Air Pollution Control Division

Technical Services Program

APPENDIX QA3

Standard Operating Procedure for the
Quality Assurance Review of Gaseous and Meteorological Data

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1.0   INTRODUCTION

This standard operating procedure (SOP) document describes the procedures used by members of the quality assurance unit of the Technical Services Program, Air Pollution Control Division (APCD) to conduct reviews of monthly data packages of gaseous and meteorological monitoring data. Initial data screening and review of hourly gaseous and meteorological data is conducted by the monitoring unit. The data packet then undergoes review by a second individual, who is a member of the quality assurance unit. The goal of the review is to screen out data that is invalid or inaccurate.

1.1   Scope

This procedure involves review of data packages that are created during initial review and validation of gaseous and meteorological data. Data packages include reports from the monitoring sites, and printouts from the computer data acquisition system. The data packages represent one month of activity in the air monitoring network. Reports included in the data package are:

- A Data Package Control Sheet, Which Tracks Data Review Steps Conducted on this package
- List of Power Failures During the Month
- Control Charts of Zero, Span, and Precision Test Data for Each Gaseous Monitor
- Manual Monthly Maintenance Logs for Each Gaseous Monitor, and each Meteorological Tower
- Manual or Printed Precision Test Results
- Printouts of All Hourly Gaseous or Visibility Data, 1 page per monitor
- Printouts of All Meteorological Data, 1 page per meteorological parameter
- A Manual Zero Adjust Data Analysis
- Maintenance Reports, Generated by Management, or by Site Technicians
- Internal Station Temperature Logs, by Station, by Hour
- The Logger Central Message Report
- Printouts of Zero and Span Check Results for Each Gaseous Monitor

All of the above products should be present in the data package when received by quality assurance, with the possible exception of the last item listed. In the event that the data package does not include the daily zero and span results, the quality assurance unit requests, or generates, a report of these.

1.2   Method Description

The data package inspection is generally done by a member of the Quality Assurance group. The inspector reviews all documents in the data package, noting any problems that occurred, and how they were resolved. The inspector uses screening criteria, and best professional judgment, to review the documents. Specific review criteria for each report are described below.

1.3   Interferences

This quality assurance data review method does not have interferences. The purpose of the inspection is to ensure that all questionable data have been invalidated.

1.4   Data Quality Objectives

The data quality objectives to be met are the EPA quality assurance criteria for each pollutant and meteorological parameter. Criteria relate to percentage of error allowed in zero, span, precision, or audit results, percentage data recovery for the monitoring quarter, temperature of the monitoring station, etc.

1.5   Personnel Qualifications and Training

Personnel qualifications for the conduct of these quality assurance evaluations are similar to requirements for other operations described in the QAPP. Individuals must be familiar with the monitoring equipment, the data acquisition system, and EPA guidelines regarding monitor operation. Most training in the Technical Services Program is received on-the-job. New individuals shadow more experienced personnel, until they become proficient at their tasks. Individuals also become familiar with EPA guidance, as reflected in the Code of Federal Regulations, and the Federal Register. The State of Colorado periodically offers employee training sessions on subjects such as safely driving vehicles, computer software, and workplace safety topics.

2.0   DEFINITIONS

The data evaluation procedure does not involve the use of unusual scientific terms or definitions. Acronyms are described within this document, when the term is first introduced.

3.0   HEALTH AND SAFETY PROCEDURES

The data evaluation procedure involves several hours of indoor work, at a desk or computer station. Therefore, there are no significant health or safety risks. The use of good body ergonomics at computer stations is recommended.

3.1   Preventing Personal Injury

There are no specific guidelines for safely conducting the data evaluation reviews.

3.2   Cautions

There are no cautions applicable to this procedure.

4.0   QUALITY ASSURANCE MONTHLY DATA EVALUATIONS

4.1   Data Package Characteristics

The hourly data to be evaluated falls under two basic types: gaseous pollutant data and meteorological monitoring data. The procedures for reviewing the data are similar, regardless of the data type.

4.2   Equipment and Supplies

Equipment needed for the conduct of quality assurance data evaluations is listed in Figure 1.

Figure 1.   Equipment List for Quality Assurance Data Evaluations

Equipment Needed for Quality Assurance Data Evaluations

1.   **Monthly Data Package, which generally contains the following forms:**

- A Data Package Control Sheet, Which Tracks Data Review Steps Conducted on this package
- List of Power Failures During the Month
- Control Charts of Zero, Span, and Precision Test Data for Each Gaseous Monitor
- Manual Monthly Maintenance Logs for Each Gaseous Monitor, and each Meteorological Tower
- Manual or Printed Precision Test Results
- Printouts of All Hourly Gaseous or Visibility Data, 1 page per monitor
- Printouts of All Meteorological Data, 1 page per meteorological parameter

- A Manual Zero Adjust Data Analysis
- Maintenance Reports, Generated by Management, or by Site Technicians
- Internal Station Temperature Printouts, by Station, by Hour
- The Logger Central Message Report
- Printouts of Zero and Span Check Results for Each Gaseous Monitor

2. **Pen and Pencil**
3. **Yellow Sticky Notes**
4. **Calculator**
5. **Data Comment / Question Form**

5.0 FORMS TO BE REVIEWED FOR QUALITY ASSURANCE DATA EVALUATIONS

5.1 Overview

In each monthly data package, there are a number of forms to be reviewed. The forms can be reviewed in any order that works for the inspector. Each form, and some criteria for its review, is described below. During review, place a yellow sticky note on any form that raises questions, or needs further checking at a later time.

5.2 Quality Assurance Data Evaluation Forms

5.2.1. Data Package Control Sheet. The form title is: "Gaseous C & C Tracking".

Figure 2 is an example of the data package control sheet, the "Gaseous C & C Tracking" form. There is one of these forms in each monthly data packet. The form tracks the tasks needed to assemble and review a monthly data package. It lists steps, such as bringing together all monthly charts and logs, creating zero and span graphs, printing the power failure log, etc. It notes whether data completeness has been evaluated, and whether data corrections to the electronic record have been made. It also notes the status of this data with regard to submittal to the Environmental Protection Agency's Air Quality System (AQS). The state of Colorado is required to submit all data to the Air Quality System on a quarterly basis.

When each task is completed, the individual assigned initials and dates the data package control sheet. Note that this quality assurance data evaluation is listed as: "Independent Check Completed". After finishing the quality assurance review, the reviewer should sign and date this section of the form.

5.2.2. List of Power Failures During the Month. The form title is: "Logger Power Failure Report".

Figure 3 is an example of the logger power failure form. This is a report generated through the AirVision data acquisition system. It lists all losses of power that occurred during the month, by monitoring station. Note that many of the power losses lasted only a few seconds. These are noticed by the data logger, but are not significant. The Air Pollution Control Division quality assurance procedures require that an hour of gaseous or meteorological data contain at least 45 minutes of data. Therefore, any power failures at a station that last more than 15 minutes will invalidate the hour(s) when the power failure occurred. As part of the quality assurance review, the inspector checks the hourly gaseous and meteorological data printouts to make sure that all affected data have been flagged as invalidated. If data have not been invalidated, a yellow sticky note is attached to the Logger Power Failure Report form. A comment requesting that the affected data be invalidated is added to the data review sheet.

Figure 2. Data Package Control Sheet. The form title is: "Gaseous C & C Tracking".

MONTH: September 2014

GASEOUS C & C TRACKING

	DATE	BY	NOTES
ALL CHARTS AND LOGS IN	10/22/2014	EJM	
ZERO/SPAN GRAPHS PRINTED	10/22/2014	EJM	
POWER FAILURE LOG PRINTED	10/22/2014	EJM	
INITIAL PRINTOUT COMPLETED	10/22/2014	EJM	
INITIAL DATA REVIEW	10/22/2014	EJM	
ROUND 1 COMPLETENESS	11/4/14	VS	
DATABASE CORRECTION	11/4	VS	
NEW PRINTOUTS	11/4	VS	
COMPLETENESS FINAL (ESC PRINT)	11/4	VS	
ROUND 1 CORRECTNESS	11/4	VS	
DATABASE CORRECTION	11/4	VS	
NEW PRINTOUTS	11/4	VS	
CORRECTNESS FINAL (ESC PRINT)	11/4	VS	
MET DATA CHECKED	11/4	VS	
NEW PRINTOUTS	11/4	VS	
AQS FILE GENERATED	11/4	VS	
AQS FILE ERROR CHECKED	11/4	VS	
AQS FILE REGENERATED PA File	11/20	GJH	
AQS FILE RECHECKED PA File	11/20	GJH	
AQS FILE SENT	11/20 (data) 11/21 (PA)	WmSK WmSK	
INDEPENDENT CHECK COMPLETED			
CORRECTIONS SENT TO AQS			

J:\zsfiles\forms\forms.xls:C&C Tracking

Figure 3. List of Power Failures During the Month. The form title is: "Logger Power Failure Report".

3/5/14 QA check,
—MC

Logger Power Failure Report

Site Name CAMP   **Site Description** CAMP

Logger Name CAMP_72   **Logger Identifier** 06

Failure Time	Restored Time	Duration
16-Jan-2014 15:27	16-Jan-2014 15:27	0:0
16-Jan-2014 15:27	16-Jan-2014 15:28	0:0
16-Jan-2014 16:03	16-Jan-2014 16:03	0:0
16-Jan-2014 16:03	16-Jan-2014 16:04	0:0
21-Jan-2014 12:22	21-Jan-2014 12:22	0:0
21-Jan-2014 12:22	21-Jan-2014 12:24	0:1
21-Jan-2014 12:27	21-Jan-2014 12:28	0:0
21-Jan-2014 12:31	21-Jan-2014 12:31	0:0
23-Jan-2014 07:22	23-Jan-2014 07:22	0:0
23-Jan-2014 07:22	23-Jan-2014 07:22	0:0
23-Jan-2014 07:22	23-Jan-2014 07:22	0:0
23-Jan-2014 07:28	23-Jan-2014 07:29	0:0
23-Jan-2014 07:29	23-Jan-2014 07:39	0:9
23-Jan-2014 07:39	23-Jan-2014 07:39	0:0

Site Name FTCWEST   **Site Description** Ft. Collins - West

Logger Name FTCWEST   **Logger Identifier** 42

Failure Time	Restored Time	Duration
13-Jan-2014 10:37	13-Jan-2014 10:37	0:0

Site Name I25-DENVER   **Site Description** Near Roadway site at Yuma Street near I-25 and 9th Avenue

Logger Name I25-DENVER   **Logger Identifier** 20

Failure Time	Restored Time	Duration
10-Jan-2014 14:09	10-Jan-2014 14:11	0:1
12-Jan-2014 10:02	12-Jan-2014 10:02	0:0
12-Jan-2014 10:07	12-Jan-2014 10:08	0:0
12-Jan-2014 10:21	12-Jan-2014 10:22	0:0
12-Jan-2014 10:28	12-Jan-2014 10:28	0:0
13-Jan-2014 07:55	13-Jan-2014 07:55	0:0
15-Jan-2014 15:00	15-Jan-2014 15:00	0:0
15-Jan-2014 15:33	15-Jan-2014 15:39	0:6
16-Jan-2014 09:16	16-Jan-2014 09:16	0:0
16-Jan-2014 10:19	16-Jan-2014 10:19	0:0

Site Name LACASA   **Site Description**

Logger Name LACASA   **Logger Identifier** 14

Wednesday, February 19, 2014 10:15 AM   *Page 1 of 2*

5.2.3. Control Charts of Zero, Span, and Precision Test Data for Each Gaseous Monitor.

Each day at approximately midnight, every gaseous analyzer in the Air Pollution Control Division air monitoring network is subjected to a two-point quality check. The check is conducted by supplying clean air, mixed with known concentrations of air pollution, to each monitor. The data acquisition system signals the on-site equipment to conduct the check. First, a clean-air sample ("zero" air) is supplied to the analyzer, to check its zero response. Then, a higher-level concentration of the monitored air pollutant is supplied. This pollutant concentration may be near the top of the measurement range of the analyzer (a "span" concentration), or at levels of pollution routinely encountered in ambient air (a "precision" concentration).

The analyzer's response to the sample supplied is recorded by the data logger. The data acquisition system then calculates the difference between the known pollutant concentration supplied, and the analyzer's concentration reading. For each month's data package, a graph ("control chart") is developed to summarize each analyzer's response to the daily checks. Figure 4 shows one of these graphs. It is read as follows.

Zero Concentrations

The right-side Y axis of the plot shows the zero concentrations, which are plotted on the graph with a diamond symbol. The quality assurance reviewer should check that the zero concentrations are reasonably consistent throughout the month.

Span Concentrations

The left-side Y axis of the plot shows the span concentrations, which are plotted on the graph with a square symbol. The data reviewer should check that the spans stay relatively consistent throughout the month. Graph two shows the span percentage difference, calculated as shown in Equation 1.

> Equation 1
> ((Span analyzer reading – expected concentration)/expected concentration) * 100

The second graph shows "warning" and "fail" levels. If the span percentage difference plotted is within these ranges, the data reviewer should attempt to identify the problem. This is done by reviewing other forms within the data package. The monthly maintenance form, and the logger message form, are often useful in determining whether there were problems with the equipment. Problems may be either with the pollutant concentration generation system ("span system", or "source system"), or with the analyzer itself. If problems are noted, the reviewer attaches a yellow sticky note to the control chart of that analyzer, and writes up questions or comments in the final data review report.

Precision Concentrations

The left-side Y axis of the plot shows the precision concentrations, which are plotted on the graph with a circle symbol. The data reviewer should check that the precision tests stay relatively consistent throughout the month. Graph two shows the precision percentage difference, calculated as shown in Equation 2.

> Equation 2
> ((Precision analyzer reading – expected concentration)/expected concentration) * 100

The second graph shows "warning" and "fail" levels. If the precision percentage difference plotted is within these ranges, the data reviewer should attempt to identify the problem. This is done by reviewing other forms within the data package. The monthly maintenance form, and the logger message form, are often useful in determining whether there were problems with the equipment. Problems may be either with the pollutant concentration generation system ("precision system", or "source system"), or with the analyzer itself. If problems are noted, the reviewer attaches a yellow sticky note to the control chart of that analyzer, and writes up questions or comments in the final data review report.

Figure 4. Example Control Chart of Zero, Span, and Precision Test Data for a Gaseous Monitor.

CO   Welby (42101)   6/1/2014 to 6/30/2014

Recent Calibrations				
Date:	6/7/2014	2/18/2014	12/19/2013	9/5/2013
Initials:	VRS	VRS	VRS	VRS
Zero:	0	0	0	0
Span:	8.65	8.78	8.78	8.8
Prec:	3.96	4.02	4	4.03
PreCal S/P:				
Notes:	SBOT=8.739;	SBOT=8.739;	SBOT=8.739;	##########

S/P/Bottle Source Information				
Type:	42101	42101	42101	42101
SN:	CC72424	CC420371	CC213284	CC181781
Start Date:	6/11/2013	6/11/2013	3/26/2013	3/26/2013
Exp. Date:	4/13/2021	4/13/2021	7/26/2009	6/18/2013
Conc:	3.982	8.739	3.967	8.18
End Date:			6/11/2013	6/11/2013
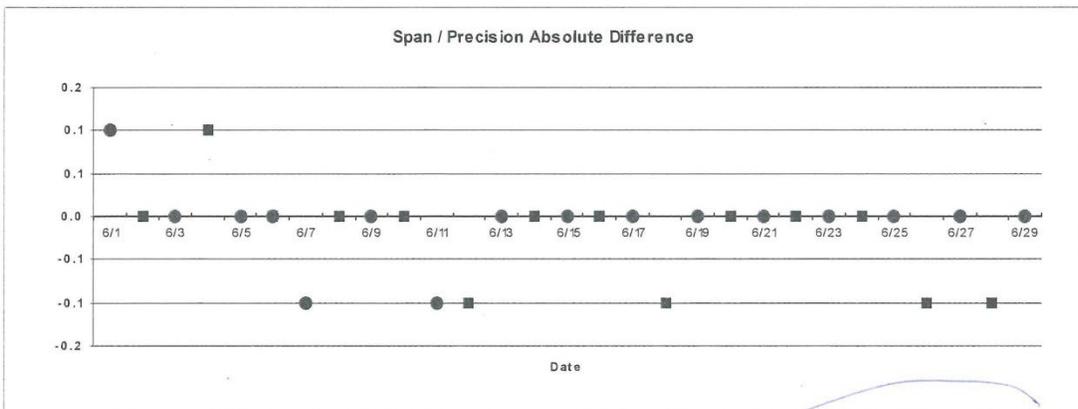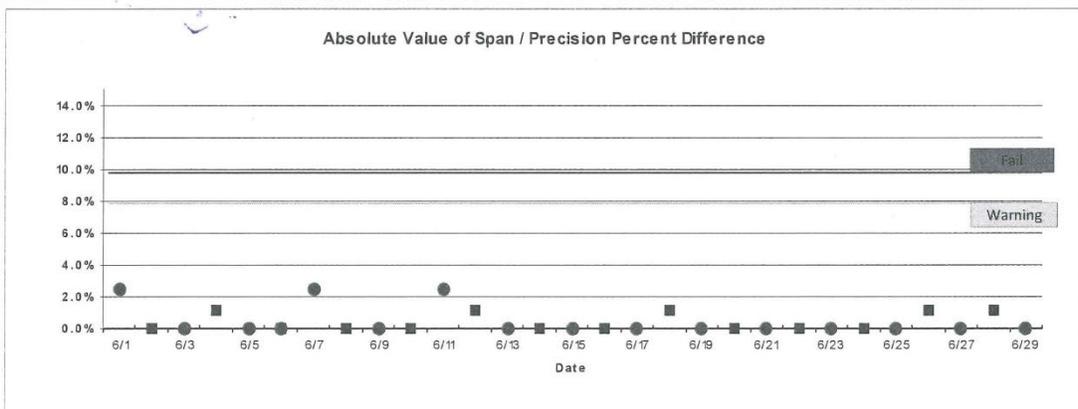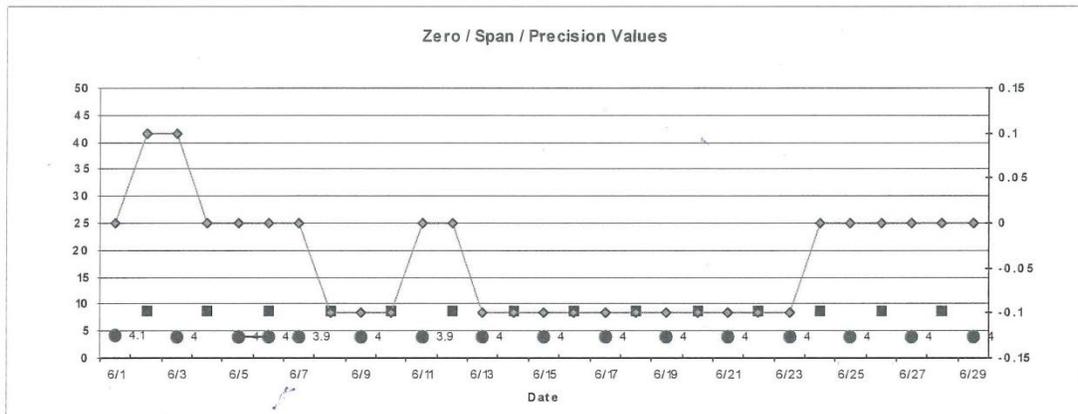
5.2.4. Manual Monthly Maintenance Logs for Each Gaseous Monitor, and each Meteorological Tower

For each air pollutant monitored in the Air Pollution Control Division network, there is a one-page monthly maintenance log located at the air pollution monitoring site. There are logs for carbon monoxide, ozone, nitrogen dioxide, and sulfur dioxide analyzers. There are also logs for the zero and span generation devices, for the meteorological tower, and for the station itself. These logs are used to record routine site inspection visits, calibration visits, audit visits, or other activity involving the analyzer. Figure 5 is an example of one type of monthly log sheet.

At each station visit, the Technical Services staff member records analyzer diagnostic check results in the top grid on the form. In the bottom section, the visitor records the date and time the analyzer was taken off-line, and why. Weekly and monthly maintenance, as well as calibrations, audits, and analyzer installation and replacements, are noted on these forms.

As part of the data quality assurance review, the inspector reads all of these log sheets. Any log sheets that seem to indicate an equipment problem are reviewed in more detail. If the reviewer has questions, or if there is data that should be invalidated, the reviewer attaches a yellow sticky note to the log in question, and writes up questions or comments in the final data review report.

5.2.5. Manual or Printed Precision Test Results.

As part of each monthly data packet, there are forms listing precision test results. These may be manually-recorded forms, such as Figure 6, or a system-wide printout produced by the data acquisition system (Figure 7). Precision test concentrations should be within a plus or minus ten percent difference from the true value, as calculated in Equation 2 above. For tests outside of the allowable ten percent difference (or 7% for Ozone), review the monthly maintenance logs, the control charts, and various other monthly data package documents, to try and identify the problem. The Environmental Protection Agency states that an out-of-range precision test, standing alone, is not reason to invalidate associated data. However, if ambient monitoring data from the time period when the precision test was conducted is invalidated, then the associated precision test should also be invalidated. This is because precision test statistics are supposed to reflect the analyzer's performance during the period that the valid ambient data were collected. If the reviewer has questions, or if there is data that should be invalidated, the reviewer attaches a yellow sticky note to the log in question, and writes up questions or comments in the final data review report.

5.2.6. Printouts of All Hourly Gaseous or Visibility Data, 1 page per monitor

For each air pollutant monitor, and each visibility monitor, the data acquisition system prints out a monthly list of hourly pollutant values. This report takes the form shown in Figure 8. Note that some hours have been colored or shaded on the printout. These shadings are based on automatic data flags issued by the data system, or by flags for changes that were made in the first-round data validation review. If the reviewer has questions about these flags, they can check the color symbols as described in the AirVision system.

The data reviewer should scan each of these hourly data sheets. The reviewer should look to see whether the data show problems, or look reasonable for the pollutant. Things to look for are:

- Long periods of zero values
- Long periods of very high values
- Unusual patterns of missing data
- Data show normal trends for the pollutant of interest (For example, CO should be higher at rush hour, ozone is highest during mid-afternoon)

If the reviewer has questions, or if there is data that should be invalidated, the reviewer attaches a yellow sticky note to the data sheet in question, and writes up questions or comments in the final data review report.

Figure 5. Example Manual Monthly Maintenance Log for a Gaseous Monitor

Colorado Department of Public Health and Environment
Air Pollution Control Division - Technical Services Program

O3 API 400   sn: 1819 / _____   STATION: Academy
1: A (E) T   2: A E T

June / 2014
Month   Year

Monthly Station Activities Log	Date	3	9	19	25		
O3 Measure	2500 - 4500	3296	3282	3278	3273		
O3 Reference	2500 - 4500	3297	3283	3279	3274		
Sample Pressure	ambient +/- 2	22.2	22.3	22.3	22.4		
Sample Flow	500 - 800	724	730	721	722		
Sample Temp	10 - 50	34.8	36.9	25.4	35.5		
Photo Lamp Tmp	49 - 51	58	58	58	58		
Box Temp	10 - 50	25.4	27.9	26.1	26.2		
Slope	0.7 - 1.3	1.008	1.008	1.008	1.008		
Intercept	-4 - 4	-3.8	-3.8	-3.8	-3.8		
Clock	+/- 2 min	—	✓	—	—		
Dessicant	Changed?	—	—	—	—		
Filter	Changed?	—	Δ	CHANGED	—		
Leak Check	<10 S Press	—	3	—	—		
	Operator	TB	mph	TB	TB		

IDAS (Monthly), >30 Days Initials: ____✓____   Water dropout (monthly): ____✓____

Day	Time	Action	Initials	Date Online
3	1611	Weekly	TB	1405
9	1135	Monthl	mph	1145
9	1540	Weekly CDPHE visited already today.	TB	—
19	1620	Weekly	TB	1630
25	1645	Weekly	TB	1655

Use ✓ for yes and in-range and ✗ for no and out-of-range, Δ for changed

Figure 6. Precision Test Tracking & Results

DATE: 7-10-14

PRECISION TEST TRACKING & RESULTS

STATION / AIRS ID	PARAMETER	LOGGER START TIME	CALIBRATOR / CYLINDER SOURCE MODEL & S/N or BOTTLE #	CO,O3,NOx,SO2 ACTUAL CONC	ZERO ACTUAL CONC	ANALYZER PRECISION INDICATED CONC	ZERO INDICATED CONC	LOGGER END TIME	RECORD ENTERED IN DATABASE
WELBY (01) 08 001 3001	CO	0622		4.0	0	3.839	-.125		
	O3	0622		60	0	57	0		
	NO2				0				
	SO2				0				
HIGHLAND (02) 08050002	O3								
CAMP (06) 08 031 0002	CO				0				
	NO2				0				
	O3								
	SO2				0				
I-25 DENVER 08 0X XXXX	CO				0				
	NO2 - Ph				0				
CHATPARK(08) 08 035 0004	O3	0624		60.29	.95	57.01	-1.89		
NREL (11) 08 059 0011	O3								
WELCH (12) 08 059 0005	O3	0624		60.24	-1.4	62.44	.49		
LA CASA (14) 08 031 0025	CO-T				0				
	O3								
	NO				0				
	NOy / NPN				0				
	SO2-T				0				
R.F.N (15) 08 059 0006	O3								
ASPEN PK. (17) 08 059 0013	O3	0625		60.16	-.39	58.51	.16		
AUR. EAST(18) 08 005 0006	O3	0530		60.03	0	58.66	-.15		
SBCREEK (31) 08 013 0011	O3								
FCOLLINS CSU (41) 08 069 1004	CO				0				
	O3								
FTCWEST (42) 08 069 0011	O3								
WCTOWER(51) 08 123 0009	O3								
GREANNEX(52) 08 123 0010	CO				0				
ACADEMY (62) 08 041 0013	O3	0626		59.97	-.16	60.79	.71		
HIWAY24 (63) 08 041 0015	CO	0627		4	0	3.99	.008		
	SO2-T	0627		20	0	19.5	-.26		
MANITOU (64) 08 041 0016	O3	0629		60.29	.29	59.37	-.62		
GJ PITKIN (71) 08 077 0018	CO				0				

Needed? Debug?

form: J:/ZSFILES/Forms/Manual Precision 2013.xls

Figure 7. Manual Precision Summary Report

Manual Precision Summary Report

Prec. Date Cycle			Prec. Date	Typ	A	AZC	J	JZC	% Diff	Count	ZC	Test	AQ	Invalid	Notes
CO 42101															
CAMP															
6/1/2014	to	6/14/2014	6/3/2014	M	4	4	3.9	3.9	-3%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/1/2014	to	6/14/2014	6/3/2014	M	4	4	3.9	3.9	-3%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/15/2014	to	6/28/2014	6/18/2014	M	4	4	3.8	4	0%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/15/2014	to	6/28/2014	6/18/2014	M	4	4	3.8	4	0%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/29/2014	to	7/12/2014	7/8/2014	M	4	4	4	4	0%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/29/2014	to	7/12/2014	7/8/2014	M	4	4	4	4	0%	1	☑	☐	☑	☐	Actual Zero Assumed.
CO Springs - Highway 24															
6/1/2014	to	6/14/2014	6/6/2014	M	4.02	4.02	4	4	0%	1	☐	☐	☑	☐	Actual Zero Assumed.
6/15/2014	to	6/28/2014	6/23/2014	M	4.02	4.02	4	4	0%	1	☐	☐	☑	☐	Actual Zero Assumed.
6/29/2014	to	7/12/2014	7/10/2014	M	4.02	4.02	4	4	0%	1	☐	☐	☑	☐	Actual Zero Assumed.
Fort Colins CSU															
6/1/2014	to	6/14/2014	6/3/2014	M	4	4	4.1	4	0%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/15/2014	to	6/28/2014	6/18/2014	M	4	4	4.1	4	0%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/29/2014	to	7/12/2014	7/8/2014	M	4	4	4.1	4	0%	1	☑	☐	☑	☐	Actual Zero Assumed.
Grand Junction - Pitkin															
6/1/2014	to	6/14/2014	6/3/2014	M	4	4	4.3	4.1	3%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/15/2014	to	6/28/2014	6/18/2014	M	4	4	4.2	4.1	3%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/29/2014	to	7/12/2014	7/8/2014	M	4	4	4.3	4.1	3%	1	☑	☐	☑	☐	Actual Zero Assumed.
Greeley Annex															
6/1/2014	to	6/14/2014	6/3/2014	M	4	4	3.8	4	0%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/15/2014	to	6/28/2014	6/18/2014	M	4	4	3.7	4	0%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/29/2014	to	7/12/2014	7/8/2014	M	4	4	4.2	4.1	3%	1	☑	☐	☑	☐	Actual Zero Assumed.
I25 Denver (Near Roadway)															
6/1/2014	to	6/14/2014	6/3/2014	M	4	4	4	4	0%	1	☐	☐	☑	☐	Actual Zero Assumed.
6/15/2014	to	6/28/2014	6/18/2014	M	4	4	4	4	0%	1	☐	☐	☑	☐	Actual Zero Assumed.
6/29/2014	to	7/12/2014	7/8/2014	M	4	4	4	4	0%	1	☐	☐	☑	☐	Actual Zero Assumed.
La Casa															
6/1/2014	to	6/14/2014	6/6/2014	M	1	1	1.04	#####	4%	1	☐	☐	☑	☐	Actual Zero Assumed.
6/15/2014	to	6/28/2014	6/26/2014	M	1	1	1.06	1.02	6%	1	☐	☐	☑	☐	Actual Zero Assumed.
6/29/2014	to	7/12/2014	7/1/2014	A	1	1	1.03	1.03	3%	1	☐	☐	☑	☐	Actual Zero Assumed.
Welby															
6/1/2014	to	6/14/2014	6/6/2014	M	4	4	4	4	0%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/15/2014	to	6/28/2014	6/19/2014	M	4	4	3.9	4	0%	1	☑	☐	☑	☐	Actual Zero Assumed.
6/29/2014	to	7/12/2014	7/10/2014	M	4	4	3.8	3.9	-3%	1	☑	☐	☑	☐	Actual Zero Assumed.
SO2 42401															
CAMP															
6/1/2014	to	6/14/2014	6/3/2014	M	20	20	22	21	5%	1	☑	☐	☑	☐	Ambient Data ZA. Actual Z
6/15/2014	to	6/28/2014	6/18/2014	M	20	20	22	21	5%	1	☑	☐	☑	☐	Ambient Data ZA. Actual Z
6/29/2014	to	7/12/2014	7/8/2014	M	20	20	20	20	0%	1	☐	☐	☑	☐	Actual Zero Assumed.
CO Springs - Highway 24															
6/1/2014	to	6/14/2014	6/6/2014	M	20	20	19.4	19.6	-2%	1	☑	☐	☑	☐	ZA +0.2
6/15/2014	to	6/28/2014	6/21/2014	A	20	20	19.3	19.7	-2%	1	☑	☐	☑	☐	ZA +0.3
6/29/2014	to	7/12/2014	7/5/2014	A	20	20	19.2	19.6	-4%	1	☐	☐	☑	☐	Actual Z/P Assumed
La Casa															
6/1/2014	to	6/14/2014	6/6/2014	M	20	20	20.4	19.9	-1%	1	☑	☐	☑	☐	ZA = -0.3, Actual Zero Ass
6/15/2014	to	6/28/2014	6/27/2014	M	20	20	20.4	20.4	2%	1	☑	☐	☑	☐	ZA = -0.3, Actual Zero Ass
6/29/2014	to	7/12/2014	7/9/2014	A	20	20	20.1	19.5	1%	1	☐	☐	☑	☐	Actual Zero Assumed.

Figure 8. Example Printout of All Hourly Gaseous or Visibility Data, 1 page per monitor

Day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Max	Avg	RDS
01	.014	.009	.007	.006	.009	.009	.015	.024	.037	.049	.054	.059	.060	.055	.055	.056	.056	.057	.055	.046	.046	.046	.048	.049	.060	.038	24
02	.051	.048	.042	.038	.023	.019	.033	.038	.042	.051	.055	.065	.070	.071	.070	.066	.064	.059	.053	.061	.063	.058	.049	.034	.071	.050	24
03	.022	.011	.007	.003	.005	.007	.014	.025	.018	.038	.050	.045	.047	.049	.054	.059	.058	.057	.053	.043	.036	.038	.034	.031	.059	.033	24
04	.021	.017	.018	.014	.012	.003	.008	.015	.018	.019	.044	.066	.064	.060	.057	.057	.057	.054	.049	.041	.040	.047	.044	.046	.066	.036	24
05	.045	.043	.041	.034	.033	.025	.031	.039	.045	.038	.044	.061	.068	.064	.061	.055	.045	.048	.047	.048	.047	.040	.039	.047	.068	.045	24
06	.052	.035	.051	.049	.045	Apm	.041	.040	.039	.052	.059	.059	.054	.062	.061	.052	.057	.054	.056	.054	.053	.047	.040	.039	.062	.050	23
07	.036	.033	.028	.035	.034	.029	.041	.047	.048	.054	.056	.056	.058	.046	.038	.036	.032	.033	.034	.036	.036	.035	.032	.031	.058	.039	24
08	.028	.025	.022	.022	.023	.020	.025	.027	.029	.033	.036	.031	.033	.043	.043	.035	.032	.030	.030	.032	.030	.030	.029	.028	.043	.029	24
09	.033	.037	.030	.018	.011	.005	.024	.035	.039	.043	.048	.050	.053	.056	.058	.057	.056	.057	.055	.036	.027	.021	.017	.014	.058	.036	24
10	.010	.013	.013	.005	.002	.003	.007	.015	.013	.025	.049	.059	.065	.069	.058	.055	.058	.048	.040	.028	.011	.018	.016	.010	.069	.028	24
11	.013	.016	.024	.015	.005	.004	.005	.006	.012	.026	.054	.057	.050	.055	.053	.046	.044	.040	.040	.035	.029	.035	.034	.032	.057	.030	24
12	.031	.029	.032	.035	.033	.030	.029	.028	.031	.034	.042	.047	.050	.059	.062	.061	.059	.060	.058	.043	.026	.020	.014	.025	.062	.039	24
13	.026	.011	.007	.002	.001	.003	.022	.019	.021	.033	.049	.059	.060	.062	.065	.068	.067	.065	.057	.047	.030	.008	.020	.009	.068	.033	24
14	.011	.006	.010	.008	.019	.011	.035	.040	.046	.050	.055	.056	.056	.053	.050	.047	.046	.046	.048	.045	.036	.029	.024	.020	.056	.035	24
15	.007	.005	.009	.011	.017	.025	.030	.036	.041	.048	.053	.051	.054	.057	.060	.056	.053	.048	.043	.034	.027	.027	.018	.014	.060	.034	24
16	.007	.018	.010	.006	.009	.012	.010	.020	.019	.046	.055	.058	.057	.058	.056	.054	.051	.051	.038	.046	.026	.013	.002	.005	.058	.030	24
17	.005	.004	.002	.001	.001	.003	.019	.038	.043	.036	.033	.043	.048	.045	.046	.040	.041	.041	.049	.040	.012	.004	.014	.027	.048	.026	24
18	.017	.013	.012	.026	.024	.020	.034	.037	.040	.044	.046	.047	.048	.048	.048	.039	.042	.036	.028	.033	.032	.027	.017	.015	.048	.032	24
19	.016	.016	.014	.004	.001	.003	.006	.022	Apm	.040	.044	.048	.055	.061	.064	.068	.069	.068	.063	.040	.046	.048	.029	.024	.069	.036	23
20	.016	.016	.016	.007	.005	.004	.010	.024	.037	.046	.058	.064	.070	.076	.077	.077	.076	.073	.065	.046	.035	.020	.020	.016	.077	.039	24
21	.011	.005	.004	.014	.008	.003	.004	.013	.020	.033	.053	.064	.057	.048	.051	.051	.048	.048	.045	.039	.032	.024	.019	.013	.064	.029	24
22	.012	.007	.003	.001	.003	.010	.021	.029	.035	.043	.051	.052	.051	.058	.046	.044	.045	.045	.045	.041	.040	.032	.028	.023	.058	.031	24
23	.026	.018	.018	.021	.012	.010	.026	.033	.027	.032	.042	.055	.055	.056	.057	.054	.055	.054	.049	.044	.038	.036	.036	.034	.057	.037	24
24	.035	.035	.032	.029	.025	.025	.024	.021	.026	.035	.043	.052	.065	.072	.075	.073	.067	.060	.056	.051	.045	.040	.033	.027	.075	.043	24
25	.017	.020	.016	.011	.003	.003	.014	.014	.022	.029	.045	.051	.052	.051	.045	.056	.057	.057	.054	.038	.037	.040	.039	.035	.057	.033	24
26	.026	.018	.017	.014	.007	.004	.016	.023	.026	.035	.047	.057	.063	.060	.048	.048	.054	.052	.042	.036	.027	.034	.021	.008	.063	.032	24
27	.024	.031	.031	.029	.013	.009	.027	.040	.045	.048	.055	.055	.040	.044	.044	.045	.040	.045	.049	.032	.013	.014	.012	.008	.055	.033	24
28	.013	.041	.043	.035	.026	.030	.036	.047	.050	.053	.054	.054	.054	.056	.057	.058	.061	.059	.050	.038	.023	.013	.013	.010	.061	.042	24
29	.017	.021	.026	.025	.020	.022	.020	.026	.051	.061	.064	.065	.064	.064	.065	.065	.066	.061	.062	.053	.049	.043	.028	.024	.066	.044	24
30	.025	.016	.005	.002	.001	.003	.004	.009	.032	.047	.049	.046	.052	.063	.061	.059	.058	.057	.057	.049	.046	.042	.041	.037	.063	.035	24
Max	.052	.048	.051	.049	.045	.030	.041	.047	.051	.061	.064	.066	.070	.076	.077	.077	.076	.073	.065	.061	.063	.058	.049	.049	.077		
Avg	.022	.020	.019	.017	.014	.012	.021	.027	.032	.040	.049	.054	.055	.057	.056	.054	.053	.052	.049	.042	.035	.031	.027	.024		.036	
Count	30	30	30	30	30	29	30	30	29	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30			718

5.2.7. Printouts of All Meteorological Data, 1 page per meteorological parameter

For each meteorological parameter, such as wind speed, wind direction, temperature, etc, the data acquisition system prints out a monthly list of hourly values. This report takes the form shown in Figure 9. Note that some hours have been colored or shaded on the printout. These shadings are based on automatic data flags issued by the data system, or by flags for changes that were made in the first-round data validation review. If the reviewer has questions about these flags, they can check the color symbols as described in the AirVision system.

The data reviewer should scan each of these hourly data sheets. The reviewer should look to see whether the data show problems, or look reasonable for the meteorological parameter. Things to look for are:

- Long periods of zero values
- Long periods of very high values
- Unusual patterns of missing data
- Data show normal trends for the meteorological parameter of interest (Temperature shows normal daily patterns and typical seasonal values, wind direction is reasonable for the topography of the area)

If the reviewer has questions, or if there is data that should be invalidated, the reviewer attaches a yellow sticky note to the data sheet in question, and writes up questions or comments in the final data review report.

Figure 9. Example Printout of Hourly Meteorological Data, 1 page per parameter

Current Date: 7/25/2014   12:35 PM   Monthly Report
Site Name: ASPENPK   059 : 0013   June   2014   Avg Interval: 1 hour
Parameter: WS   61101   Hours   Units: MPH   012   Method: 050

Day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Max	Avg	RDS
01	3.5	2.3	3.1	7.6	8.8	6.6	7.9	11.1	10.8	10.8	10.0	7.3	6.5	6.0	5.4	6.0	5.3	2.9	3.9	3.3	4.8	9.0	9.4	8.7	11.1	6.7	24
02	4.4	4.5	3.8	3.0	3.8	8.6	6.6	9.4	9.2	5.6	6.0	8.1	10.6	10.3	11.1	11.9	11.4	9.5	6.3	2.6	2.4	2.2	1.7	2.2	11.9	6.4	24
03	4.5	4.5	5.0	4.2	5.7	8.3	10.9	8.8	10.2	15.1	16.0	12.8	17.2	15.7	15.9	13.6	10.8	7.5	7.7	5.6	5.6	5.5	4.0	2.4	17.2	9.0	24
04	2.0	1.8	1.8	2.9	3.4	3.6	2.7	4.6	8.3	9.8	13.3	15.0	16.8	12.8	8.8	8.9	6.5	4.4	6.7	3.1	4.1	3.0	5.5	7.9	16.8	6.5	24
05	4.1	3.5	1.9	3.0	3.3	2.0	5.2	8.1	5.6	6.7	12.0	11.1	5.3	5.8	8.6	9.8	8.1	8.9	7.2	5.1	6.3	5.8	7.8	5.5	12.0	6.2	24
06	5.7	7.1	6.3	4.1	3.6	9.5	11.0	10.8	9.6	7.3	6.7	8.4	3.5	7.9	7.8	7.1	5.6	9.7	5.7	6.7	7.3	7.3	3.6	2.4	11.0	6.8	24
07	3.1	2.9	3.4	1.7	2.3	3.4	2.8	3.7	9.8	13.3	10.7	7.0	6.2	4.8	5.7	6.5	5.9	9.7	8.9	6.9	4.9	5.9	4.3	5.5	13.3	5.8	24
08	4.9	2.7	2.8	3.3	3.4	4.4	3.6	4.3	5.3	6.4	11.4	6.3	7.8	3.7	4.3	6.3	4.9	9.7	11.8	9.5	6.0	5.0	4.6	7.3	11.8	5.8	24
09	5.4	2.5	1.9	1.7	1.3	2.0	5.4	7.3	9.0	10.8	8.7	9.5	9.3	7.4	9.1	9.0	8.4	7.5	5.3	1.6	4.3	5.8	4.9	4.0	10.8	5.9	24
10	2.5	6.3	6.8	4.4	3.4	3.8	4.7	4.8	5.5	4.6	8.1	7.4	4.8	4.1	5.9	7.7	7.0	3.8	2.8	3.9	5.4	5.9	3.3	6.1	8.1	5.1	24
11	10.5	7.0	7.2	6.0	3.7	7.9	5.5	9.3	8.4	6.0	5.3	9.7	7.7	3.7	5.2	10.5	9.9	5.4	5.1	3.4	2.9	3.1	2.7	2.5	10.5	6.1	24
12	4.6	4.6	3.8	3.6	2.5	3.3	3.5	5.3	6.2	11.9	13.1	14.0	12.8	10.6	9.2	9.2	9.2	6.7	3.4	3.5	6.4	5.6	3.9	4.4	14.0	6.7	24
13	5.2	5.1	5.4	6.0	6.3	6.6	8.1	9.6	6.9	8.2	10.5	9.6	10.9	10.9	10.7	10.7	10.4	8.9	6.6	4.6	6.3	6.3	5.7	6.1	10.9	7.7	24
14	5.8	6.4	5.4	5.4	7.2	2.4	3.7	5.0	7.4	10.8	15.4	14.6	13.5	9.8	5.8	6.9	12.8	6.1	3.8	5.3	2.9	2.3	3.3	2.7	15.4	6.8	24
15	2.6	2.6	1.1	1.9	2.9	2.6	5.8	9.7	9.7	8.6	7.5	10.8	10.3	11.3	10.1	7.1	3.4	2.8	1.6	2.1	3.3	3.8	2.4	1.2	11.3	5.2	24
16	1.0	1.8	3.7	4.1	4.8	4.5	7.0	9.7	10.4	7.6	8.8	9.3	7.7	12.5	12.9	10.1	12.3	11.3	9.0	6.6	3.4	4.2	4.7	2.7	12.9	7.0	24
17	3.0	2.7	2.6	4.2	5.4	1.8	4.6	6.6	7.7	11.5	12.1	9.5	10.1	10.6	10.8	9.5	10.8	10.6	10.3	7.0	5.0	2.2	2.6	5.5	12.1	6.6	24
18	5.3	2.5	2.8	1.7	2.4	2.5	4.0	7.3	9.5	10.7	10.2	11.6	12.6	9.8	8.2	5.3	3.5	4.4	4.0	3.5	3.0	3.1	2.3	2.5	12.6	5.5	24
19	2.2	2.4	2.5	2.0	2.5	8.5	5.5	4.4	9.8	8.7	10.2	9.6	9.7	10.6	11.1	9.8	9.7	6.6	5.3	2.0	2.7	2.6	4.6	4.3	11.1	6.1	24
20	3.3	3.4	2.5	2.0	3.5	1.7	1.8	5.2	7.3	10.9	9.5	10.8	9.8	10.3	10.1	10.2	9.1	7.4	4.9	2.5	3.2	3.1	3.2	2.3	10.9	5.7	24
21	2.0	2.7	2.7	2.8	3.0	3.2	3.3	5.0	6.7	7.0	8.0	8.6	9.9	8.0	6.6	8.6	7.9	7.1	6.0	1.4	3.2	3.7	2.0	3.0	9.9	5.1	24
22	3.8	2.1	2.1	2.7	1.2	2.5	3.6	5.3	6.0	4.3	6.9	5.1	6.4	7.1	5.0	5.4	4.2	4.3	4.5	5.0	7.1	2.8	2.2	3.1	7.1	4.2	24
23	3.2	3.3	3.8	2.0	3.4	5.7	3.7	2.4	2.8	8.8	11.9	11.8	9.4	9.1	6.2	5.2	3.7	3.3	4.6	6.2	3.6	2.8	3.6	2.4	11.9	5.1	24
24	3.1	4.5	4.3	3.8	2.9	3.1	2.7	4.0	5.0	10.8	12.2	10.3	10.7	8.8	6.9	5.3	10.5	7.6	2.6	2.5	2.0	2.7	3.2	3.8	12.2	5.5	24
25	2.0	2.4	4.2	6.7	5.9	7.6	7.0	7.7	8.6	7.9	6.9	8.7	6.7	10.3	12.4	10.0	4.9	4.4	4.1	2.6	2.5	3.6	2.9	2.3	12.4	5.9	24
26	2.2	2.3	2.3	2.2	3.5	3.1	4.1	9.0	8.3	6.9	7.6	9.9	9.7	9.4	4.7	2.9	3.8	6.1	3.2	3.7	6.2	5.3	4.6	2.5	9.9	5.1	24
27	7.0	3.0	2.4	3.2	2.2	2.3	1.8	6.8	8.0	11.0	10.6	4.4	5.5	4.0	5.4	9.3	12.1	8.4	4.2	2.9	2.6	2.3	2.2	3.5	12.1	5.2	24
28	3.8	4.4	7.3	3.6	4.3	4.4	5.8	5.0	5.9	9.0	10.8	8.7	10.0	6.2	6.8	5.2	9.6	5.9	4.6	2.8	2.6	2.7	5.2	4.9	10.8	5.8	24
29	5.1	4.9	4.1	4.0	2.6	1.8	4.9	8.3	9.7	10.3	10.7	11.2	9.8	8.5	7.3	5.4	7.7	5.6	4.9	3.9	3.4	5.0	5.2	6.1	11.2	6.2	24
30	6.1	5.2	5.4	4.8	3.5	3.5	4.0	5.7	7.5	9.9	10.0	10.6	9.1	10.4	13.4	11.0	11.6	11.7	10.4	5.1	2.2	3.9	6.1	5.0	13.4	7.3	24
Max	10.5	7.1	7.3	7.6	8.8	9.5	11.0	11.1	10.8	15.1	16.0	15.0	17.2	15.7	15.9	13.6	12.8	11.7	11.8	9.5	7.3	9.0	9.4	8.7	17.2		
Avg	4.0	3.7	3.7	3.6	3.7	4.3	5.0	6.8	7.8	9.0	10.0	9.7	9.3	8.6	8.3	8.1	8.0	6.9	5.5	4.0	4.0	4.2	4.1	4.0		6.1	
Count	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30			720

5.2.8. Manual Zero Adjust Data Analysis

The monitoring unit conducts an analysis on sulfur dioxide, oxides of nitrogen, and NO_y analyzer data, to see if zero adjustment of the hourly values is necessary. This analysis, described elsewhere in the standard operating procedures, involves graphing the daily zeros for each analyzer, for the month of data being analyzed. Three reviewers then independently analyze the graphs, to recommend whether zero adjustment is necessary, or not. Data adjustment is based on the consensus between the three reviewers. In the event of a lack of consensus, the monitoring unit supervisor makes the decision.

Historically, the quality assurance reviewer has not addressed this portion of the packet, as it already represents the consensus of several individuals. However, this may change in the future, as the quality assurance unit supervisor has indicated an interest in this issue.

5.2.9. Maintenance Reports, Generated by Management, or by Site Technicians

All personnel involved in the monitoring network are encouraged to generate "maintenance reports" when a problem is noted. An example is shown in Figure 11. Often, these take the form of maintenance requests from management to site technicians. These requests are the result of review of zero, span or hourly concentration values at headquarters, via a check of the data acquisition program. However, it is also possible for calibration, audit, or maintenance staff to generate these requests. The form is also used when an individual notices a problem, and then immediately fixes it. The bottom of the form notes if any data are affected. The quality assurance reviewer should read these forms, and check to see that any recommended data deletion or adjustment has been done.

Figure 10. Manual Zero Adjust Form

June 2014   Manual Zero Adjust

Welby SO2 / SO2 Max	
Reviewer 1:	-1ppb for 6/1 - 6/11 EDM
Reviewer 2:	-1ppb for 6/1 → 6/16 GJ
Reviewer 3:	Add ⊖1ppb 6/1 → 6/16 VS - Completed
Reviewer 4:	8/14/14 — After further consideration removed ZA correction to because it is not necessary (< mdl) and to keep consistent with May Data + to be more in line with surrounding data. GH

Welby NO / NO2 / Nox	
Reviewer 1:	NO ZA EDM
Reviewer 2:	NO ZA GH
Reviewer 3:	NO ZA VS
Reviewer 4:	

CAMP SO2 / SO2 Max	
Reviewer 1:	-1ppb for 6/1 - 6/19 EDM
Reviewer 2:	-1ppb for 6/1 → 6/18 GH
Reviewer 3:	Add ⊖1ppb for 6/1 → 6/18 hr 0600 VS Completed
Reviewer 4:	

CAMP NO / NO2 / NOx	
Reviewer 1:	No ZA EDM
Reviewer 2:	NO ZA GH
Reviewer 3:	No ZA VS
Reviewer 4:	

LA CASA SO2 / SO2 Max	
Reviewer 1:	No ZA EDM
Reviewer 2:	ZA -0.3 6/1 → 6/30
Reviewer 3:	ZA ⊖0.3 ppb 6/1 → 6/30 VS Completed
Reviewer 4:	

LA CASA NO / Noy	
Reviewer 1:	No ZA EDM
Reviewer 2:	NO ZA GH
Reviewer 3:	No ZA VS
Reviewer 4:	

Figure 11. Maintenance Report

MAINTENANCE REPORT

DATE ___6.25.2014___

STATION ___WCT___

ASSIGNED TO ___K Heald___

ORIGINATED BY ___K. Heald___

ANALYZER or EQUIPMENT ___400E O₃ Analyzer___   S/N ___497___

MALFUNCTION DESCRIPTION OR COMPLAINT

At WCT at the monthly inspection 400E pressure was 15 and Flow ~ 440 cc/m. After troubleshooting it was discovered that the filter retainer ring was upside down.

ACTION TAKEN

Filter was replaced and filter ring installed properly. The problem was corrected.

DATA TO BE DELETED (IF ANY)
ENTER EXACT DATES AND DATA HOURS

Data that impacted was from 22 June @ 1015 to 25 June @ 0930 Both morning A.M. times.

7/31 vs - Keep data - s/p's good + didnt change; very good hourly avg correlation w/FC·CSU + FC·W before, after + during 6/22-6/25 block.

5.2.10. Internal Station Temperature Printouts, by Station, by Hour

For each station shelter with gaseous instrumentation, the Air Pollution Control Division measures the internal station temperature. This is required, as the gaseous instruments must have a fairly stable station temperature in order to function. For the station's temperature, the data acquisition system prints out a monthly list of hourly values. This report takes the form shown in Figure 12. Note that some hours have been colored or shaded on the printout. These shadings are based on automatic data flags issued by the data system, or by flags for changes that were made in the first-round data validation review. If the reviewer has questions about these flags, they can check the color symbols as described in the AirVision system.

The data reviewer should scan each of these station temperature data sheets. The reviewer should look to see whether the data show problems, or look reasonable. Things to look for are:

- Long periods of cold values
- Long periods of very hot values
- Unusual patterns of missing data
- Data show normal trends for the station temperature (Temperature is generally stable, but may show some day-night variation)

The temperature conditions that are of concern vary somewhat with each type of pollutant analyzer. For example, the carbon monoxide analyzer is generally not affected by high temperatures, but temperatures over 95 degrees Fahrenheit are a problem for the ozone analyzer.

If the reviewer has questions, or if there is data that should be invalidated, the reviewer attaches a yellow sticky note to the data sheet in question, and writes up questions or comments in the final data review report.

5.2.11. The Logger Central Message Report

The AirVision data acquisition system permits the recording of comments regarding station activities, or unusual station events that could affect data. Individuals may record comments while at a gaseous monitoring site, or may log in remotely to record statements. Generally, station operators record routine maintenance and analyzer adjustments. At the end of the month, a report of all the month's comments, listed by station, is generated for the monthly data packet. An example of this report is shown in Figure 13.

The quality assurance data reviewer should read these comments, as they may provide clues to periods of analyzer instability, or explanations of why the equipment did not perform as expected. If the reviewer has comments or questions, a yellow sticky form is attached to the appropriate report page, and comments are written up in the final data review report.

5.2.12. Printouts of Zero and Span Check Results for Each Gaseous Monitor

As part of its data validation review, the quality assurance unit reviews daily zero/span records for all gaseous monitors. An example of a report form that can be used for this activity is shown in Figure 14. This report was recently developed by the monitoring unit, for the use of the quality assurance unit. The "actual" concentration is the concentration generated by the test source. This concentration is determined during the instrument calibration. The "indicated" concentration is the analyzer's measured response. The "%Difference" is calculated according to Equation 1 or 2 of Section 5.2.3. The percentage difference should be within +/- 10%, except for ozone, where it is required to be within +/- 7%.

If the percentage difference is outside the acceptable range, the data reviewer should attempt to identify the problem. This is done by reviewing other forms within the data package. The monthly maintenance and the logger message forms are often useful in determining whether there were problems with the equipment. Problems may be either with the pollutant concentration generation system ("precision system", or "source

system"), or with the analyzer itself. If problems are noted, the reviewer attaches a yellow sticky note to the control chart of that analyzer, and writes up questions or comments in the final data review report.

Figure 12. Example of an Internal Station Temperature Printout

Current Date: 7/25/2014 12:35 PM Monthly Report
Site Name: AUREAST 005 : 0006 June 2014 Avg Interval: 1 hour
Parameter: ITEMP 62107 Units: DEGF Method:

Hours

Day	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Max	Avg	RDS
01	74.2	74.7	74.8	74.8	75.4	75.3	76.1	77.9	80.1	81.2	79.8	81.3	80.9	80.1	80.4	81.7	80.4	81.0	81.4	81.3	81.4	81.3	81.3	80.9	81.7	79.0	24
02	80.6	81.0	81.1	80.8	80.1	79.0	78.4	77.9	78.5	80.4	81.1	81.5	81.8	80.4	81.3	80.5	81.1	81.3	79.0	79.9	80.9	80.5	79.3	76.4	81.8	80.1	24
03	77.3	77.2	76.5	76.2	76.0	75.7	76.2	77.9	78.8	80.4	81.7	81.7	82.0	81.4	80.4	80.4	79.9	81.1	81.4	80.3	79.1	80.3	81.4	80.5	82.0	79.3	24
04	81.4	80.0	80.3	79.8	79.2	78.3	78.4	79.8	81.1	81.4	81.6	82.0	82.1	81.0	80.0	81.6	81.4	81.7	81.3	81.1	79.8	77.7	77.6	78.7	82.1	80.3	24
05	79.4	78.3	77.3	76.8	76.3	76.0	76.2	77.2	79.0	81.3	80.9	81.9	81.3	81.3	81.4	81.3	81.3	81.8	81.4	79.4	77.1	74.6	73.1	72.5	81.9	78.6	24
06	70.8	69.6	69.3	69.3	69.2	68.9	69.3	70.7	73.6	76.3	78.7	80.6	80.6	79.9	79.0	80.6	81.1	81.1	81.1	81.4	81.4	80.9	80.7	80.2	81.4	76.4	24
07	79.8	78.9	77.8	76.6	75.9	75.4	74.9	74.7	75.3	76.8	78.8	80.9	81.0	80.6	80.6	80.7	81.1	76.6	77.6	77.6	77.1	76.8	76.6	76.5	81.1	77.8	24
08	75.7	73.8	72.2	70.8	69.6	69.0	69.3	69.0	69.9	71.4	73.0	75.0	75.4	74.5	74.4	74.2	72.0	69.6	67.8	66.3	64.9	64.4	63.3	65.4	75.7	70.4	24
09	66.6	66.1	65.3	65.6	65.6	65.6	65.8	63.9	63.3	63.6	64.9	66.5	67.5	67.7	69.9	72.7	74.7	76.4	77.5	77.7	76.4	74.6	72.5	70.7	77.7	69.2	24
10	69.7	68.7	67.6	67.0	66.7	66.9	68.3	70.6	73.7	77.1	80.0	80.5	79.3	81.7	80.0	80.1	79.1	78.7	79.7	81.0	77.3	76.8	76.6	76.6	81.7	75.1	24
11	77.3	77.3	77.6	77.6	77.6	77.3	77.2	78.0	79.1	78.6	79.9	81.7	81.6	81.4	81.0	81.4	81.6	80.9	80.7	81.6	81.6	81.3	80.8	81.7	81.7	79.7	24
12	80.7	80.1	79.7	79.2	78.7	77.8	76.8	76.3	76.1	76.8	78.4	80.2	81.0	80.8	81.1	81.0	80.8	80.0	80.3	80.9	79.7	79.9	78.4	76.0	81.1	79.1	24
13	75.7	74.6	74.3	74.1	74.5	73.7	74.0	75.8	78.4	80.5	81.1	80.7	81.3	81.6	81.5	81.8	81.6	82.0	79.3	81.5	81.5	81.7	81.4	80.7	82.0	78.8	24
14	81.2	80.0	79.0	78.6	79.1	79.5	80.3	81.4	81.4	78.9	79.6	79.8	80.8	82.0	81.7	81.6	81.8	81.5	81.5	81.4	80.9	79.8	78.8	77.4	82.0	80.3	24
15	76.6	75.4	74.0	72.7	71.5	70.1	68.6	68.4	69.4	71.5	73.7	76.5	79.3	81.1	81.0	81.5	81.1	77.7	79.4	80.3	80.8	81.3	80.4	80.6	81.5	76.3	24
16	79.8	79.1	78.4	77.8	77.3	76.2	75.7	76.3	78.6	80.8	81.3	81.8	82.2	81.6	80.8	81.0	80.1	81.4	81.8	81.4	81.3	79.4	77.1	77.3	82.2	79.5	24
17	76.9	75.7	75.2	74.1	73.4	72.9	73.0	74.6	78.0	80.7	80.0	82.1	81.8	82.2	81.7	81.9	81.8	81.7	81.6	81.3	81.1	80.3	80.4	81.0	82.2	78.8	24
18	80.0	80.9	80.7	80.6	81.5	81.0	80.2	79.5	79.6	80.7	81.1	81.6	78.8	81.1	78.6	80.3	79.2	81.4	81.9	81.6	81.4	81.0	80.8	80.7	82.0	80.7	24
19	80.8	79.9	78.8	77.8	76.9	76.0	75.7	76.4	77.0	78.7	80.6	81.0	80.2	80.4	82.0	81.6	81.9	80.1	81.0	81.6	81.4	81.4	80.8	81.4	82.0	79.7	24
20	80.3	80.7	80.4	80.2	79.9	79.6	79.8	81.0	81.1	81.1	80.2	80.9	81.8	82.2	81.8	82.2	81.8	81.9	82.1	81.4	81.6	81.6	79.9	77.5	82.2	80.8	24
21	78.9	78.9	78.5	78.2	77.7	77.6	77.9	78.5	79.4	80.8	81.3	80.2	81.1	81.6	81.4	81.2	80.7	77.7	77.5	77.7	77.8	77.6	81.6	79.3	81.6	79.3	24
22	77.3	76.9	76.6	76.4	75.9	75.7	76.4	77.8	79.3	80.6	81.2	80.0	80.0	78.3	80.5	81.2	79.1	81.1	81.0	81.3	80.9	80.4	80.8	80.9	81.3	79.1	24
23	80.9	80.0	78.4	78.0	77.6	76.8	76.4	76.4	78.3	80.5	78.9	80.4	81.6	79.9	79.1	81.3	80.9	80.7	80.9	80.6	80.1	80.6	81.0	81.4	81.6	79.6	24
24	79.9	80.6	80.9	81.0	81.1	81.2	80.9	80.8	78.8	78.3	80.4	81.3	81.4	81.5	81.3	79.1	79.4	79.2	80.7	78.1	78.2	77.4	76.9	76.5	81.5	79.7	24
25	76.6	76.3	75.7	75.0	74.2	73.2	73.2	74.3	76.3	78.9	80.6	81.3	81.5	80.3	80.8	78.9	79.5	81.0	81.0	78.9	78.5	79.2	79.7	81.5	81.5	78.1	24
26	80.4	79.9	79.9	79.5	79.6	79.5	79.9	80.6	80.9	81.0	81.3	81.7	82.0	81.7	81.6	81.6	81.4	78.5	78.8	80.3	80.4	80.8	80.4	80.4	82.0	80.5	24
27	80.4	81.1	80.4	81.2	81.1	81.1	81.2	80.9	81.1	81.0	81.3	81.2	81.4	81.7	81.3	80.6	80.6	81.2	75.6	77.3	80.8	79.8	80.5	80.6	81.7	80.5	24
28	81.2	81.0	80.0	79.6	79.4	78.7	79.1	79.9	81.2	81.2	81.1	79.2	80.0	81.4	79.8	80.4	81.5	78.6	79.0	80.4	80.6	80.8	80.9	81.5	81.5	80.2	24
29	79.6	79.7	80.0	80.1	80.2	79.9	80.4	80.7	80.9	78.5	80.8	80.6	80.7	80.8	81.4	81.5	81.6	80.4	81.5	81.5	79.3	80.4	81.2	80.6	81.6	80.5	24
30	78.5	77.0	77.8	78.2	78.3	78.3	79.2	80.1	80.9	81.0	81.5	81.3	81.4	81.5	80.5	80.9	81.3	81.6	81.1	78.8	79.3	80.2	80.7	81.5	81.6	80.0	24
Max	81.4	81.1	81.1	81.2	81.5	81.2	81.2	81.4	81.4	81.4	81.7	82.1	82.2	82.2	82.0	82.2	81.9	82.0	82.1	81.6	81.6	81.7	81.4	81.5	82.2		
Avg	77.9	77.4	76.9	76.5	76.3	75.8	75.9	76.5	77.6	78.6	79.4	80.1	80.3	80.3	80.2	80.5	80.3	80.0	79.9	79.7	79.4	79.0	78.7	78.3		78.6	
Count	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30			720

Figure 13. Logger Central Message Report

Logger Central Message Report

QA ck 9/2/14 - mdr

Site Name ACADEMY   **Site Description** Co. Springs - Air Force Academ

Logger Identifier 62   **Logger Name** ACADEMY

Message Time	Message Text
7/2/2014 3:11:21 PM	WEEKLY. DH
7/8/2014 7:33:19 AM	WEEKLY. DH
7/11/2014 10:23:52 AM	TOOK OZONE OFFLINE FOR AUDIT AT 8:42. PUT BACK ONLINE AT 10:21. CWS
7/17/2014 6:43:16 AM	A/C CLEANING.MDR
7/17/2014 3:11:56 PM	WEEKLY. DH
7/23/2014 7:35:57 AM	WEEKLY. DH
7/28/2014 3:12:59 PM	WEEKLY. DH

Site Name ARVADA   **Site Description** ARVADA

Logger Identifier 03   **Logger Name** ARVADA

Message Time	Message Text
7/28/2014 11:36:30 AM	MONTHLY COMPLETE. - KH

Site Name ASPENPK   **Site Description** Aspen Park

Logger Identifier 17   **Logger Name** ASPENPK

Message Time	Message Text
7/1/2014 10:51:25 AM	MONTHLY.MDR
7/9/2014 6:51:00 AM	WEEKLY. A/C CLEANING.MDR
7/14/2014 11:21:02 AM	PERFORMED O3 AUDIT - 0740 TO 0920
7/14/2014 11:23:15 AM	PERFORMED O3 AUDIT FROM 0740 TO 0920 - ON SOURCE 401 O3 LAMP OUT OF SPEC
7/14/2014 11:24:00 AM	PERFORMED METEOROLOGICAL AUDIT FROM 0950 TO 1115 MST -
7/14/2014 1:44:04 PM	WEEKLY.MDR
7/14/2014 1:50:36 PM	AMBIENT OZONE CLIMBING TO OVER 79. LANDSCAPING EQIPMENT ON STREET SIDE.MDR
7/14/2014 1:52:51 PM	WIND COMING FROM DIRECTION OF GAS STATION.MDR
7/21/2014 1:49:21 PM	WEEKLY.MDR
7/30/2014 5:35:35 AM	MONTHLY.MDR

Site Name AUREAST   **Site Description** Aurora East

Logger Identifier 18   **Logger Name** AUREAST

Message Time	Message Text
7/1/2014 1:48:03 PM	MONTHLY.MDR
7/10/2014 5:27:03 AM	WEEKLY PLUS A/C CLEANING.MDR
7/14/2014 8:57:00 AM	WEEKLY.MDR
7/22/2014 12:41:21 PM	WEEKLY.MDR
7/30/2014 7:37:11 AM	MONTHLY.MDR

Site Name CAMP   **Site Description** CAMP

Wednesday, August 27, 2014 10:48 AM   Page 1 of 7

Figure 14. Printouts of Zero and Span Check Results for Each Gaseous Monitor

Monthly Calibration Data Report

Site	System	Date	Auto/Manual	Actual	AZero	Indicated	IZero	%Difference
Aspen Park	O3	7/1/2014	A	60.00	0.00	58.00	0.00	-3.3%
		7/2/2014	A	240.00	0.00	242.00	0.00	0.8%
		7/3/2014	A	60.00	0.00	59.00	0.00	-1.7%
		7/4/2014	A	240.00	0.00	242.00	0.00	0.8%
		7/5/2014	A	60.00	0.00	59.00	0.00	-1.7%
		7/6/2014	A	240.00	0.00	242.00	0.00	0.8%
		7/7/2014	A	60.00	0.00	58.00	0.00	-3.3%
		7/8/2014	A	240.00	0.00	241.00	0.00	0.4%
		7/9/2014	A	60.00	0.00	58.00	0.00	-3.3%
		7/10/2014	M	60.00	0.00	58.00	0.00	-3.3%
		7/10/2014	A	240.00	0.00	242.00	0.00	0.8%
		7/11/2014	A	60.00	0.00	58.00	0.00	-3.3%
		7/12/2014	A	240.00	0.00	240.00	0.00	0.0%
		7/13/2014	A	60.00	0.00	57.00	0.00	-5.0%
		7/14/2014	A	240.00	0.00	240.00	0.00	0.0%
		7/15/2014	A	60.00	0.00	58.00	0.00	-3.3%
		7/16/2014	A	240.00	0.00	240.00	0.00	0.0%
		7/17/2014	A	60.00	0.00	58.00	0.00	-3.3%
		7/18/2014	M	60.00	0.00	57.00	0.00	-5.0%
		7/18/2014	A	240.00	0.00	241.00	0.00	0.4%
		7/19/2014	A	60.00	0.00	58.00	0.00	-3.3%
		7/20/2014	A	240.00	0.00	242.00	0.00	0.8%
		7/21/2014	A	60.00	0.00	59.00	0.00	-1.7%
		7/22/2014	A	240.00	0.00	242.00	0.00	0.8%
		7/23/2014	A	60.00	0.00	59.00	0.00	-1.7%
		7/24/2014	A	240.00	0.00	243.00	0.00	1.3%
		7/25/2014	A	60.00	0.00	60.00	0.00	0.0%
		7/26/2014	A	240.00	0.00	245.00	0.00	2.1%
		7/27/2014	A	60.00	0.00	61.00	0.00	1.7%
		7/28/2014	A	240.00	0.00	245.00	0.00	2.1%
		7/29/2014	A	60.00	0.00	61.00	0.00	1.7%
		7/30/2014	A	240.00	0.00	244.00	0.00	1.7%
		7/31/2014	A	60.00	0.00	60.00	0.00	0.0%
Aurora East	O3	7/1/2014	A	60.00	0.00	59.00	0.00	-1.7%
		7/2/2014	A	240.00	0.00	238.00	0.00	-0.8%
		7/3/2014	A	60.00	0.00	58.00	0.00	-3.3%
		7/4/2014	A	240.00	0.00	238.00	0.00	-0.8%
		7/5/2014	A	60.00	0.00	58.00	0.00	-3.3%
		7/6/2014	A	240.00	0.00	237.00	0.00	-1.3%
		7/7/2014	A	60.00	0.00	58.00	0.00	-3.3%

6.0   MONTHLY DATA PACKAGE – SECONDARY QUALITY ASSURANCE REVIEW FORM INSTRUCTIONS

This section describes the quality assurance review summary form filled out for each data package that is reviewed. This form is shown in Figure 15. The reviewer fills out the top of the form, listing the month of the data package reviewed, the date the review was completed, and the reviewer's name. Questions, recommendations, and requests resulting from the review are then listed as items 1-4 below. If more space is needed, an additional form can be filled out. For each numbered item, a yellow sticky note is attached to a portion of the data package, to indicate to the gaseous monitoring unit the documentation that is the basis for the comment. The comment number is placed on the yellow sticky paper. Note that the yellow sticky notes are not permanent. They are simply a convenience for indicating the basis of each comment. The data package is returned to the gaseous monitoring unit. That unit responds to the comments in the allotted space on the form. The form stays with the monthly data package, as a permanent record of the data review.

7.0   DATA ACQUISITION, CALCULATIONS, AND DATA REDUCTION

At the present time, the means of recording the data review comments is by way of a manual data sheet, as shown in Figure 15. This data sheet stays with the monthly data packet. There are no calculations required. As a result of the data review, some of the monthly data in the AirVision system may be adjusted or invalidated. The AirVision system can recalculate data recovery, and regenerate reports, that may change due to the quality assurance review.

8.0   DATA MANAGEMENT AND RECORDS MANAGEMENT

8.1   Data Management

The monthly data packages are returned to the gaseous monitoring group. They are stored on-site in a file cabinet for two to three years. After that, they are placed in cardboard storage boxes, with one year per box, and moved to off-site storage. As these records are the basis of our monitoring data, they are stored off-site indefinitely.

8.2   Records Management

If needed, monthly gaseous and meteorological data packages can be retrieved from the on-site or off-site storage locations discussed above.

9.0   QUALITY ASSURANCE AND QUALITY CONTROL

The secondary gaseous and meteorological monitoring data review by the quality assurance unit is itself a quality control procedure, as it involves the re-inspection of gaseous and meteorological data. Quality assurance is maintained by the use of data sheets, which record the results of the inspection process. Reviewers use EPA policy and guidance documents as the basis of their reviews. Some of these documents are listed in Section 12.0.

10.0   HANDLING AND PRESERVATION

This process involves monthly data review packages, and a data review sheet. The handling and preservation of these materials has been discussed previously. The secondary data review process does not involve the collection of physical air quality samples, so no further discussion is needed.

11.0   COMPUTER HARDWARE AND SOFTWARE

The data review process does not directly involve the use of a computer. The process reviews products produced by the AirVision data acquisition system. This data system is described in other standard operating procedures.

Figure 15.   Monthly Data Package Secondary Quality Assurance Review Form

Monthly Data Package
Secondary Quality Assurance Review

Monthly Data Package   _____

Date Review Completed _____

Reviewer   _____

    1.   Issue/Question

           _____
           _____
           _____

           Reviewer Recommendation

           _____
           _____
           _____
           _____

           Resolution / Reason Why

           _____
           _____
           _____
           _____

    2.   Issue/Question

           _____
           _____
           _____

           Reviewer Recommendation

           _____
           _____
           _____
           _____

           Resolution / Reason Why

           _____
           _____
           _____
           _____

    3.   Issue/Question

           _____

_____
_____

Reviewer Recommendation

_____
_____
_____
_____

Resolution / Reason Why

_____
_____
_____
_____

4. Issue/Question

_____
_____
_____

Reviewer Recommendation

_____
_____
_____
_____

Resolution / Reason Why

_____
_____
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