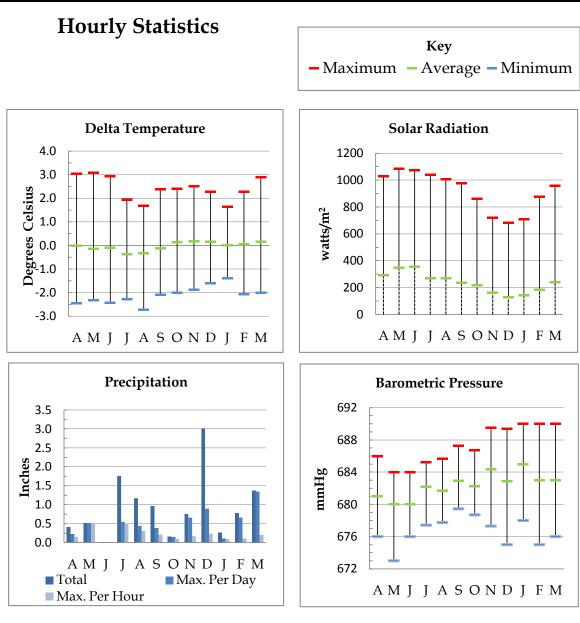


Figure 4: West Plant Meteorological Data Summary

Meteorological Data: April 1, 2012 - March 31, 2013



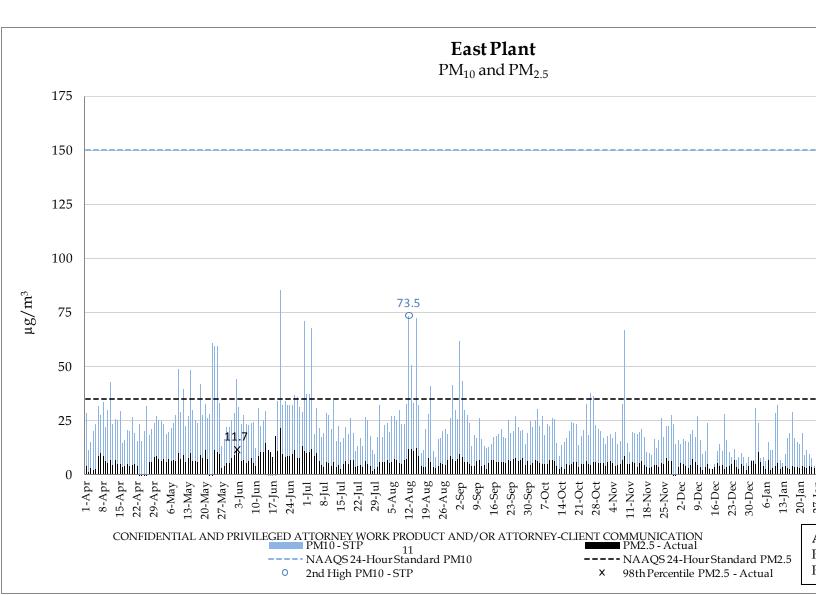


4.0 PM DATA SUMMARY AND DISCUSSION

4.1 East Plant PM Data Summary

Figure 5 presents the PM_{10} and $PM_{2.5}$ data collected at the East Plant site for the year, and compares the data to the PM_{10} and $PM_{2.5}$ NAAQS. The second-high 24-hour average for PM_{10} , and the 98th percentile for $PM_{2.5}$ are labeled. The annual mean value for PM_{10} and $PM_{2.5}$ are shown in the lower-right corner.

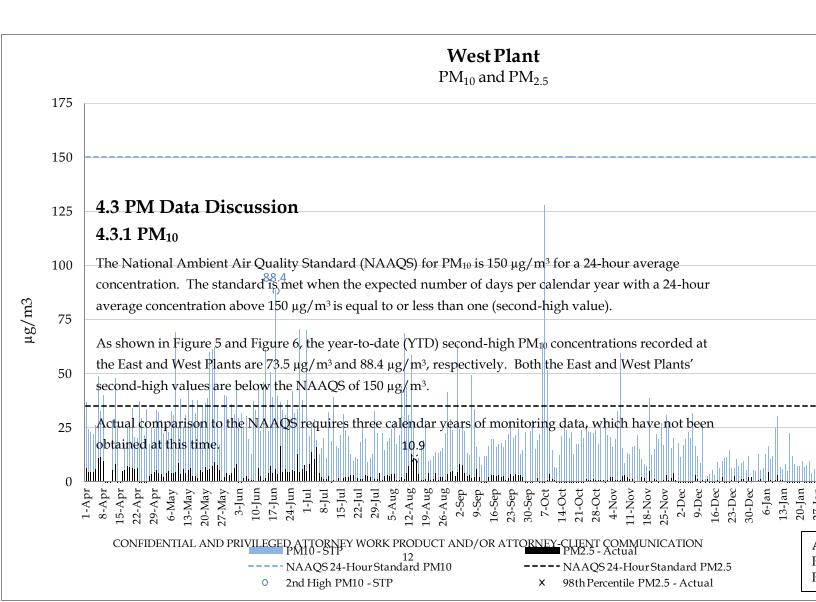
Figure 5. East Plant Particulate Data - (April 1, 2012 - March 31, 2013)



4.2 West Plant PM Data Summary

Figure 6 presents the PM_{10} and $PM_{2.5}$ data collected at the West Plant site for the year, and compares the data to the PM_{10} and $PM_{2.5}$ NAAQS. The second-high 24-hour average for PM_{10} , and the 98th percentile for $PM_{2.5}$ are labeled. The annual mean value for PM_{10} and $PM_{2.5}$ are shown in the lower-right corner.

Figure 6. West Plant Particulate Data - (April 1, 2012 - March 31, 2013)



4.3.2 PM_{2.5}

The annual primary and secondary $PM_{2.5}$ standards are met when the annual arithmetic mean concentration is less than or equal to $12.0 \ \mu g/m^3$. The 24-hour primary and secondary $PM_{2.5}$ standards are met when the 98th percentile 24-hour concentration is less than or equal to $35 \ \mu g/m^3$.

As shown in Figure 5 and Figure 6, YTD arithmetic mean concentrations for the East and West Plants are 5.6 and 2.1 μ g/m³, respectively. Both the East and West Plants' arithmetic mean values are below the NAAQS of 12 μ g/m³.

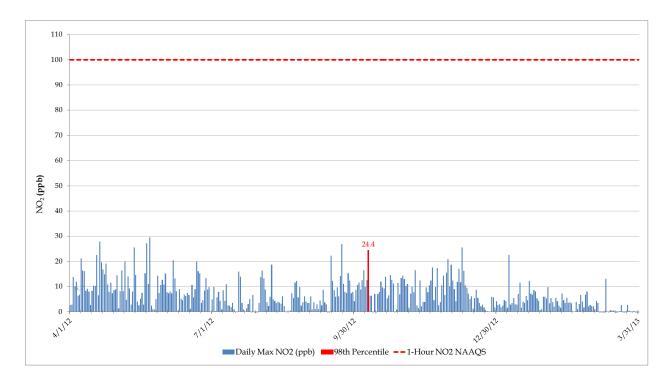
Figure 5 and Figure 6 also show the 98th percentile concentrations at the East and West Plants, which were 11.7 and 10.9 μ g/m³, respectively. The 98th percentiles of both the East and West Plants' 24-hour concentrations are also below 35 μ g/m³.

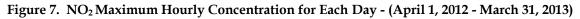
Actual comparison to the NAAQS requires three calendar years of monitoring data, which have not been obtained at this time.

5.0 NO₂ DATA SUMMARY AND DISCUSSION

5.1 NO₂ Data Summary

Figure 7 and Figure 8 present the NO₂ maximum hourly concentrations for each calendar day, and hourly data collected at the East Plant site for the year. Figure 7 shows the 98th percentile compared to the one-hour NO₂ standard. Figure 8 shows the mean hourly NO₂ concentration compared with the annual NO₂ standard.





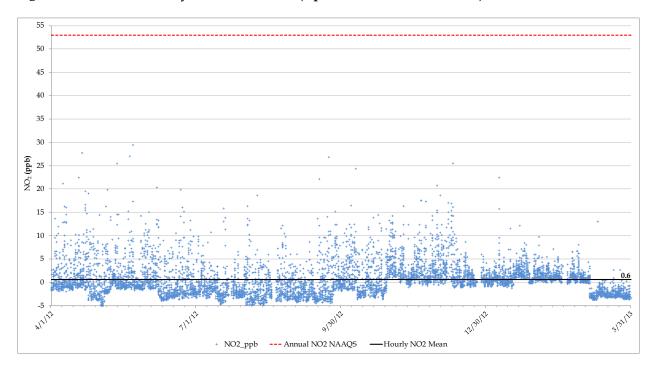


Figure 8. NO₂ Mean Hourly Concentrations - (April 1, 2012 - March 31, 2013)

5.2 NO₂ Data Discussion

The level of the annual NAAQS for oxides of nitrogen is 53 parts per billion (ppb), measured in the ambient air as NO₂. The annual NAAQS is met when the annual average concentration in a calendar year is less than or equal to 53 ppb.

The level of the 1-hour NAAQS for oxides of nitrogen is 100 ppb, measured in the ambient air as NO₂. The 1-hour NAAQS is met when the three-year average of the annual 98th percentile of the daily maximum 1-hour average concentration is less than or equal to 100 ppb.

As shown in Figure 7, the 98th percentile of the daily maximum 1-hour average NO₂ concentration for the year is 24.4 ppb, which is less than the NAAQS 1-hour primary standard of 100. As shown in Figure 8, hourly NO₂ average is 0.6 ppb, which is below the annual NO₂ NAAQS of 53 ppb.

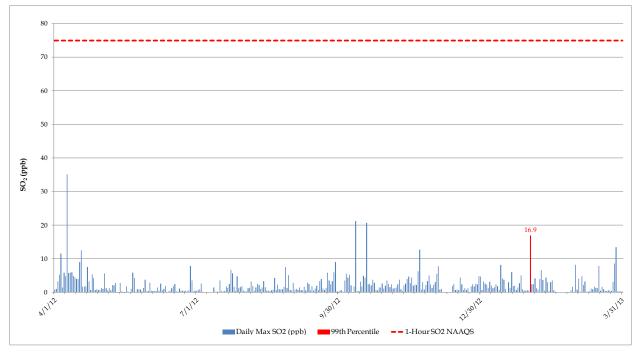
Actual comparison to the NAAQS requires three calendar years of monitoring data, which have not been obtained at this time.

6.0 SO₂ DATA SUMMARY AND DISCUSSION

6.1 SO₂ Data Summary

Figure 9 presents the maximum hourly SO₂ concentrations for each calendar day collected at the East Plant site for the year, and it shows the 99th percentile (labeled) compared to the one-hour SO₂ standard.

Figure 9. SO₂ Maximum Hourly Concentration for Each Day - (April 1, 2012 - March 31, 2013)



6.2 SO₂ Data Discussion

The level of the primary 1-hour NAAQS for oxides of sulfur is 75 ppb measured in the ambient air as sulfur dioxide (SO₂). The 1-hour primary standard is met at an ambient air quality monitoring site when the three-year average of the annual (99th percentile) daily maximum 1-hour average concentrations is less than or equal to 75 ppb.

As shown in Figure 9, the 99th percentile 1-hour maximum concentration for the year is 16.9 ppb, which is below the annual SO₂ NAAQS of 75 ppb.

Actual comparison to the NAAQS requires three calendar years of monitoring data, which have not been obtained at this time.

7.0 O₃ DATA SUMMARY AND DISCUSSION

7.1 O₃ Data Summary

Figure 10 presents the daily rolling 8-hour maximum O_3 data collected at the East Plant site for the year, and it shows the year-to-date first-highest rolling 8-hour average compared to the eight-hour O_3 standard.

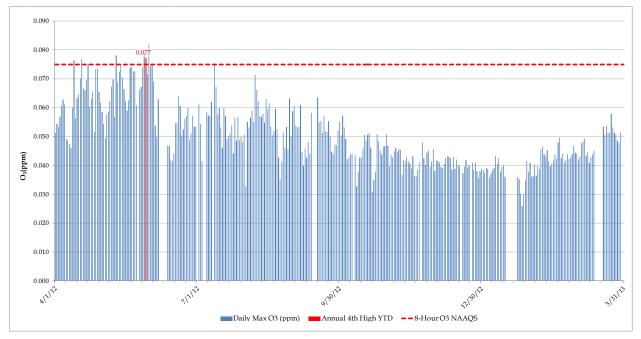


Figure 10. O₃ Daily Rolling 8-Hour Maximum - (April 1, 2012 - March 31, 2013)

7.2 O₃ Data Discussion

The level of the primary and secondary 8-hour NAAQS for ozone is 0.075 parts per million, daily maximum average. The 8-hour primary and secondary standard is met at an ambient air quality monitoring site when the three-year average of the annual fourth-highest daily maximum 8-hour average O₃ concentration is less than or equal to 0.075 ppm.

Figure 10 shows that the year-to-date averaged fourth-high maximum recorded at the East Plant for the year is 0.077 ppm. This concentration is above the NAAQS 8-hour O_3 standard of 0.075 ppm.

Parts of Pinal County and adjacent Maricopa County have been designated as non-attainment areas for 8-hour ozone by the Arizona Department of Environmental Quality (ADEQ).

Actual comparison to the NAAQS requires three calendar years of monitoring data, which have not been obtained at this time