DEPARTMENT OF
ECOLOGY
State of Washington

Automated Method Data Documentation, Review and Validation Procedure

Air Quality Program

October 2009

95-201C (rev. 10/09)

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State of Washington
Department of Ecology
Air Quality Program

AUTOMATED METHOD DATA DOCUMENTATION, REVIEW AND VALIDATION PROCEDURE

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95-201C (rev 10/09)

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TABLE OF CONTENTS

TABLES AND FIGURES

1 INTRODUCTION

This document details the procedure for the documentation and validation of data collected from automated ambient air monitors within the Washington State Department of Ecology Air Quality Program (AQP) network.

The data collected by the AQP will be utilized to make decisions that affect human and environmental health and may have economic impacts. High quality data increases the likelihood that these decisions will be well-informed and that the data will withstand scrutiny, particularly in cases of litigation. Ultimately, consistently high quality data will enable the AQP to better serve the public's charge and Ecology's mission of improving and protecting the air for present and future generations.

Strict adherence to the following procedure will ensure that the data collected by the AQP will be of consistently high quality.

2 DATA QUALITY INDICATORS

The "EPA Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Section 3" states that data quality can be defined in terms of several key data quality indicators; precision, bias, detection limit, completeness, and comparability. In accordance with this rationale, it is the policy of the AQP to provide for the generation, storage, and use of data that meet these indicators. EPA defines these indicators as follows.

2.1 Precision

Precision is a measure of agreement among repeated measurements of the same property under identical, or substantially similar, conditions. This is the random component of error. Precision is estimated by various statistical techniques typically using some derivation of the standard deviation.

Ecology assesses individual automated method precision through routine quality control checks that must fall within predefined acceptance criteria (Table 1 below).

2.2 Bias

Bias is the systematic or persistent distortion of a measurement process which causes error in one direction. Bias will be determined by estimating the positive and negative deviation from the true value as a percentage of the true value.

Network bias is assessed through routine quality control checks and performance audits.

2.3 Detection Limit

The detection limit is the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability.

Detection limits are generally not a concern for the majority of Ecology's monitors. However, detection limits are important at NCore sites which require some instruments to quantify at lower concentrations (e.g., trace gases).

2.4 Completeness

Completeness describes the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under correct, normal conditions.

The AQP requires that a minimum of 75% of each monitored hour be valid. It is the AQP's goal that a minimum of 80% certified valid data (hourly averages) should be collected each month per parameter.

2.5 Comparability

Comparability is a measure of the confidence with which one dataset or method can be compared to another, considering the units of measurement and applicability to standard statistical techniques. Comparability of datasets is critical to evaluating their measurement uncertainty and usefulness.

In accordance with 40 CFR, Part 58, Ecology has established acceptance criteria for quality control and performance audits. These acceptance criteria, excluding meteorological parameters and trace gases, are presented in Table 1 below.

Table 1: Automated Gaseous and Particulate Instrument Acceptance Criteria

	Action	BSCAT (nephelometer)	Carbon Monoxide (CO)	Ozone (O_3)	PM_{10} TEOM (Flow Rate Verification)	$PM_{2.5}$ TEOM (Flow Rate Verification)
Zero	Corrective Action	> ± .3 e^{-5}	> ± .5 ppm	> ± 3 ppb	N/A	
	Invalidate Data	> ± .5 e^{-5}	> ± 1 ppm	> ± 6 ppb		
Precision/Span	Corrective Action	> ± 7%		> ± 5%		
	Invalidate Data	> ± 10%		> ± 7%	> ± 10%	

Meteorological precision and accuracy are assessed through quality control checks and performance audits. Acceptance criteria for meteorological parameters are presented in Table 2:

Table 2: Meteorological Acceptance Criteria

Parameter	Acceptance Limit
Wind Speed	± 5%
Wind Direction	± 3 Degrees
Temperature	± .5 ºC
Relative Humidity	X% ± 5

For additional quality control criteria information, please refer to the AQP Quality Assurance Plan.

3 DOCUMENTATION

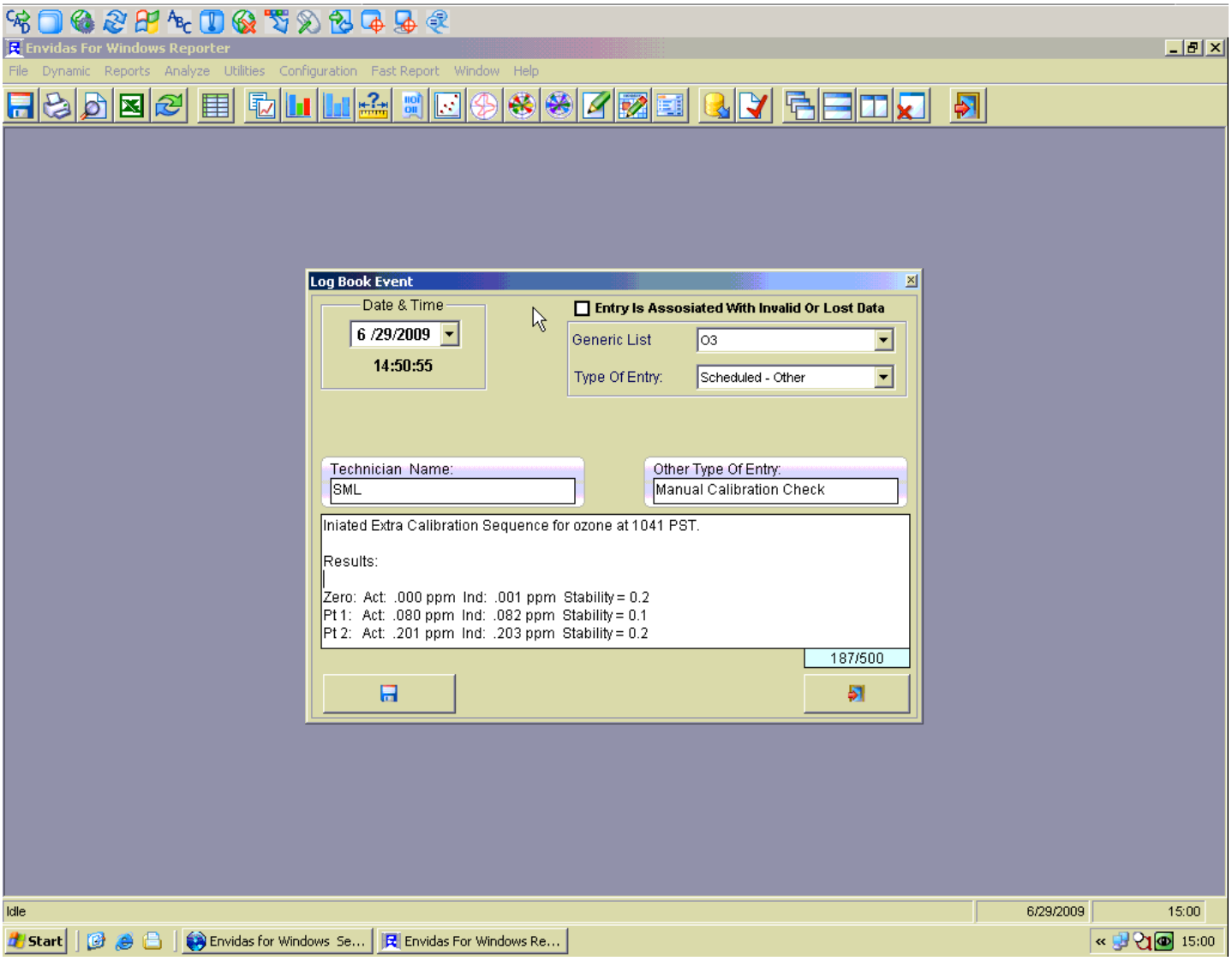
Maintaining a high level of data quality is critical in order to meet data quality and measurement objectives and fulfill the mission of the AQP. Detailed documentation is an important factor in ensuring high data quality because it allows for the thorough review of the monitoring and collection processes, facilitates troubleshooting of systematic or other sampling errors, and ensures the data stand up under scrutiny. This section details the procedures for proper documentation of air monitoring activities and data.

Documentation is accomplished primarily through the use of the monitoring station log book. Additional documentation is parameter-specific and is not included here. For more information on parameter-specific documentation requirements, please refer to the appropriate standard operating procedure (SOP). The minimum requirements for documenting log books are detailed in the following section.

3.1 Station Log book

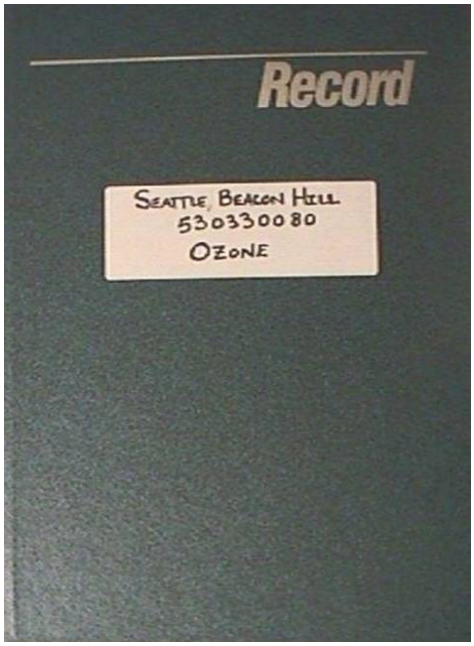
Each station must be equipped with a log book that is accessible from the monitoring site itself. The vast majority of air monitoring stations meet this requirement via an electronic log accessible through a PC-based data logger, hereafter referred to as an Envidas For Windows (EnvidasFW) data logger. These data loggers are loaded with software called EnvidasFW Reporter that is used to make electronic log book entries while on site or remotely through an internet connection. Electronic log books offer distinct advantages over paper log books in that they allow for log entries and systematic and operational review from remote locations, facilitating instrument troubleshooting, data validation, and other activities. Operators must use the electronic log book if the station is equipped with one. The electronic log book entry screen and an example entry for an ozone quality control check are shown in Figure 1 below.

Figure 1: Electronic Log Book Entry Screen in EnvidasFW Reporter



For stations not equipped with an EnvidasFW data logger, operators must maintain a paper log book. Paper log books must remain at their assigned station at all times and should be kept in a highly visible location so that they may be easily accessed by those not routinely familiar with the station such as substitute operators, quality assurance personnel, and EPA auditors. The front cover must be clearly labeled with the station name, EPA Air Quality System (AQS) station number, and parameter as shown in Figure 2 below. Separate log books should be maintained for each monitored parameter (meteorological parameters may be combined) to minimize confusion and expedite the finding of important information.

Figure 2: Example of a Paper Log Book



3.2 Documenting Log Books

The log book, whether electronic or paper-based, functions as a legal record and is the repository for detailed documentation regarding station operation. At a minimum the station log book should fully document the following:

- Dates and times of all station activities (in PST military time – e.g., "0835 PST") *(dates and times are automatically recorded by the logger in the electronic log book)*
- All maintenance activities such as analyzer or instrument replacements, shelter upgrades or changes, filter changes, cylinder changes, and probe cleaning and replacement
- All quality control check activities and results
- Unusual events and station conditions such as incidences of vandalism, smoke and weather events, shelter leaks, and insect or vermin intrusions
- Performance audits and results including actual and indicated levels
- Other activities or information that may affect monitored readings or data collection

3.2.1 Documenting Quality Control Checks

All automated instruments must be checked for proper calibration at regular pre-defined intervals. Please refer to the parameter-specific SOPs for quality control check schedules. Quality control checks for many instruments are performed both automatically and manually. Automated quality control checks are initiated by the EnvidasFW data logger and occur at preprogrammed intervals. Automated quality control check results are recorded by EnvidasFW. Manual checks are initiated by the station operator, in most cases in tandem with the EnvidasFW data logger software via the Extra Calibration feature.

3.2.1.1 Extra Calibration Feature of EnvidasFW

The Extra Calibration feature allows an operator to perform a manual quality control check on demand while at the monitoring site or from a remote location through an internet connection. The EnvidasFW data logger records the date, time, and actual and indicated level results of these checks. The results are then polled by the central telemetry system and can be easily sent to EPA, meeting reporting requirements. The capture of quality control check information by the data logger facilitates operator data review and quality assurance personnel data validation as all manual and automated quality control check results are readily available through the data loggers' EnvidasFW Reporter and EnvistaARM software. ***It is for these reasons that operators are required to use the Extra Calibration feature when performing a manual quality control check.*** The Extra Calibration feature has been implemented on the following parameters at nearly every station with an EnvidasFW data logger:

- Ozone
- Nephelometer
- Carbon Monoxide
- Trace-level instruments (NOy, SO2, and CO)

3.2.1.2 Documenting Manual Quality Control Checks

At a minimum, manual quality control checks for automated instruments must be documented in the log book in the manner described below. Station operators may record additional information as they see fit.

- Record the instrument state tag or ID number
- Record the transfer standard serial number or remaining pounds per square inch (PSI) values for calibration gas cylinders
- Record both the indicated and actual values for zero, precision, and span
- Calculate the percent difference using the following equation and record the percentages:

$$\left(\frac{Indicated - Actual}{Actual}\right) * 100 = \%difference$$

- Using Table 1, determine the acceptance criteria for the appropriate pollutant and take any necessary action. For parameters not listed in Table 1, please refer to the parameter-specific SOPs.
- ***Do not make any instrument adjustments until the entire quality control check has been completed***
- Record any corrective action taken as well as post-adjustment values in the log book

3.2.1.3 Documenting Automated Quality Control Checks

Station operators do not need to document automated quality control checks in the station log book as the critical information is collected and recorded by the logger automatically and subsequently polled and stored by the central telemetry system. While operators do not need to document automated quality control checks in the station log book, in the event of a quality control check failure, operators must record any corrective action taken.

3.2.1.4 Documenting Failed Quality Control Checks

In the event of a quality control check failure, operators must document any corrective action taken in the station log book. If for any reason the operator determines that a quality control check failed for reasons that shouldn't result in data invalidation, the operator must document the reason(s) the data should be considered valid in the log book. In the absence of documentation to the contrary, the data collected prior to the quality control check failure back to the last valid quality control check and forward to the next valid quality control check will be considered invalid.

3.3 Other Required Documentation

Depending on the parameter, additional documentation of quality control checks and other maintenance activities may be required. Please refer to the parameter-specific SOPs to determine additional documentation requirements. As a general rule, when performing a manual quality control check that is not being recorded by the EnvidasFW logger, the operator must record the precision point on the Monthly Precision Check Summary form. This form is to be filled out in addition to the information that is required in the log book. Operators must complete the Monthly Precision Check Summary form when:

- The station is not equipped with an EnvidasFW logger
- The EnvidasFW logger is not programmed to perform and record quality control checks using the Extra Calibration feature
- The EnvidasFW logger is not expected to be polled by the central system for an extended period of time
- The EnvidasFW logger fails to trigger the quality control check sequence

An example of a correctly documented Precision Check Summary Form is presented in Figure 3 below.

Figure 3: Monthly Precision Check Summary Form

Monthly Precision Check Summary

AIRS NUMBER: 530010001

PARAMETER: Ozone **YEAR:** 2009 **MONTH:** July

STATE TAG OR ID #: E123456

LOCATION: Timbuktu **OPERATOR:** Jack Frost

DATE			ACTUAL CONC.	INDICATED CONC.	UNITS	PASSED? YES/NO	COMMENTS
Month	Day	Year					
7	3	2009	.080	.079	ppm	**Y**	Manual
7	14	2009	.081	.080	ppm	**Y**	Manual
7	26	2009	.080	.080	ppm	**Y**	Manual

PRECISION CHECK EQUIPMENT:

Gas Cylinder Serial #: _____

Calibrator Model: _____

Calibrator Serial #: _____

ADDITIONAL COMMENTS:

Performed 3 manual precision checks due to the fact that this site is not equipped with an EnvidasFW data logger.

3.4 Submitting Required Documentation and Electronic Forms/Correspondence

Operators are encouraged to submit all paper documentation and any electronic forms and correspondence regarding data review and validation on a weekly basis. Paper documentation includes all items such as the Monthly Precision Check Summary Form and any parameter-specific paperwork. At a minimum, all paper documentation and any associated electronic forms and correspondence regarding data review and validation must be sent to Quality Assurance by the 10th of the month following the end of each calendar month of data collection. Quality assurance personnel will proceed with final data validation regardless of whether the required documentation is submitted on time or not. If no documentation is submitted, the data in question may be considered invalid.

Operators unable to meet the submittal deadline should notify the Quality Assurance Coordinator immediately and make alternate arrangements.

4 DATA VALIDATION

Thorough data validation ensures that the data quality and measurement objectives of the AQP are met and that the data generated during monitoring can be used to inform policy and protect public and environmental health. In addition, a thorough validation process will detect collection system errors and therefore facilitate subsequent improvements.

Data validation consists of two separate activities: initial review and final validation. Initial review is that which is conducted by station operators during and after data collection but prior to final validation. Final validation is conducted by quality assurance personnel and involves a separate, thorough, qualitative and quantitative system and data review.

Data that has been through the entire validation process is sent electronically to the EPA's Air Quality System (AQS) database. Among other uses, validated data will be utilized by AQP management to inform Program policy and craft pollution control strategies. Criteria pollutant data will be used by EPA to determine attainment status regarding the National Ambient Air Quality Standards (NAAQS).

Data satisfying the criteria in Section 4.1 below will be considered valid. Data not satisfying these conditions will be invalidated back to the time of the last quality control check that was within acceptance criteria and forward to the point of the next quality control check or performance audit that shows the parameter is once again within acceptance criteria.

4.1 Data Validation Criteria

Data will only be considered valid when the following criteria have been satisfied:

1. The air monitoring instrumentation has been calibrated and operated according to the AQP's approved SOPs
2. The instrument has been operating within acceptance criteria listed in Table 1 during the period of data collection as determined by manual and automated quality control checks and performance audits
3. All quality control checks have been performed within the required time intervals and have been sufficiently documented
4. The data is consistently free of excessive drift, noise, spiking, and statistical outliers

4.2 Initial Data Review

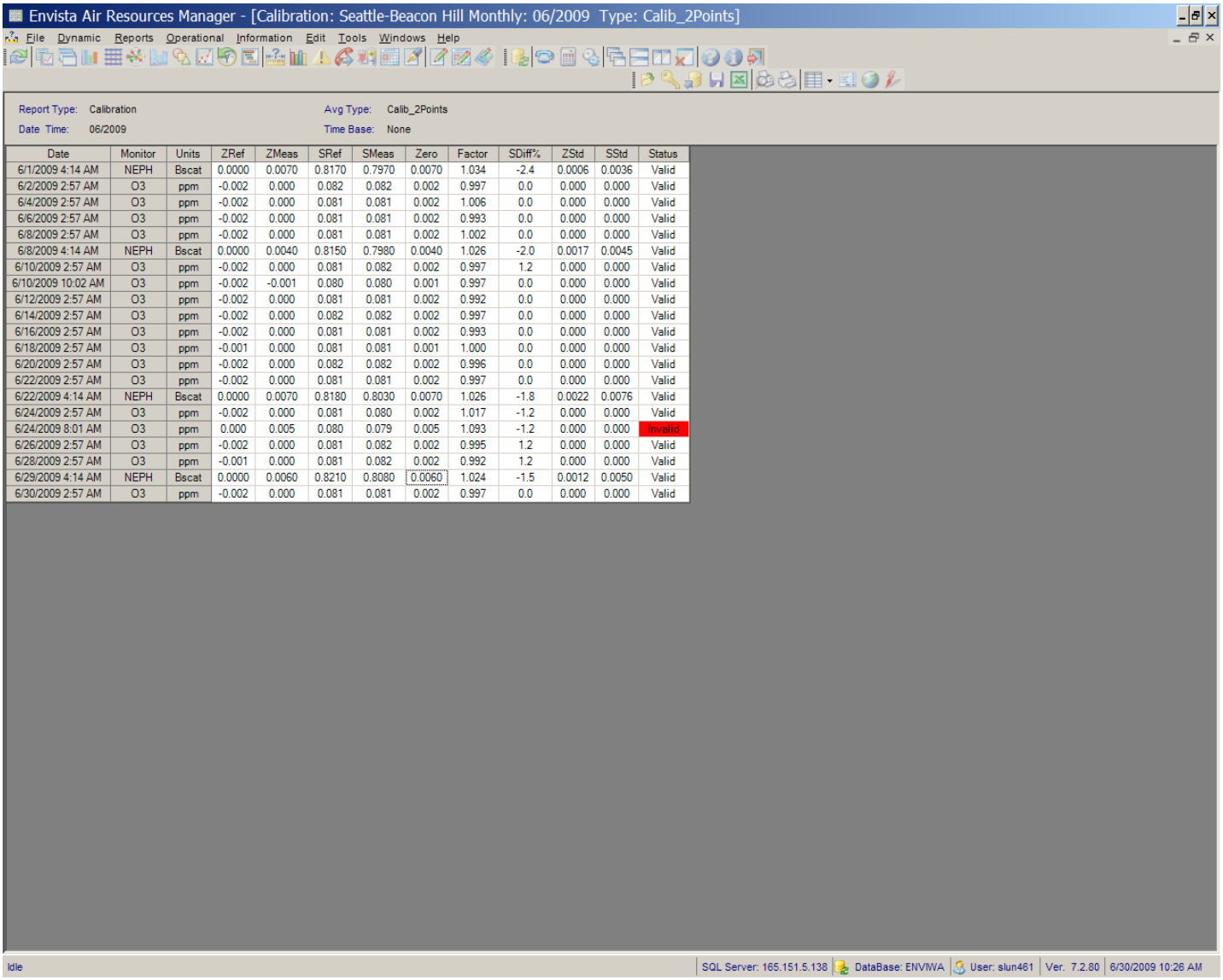
The site operator is responsible for ensuring that the data collected at his or her station(s) has been thoroughly reviewed. The primary tool for reviewing data is the Envista Air Resource Manager (EnvistaARM). This software tool allows for a variety of graphical and tabular analyses that, when thoroughly inspected, reveal the great majority of instrument problems and suspect data.

In an effort to ensure that collected data meets the data validation criteria (see section 4.1 above), operators should thoroughly review monitoring data on a weekly basis (i.e., review the previous week's data during the current week). At a minimum, a thorough review of the data includes:

4.2.1 Calibration Report

The Calibration Report contains results from automated and manual quality control checks. The EnvistaARM Calibration Report should be reviewed on a weekly basis. An optimal time to review the Calibration Report is Monday morning as many quality control checks occur early on Monday mornings (before business hours). Doing so should provide operators with ample lead time to plan their schedules to ensure that any failed quality control checks and instrument malfunctions can be investigated and addressed as soon as possible. Figure 4 below presents a monthly Calibration Report for the Seattle, Beacon Hill station. In the event of a quality control check failure such as the one in red below, operators should investigate the failure, take any necessary corrective action, and alert quality assurance personnel in regard to erroneous or suspect data. Any calibration check failures and any subsequent action taken should be documented in the station log book.

Figure 4: EnvistaARM Calibration Report



Date	Monitor	Units	ZRef	ZMeas	SRef	SMeas	Zero	Factor	SDiff%	ZStd	SStd	Status
6/1/2009 4:14 AM	NEPH	Bscat	0.0000	0.0070	0.8170	0.7970	0.0070	1.034	-2.4	0.0006	0.0036	Valid
6/2/2009 2:57 AM	O3	ppm	-0.002	0.000	0.082	0.082	0.002	0.997	0.0	0.000	0.000	Valid
6/4/2009 2:57 AM	O3	ppm	-0.002	0.000	0.081	0.081	0.002	1.006	0.0	0.000	0.000	Valid
6/6/2009 2:57 AM	O3	ppm	-0.002	0.000	0.081	0.081	0.002	0.993	0.0	0.000	0.000	Valid
6/8/2009 2:57 AM	O3	ppm	-0.002	0.000	0.081	0.081	0.002	1.002	0.0	0.000	0.000	Valid
6/8/2009 4:14 AM	NEPH	Bscat	0.0000	0.0040	0.8150	0.7980	0.0040	1.026	-2.0	0.0017	0.0045	Valid
6/10/2009 2:57 AM	O3	ppm	-0.002	0.000	0.081	0.082	0.002	0.997	1.2	0.000	0.000	Valid
6/10/2009 10:02 AM	O3	ppm	-0.002	-0.001	0.080	0.080	0.001	0.997	0.0	0.000	0.000	Valid
6/12/2009 2:57 AM	O3	ppm	-0.002	0.000	0.081	0.081	0.002	0.992	0.0	0.000	0.000	Valid
6/14/2009 2:57 AM	O3	ppm	-0.002	0.000	0.082	0.082	0.002	0.997	0.0	0.000	0.000	Valid
6/16/2009 2:57 AM	O3	ppm	-0.002	0.000	0.081	0.081	0.002	0.993	0.0	0.000	0.000	Valid
6/18/2009 2:57 AM	O3	ppm	-0.001	0.000	0.081	0.081	0.001	1.000	0.0	0.000	0.000	Valid
6/20/2009 2:57 AM	O3	ppm	-0.002	0.000	0.082	0.082	0.002	0.996	0.0	0.000	0.000	Valid
6/22/2009 2:57 AM	O3	ppm	-0.002	0.000	0.081	0.081	0.002	0.997	0.0	0.000	0.000	Valid
6/22/2009 4:14 AM	NEPH	Bscat	0.0000	0.0070	0.8180	0.8030	0.0070	1.026	-1.8	0.0022	0.0076	Valid
6/24/2009 2:57 AM	O3	ppm	-0.002	0.000	0.081	0.080	0.002	1.017	-1.2	0.000	0.000	Valid
6/24/2009 8:01 AM	O3	ppm	0.000	0.005	0.080	0.079	0.005	1.093	-1.2	0.000	0.000	Invalid
6/26/2009 2:57 AM	O3	ppm	-0.002	0.000	0.081	0.082	0.002	0.995	1.2	0.000	0.000	Valid
6/28/2009 2:57 AM	O3	ppm	-0.001	0.000	0.081	0.082	0.002	0.992	1.2	0.000	0.000	Valid
6/29/2009 4:14 AM	NEPH	Bscat	0.0000	0.0060	0.8210	0.8080	0.0060	1.024	-1.5	0.0012	0.0050	Valid
6/30/2009 2:57 AM	O3	ppm	-0.002	0.000	0.081	0.081	0.002	0.997	0.0	0.000	0.000	Valid

4.2.2 EnvistaARM Graphical Data Review

In many cases, viewing data graphically is superior to viewing data in tabular form as instrument malfunctions tend to be obvious when data is displayed graphically. Nevertheless, tabular data can prove useful in identifying minimum and maximum values (e.g., using the Station Report). Maximum and minimum values outside of normal instrument operation are indications of a problem and should be investigated and resolved. At a minimum, operators should review the following graphical data on a weekly basis:

4.2.2.1 Station Report: 1-Hour Averages

Figure 5 below presents $PM_{2.5}$ TEOM (TPM25) data that has at least one readily identifiable irregularity; a large negative value (a second irregularity may be the corresponding positive spike following the negative reading). Operators must investigate the cause of such problems and take

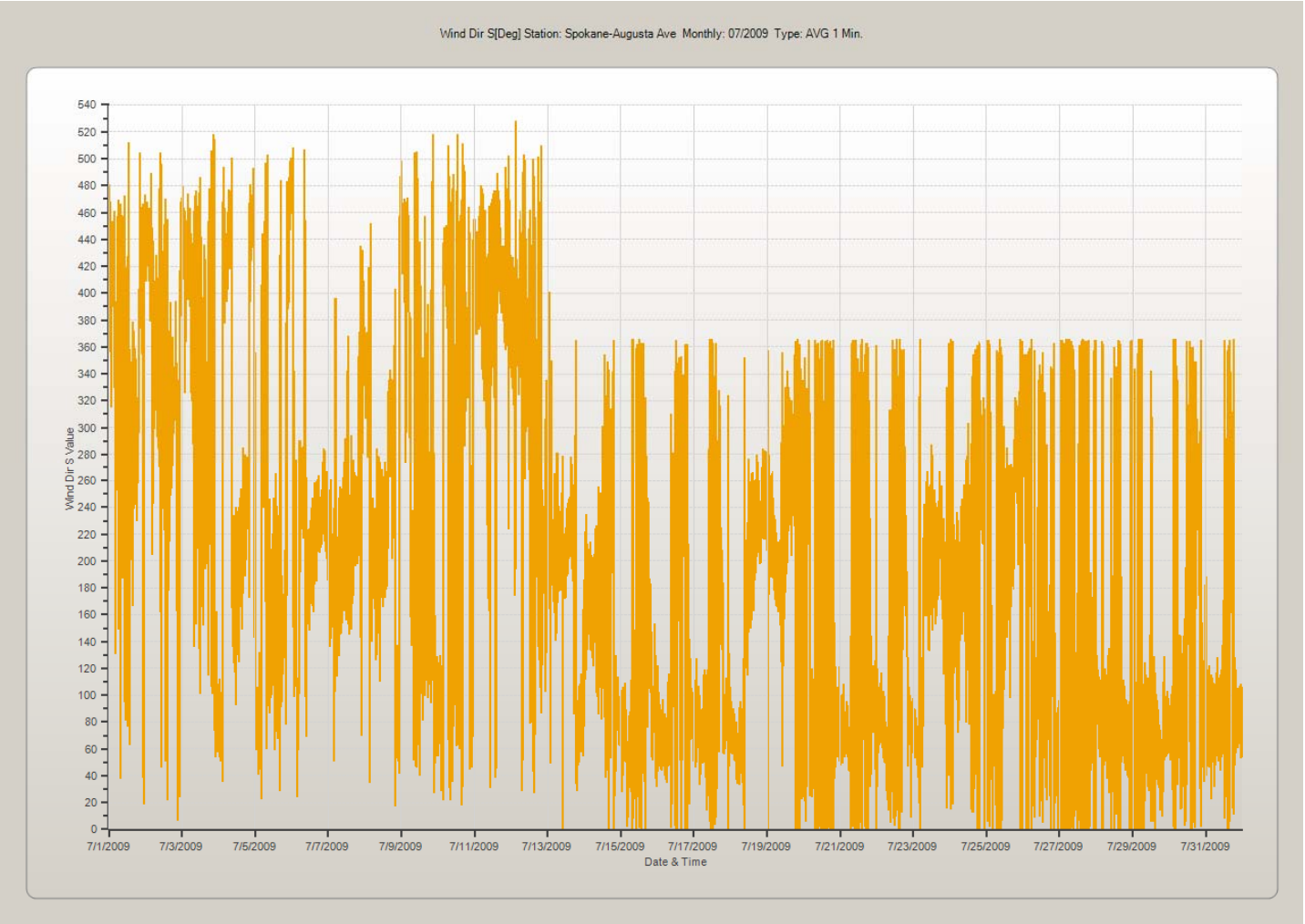
appropriate corrective action. In addition, operators should alert quality assurance to all such problems so that any erroneous data can be invalidated.

Figure 5: Station Report – 1-Hour Averages

4.2.2.2 Station Report: 1-Minute Averages

Some problems may not be visible through viewing hourly averages. Therefore, operators should also review graphs of 1-minute data (1-minute averages). As can be easily seen in Figure 6 below, there is an obvious problem with the wind direction in the first part of the month as 1-minute values exceed 360 degrees. In addition to obvious errors like this one, other less obvious problems such as erratic instrument operation (i.e., spiking, noise, etc.) that may be smoothed out in 1-hour averages are readily identifiable in the 1-minute graph.

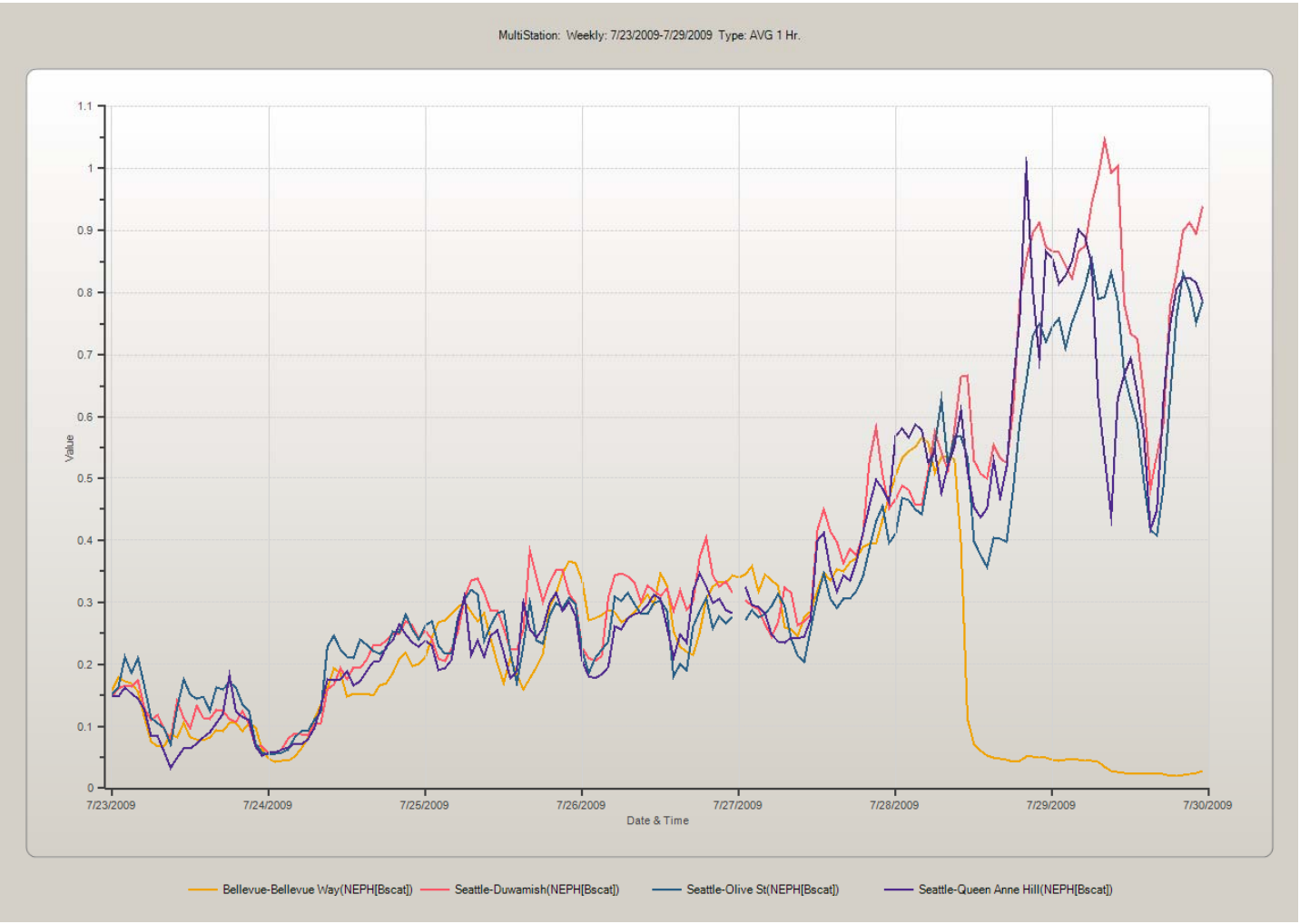
Figure 6: Station Report - 1-Minute Averages



4.2.2.3 Multi-Station Report: Hourly Averages

Graphical displays of data collected by the same or like-monitors in the same airshed should appear somewhat similar – in other words, the data should be comparable. Comparing the graphical traces from several stations for the same parameter is an excellent way to identify suspect data. To do such comparisons, operators should generate a Multi-Station Report for several monitors in the same geographic area. Data that does not compare well to other area monitors should be examined more closely for instrument/sensor malfunction(s). Figure 7 below presents an hourly Multi-Station Report for nephelometer monitors (bscat) in the Seattle/Bellevue area for the week of July 23rd through July 30th, 2009. The monitors appear to compare well until sometime late in the day on July 28th when the Bellevue monitor stops tracking. This is indicative of an instrument/equipment problem at the Bellevue site. Discrepancies warrant further investigation as soon as possible.

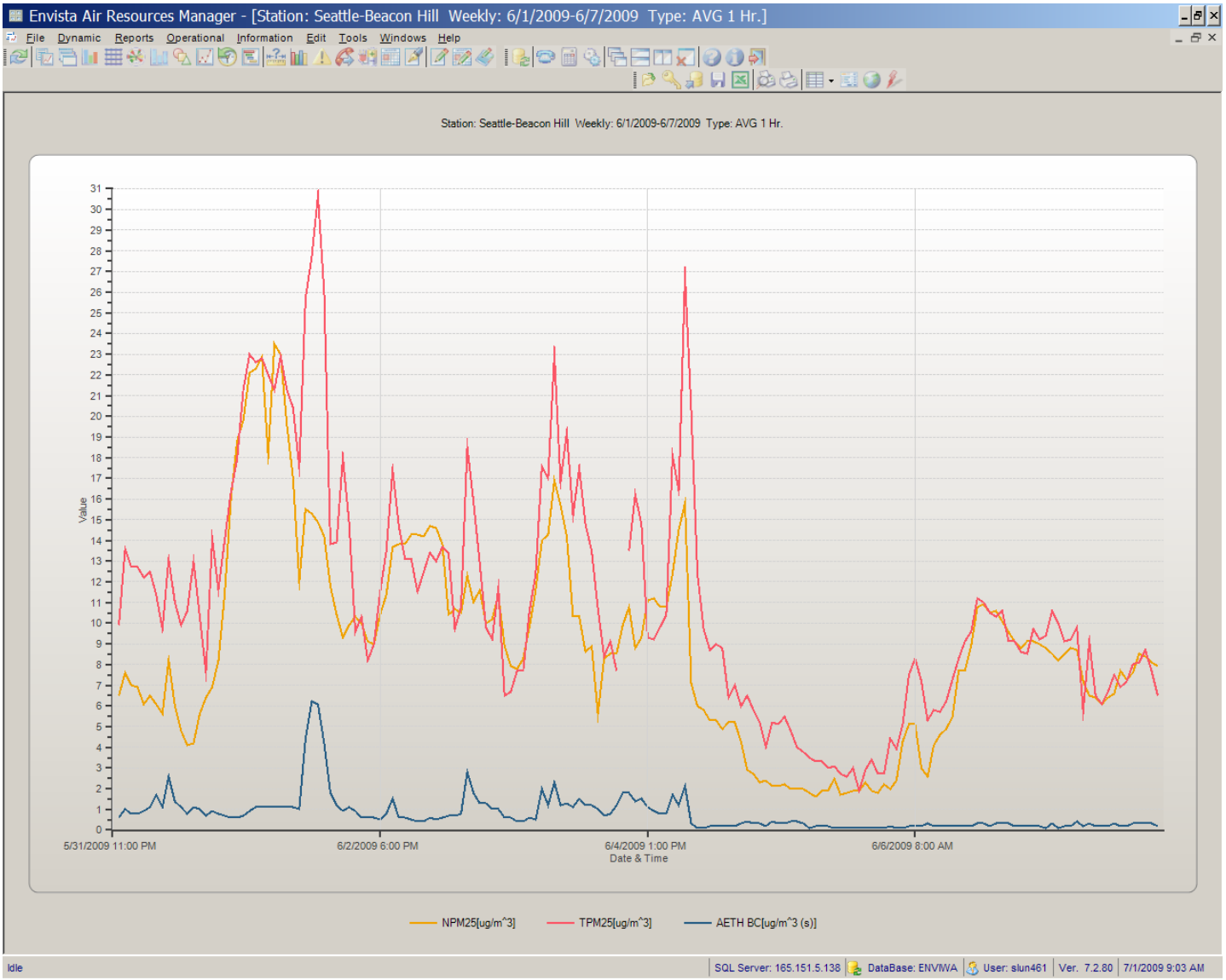
Figure 7: Multi-Station Report



4.2.2.4 Station Report, Group Report and Multi-Station Report – Hourly Averages

Operators should review like-parameters from the same site or from different sites in the same airshed using one or several of the following reports: Station Report, Group Report, Multi-Station Report. Figure 8 below presents a Station Report hourly average comparison of NPM25, TPM25, and the black carbon portion of $PM_{2.5}$ as collected by an Aethalometer (AETH BC) at the Seattle, Beacon Hill station. These parameters compare fairly well with the exception of the Aethalometer. It appears to stop tracking on the 4th of June, possibly an indication of an instrument problem that should be investigated further.

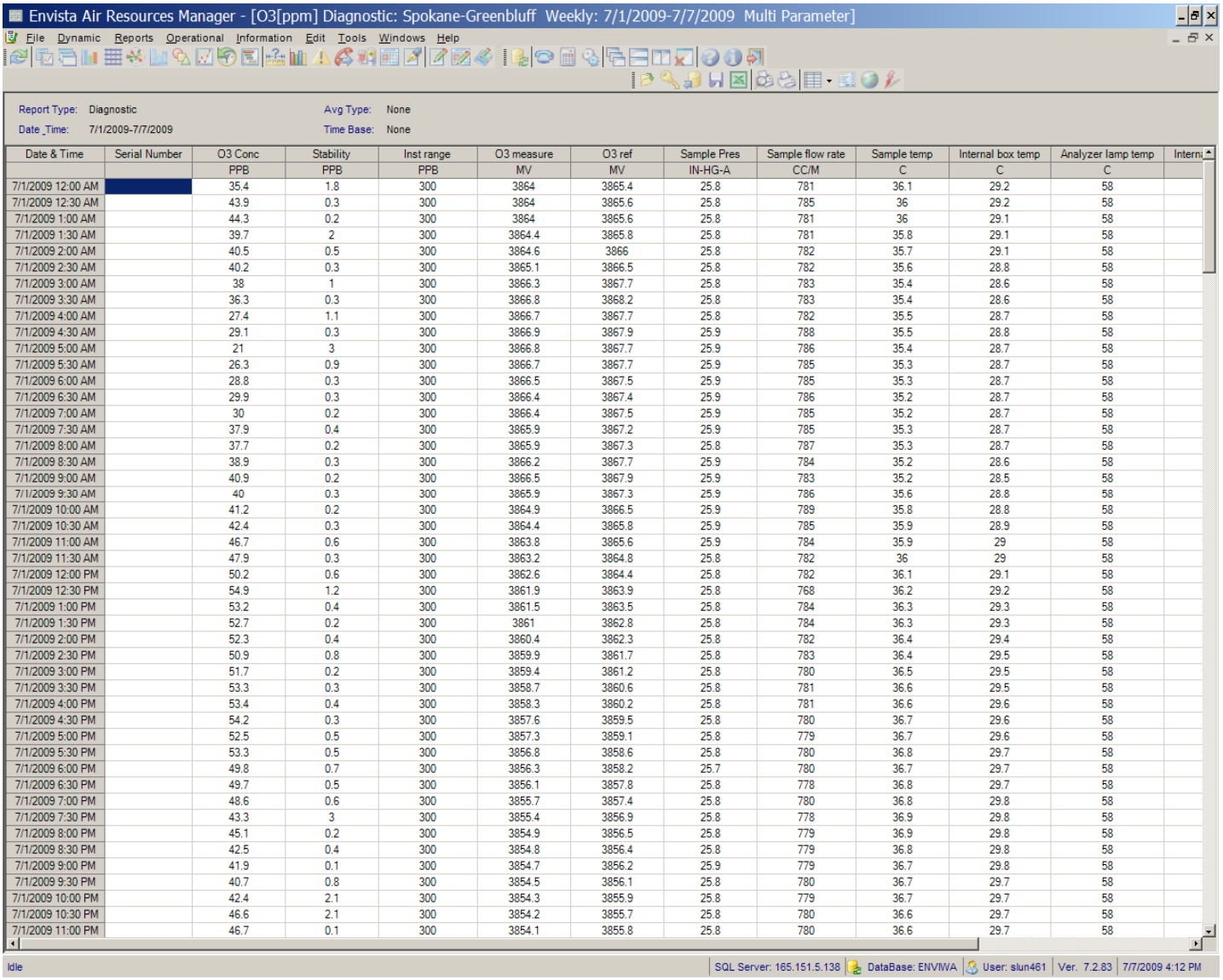
Figure 8: Station Report - Multiple Parameters



4.2.3 Diagnostic Report

Operators should review diagnostic data from their monitors via the EnvistaARM Diagnostic Report. Diagnostic values outside the range of normal instrument operation as defined in the parameter-specific SOPs should be investigated further and corrective action taken as soon as possible. Figure 9 below is an example of a Diagnostic Report for ozone.

Figure 9: Diagnostic Report for Ozone



Envista Air Resources Manager - [O3[ppm] Diagnostic: Spokane-Greenbluff Weekly: 7/1/2009-7/7/2009 Multi Parameter]

File Dynamic Reports Operational Information Edit Tools Windows Help

Report Type: Diagnostic Avg Type: None

Date _Time: 7/1/2009-7/7/2009 Time Base: None

Date & Time	Serial Number	O3 Conc	Stability	Inst range	O3 measure	O3 ref	Sample Pres	Sample flow rate	Sample temp	Internal box temp	Analyzer lamp temp	Interna
		PPB	PPB	PPB	MV	MV	IN-HG-A	CC/M	C	C	C	
7/1/2009 12:00 AM		35.4	1.8	300	3864	3865.4	25.8	781	36.1	29.2	58	
7/1/2009 12:30 AM		43.9	0.3	300	3864	3865.6	25.8	785	36	29.2	58	
7/1/2009 1:00 AM		44.3	0.2	300	3864	3865.6	25.8	781	36	29.1	58	
7/1/2009 1:30 AM		39.7	2	300	3864.4	3865.8	25.8	781	35.8	29.1	58	
7/1/2009 2:00 AM		40.5	0.5	300	3864.6	3866	25.8	782	35.7	29.1	58	
7/1/2009 2:30 AM		40.2	0.3	300	3865.1	3866.5	25.8	782	35.6	28.8	58	
7/1/2009 3:00 AM		38	1	300	3866.3	3867.7	25.8	783	35.4	28.6	58	
7/1/2009 3:30 AM		36.3	0.3	300	3866.8	3868.2	25.8	783	35.4	28.6	58	
7/1/2009 4:00 AM		27.4	1.1	300	3866.7	3867.7	25.8	782	35.5	28.7	58	
7/1/2009 4:30 AM		29.1	0.3	300	3866.9	3867.9	25.9	788	35.5	28.8	58	
7/1/2009 5:00 AM		21	3	300	3866.8	3867.7	25.9	786	35.4	28.7	58	
7/1/2009 5:30 AM		26.3	0.9	300	3866.7	3867.7	25.9	785	35.3	28.7	58	
7/1/2009 6:00 AM		28.8	0.3	300	3866.5	3867.5	25.9	785	35.3	28.7	58	
7/1/2009 6:30 AM		29.9	0.3	300	3866.4	3867.4	25.9	786	35.2	28.7	58	
7/1/2009 7:00 AM		30	0.2	300	3866.4	3867.5	25.9	785	35.2	28.7	58	
7/1/2009 7:30 AM		37.9	0.4	300	3865.9	3867.2	25.9	785	35.3	28.7	58	
7/1/2009 8:00 AM		37.7	0.2	300	3865.9	3867.3	25.8	787	35.3	28.7	58	
7/1/2009 8:30 AM		38.9	0.3	300	3866.2	3867.7	25.9	784	35.2	28.6	58	
7/1/2009 9:00 AM		40.9	0.2	300	3866.5	3867.9	25.9	783	35.2	28.5	58	
7/1/2009 9:30 AM		40	0.3	300	3865.9	3867.3	25.9	786	35.6	28.8	58	
7/1/2009 10:00 AM		41.2	0.2	300	3864.9	3866.5	25.9	789	35.8	28.8	58	
7/1/2009 10:30 AM		42.4	0.3	300	3864.4	3865.8	25.9	785	35.9	28.9	58	
7/1/2009 11:00 AM		46.7	0.6	300	3863.8	3865.6	25.9	784	35.9	29	58	
7/1/2009 11:30 AM		47.9	0.3	300	3863.2	3864.8	25.8	782	36	29	58	
7/1/2009 12:00 PM		50.2	0.6	300	3862.6	3864.4	25.8	782	36.1	29.1	58	
7/1/2009 12:30 PM		54.9	1.2	300	3861.9	3863.9	25.8	768	36.2	29.2	58	
7/1/2009 1:00 PM		53.2	0.4	300	3861.5	3863.5	25.8	784	36.3	29.3	58	
7/1/2009 1:30 PM		52.7	0.2	300	3861	3862.8	25.8	784	36.3	29.3	58	
7/1/2009 2:00 PM		52.3	0.4	300	3860.4	3862.3	25.8	782	36.4	29.4	58	
7/1/2009 2:30 PM		50.9	0.8	300	3859.9	3861.7	25.8	783	36.4	29.5	58	
7/1/2009 3:00 PM		51.7	0.2	300	3859.4	3861.2	25.8	780	36.5	29.5	58	
7/1/2009 3:30 PM		53.3	0.3	300	3858.7	3860.6	25.8	781	36.6	29.5	58	
7/1/2009 4:00 PM		53.4	0.4	300	3858.3	3860.2	25.8	781	36.6	29.6	58	
7/1/2009 4:30 PM		54.2	0.3	300	3857.6	3859.5	25.8	780	36.7	29.6	58	
7/1/2009 5:00 PM		52.5	0.5	300	3857.3	3859.1	25.8	779	36.7	29.6	58	
7/1/2009 5:30 PM		53.3	0.5	300	3856.8	3858.6	25.8	780	36.8	29.7	58	
7/1/2009 6:00 PM		49.8	0.7	300	3856.3	3858.2	25.7	780	36.7	29.7	58	
7/1/2009 6:30 PM		49.7	0.5	300	3856.1	3857.8	25.8	778	36.8	29.7	58	
7/1/2009 7:00 PM		48.6	0.6	300	3855.7	3857.4	25.8	780	36.8	29.8	58	
7/1/2009 7:30 PM		43.3	3	300	3855.4	3856.9	25.8	778	36.9	29.8	58	
7/1/2009 8:00 PM		45.1	0.2	300	3854.9	3856.5	25.8	779	36.9	29.8	58	
7/1/2009 8:30 PM		42.5	0.4	300	3854.8	3856.4	25.8	779	36.8	29.8	58	
7/1/2009 9:00 PM		41.9	0.1	300	3854.7	3856.2	25.9	779	36.7	29.8	58	
7/1/2009 9:30 PM		40.7	0.8	300	3854.5	3856.1	25.8	780	36.7	29.7	58	
7/1/2009 10:00 PM		42.4	2.1	300	3854.3	3855.9	25.8	779	36.7	29.7	58	
7/1/2009 10:30 PM		46.6	2.1	300	3854.2	3855.7	25.8	780	36.6	29.7	58	
7/1/2009 11:00 PM		46.7	0.1	300	3854.1	3855.8	25.8	780	36.6	29.7	58	

Idle SQL Server: 165.151.5.138 DataBase: ENVIWA User: slun461 Ver. 7.2.83 7/7/2009 4:12 PM

4.3 Final Data Validation

Final data validation is conducted by Quality Assurance personnel and is an independent, thorough review of the data.

Quality Assurance personnel will conduct a thorough qualitative and quantitative review of the station log book entries, quality control check results, performance audit results, operator documentation, and collected data that will include, but is not limited to, the following activities:

- **Assessment of Data Completeness** – contact operator regarding unaccounted-for missing information and data
- **Assessment and Review of Documentation** – ensure all station log books and required forms are properly and thoroughly documented

- **Quality control and quality assurance activities** – ensure all required precision checks and performance audits are within acceptance criteria via the EnvistaARM Calibration Report, operator documentation, and performance audit results
- **Proper operation and maintenance of instrument** – verify that all maintenance activities have been completed
- **Comparability** – using the EnvistaARM, review Station, Group, and Multi-Station Reports to ensure comparability of monitored data
- **Edit data** – invalidate erroneous data and data that does not meet data quality objectives
- **Lock data per Final Validation** – after thorough review of all data, set the Final Validation designation in the EnvistaARM software, locking all validated data from further edits
- **Notify AQS Coordinator** – within the required timeframe outlined in the Federal Register, notify AQS Coordinator that data have been validated and are ready for submittal to EPA

5 REFERENCES

"Quality Assurance Handbook for Air Pollution Measurement Systems, Volume I – A Field Guide to Environmental Quality Assurance." EPA-600/R-94/038a. April, 1994.

“Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II – Ambient Air Quality Monitoring Program.” EPA-454/B-08-003. December, 2008.

Code of Federal Regulations, Title 40, Part 58 (40 CFR 58).

“Envista ARM Air Resources Manager”. Revision 1.6.09. Envitech Ltd. Envista ARM Ver. 7.2.72. June, 2009.

6 FORMS

- Precision Check Summary

Monthly Precision Check Summary

AIRS NUMBER: _____

PARAMETER: _____ **YEAR:** _____ **MONTH:** _____

STATE TAG OR ID #: _____

LOCATION: _____ **OPERATOR:** _____

DATE			ACTUAL CONC.	INDICATED CONC.	UNITS	PASSED? YES/NO	COMMENTS
Month	Day	Year					

PRECISION CHECK EQUIPMENT:

Gas Cylinder Serial #: _____

Calibrator Model: _____

Calibrator Serial #: _____

ADDITIONAL COMMENTS: