Air Monitoring Directive – Summary of Feedback and Responses for Chapter 7 Calibration

This feedback was received following the 60-day public review (July – August 2014) of the Air Monitoring Directive Chapter 7, Calibration.

	Chapter 7: Calibration		
#	**Comment**	**Response from ESRD**	**Action Taken**
1	2.0 *Opportunity to match wording with intent.* First bullet "Excessive noise" change to "*excessive signal output noise and audible noise*"	Change to excessive signal noise. No other changes required.	Wording changed.
2	Cal 2-G (b) *Clarify.* Requirement is unclear - First time for what?	Add "a regulator is installed on a cylinder".	Wording added.
3	Cal 2-G (c) *Objection.* Please remove this requirement. When calibrations systems are closed and remain closed as for in-situ calibrators that remain at stations, there is no need to open up the system just to evacuate the regulator.	Bullet "c" is in place where a cylinder is left with the regulator on but is not used daily as in some systems. Needs to remain.	None.
4	Cal 2-H (c) *Opportunity to match wording with intent.* Sometimes a calibration "before repair" is not possible or completely pointless since the analyzer is not functioning and cannot produce even a remotely linear response. Suggest adding the wording. "*Where no output measurement concentration is evident or if it becomes apparent at any time during the calibration that continuing the calibration would yield no useable points or information due to improperly functioning analyzer, the 'before repair' calibration can be aborted"*	Add "if able to complete a calibration".	Wording added.
5	Cal 2-H (d) *Opportunity to match wording with intent.* Prior to shutdown - add some wording such that calibration is not required for short power outs. For instance if a power cord is unplugged from an analyzer simply to reroute it. Technically it's a shut down and the wording would require a calibration but calibration is unnecessary in this case. Clause (f) covers it if a short shutdown causes some operational problems. Maybe add *"If the shutdown is expected to last 3 days or more."*	Believe the wording in the chapter is clear.	None.
6	Cal 2-M *Opportunity to match wording with intent.* Specify that this clause refers to zero or slope corrections after the output of the analyzer. Analyzers themselves usually make these corrections internally also and I don't believe the intent of this clause is to set those factors in the analyzer to zero at 0.0 and slope of 1.000	The intent of this clause applies to raw data going into the DAS. Analyzers correct data outputs when the operator manually corrects the zero and high points to match expected calibrator responses.	None.

7	Cal 2-N *Clarify.* Does Bulletin BUL-023 still apply where certain hydrocarbon analyzers can be adjusted using the mid-point of the calibration?	BUL-023 covered a calibration requirement for a certain model of Methane/Non-methane hydrocarbon analyzer. It is not all encompassing for all hydrocarbon analyzers.	None.
8	Cal 3-E *Clarify.* States this is an alternative to GPT but goes on to describe equipment etc. very much like a GPT.	Clause wording changed.	Removed “alternative to” and add in “mentioned in”.
9	Cal 3-G *Clarify.* Is the intent that flow measurements must be made for each point and during each calibration? Or simply, that measurements must be made at each flow setting to be used during the calibrations. Does not the flow calibration take care of this?	The intent was to have each point used for calibrations measured with a NIST traceable device.	None.
10	Cal 3-H (c) *Objection.* Overkill. Will require doubling of flow measurement devices since one set will almost always be in transit for this verification. Or does AEMERA intend to offer this service?	Should be annually, not every 3 months.	Clause changed to read annually.
11	Cal 5-A *Clarify.* Sentence between Cal 5-A (d) and (e) is this referring to an analyzer of calibrator?	Should be calibrator.	Changed guidance to “calibrator”.
12	Cal 5-A (e) ii *Opportunity to match wording with intent.* Stabilize? Suggest adding the words *“at normal operating oven temperature”* otherwise ‘stable’ could refer to vibration, flow or some other physical condition	This is referring to the permeation device not oven temperature.	None.
13	Cal 5-A (g) *Wording/grammar.* Suggest using the word tubing rather than lines. Applies elsewhere in the document also.	Where applicable, calibration tubing should replace “lines”.	Wording changed.
14	Cal 5-A (h) (i)- (iv) *Objection.* Too much information for an enforceable clause. If I open a regulator quickly am I in contravention of the AMD? Thereby requiring another series of documents and steps i.e. corrective action report etc. This should be a guidance statement.	The steps are provided to give the accepted method.	None.
15	Cal 5-A (h), (i), (r) *Clarify.* Sub-clause is written for a dilution calibration and doesn’t apply to a permeation calibration. Maybe split out the general calibration requirements in 5.0 then go into detail for dilution calibrations in 5.1 and permeation calibrations in 5.2 etc.	This is general information and makes no mention of permeation calibrators.	None.

16	The following suggestions are based on the EPA proposal for QA checks on analyzers in the US. Rather than use the analyzer full scale as the determining factor for calibration gas concentration, the history of readings experienced at the station in combination with the Alberta Ambient Air Quality Objectives (AAAQO) should be used. CAL 5-A (r): Currently the highest calibration point should be 60% to 80% of the operating range. Suggest a change to follow EPA's lead to reference the calibration scale to the actual readings experienced at that location or the relevant ambient air quality standards. Highest calibration point should be 1.5 times the highest concentration measured in 3 years at that site. This would be defined as the "calibration scale". CAL 4-A (d): The test gas concentration, i.e., span gas concentration, would then be 80% of calibration scale instead of the full scale. If the calibration scale is lower than Alberta's AAAQO then the span gas concentration should be 1.5 times the AAAQO.	This is only a proposal, and there will be no change regarding calibrating analyzers at this time.	None.
17	Cal 5-A (z) and (aa) *Clarify.* Two sub-clauses appear to contradict each other. Should it state: (z) "Except for NH3, the time required to reach....." (aa) "The time required for NH3 to reach a stable response shall not exceed 45 minutes".	Remove the word "except" from clause (aa). You can wait a max of 20 minutes for a stable response, unless it is NH_3, for which you are able to wait 45 minutes for a stable response.	Removed "except" from the clause.
18	Cal 5-B *Clarify.* Can't follow clause 5-A to perform a permeation calibration since some of the sub-clauses in 5-A don't apply. Suggest either restating the steps that do apply or simply state "follow the multi-point calibration procedure sub-clauses in 5-A that apply".	This is a generalized procedure. The operators need to utilize the correct information regarding their method of calibration.	None.
19	Cal 5.3.2 NO2 GPT calibration. *Clarify.* An acknowledgement might be a good idea in the text or guidance that the NO2 high point could be as little as 40% of full scale and that's OK (given the suggested high point for NO and subsequent NO2).	Statement is correct.	None.
20	Cal 5.4.2 *Wording/grammar.* A more correct way to describe the feedback loop is; "*A photometer is an integral calibrated ozone measurement system that provides a feedback loop to the ozone generator to ensure the output remains at the desired set concentration*."	Believe wording in chapter is clear.	None.
21	Cal 5-I (e) *Clarify.* 'Introduce ozone at the same rate as the high point of NO2 calibration'. This is not possible if ozone analyzer is run at 500ppb and the NO2 at 1000ppb. Last sentence in 5.4.3 states NO concentration should be equivalent to approx. 80% of NO. The dichotomy between specifications for the 2 point settings should be reconciled.	Statement in the chapter is correct. Users need to select a point that will reflect being used for ozone calibrations after the GPT and remain compliant with the AMD.	None.

22	Cal 5-I (e) (m) (p) *Clarify.* Change from 'lamp voltage' to "*ozone lamp output setting*" to coincide with the text description in 5.4.2 (it may not be obvious in some calibrator models that changing the ozone setting is the same as changing the voltage).	Agree with this statement as some calibrations use concentration and not lamp voltage/current.	Cal 5-I (e) (m) (p) Changed from 'lamp voltage' to "ozone lamp output setting".
23	Cal 9.0 Table 2 *Calibration acceptance criteria.* Be careful relying too heavily on least squares regression. If the top point is 1:1 but the lowest point deviates by 60% or more from expected the LSR calculation will still yield the required slope and coefficient. One of the calibration criteria must also be no point more than 10% or 15% of expected concentration	This is the most widely accepted method and must remain so. Note: if 1 or more points are that far out it means work is required for that analyzer.	None.
24	Cal 10-A, B *Clarify.* Data flagging. On what data? Assumed to be flagging of data submitted to Government but it's not explicit.	The clause states ambient measurements.	None.
25	Cal 11-A *Objection.* Suggest change to calibration records are "*recorded and retained* as *accessible at the analyzers location*". Then a centralized system of electronic storage for a network of stations that is accessible via the internet or on station computers or technicians laptops is acceptable. It is very difficult to have paper copies of calibration reports follow an analyzer around to the various locations it may move in 3 years.	See comments #88 and #92. The form of data storage is not stipulated.	None.
26	Cal 11-E (a) (vi) *Objection.* Suggest change to "*Serial number or unique inventory identifier"* to allow large networks to use an internal inventory system and identify equipment that way (AMU#, FAP or WBEA ID#).	The most important calibration information is already requested. If operators wish to add more information, then add what identifiers will aid your operation.	None.
27	Cal 11-E *Clarify.* Add: • Calibration standard ID# or gas cylinder serial number • Calibration gas standard concentration • Ozone lamp setting	See comment #26	None.
28	Cal 11-F *Objection.* Suggest change to calibration records are "*accessible at the analyzers location*". Then a centralized system of electronic storage for a network of stations that is accessible via the internet or on station computers or technicians laptops is acceptable	See comment #88 and #92. The form of data storage is not stipulated.	None.
29	Appendix A 1. *Wording/grammar.* Suggest wording change to: Connect to "*inlet side*" of vacuum pump.	Current wording is preferred.	None.

30	Appendix A2 *Wording/grammar.* Suggest wording change to: Open the "*regulator outlet valve*"... then close the *"outlet valve.*	Believe wording in chapter is clear.	None.
31	Appendix A3 *Wording/grammar.* Suggest wording change to *"Open and close the cylinder valve to fill the regulator with the gas*"	Believe wording in chapter is clear.	None.
32	Appendix D *Clarify.* Wouldn't hurt to throw a table listing the molar constants in the appendix since only 4 are allowed SO2, H2S, NH3, TRS	Agree.	Molar constant table for SO_2, H_2S and NH_3 added to Appendix D.
33	Appendix F *Clarify.* Can any other transfer standard be used to calibrate a mass flow meter other than a bubble meter?	Appendix F lists 4 methods.	None.
34	Overall Comment • Consider adding a definition for "downtime".	No definition will be added at this time.	None.
35	Cal 2-G (c) states that "prior to every use" the person responsible must evacuate any regulator to remove oxygen and other contaminants from the pressure regulator. • Please provide clarity for what would be considered "use" of the calibration gas regulator in this clause.	See comment #3 above.	None.
36	Section 3.3 Flow Calibration. This section pertains to calibrating field calibration devices and it does not state if these devices are the mass flow calibrators that are installed in the analyzer equipment or if they are the dry cell calibrators that facilities use to calibrate the mass flow controllers in the analyzer equipment. • Please specify which field calibration devices this section is intended for.	Flow calibrations should be conducted on field calibration devices, as they can be one of the largest sources of error in a dilution calibration. Example: Bios Dry Cal	None.
37	Cal 3-H (a) states that the flow or volume measuring instruments must be "verified at least every 3 months..." • Are facilities required to verify the analyzer equipment quarterly or the dry cell calibrators which are used to calibrate the analyzer calibrators quarterly?	See comment #10.	None.
38	Section 4.0 Daily Zero-Span Test Procedure. In regards to the paragraph "To prevent the loss of data from the daily zero-span, the test should be started no earlier than 15 minutes before the hour and end no later than 15 minutes past the hour. As a result, both hours would have at least 45 minutes." • Are facilities required to change the system that is currently in place if different from the paragraph above? Please clarify.	This is guidance only but using this time frame for daily zero-span will help meet data completeness requirements.	None.

39	Cal 4-A (a) states that the daily zero-span tests must be "daily, 23 to 25 hours apart". • If the morning verification fails and the verification does not pass for several hours after it was scheduled due to maintenance, does the next day auto verification have to be changed to reflect the 23-25 hours?	Daily span zeros must occur every 23 to 25 hours. If a failure occurs then repairs must be done. It should have no effect on the cycle time.	None.
40	Section 5.0 Multi Point Calibration Procedure. Cal 5-A (m) states that "the calibration gas must be introduced through all filters, scrubbers, conditions ,and other components used during normal ambient sampling and through as much of the ambient air inlet system as is practicable." • Clarification on whether or not the calibration gas must be introduced through the manifold because the facility manuals do not recommend using the sample manifold for calibration gas if internal zero/span calibration valves are used.	This is the monthly multipoint calibration. The gas is generally introduced at the inlet of the sample particulate filter.	None.
41	Section 5.3 Gas Phase Titration. Cal 5-H states that "the person responsible must have the analyzer serviced by a qualified technician or by the manufacturer if the converter efficiency falls outside the range..." • Please provide a definition for "qualified technician".	Someone who is properly trained on the operation/calibration of the instrument. Can be internal or external to the company.	None.
42	Section 6.0 Calibration of Wind Instruments. Cal 6-B (a) states that the ultrasonic wind system must be "electronically inspected once a year". • Please provide some clarity as to how an instrument can be electronically inspected.	Refer to manufacturers manual.	None.
43	Section 7.0 Calibration of High Volume Samplers. Understood that AESRD was considering the use of partisol samplers. However, there does not appear to be a section that covers partisol Calibration. • Please provide some clarity on whether partisol samplers will be considered in the future.	Chapter 4 – Monitoring Requirements and Equipment Technical Specifications will provide minimum specifications for equipment. Will be released for comment later this fall.	None.
44	Page IV Definitions: “ppb”, “ppm” - Clarification is required throughout the document when referring to ppm and ppb on either a volume or a weight basis.	Typically ppmv or ppbv.	None.
45	Page 11, Section 5, Cal 5-A (z): There seems to be a contradiction between the requirements stipulated under items (z) and (aa). (z) the maximum time required to reach a stable response shall not exceed 20 minutes; (aa) except for NH3, the time required to reach a stable response shall not exceed 45 minutes.	See Comment #17.	None.

46	Page 31, Appendix G Methane Equivalent - Calculation. Methane Equivalent = $\frac{\text{Molecular weight of hydrocarbon gas (in calibration mixture)}}{\text{Molecular weight of methane}}$ This calculation is correct only if the hydrocarbon concentrations in calibration mixture are expressed as ppmw (i.e. on a weight basis), whereas it is incorrect for ppmv (i.e. on a volume basis).	Wording in equation reflects comment.	None.
47	Page 34 Appendix I High Volume Sampler - Calculations – Corrections for pressure or temperature: The following formula needs to be corrected for the 1/2 exponent to apply to the entire fraction (T2 P1 / T1 P2) rather than only to the numerator. $Q_2 = Q_1 \frac{[T_2 P_1]^{1/2}}{T_1 P_2}$ – Calculation of Mass Concentration of Suspended Particulates: The following formula needs to be corrected by including a minus sign between w2 and w1. $S.P. = \frac{(W_2 W_1) \times 10^6}{V}$	Will correct. Will correct.	Equation corrected. Equation corrected.
48	The term "third party" is used throughout Section 7 but is not included in the definitions. We suggest that a definition for third party be added to the definitions.	Definition in Introduction Chapter.	None.
49	Subsection 11.0, Calibration Records, Page 21, Cal 11-A: The person responsible shall a) record and b) retain with the analyzer for a minimum of three years, all data and calculations involved in the calibration activities of each analyzer. Feedback and Recommendation: The three year retention period for calibration records seems unnecessarily long and will create additional administrative burden related to historical data management. Would like clarification on why the three year period was selected and would suggest the required retention period be reduced to one year.	This time frame reflects the requirements of the Quality System Chapter (Chapter 5) – see QS 3-G. Electronic records are the most common storage method and do not require a lot of space.	None.

50	Cal 2-F – the base intent of this clause, I believe, is to state that the data system should be flagged during calibration to ensure the data is not considered ambient data. Cal 10-A and Cal-10-B are related to data validation only, and would not need to be referenced in this clause. Additional comments will be provided for section 10.0.	Agree clause should be adjusted.	Clause wording adjusted.
51	Cal 2-H (c) this clause requires some clarification. The interpretation of repairs and maintenance is quite broad. If there are specific cases or events where two multipoint calibrations are required, this should be stated here for clarity. “Maintenance” in this clause ought to be clearly defined as it could be interpreted to include the monthly inlet filter change as well.	See comment #4.	None.
52	Cal 2-K – it would be helpful if some examples were provided as to “nonlinear analyzers”. I presume that the reason this clause has been included is for a specific analyser or system.	GC type of ambient analyzers.	Added “(e.g. with GC type analyzers)” to guidance.
53	3.1 – Zero Standards – it would be helpful for persons responsible in the province if ESRD maintained a bench reference of zero gas at the McIntyre Centre to reference if there is a question of a person responsible’ s zero standard or generator, similar to current calibrator audit practices.	AEMERA maintains zero air systems used in the field and audit center calibration systems are referenced to.	None.
54	3.3 Flow Calibration – the clauses in this section are a little confusing as written. My interpretation is: Cal 3-F – a dilution calibration system should contain a mass flow controller that has been calibrated using a referenced flow measurement device that meets the criteria in Cal 3-H.	See comment #36.	None.
55	3.3 Flow Calibration – the clauses in this section are a little confusing as written. My interpretation is: Cal 3-G – There ought to be a set frequency of when the dilution mass flow controller flow calibrations are completed; quarterly would be reasonable.	See comment #9	None.
56	3.3 Flow Calibration – the clauses in this section are a little confusing as written. My interpretation is: Cal 3-H – The clause here is reasonable, however, similar to the previous comment regarding a bench zero standard, it would be useful if ESRD maintained a bench flow standard when disputes arise between measurement devices, the ESRD bench reference would be used as the standard.	See Comment #53 – AEMERA does have primary reference standards. Field and bench.	None.

57	4.0 Daily Zero Span Test Procedure. This section is a significant change from the previous AMD requirements. Through review of section 5, calibration, it indicates a change from the previous 20 minutes required to show stability of the analyzer on calibration points, to 15 minutes for this period. This means that the new AMD requires 15 minutes of stable response to indicate the analyzer is functioning properly and is considered the set point of acceptable criteria for stability, so a 10 minute point would not meet this criterion. By changing the zero and span cycle time to take place within the 15 minute allowance for acceptance of a one hour average as valid, means there is no time available for rise, fall and stabilization time. The daily zero value needs to be within the accepted criteria as a stable point, as it is used as a primary reference point of data validation and baseline adjustment and needs to be the full 15 minute length of stability. The span point is also used as a primary data point for evaluating the performance of the analyzer (10% rule). Based on section 10 of this document, data would be flagged based on an evaluation of the daily span point. A reference response evaluating data must be aligned with the length of time that demonstrates a valid point, 15 minutes. It is generally accepted worldwide that daily checks should be collected using the same criteria as the multipoint calibrations. I feel strongly that a move away from the current zero, span, recovery time utilizing one hour per day is not the path towards better data quality, but a step away from better data quality. The current AMD criteria (other than the change to 15 minute stability) should not be changed.	The guidance reads “the test should be started no earlier than 15 minutes before the hour and end no later than 15 minutes past the hour. As a result, both hours would have at least 45 minutes of data”. The daily zero span cycle would then be approximately 30 minutes. This is a suggestion only to help reduce data loss. Add to that if the operator feels more time is required to provide stable outputs than the historical 1 hour of span zero and recovery time can still be utilized. It just can’t exceed 1 hr/day.	None.

58	Cal 5-A Below are specific comments on the calibration steps: A step should be included to flag the data logger collecting data that the system is in calibration mode so the data is not considered valid ambient data. (a) – this step of changing the filter is in the wrong location, the as found points must be completed before the filter is changed. (j) – this step may be necessary for a permeation calibrator, however, this would not be required every calibration for a dilution system referring to Cal 3-F where mass flow controllers are calibrated on a set frequency. (p) – The change of accepted stability time from 20 minutes , which is the generally accepted standard, to 15 minutes should be prominently stated prior to the steps of the calibration for clarity. (q) – currently the scientifically accepted practice is to complete both the "as found" zero and span points prior to any adjustments of the analyzer. Adjusting the zero prior to the "as found" span point may affect the "as found" span point and should be performed after both "as found" points are completed. (x) – referring to Cal 3-F, mass flow controllers are accepted measurement devices. – The scientifically accepted practice for dilution calibrators is to complete a mass flow controller calibration of the source gas and dilution gas mass flow controllers on a set frequency (typically quarterly) to prove the mass flow controllers are within specifications. Measuring flows on every point is generally not done, and would add excessive hrs to calibration times. (z) and (aa) – these two clauses contradict each other. I believe (z) is intending to state all calibration points require 15 minutes of stable response (including daily zero and span points). I believe (aa) is intending to state that 45 minutes would be acceptable for the NH3 parameter, only, due to its inherent slow response time. (cc) – The very wording of this clause is confusing – the terminology we have used to date might have this clause worded something like: The values obtained from the "as left" zero and span points must be used to evaluate the subsequent daily zero and span values up to the next multipoint calibration. Generally we refer to these values as "expected" zero and span values. There also should be more information and direction on the completion of the as left zero and span points.	See Cal 2-F Step is in the correct position (requirement same as 1989 AMD). See comment #9 It is mentioned where it needs to be stated – no change. Need to see scientific documentation to validate statement – no change required. See comment #9 See comment #17 Wording is clear language – no change required.	None.
59	5.1 – Permeation calibrator temperature control of ±0.1 degrees C was previously quoted in Cal 5-A E and should be consistent throughout the document. Many calibrators use a set point of 50 degrees C, curious why 35 degrees C is stated as acceptable.	The temperature control of ±0.1°C in the guidance is referring to the permeation oven. Re: the 35°C - it's an example of one type of permeation calibrator that uses 35°C as its temperature setting.	None.

60	Appendix D – the final calculation should have flow as the denominator. This is required to calculate a concentration.	Agreed.	Equation corrected.
61	Appendix E – in this appendix there is no mention of currently used, state of the art devices like piston displacement devices. These should be included in this appendix.	Not sure what is being commented on. Appendix E is for concentration calculations.	None.
62	5.2.1 – Appendix G – the calculation ought to be completed to indicate the result of a factor of 2.75. This is the same as the previous AMD.	This calculation is exactly the same as in the 1989 AMD.	None.
63	5.3 – Cal 5-G (g) – I disagree with adjusting the NO2 response in the analyzer. If this channel needs to be adjusted, this is an indication there are problems with the other channels of this analyzer, or the calibration system.	This is a manufacturer requirement and must remain.	None.
64	5.4.3 – Cal 5-I (d) – The issue with this step is the same as was noted above for Cal-5-A (q) where the as found zero and high points should be completed prior to any adjustments.	The step is accurate as written.	None.
65	Cal 5-I (g) – This clause ought to reference Appendix H as the description in the appendix is clear.	Appendix H was referenced at the beginning of the section.	None.
66	6.0 Calibration of Wind Instruments. There are no references to other meteorological parameters that are currently collected at most stations like ambient and station temperature (parameters that are assessed during a station audit), relative humidity, barometric pressure, solar radiation, precipitation collection and measurement, etc. If these are not to be included in this version of the AMD, there ought to be a mechanism to add them moving forward.	Meteorological equipment not mentioned in this chapter typically require factory calibration. Performance specifications for meteorological sensors will be provided in Chapter 4 of the AMD (Monitoring Chapter) – see comment #67.	None.
67	7.0 Calibration of High Volume Samplers. Current particulate and other intermittent sampling methods or technologies are not mentioned in this section or the document overall. If they are not to be included in this version of the AMD, there ought to be a mechanism to add them moving forward. These technologies include: Partisol type PM samplers, PUF based PAH samplers, Canister VOC sampling, Dichot. particulate sampling, Denuder type sampling, etc.	Chapter 4 – Monitoring Requirements and Equipment Technical Specifications will provide minimum specifications and will be released for comment later this fall. Requirements of the AMD can be amended as required.	None.

68	8.0 Calibration of Other Analyzers. As there are numerous “other analyzers” that require calibration, audits, or routine performance checks that are currently used all over the province, a detail of the mechanism to request written permission to the director should be included here. Some of the very common analyzers and sensors collecting data in the province and are not mentioned in this document are: Continuous PM2.5 analyzers, TEOM, FDMS, SHARP BAM systems. TEOM, FDMS and BAM units are audited annually in the airsheds and should be included in this document to provide the proper direction for operation and outline of acceptance criteria’s etc. SHARP units should be considered as well as there are key performance indicators that need to be assessed and monitored. Intermittent Partisol PM2.5 and PM10 samplers Intermittent PUF samplers for PAH compounds Intermittent VOC samplers for VOC compounds Precipitation gauges and collectors Temperature sensors Relative Humidity sensors If these methods and criteria are not to be included in this version of the AMD, there ought to be a mechanism to add them moving forward.	See comment #67.	None.
69	Cal 9-G – This method of calculation is different from the previous method of greater than 5% from a 1:1 relationship. As it is now 5% deviation from the adjusted slope, it would be helpful if the method to calculate this is clarified in this document.	This clause was in the 1989 AMD.	None.
70	Cal 9-J – This clause requires clarification as it refers to a requirement to maintain accuracy within 2.5% but does not state as to what reference.	Refer to the guidance that accompanies this set of clauses.	None.
71	Cal 10-A – This clause presumes that the reason for the movement outside the 10% acceptance limits is due to analyzer response. It has been demonstrated that this issue could and is caused by problems with the internal or external span system providing the gas to the analyzer. This requirement and statement should be included in Chapter 6 – Ambient Data Quality as it relates to validation and flagging of data that must include assessment of all possible causes after the fact. Data should not be flagged in the field for this criteria as it may compromise the integrity of the raw data set.	Refer to the guidance in this section.	None.
72	Cal 10-B – As with clause Cal 10-A – this function should be included in Chapter 6 – Ambient Data Quality as all factors must be assessed prior to flagging any data. Raw data should not be flagged in the field.	See comment #71.	None.

73	Cal 11-C – This statement fits in the previous statement (Cal 9-E) on the same point. One requirement listing would be less confusing.	Please reread the two clauses, they are for different situations.	None.
74	Need to add a definition of "third party" (e.g. Cal 3-E (d)).	See comment #48. Definition resides in Chapter 1 (Introduction).	None.
75	Cal 2-L "For analyzers in routine operation, the person responsible must obtain unadjusted zero and high point response readings prior to making any zero or high point adjustments." This statement is in direct contradiction to the later description of the calibration procedure (i.e. Cal 5-A (q)) as well as current practice. These require that the zero is adjusted prior to the as-found high point. Clarification of the correct procedure is required.	Cal 2-L is correct in stating that an unadjusted response must be obtained *first*. Cal 5-A (p) also requires that a stable zero response must be obtained first, before (q) adjusting the zero reading if needed.	No change.
76	Cal 2-N "Analyzers that have zero and high concentration adjustment controls shall be adjusted based on the (a) zero and (b) highest test concentrations, respectively, during the multipoint calibration." This statement is not always true. It should not be required that adjustments be made prior to repair or shut-down. At the moment, there is no such flexibility in the new directive. Suggest that "Where applicable…" is added to this section.	Added wording: "routine monthly"	Clause wording adjusted.
77	3.3 Flow Calibration. It is not clear what the directive requires for which equipment. Cal 3-F appears to allow that devices with Mass Flow Controllers (MFCs) do not require volumetric flow calibration. Cal 3-G requires that all devices are verified at all flow rates for multi-point calibrations. Given Cal 3-F, Cal 3-H does not currently apply to MFC metered flow rates, but I suspect this is incorrect. Does Cal 3-G mean that we need to verify every flow rate for every calibration (in real-time)? If so, then this is excessive. It is not possible to comment further on this section until the meaning and application of the procedures are clarified. This should be done before the document is finalized.	See comment #36 for CAL 3-F to CAL 3-G. The operator should measure the flow for each point of a multipoint calibration.	None.
78	4.0 Daily Zero-Span. "To prevent the loss of data from the daily zero-span, the test should be started no earlier than 15 minutes before the hour and end no later than 15 minutes past the hour. As a result, both hours would have at least 45 minutes of data." This implies that the daily zero-span is < 30 min. in total. This is not the case for us where our standard (total) duration is 45 min. (see next point). Data suggest it takes ~10 min. for permeation tube (IZS) systems to stabilise on the span value.	See comment #57	None.

79	Cal 4-A (b) “daily zero-span test time shall not exceed 1 hour per calendar day for commercial ambient air quality analyzers;” This prevents repeats to daily zero-span checks. Such repeats are a useful tool in determining trends in analyzer performance and whether a site-visit is justified or not. Also, this prevents 23-hour programs, as occasionally these will operate twice on the same day (i.e. Hour 0 and Hour 23). Suggest this is reworded to “individual daily zero-span test times shall not exceed 1 hour for commercial ambient air quality analyzers.”	This requirement has not changed from current 1989 AMD requirements.	No change.
80	Cal 5-A (f) “gas cylinders, including the necessary regulators, must be allowed to warm up to room temperature; Gas cylinders can take 12-24 hours to warm up to room temperature.” If changing the gas cylinder temperature has such a marked effect on the concentration coming out of a calibrator, then this would be apparent during the 4-7 hour calibration procedure and the tech would have to repeat … and if it doesn’t have a marked effect, what is the justification for this requirement?. Suggest that, as a minimum, this is modified to “approximately shelter temperature”. As currently written this will have a huge impact on our operations in winter. It is not always possible to leave cylinders in the station the night prior to calibration.	Gases must be at room temperature for proper operation and to ensure calibration results are valid.	No change.
81	Section 5.0 Multi Point Calibration. "Note if the “as found response” of this first calibration point deviates more than ±10% from the expected calibrator response as per Cal 9-F, corrective action must be taken (repair or maintenance is required)." Cal 9-F “The first calibration point “as found” must not deviate more than ± 10% from the expected calibrator response.” The change from a +/-15% standard for “as found” checks to a +/-10% standard is concerning as many airsheds and compliance trailers throughout the province have aging equipment that will struggle to meet this new standard. If the standard is to be tightened such as this, it will be necessary to have a long lead time for implementation of this change so that airsheds and compliance trailers have adequate time to replace aging equipment.	Most airsheds already use this criterion.	None.
82	Cal 5-A (j) “the flow rate(s) of the calibrator must be checked with a certified flow meter against the operating specifications to achieve the desired concentrations required for the calibration;” Clarification required. How frequent is this check? Annual, quarterly, monthly, every use? Does this apply to MFCs or just non-MFC calibrators? It is not possible to comment further on this section until the meaning and application of the procedure are clarified. This should be done before the document is finalized.	See comment #9.	No change.

83	Cal 5-A (r) “the highest test concentration (60-80% of the operating range) must be introduced into the analyzer to: (i) measure gas flow and total flow to determine the high point concentration; (ii) obtain and record stable response for 15 minutes; and (iii) record as the “as found response”; “ As written, this section makes no sense. Rewrite required.	Add after the word analyzer: “the operator must do the following”, remove the word “to”.	Wording changed.
84	Cal 5-A (w) “after the zero and high point settings are satisfactory, consecutively lower gas concentrations of (i) 30- 40% then (ii) 10-20% must be introduced into the analyzer.” Setting the low point at 10-20% for H2S instruments requires that most calibrators are operated at <10% of the MFC’s range. This is not recommended due to instability and inaccuracy. Such a limitation is inherent in the design of MFC and is a standard limitation whatever the application. Alternatively, a calibration gas <10 ppb is required. Such gases are difficult to manufacture and experience suggests they will not be of sufficient accuracy. It is suggested that for operating ranges <=100 ppb, the low point is modified to 12-24% of full scale.	This 10-20% requirement has not changed from current 1989 AMD requirements.	No change.
85	Cal 5-A (x) “gas flow and total flow must be measured at the completion of the mid-point and start of the low point gas concentrations;” Clarification required. Is this a separate measurement than that provided by the calibrator’s MFCs? What is the justification for the end of one point and the start of the other?	This is two separate measurements. See comment #77.	None.
86	Cal 5-A (z) and (aa) - (z) the maximum time required to reach a stable response shall not exceed 20 minutes; (aa) except for NH3, the time required to reach a stable response shall not exceed 45 minutes; Clarification required. Is the maximum time to achieve stability 20 minutes or 45 minutes? It may be necessary to define “stable”. Increases in gas concentrations in a dynamic system are asymptotic.	See comment #17	None.
87	5.3.2 NO2 Calibration Note: API 200: Manufacturer states 96-102% range for converter efficiency (cf: 96-104% for AMD). Note: API 200: Manufacturer states that no adjustments should be made to the instrument until the NO2 calibration is complete. It is possible that adjustment of the converter efficiency requires the NO/NOx to be recalibrated.	EPA indicates that when a converter is <96% efficient then repairs must be completed. With newer technology, the NO2 channel can be adjusted.	None.

88	Cal 11-A "The person responsible shall a) record and b) retain with the analyzer for a minimum of three years, all data and calculations involved in the calibration activities for each analyzer." It is not obvious what is gained by retaining 3 years of records on-site. Suggest this is reduced to one year. Does this include electronic data? If so, this will be very difficult to implement whatever the retention period. Compare to Cal 11-F: "The person responsible shall keep copies of Calibration reports in Cal 11-E at the continuous ambient air monitoring station." This statement (with an indication of the retention period) is much more clearly and easily achieved.	All data and records must be retained for 3 years. See the Quality System Chapter of the AMD (Chapter 5), QS 3-G. The form of data storage is not stipulated.	None.
89	Page 21: Cal 11-D. "The person responsible shall graph data to demonstrate the stability of each measurement point." Definition of stability is required otherwise such a demonstration is subjective.	See comment #96.	None.
90	Cal 4-A (k) Suggest that zero and span control charts can be replaced with equivalent digital systems.	How control charts are maintained is at the user's discretion.	None.
91	Cal 6-A Specifying that the requirement is once each calendar year as opposed to within a year might provide clarity. For example, if I calibrate in August 2014, am I required to complete the next test by August 2015, or by the end of 2015?	Once per year – no change required.	None.
92	Cal 11-F Is this necessary if remote access to the files is available at the station?	Remote access is acceptable if access to main server can be guaranteed and maintained, otherwise records need to be stored at the station.	None.
93	Cal 2-L • "For analyzers in routine operation, the person responsible must obtain unadjusted zero and high point response readings prior to making any zero or high point adjustments." • This statement appears to contradict the description of the calibration procedure that appears later in this document (i.e. Cal 5-A (q)) including current practice (zero is adjusted prior to the as found high point). Please clarify.	See comment #75.	None.

94	Cal 4-A(b) • "daily zero-span test time shall not exceed 1 hour per calendar day for commercial ambient air quality analyzers;" • Presents a problem for 23-hour programs (it is possible for two zero-span cycles to occur in one day: hour 0 and hour 23)	1 cycle per day – no change required.	None.
95	Cal 5-A(j) • "the flow rate(s) of the calibrator must be checked with a certified flow meter against the operating specifications to achieve the desired concentrations required for the calibration;" • How often does ESRD want these rates checked? Every time the calibrator is used? Annually? Quarterly? Monthly?	Frequency is dependent on the equipment manufacturer.	None.
96	Cal 11-D, Page 10, Cal 5-A(v) • "The person responsible shall graph data to demonstrate the stability of each measurement point." • "the maximum time required to reach a stable response shall not exceed 20 minutes;" and other places • Clarity on what constitutes stability and/or a stable response should be provided. If relying on a graphical representation to demonstrate stability, a wide variety of responses may be provided. Currently, only the requirement of the time period for a stable response is provided. The characteristics of a stable response should be defined numerically (?) by ESRD.	A stable response should not show significant variation over the period of time it is demonstrating stability. E.g., a high point of SO_2 should not vary more than +/- 0.001 ppm over a 15 minute period if the concentration is 0.800ppm. If this response continues to climb or starts dropping it's not stable. Also, age and current operating condition of the analyzer affect stability.	None.