

Washington State Patrol

TOXICOLOGY LABORATORY DIVISION

Calibration: Technical Manual

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1 TECHNICAL SERVICE PROGRAM

This manual describes the Technical Services Program of the Washington State Patrol (WSP) Toxicology Laboratory Division (TLD) as it relates to its breath alcohol calibration functions.

The Toxicology Laboratory (Toxicology Lab) and the Breath Test Program (BTP) are both responsible for the breath alcohol calibration functions of the TLD. The Toxicology Lab prepares and certifies two types of simulator solutions: the Quality Assurance Procedure (QAP) solutions and the External Standard solution. These solutions are then used by the BTP, where the QAP solutions are used to set and confirm the calibration of the evidentiary breath test instruments, and the External Standard solution is used to verify the accuracy and proper working order of the instruments as part of a field evidential breath test.

The purpose of this manual is to specify in detail the many policies and procedures that shall be followed in order for the TLD to fulfill its breath alcohol calibration responsibilities.

The official version of this manual is the electronic version as it appears on the Forensic Laboratory Services Bureau (FLSB) Sharepoint site (FLSB Portal). This manual covers all work done by responsible personnel, to include but not limited to work done in the individual calibration laboratories within the TLD, in addition to duties outside the laboratory, whether in court, training venues, or anywhere else the duties of responsible personnel might be employed.

1.1 POLICY

The TLD will document its policies and procedures to the extent necessary to assure the quality of the calibration results. Compliance with pre-established and carefully designed policies and procedures is important to ensure the work product and services are accurate and fit-for-purpose. The policies and procedures outlined in this manual will be communicated to, available to, understood by, and implemented by the responsible personnel.

All calibration and related services performed by the TLD shall meet generally recognized standards of the forensic community and its accrediting organizations. Specifically, the TLD shall perform all calibration activities in accordance with the specified program policies and the ISO 17025:2005 accreditation standards.

All employees are required to familiarize themselves with this manual and implement the policies and procedures specified herein. In doing so, the TLD will maintain the highest level of expertise and analytical confidence for the criminal justice system and comply with the ISO 17025:2005 accreditation standards and ASCLD/LAB-*International* supplemental standards.

Any adjustments or deviations from the policies and procedures detailed in this manual must be approved by the State Toxicologist, the Impaired Driving Section Commander, or the Quality Assurance (QA) Manager, and appropriately documented in the Batch Record and/or the Instrument Record.

1.2 DEFINITIONS

1.2.1 ACCURACY

The proximity of a measured value to a reference value.

1.2.2 BACK-UP TECHNICIANS

Personnel who are fully trained as Breath Test Technicians. Their assignments, however, are typically in the WSP Field Operations Bureau (see *TLD Calibration Operations Manual Appendix A*). They will assist the local full-time Breath Test Technician, as required.

1.2.3 BATCH FILE

A file containing documentation produced as a result of certifying either an external standard solution or QAP solutions. Records include the Simulator Solution Data Entry Review form, the QAP or External Standard Solution Test Report, the Solution Certificate Review, analyst affidavits/certifications, sequence tables and corresponding chromatograms, and the Solution Preparation Worksheet.

1.2.4 BATCH RECORD

All documentation related to the preparation and/or certification of either an external standard solution or QAP solutions. In addition to those records contained within the batch file, records may include simulator solution preparation log, alcohol preparation log, alcohol control log, instrument maintenance records, etc.

1.2.5 BIAS

The difference between a measurement result and the true reference value of the property being measured. The bias quantifies the accuracy of the measurement.

1.2.6 BREATH TEST TECHNICIANS / TECHNICIANS

Currently qualified Operators who are trained in the following areas of responsibility: instrument calibration, certification, repair, maintenance, documentation, training of operators and expert court testimony. Technicians are also qualified Instructors, and Solution Changers.

1.2.7 CALIBRATION

The process by which known traceable standards having reference values are introduced into an instrument. The instrument is then adjusted or programmed (either by software, hardware, electronics, etc.) to report a measurement based on the known reference value(s).

1.2.8 CALIBRATION CERTIFICATE

The final result sheet produced at the end of the process of calibrating a breath test instrument, known herein as the Quality Assurance Procedure (QAP).

1.2.9 CALIBRATION FILES

Refers to documents kept as part of either the Batch File and/or QAP File.

1.2.10 CALIBRATION RECORDS

Refers to documents kept as part of either the Batch Record and/or the Instrument Record.

1.2.11 COEFFICIENT OF VARIATION (C.V.)

The relative standard deviation expressed as a percentage of the mean.

1.2.12 COMBINED UNCERTAINTY

The estimate of measurement uncertainty that includes the contribution from all components significantly influencing a measurement result

1.2.13 DATAMASTER

The evidential breath testing instrument, including both the BAC DataMaster and BAC DataMaster CDM.

1.2.14 EXTERNAL STANDARD SOLUTION

The solution used within the simulator to provide a known alcohol vapor concentration to verify the accuracy and proper working order of the instrument as part of a field evidentiary breath test.

1.2.15 FORENSIC SCIENTISTS / ANALYSTS

Personnel trained and assigned to the Toxicology Lab for the purpose of solution preparation and certification.

1.2.16 INSTRUCTORS (BREATH TEST PROGRAM)

Personnel that are currently qualified Operators and trained to have the responsibility for training other Operators on the use of the breath test instruments.

1.2.17 INSTRUMENT RECORD

All records and documentation related to a specific breath test instrument. In addition to the QAP file, records may include maintenance files, status sheets, solution change records, instrument printouts, etc.

1.2.18 NATIONAL INSTITUTE FOR STANDARDS AND TECHNOLOGY (NIST)

A federal agency located within the Department of Commerce with final authority for metrology in the United States.

1.2.19 OPERATORS (BREATH TEST PROGRAM)

Personnel trained to be Operators of the evidentiary breath test instruments. This includes most law enforcement officers within the state.

1.2.20 PBT

A handheld Preliminary Breath Test (PBT) instrument. These are breath alcohol screening devices that include both the Alco-Sensor FST and Alco-Sensor III instruments. These instruments are used by law enforcement officers at the roadside to measure breath alcohol and help establish probable cause for arrest.

1.2.21 PRECISION

The ability of a technique to perform a measurement in a reproducible manner. Precision is quantified by the standard deviation.

1.2.22 QUALITY ASSURANCE PROCEDURE (QAP)

A testing procedure for evidentiary breath test instruments in which known traceable reference materials are used to set and confirm the calibration and establish quantitative estimates for bias and precision. Several other performance measures are also evaluated in order to ensure the proper working order and evidential suitability of the instrument.

1.2.23 QUALITY ASSURANCE PROCEDURE (QAP) FILE

A file containing all documentation produced as a result of the QAP process. Documents include the QAP Worksheet, the DataMaster Calibration Certificate and the QAP Review Form.

1.2.24 QUALITY ASSURANCE PROCEDURE (QAP) SOLUTION

The solution used within the simulator to provide a known alcohol vapor concentration to set and confirm the calibration of the evidentiary breath test instrument.

1.2.25 ROUNDING

When rounding is performed for computational purposes, normal rules of rounding are followed unless otherwise specified.

1.2.26 SIMULATOR

A device, when filled with a certified simulator solution maintained at a known temperature, that provides a vapor sample of a known ethanol concentration.

1.2.27 SOLUTION CHANGERS

Currently qualified Operators who are trained to change the external standard solutions located with each breath test instrument.

1.2.28 STANDARD UNCERTAINTY

The uncertainty of a measurement result expressed as a standard deviation.

1.2.29 TEST REPORT

The final result sheet produced at the end of either a QAP solution or external standard solution testing process. It includes ethanol concentrations from individual solution aliquots, ethanol control results, statistical data, signatures of the preparer and other certifying analysts, and dates of preparation testing and issuance.

1.2.30 TRACEABILITY

The property of a measurement result whereby it can be related to standard references, usually national or international, through an unbroken chain of comparisons all having stated uncertainties.

1.2.31 UNCERTAINTY

A parameter, associated with a measurement result that characterizes the dispersion of the values that could reasonably be attributed to the true value being measured.

2 PREPARATION OF QUALITY ASSURANCE PROCEDURE (QAP) SOLUTIONS

2.1 POLICY

The Quality Assurance Procedure (QAP) solutions are a mixture of water and ethanol formulated to provide a standard ethanol vapor concentration when used in a breath alcohol simulator heated to 34.0 ± 0.2 °C. The QAP solutions are used to set and confirm the calibration of, and verify the accuracy and precision of, evidentiary breath test instruments.

The QAP program requires target vapor concentrations of 0.04, 0.08, 0.10 and 0.15 g/210L vapor. The reference value concentration of a given QAP solution is determined from replicate measurements by gas chromatography.

2.2 EQUIPMENT

- Volumetric glassware/flasks
- 2, 4, 6 L Erlenmeyer flask
- Mechanical mixer and stir rod
- 18 L containers
- Storage bottles/containers
- Tamper evident tape, or equivalent

2.3 REAGENTS

- 200 proof absolute ethanol (USP Grade)
- Laboratory grade deionized water

2.4 PROCEDURE

1. The preparer will assign a batch number to the QAP solution. The first two digits of the batch number represent the year in which the solution was made, followed by a sequential three-digit number, beginning with 001. Therefore, the first batch of 2008 would be 08001.
2. Prepare a Batch File marked with the batch number to store all relevant results and documents.
3. Using the Simulator Solution Preparation Log, record the batch number of the solution, the date of solution preparation, the preparer's name, the lot number of the absolute ethanol reagent, and the date this reagent was opened.
4. Use the values in Table 1 to prepare each QAP solution.

Table 1:	Target Vapor Concentration	Ethanol/Water Dilution Factor
	0.04	11.2 mL/18 L
	0.08	22.4 mL/18 L
	0.10	28.1 mL/18 L
	0.15	42.0 mL/18 L

5. Using an Erlenmeyer flask, fill the flask to approximately 80% of its nominal volume with deionized water.
6. Using volumetric glassware, add appropriate volume of absolute ethanol to the Erlenmeyer flask, as indicated in Table 1.
7. Fill the Erlenmeyer flask to the nominal mark with deionized water. Add the ethanol/water mixture to the 18 L vessel.
8. Fill the same Erlenmeyer flask to the nominal mark with deionized water and add this to the 18 L vessel. Repeat this step until a total of 18 L has been transferred.
9. Tighten the cap of the 18 L vessel. Mix the solution by applying mechanical mixing for a minimum of 30 minutes.
10. Once mixing is complete, purge the spigot then remove an aliquot of the solution for certification (*see 4 Certification of Simulator Solutions*).
11. Documentation of the preparation of the QAP solutions should be recorded on the Combined Simulator Solution Preparation Worksheet. This worksheet will be placed in the batch file.

2.5 PACKAGING AND DISTRIBUTION

1. The QAP solutions are provided in containers of convenient size.
2. Prior to filling, each container is labeled with "QAP", the batch number, the appropriate target vapor concentration, the preparer's initials, and the preparation and expiration date.
3. The containers are sealed with tamper evident tape, or equivalent.
4. Once the QAP solutions are certified and approved for use, they may be provided to breath test technicians for use with the breath test instruments.
5. Solutions are boxed and sent by Consolidated Mail Services, or equivalent.
6. Insert the Solution Request & Packing Slip. Retain a copy of the packing slip in the batch record.
7. The storage of QAP solutions in the Toxicology Laboratory will be in a secure location to protect against damage, deterioration or loss and to maintain the

solutions' integrity. Bottles will be stored in moderate temperatures in secured, limited-access locations similar to those under which they were produced.

2.6 RECEIPT AND STORAGE OF QAP SOLUTIONS

1. On receipt of the QAP Solutions, the Technician will sign and date the packing slip, indicating:
 - a. Verification of order – adequate amount, correct concentrations, etc
 - b. Inspection of bottles – no damage, leaking, broken seals, etc
 - c. Appropriate Test Report(s) included
 - d. Record of receipt
2. If any discrepancies are noted, the Technician should contact the Toxicology Lab. Discrepancies may include insufficient quantity of QAP solutions, incorrect concentration, damaged and/or leaking bottles, and broken seals. Based on the specific discrepancy, the Toxicology Lab will endeavor to resolve the issue to the satisfaction of the Technician. Any discrepancies and subsequent resolution will be documented in the batch record.
3. On receipt of the QAP solutions, the Technician should store them in a secure cabinet/closet separate from any volatile chemicals. Extreme heat should be avoided.
4. The QAP solutions are valid and approved for use for a period of one year from the date of preparation. QAP solutions that have expired shall be discarded. If expired solutions are retained for training purposes then each container must bear identification that reads "Training Purposes Only – Not for use in Calibration" and be stored separate from non-expired QAP and external standard solutions.
5. Expired solutions may be discarded down a drain with additional water, and the solution containers discarded in the trash or recycled.
6. When a QAP solution is transferred to a simulator, the simulator is to be labeled with the identity of the QAP solution, the QAP solution batch number and the in service date.

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3 PREPARATION OF THE EXTERNAL STANDARD SOLUTION

3.1 POLICY

The External Standard solution is a mixture of water and ethanol formulated to provide a standard ethanol vapor concentration when used in a breath alcohol simulator heated to 34.0 ± 0.2 °C, of between 0.072 and 0.088 grams of ethanol per 210 liters (g/210L) of air, inclusive. To allow for depletion of ethanol from the solution during its use, the target starting ethanol vapor concentration is 0.082 g/210L.

Based on a water/air partition coefficient at 34 °C of 2585.9 (Jones, 1983), the external standard solution concentration required to produce a 0.082 g/210L of vapor equivalent is 0.101 g/100ml. The reference value concentration of a given external standard solution is determined from replicate measurements by gas chromatography.

3.2 EQUIPMENT

- Volumetric glassware/flasks
- Mechanical mixer and stir rod
- 52 L container
- Storage bottles/containers
- Tamper evident tape, or equivalent

3.3 REAGENTS

200 proof absolute ethanol (USP Grade)
Laboratory grade deionized water

3.4 PROCEDURE

1. The preparer will assign a batch number to the external standard solution. The first two digits of the batch number represent the year in which the solution was made, followed by a sequential three-digit number, beginning with 001. Therefore, the first batch of 2008 would be 08001.
2. Prepare a Batch File marked with the batch number to store all relevant results and documents.
3. Using the Simulator Solution Preparation Log, record the batch number of the solution, the date of solution preparation, the preparer's name, the lot number of the absolute ethanol reagent, and the date this reagent was opened.
4. Fill the 52 L vessel to approximately 80% of the 52 L mark with deionized water.
5. In a volumetric flask, fill to approximately 50% with deionized water. Using volumetric glassware, add 66.5 mL of absolute ethanol. Stopper the flask and mix well and add the contents of the flask to the 52 L vessel. Rinse the flask with deionized water and add this to the 52 L vessel.

6. Fill the vessel to 52 L with deionized water and tighten the cap. Mix the solution by applying mechanical mixing for a minimum of two hours.
7. Once mixing is complete, purge the spigot then remove an aliquot of the solution for certification (*refer to 4.0 Certification of Simulator Solutions*).
8. Documentation of the preparation of the external standard solution should be recorded on the Combined Simulator Solution Preparation Worksheet. This worksheet will be placed in the batch file.

3.5 PACKAGING AND DISTRIBUTION

1. The external standard solution is provided in containers of convenient size.
2. Prior to filling, each container is labeled with “External Standard”, “ESS” or “Ext. Std.”, the batch number, the appropriate target vapor concentration, the preparer’s initials, and the preparation and expiration date.
3. The containers are sealed with tamper evident tape, or equivalent.
4. Once the external standard solution is certified and approved for use, it may be provided to breath test technicians for use with the breath test instruments.
5. Solutions are boxed and sent by Consolidated Mail Services, or equivalent.
6. Insert the Solution Request & Packing Slip. Retain a copy of the packing slip in the batch record.
7. The storage of external standard solutions in the Toxicology Laboratory will be in a secure location to protect against damage, deterioration or loss and to maintain the solutions’ integrity. Bottles will be stored in moderate temperatures in secured, limited-access locations similar to those under which they were produced.

3.6 RECEIPT AND STORAGE OF EXTERNAL STANDARD SOLUTIONS

1. On receipt of the external standard solutions, the Technician will sign and date the packing slip, indicating:
 - a. Verification of order – correct amount, correct concentrations, etc
 - b. Inspection of bottles – no damage, leaking, broken seals, etc
 - c. Appropriate Test Report included
 - d. Record of receipt
2. If any discrepancies are noted, the Technician should contact the Toxicology Lab. Discrepancies may include insufficient quantity of external standard solutions, incorrect concentration, damaged and/or leaking bottles, and broken seals. Based on the specific discrepancy, the Toxicology Lab will endeavor to resolve the issue to the satisfaction of the Technician. Any discrepancies and subsequent resolution will be documented in the Batch Record.

3. On receipt of the external standard solutions, the technician should store them in a secure cabinet/closet separate from any volatile chemicals. Extreme heat should be avoided.
4. The external standard solutions are valid and approved for use for a period of one year from the date of preparation. External standard solutions that have expired shall be discarded. If expired solutions are retained for training purposes then each container must bear identification that reads "Training Purposes Only – Not for use in Calibration" and be stored separate from non-expired external standard and QAP solutions.
5. Expired solutions may be discarded down a drain with additional water, and the solution containers discarded in the trash or recycled.

3.7 REFERENCE(S)

A.W. Jones. Determination of Liquid/Air Partition Coefficients for Dilute Solutions of Ethanol in Water, Whole Blood and Plasma. *Journal of Analytical Toxicology*, 7, 1983 pp 193-197.

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4 CERTIFICATION OF SIMULATOR SOLUTIONS

4.1 POLICY

Each external standard and QAP solution must be certified by forensic scientists prior to its distribution to breath test technicians. The forensic scientists must have a valid Blood Alcohol Analyst Permit issued by the State Toxicologist.

A minimum of three (3) analysts shall test each solution before the average solution concentration can be calculated. Typically, three (3) analysts certify each set of QAP solutions, and seven to eight (7-8) analysts certify the external standard solution. Each analyst who has results included in the final computation of the average solution concentration has certified the batch.

Batches that do not certify as specified below are not approved for use and a Test Report is not generated. However, a batch record and batch file are still produced, including documentation of why the batch did not certify.

Any adjustments or deviations from the procedures below must be approved by the State Toxicologist or the QA Manager, and appropriately documented in the batch file.

4.2 EQUIPMENT

- Balance: Mettler Toledo PL602-S, or equivalent
- Volumetric glassware
- Class A Pipettes
- Storage bottles/containers
- Microlab 500 Autopipette, Hamilton Automatic Diluter, or equivalent
- Headspace autosampler vials, 10 mL
- Headspace autosampler crimp tops
- Cap crimper
- Cap de-crimper
- Agilent (Hewlett Packard) 7694/G1888 Headspace Autosampler or equivalent
- Agilent (Hewlett Packard) 6890 gas chromatograph; equipped with a J&W DBALC1 capillary column (30 m x 0.53 mm ID x 3 μ m) and/or with a J&W DBALC2 capillary column (30 m x 0.53 mm ID x 2 μ m) or equivalent
- Computer System equipped with Agilent (Hewlett Packard) ChemStation Software

4.3 REAGENTS

- 1-Propanol
- Sodium chloride
- 200 proof absolute ethanol (USP Grade)
- Laboratory grade deionized water (d.H₂O)
- Compressed air, helium and hydrogen

4.3.1 INTERNAL STANDARD

The Internal Standard (ISTD) is prepared as follows:

ISTD Fill a 2000 mL volumetric flask to approximately 80 % with d.H₂O. Add 20 gm sodium chloride and 0.30 mL 1-propanol to the flask. Fill to the 2000 mL line with d.H₂O. Mix thoroughly. Larger volumes of internal standard may be prepared as needed provided that the preparation details are documented.

Transfer to clean, labeled storage bottles. The internal standard can be stored at room temperature. Verification of the Internal Standard is documented on the Alcohol Standard Preparation Log and the Combined Ethanol Verification Worksheet. Verification is required prior to use. The Internal Standard expires 30 days after preparation.

4.3.2 ETHANOL CALIBRATORS

Three ethanol calibrators (CAL) are used, at concentrations of: 0.079, 0.158, and 0.316 g/100 mL

Ethanol calibrators are prepared and verified according to the Laboratory's procedure for verification of ethanol calibrators.

Verification of the Ethanol Calibrators is documented on the Alcohol Standard Preparation Log and the Combined Ethanol Verification Worksheet.

Verification is required prior to use.

4.4 CONTROLS

Commercially prepared ethanol controls (CTRL) are purchased for use with each assay. The source and lot number of each control is documented in the Alcohol Control Log. The ethanol controls are verified according to the instructions on the Combined Ethanol Verification Worksheet. Verification is required prior to use. Controls are stored per manufacturer specifications.

Three ethanol controls are used, at concentrations of:

CTRL1 0.04 g/100 mL
CTRL2 0.10 g/100 mL
CTRL3 0.20 g/100 mL

Controls other than the aforementioned may be approved for use by the State Toxicologist or QA Manager, with appropriate documentation.

Ethanol controls are considered approved for use when quantifying within the following, inclusive ranges.

CTRL1 0.038 – 0.042 g/100 mL
CTRL2 0.095 – 0.105 g/100 mL
CTRL3 0.190 – 0.210 g/100 mL

4.5 PROCEDURE FOR THE ANALYSIS OF SIMULATOR SOLUTIONS

The analyst who prepared the solution(s), and each subsequent analyst, will analyze five samplings of the aliquot taken from the original mixture (either 18 or 52 L).

External Standard Solution batches should be set up using the following sequence:

1. Blank (d.H2O, no Internal Standard added)	9. Negative Control
2. CAL 1 (0.079 g/100 mL)	10. Solution aliquot #1
3. CAL 2 (0.158 g/100 mL)	11. Solution aliquot #2
4. CAL 3 (0.316 g/100 mL)	12. Solution aliquot #3
5. Negative Control (d.H2O plus Internal Standard)	13. Solution aliquot #4
6. Control 1 (0.04 g/100 mL)	14. Solution aliquot #5
7. Control 2 (0.10 g/100 mL)	15. Control 0.10 g/100 mL
8. Control 3 (0.20 g/100 mL)	16. Negative Control

QAP Solution batches should be set up using the following sequence:

1. Blank (d.H2O, no Internal Standard added)	20. QAP 0.08 aliquot #4
2. CAL 1 (0.079 g/100 mL)	21. QAP 0.08 aliquot #5
3. CAL 2 (0.158 g/100 mL)	22. Control 0.10 g/100 mL
4. CAL 3 (0.316 g/100 mL)	23. Negative Control
5. Negative Control (d.H2O plus Internal Standard)	24. QAP 0.10 aliquot #1
6. Control 1 (0.04 g/100 mL)	25. QAP 0.10 aliquot #2
7. Control 2 (0.10 g/100 mL)	26. QAP 0.10 aliquot #3
8. Control 3 (0.20 g/100 mL)	27. QAP 0.10 aliquot #4
9. Negative Control	28. QAP 0.10 aliquot #5
10. QAP 0.04 aliquot #1	29. Control 0.10 g/100 mL
11. QAP 0.04 aliquot #2	30. Negative Control
12. QAP 0.04 aliquot #3	31. QAP 0.15 aliquot #1
13. QAP 0.04 aliquot #4	32. QAP 0.15 aliquot #2
14. QAP 0.04 aliquot #5	33. QAP 0.15 aliquot #3
15. Control 0.10 g/100 mL	34. QAP 0.15 aliquot #4
16. Negative Control	35. QAP 0.15 aliquot #5
17. QAP 0.08 aliquot #1	36. Control 0.10 g/100 mL
18. QAP 0.08 aliquot #2	37. Negative Control
19. QAP 0.08 aliquot #3	

1. Using the Auto-pipetter, extract 200 µL of the calibrators, controls or simulator solution and 2 mL of the internal standard solution.
2. Elute the aliquot/extract into a clean, labeled 10 mL headspace vial.
3. Seal the vial tightly.
4. Between each aliquot/extract, rinse and wash the pipette tip appropriately (e.g. rinse pipette tip with diluted bleach and/or d.H₂O. Repeat if necessary). It is not necessary to rinse and wash the pipette tip in-between repeated aliquots from a single simulator solution.

5. Load and edit a sequence on the headspace gas chromatograph. Enter the blank, calibrators, controls and simulator solutions into the sequence table, and identify them appropriately under Sample Type.
6. Place each headspace vial in the appropriate position on the headspace autosampler and verify this placement against the sequence log.
7. Run sequence under method SIMALC. [Note: The method may contain a numeric suffix to differentiate between instruments; for example SIMALC1 for headspace instrument 1. All certification testing for a given simulator solution will take place on a single instrument.]
8. Upon completion of testing, analysts will initial their chromatograms and sequence table.

If two or more separate external standard solution batches are prepared close together, each batch may be certified using the same calibration and controls. For the analysis of multiple external standard solution batches and QAP solution batches, each set of 5 aliquots should be separated by a 0.10 g/100 mL control and a negative control. It is the 0.10 g/100 mL control run at the end of each set of 5 aliquots that is entered into the database.

4.6 ACCEPTANCE PARAMETERS

If the analysis of the batch meets the criteria listed below, the results for the simulator solution(s) are accepted.

- Ensure that the blank is devoid of any significant peaks
- Ensure that the negative control is devoid of any significant peaks other than the internal standard. Should the negative control read above 0.005 g/100 mL for ethanol, the analyst re-aliquots and reanalyzes their sequence
- Verify that each calibrator and control quantifies to within $\pm 10\%$ of the target values. Should one of the calibrators or controls read outside $\pm 10\%$ for ethanol, the analyst re-aliquots and reanalyzes their sequence
- Each individual external standard solution result must be within the range 0.096-0.106 g/100 mL, inclusive.
- Each individual QAP solution result must be within the ranges specified in Table 2

Table 2:	Target Vapor Concentration	Equivalent Solution Concentration	Acceptable Range (inclusive)
	0.04	0.049	0.047 - 0.051
	0.08	0.098	0.093 - 0.103
	0.10	0.123	0.117 - 0.129
	0.15	0.185	0.176 - 0.194

- Should any individual value be outside of the specified range, the analyst re-aliquots and reanalyzes their sequence. The original testing results will be retained but not used in calculations. If, in the course of testing a batch, two or more individual values are outside of the specified range, either during original analysis or re-analysis, then the batch will not be certified.

4.7 CERTIFICATION, DOCUMENTATION AND REVIEW

1. Analysts will place their chromatograms and sequence tables in the batch file. When all batch testing has been completed, a supervisor will generate the appropriate Solution Test Report which includes the average solution concentration (arithmetic mean) rounded to four decimal places, the standard deviation rounded to five decimal places, and the percent coefficient of variation rounded to two decimal places.
2. The solution meets the standards required by the State Toxicologist if:
 - i. For the external standard solution, the average solution concentration (final arithmetic mean) is within the range 0.096 – 0.106 g/100mL, inclusive
 - ii. For the QAP solutions, the average solution concentration (final arithmetic mean) is within the ranges specified in Table 3

Table 3:

Target Vapor Concentration	Equivalent Solution Concentration	Acceptable Range (inclusive)
0.04	0.049	0.047 - 0.051
0.08	0.098	0.093 - 0.103
0.10	0.123	0.117 - 0.129
0.15	0.185	0.176 - 0.194

- iii. The CV is 5% or less
3. The equivalent vapor concentration is calculated by dividing the final average solution concentration by 1.23 and rounding to four decimal places.
 4. For an external standard solution, the expanded uncertainty is calculated based on the Division’s policy for estimating the combined uncertainty of external standard solutions.
 5. The batch file will be forwarded to a Toxicology Lab supervisor or designee for technical review. At this stage, the batch file should contain the printed Test Report, the chromatograms and sequence tables, and the Solution Preparation Worksheet.

The supervisor or designee will verify all preparation and testing dates are correctly documented, the ethanol control expiration dates have not been exceeded, individual chromatograms are initialed, all pages of the record are labeled with the batch number, the correct ethanol concentrations were entered into the Test Report, and the calibrators and controls were within the acceptable range. The appropriate QAP

or ESS Test Report Calculation Record will be produced to document performance of calculations and technical review of the entire batch file.

6. Upon completion of the technical review, the batch file is returned to the analysts.

Each analyst should again verify that the preparation/testing dates and the data from their chromatograms correctly appear on the printed Test Report before signing on the corresponding signature line. Their signature will also reflect that the results are the results of tests that they personally performed.

Each analyst who certified the batch will also sign an affidavit as described in CrRLJ 6.13(c)(1), certification of simulator solution. Affidavits are placed in the batch file.

7. A technical and administrative review of the batch file will be performed by the Quality Assurance Manager or designee. The Quality Assurance Manager or designee will verify all preparation and testing dates are correct, chromatogram data is entered correctly, all chromatograms are included, accuracy and precision requirements are met, affidavits are signed and properly dated, etc. This review will be documented on the Simulator Solution Data Entry Review form, which will be added to the batch file.
8. Final solution calculations will be independently verified by the Quality Assurance Manager or designee and this verification documented on the Simulator Solution Data Entry Review form. Solution uncertainty calculations will also be verified at this time and the verification documented on the QAP or ESS Test Report Calculation Record.
9. A Toxicology Lab supervisor or designee will then perform a final administrative review and will sign and date the bottom of the Test Report indicating that the batch file is complete and the above procedures have been reviewed. The final review date will be the issue date of the Test Report and the batch. Simulator Solutions must not be distributed for use prior to this issue date.
10. The final batch file should contain:
 - i. The original QAP or External Standard Test Report, signed by each analyst
 - ii. The Solution Certificate Review form
 - iii. Analyst's affidavits
 - iv. All relevant sequence tables and chromatograms
 - v. The Solution Preparation Worksheet
 - vi. The QAP or ESS Test Report Calculation Record
 - vii. The Simulator Solution Data Entry Review Form

5 QUALITY ASSURANCE PROCEDURE

The Quality Assurance Procedure (QAP) ensures the accuracy, precision and forensic acceptability of the DataMaster breath test instrument for the purpose of quantitative evidential measurement of the alcohol concentration of a person's breath. The procedure evaluates critical systems within the instrument to ensure their compliance with strict predetermined criteria. When complying with the standards required in the QAP, the DataMaster can be confidently placed in the field for evidential use.

When the QAP is undertaken at sites other than a permanent laboratory facility, the location should provide moderate environmental conditions of temperature and humidity as commonly found under normal laboratory conditions. Calibration shall be stopped if the Technician determines that environmental conditions in any calibration location jeopardize the results of the calibration. The transportation, handling and storage of instruments being calibrated shall be done in such a way as to protect the integrity of the instrument. While undergoing transport and whenever stored in a permanent laboratory facility, the instruments will be treated with the care deserving of a precision measurement device and any storage both before and after conducting the QAP will be in a secure, limited-access location.

5.1 CONDITIONS REQUIRING THE QAP

The procedure described below is to be followed when performing the QAP on DataMaster instruments. This procedure shall be completed in the following circumstances:

1. Prior to an instrument being installed in the field for evidentiary use.
2. After replacing any of the following components and prior to being placed back into the field for evidentiary use:
 - a. Central Processing Unit (CPU) Board
 - b. Infrared Detector
 - c. Infrared Detector Block
 - d. Infrared Detector Board
 - e. Software
3. After disassembly and then reassembly of sample chamber.
4. If instrument requires recalibration for any reason.
5. At least once every year.

5.2 INSTRUMENT ASSESSMENT

Prior to performing the QAP, the "As found" performance of the DataMaster will be assessed. If the instrument is to be transported prior to calibration, the assessment will be conducted after it has been transported. A single supervisory test (SUP) will be performed using a certified 0.08 QAP solution in place of an external standard solution. The 0.08 QAP solution used for the assessment will be the same as that used for calibration and certification. The keyboard will be on and the Technician will enter their name and the letter "F" for the type of test. The resulting breath test document will be retained in the QAP file

and the acceptability of the assessment will be indicated by checking the appropriate section of the QAP Worksheet and entering the “As found” result on the Datamaster Calibration Certificate. Acceptability is defined as an “As found” result between 0.072 and 0.088, inclusive. In the event that the assessment indicates an unacceptable result, the QAP procedure is immediately halted and a Supervisor is contacted.

The intention of the “As Found” is to show the condition or working order of the instrument at the time it arrives at the laboratory after being removed from the field. Therefore, if a successful “As Found” test is obtained those results are to be recorded on the required documents. If a “Repair” is needed and no “As Found” results can be obtained the “As Found” test will not be applicable.

If the QAP is being conducted following any repair or replacement of components which would make instrument assessment impossible, then this section does not apply.

5.3 PROCEDURE

The following shall be conducted by the Breath Test Technician performing the calibration. This procedure shall be performed when the instrument is fully warm. While conducting the following procedure, the Technician shall complete the QAP Worksheet. If at any point throughout the QAP procedure it becomes necessary to begin the entire QAP again, all of the paperwork up to that point shall be retained while noting the reason on the QAP Worksheet.

1. ELECTRICAL CHECKS

A. Sample Chamber Control Board

1) Version #101226

a) Flow Detector

- Place black voltmeter lead on Test Point (TP)5
- Place red voltmeter lead on bottom of R28
- Adjust R26 to 0.200 (\pm 0.005) Volts Direct Current (VDC)
- Move red lead to TP2
- Adjust R29 to 1.40 (\pm 0.10) VDC
- Move red lead back to bottom of R28
- Adjust R26 to 0.020 (\pm 0.010) VDC

b) Sample Threshold

- Leave black voltmeter lead on TP5
- Place red voltmeter lead on TP1
- Adjust R34 to 2.40 (\pm 0.10) VDC

2) Sample Control Board (Version #41625)

a) Breath Volume Circuit

- Place black voltmeter lead on TP5

- Place red voltmeter lead on TP8
- Adjust R26 to 0.200 (± 0.005) VDC
- Move red lead to TP2
- Adjust R29 for 1.40 (± 0.10) VDC
- Move red lead back to TP8
- Adjust R26 to 0.020 (± 0.010) VDC

B. Detector Board: (TP4 is ground)

1) Infrared (IR) Detector Cooler (DetClr):

- a) TP1: Adjust R4 to voltage indicated on tag attached to cable coming from J37 on Detector Board (± 0.01) VDC.
- b) If the tag listing the cooler voltage is not present, turn the instrument off and let it cool down to room temperature (approximately 30 minutes). Turn the instrument on and place voltmeter across R26 on Detector Board. Adjust R4 for 0.475 (± 0.010) VDC. Recheck voltage at TP1. Note this voltage as the new Detector Cooler voltage.

2) Detector Bias (DetBias):

- a) Top of R45 or TP13 depending on board version: 120.0 (± 0.5) VDC unless a tag indicates a different value: Adjust R1

3) IR Source Intensity (MTR):

- a) Activate Meter (MTR) on keyboard so the Detector voltage is displayed. Adjust R16 on the Sample Control Board for a displayed detector voltage of 0.000 (± 0.100) VDC.

C. Analog-to-Digital Converter Reference (CPU):

- 1) The ground is TP0, or lower left corner pad.
- 2) Versions with TP2 and R37 present: TP2 or U29 pin 2: 2.00 (± 0.01) VDC: Adjust R37
- 3) No adjustment performed on Versions without TP2 and R37

D. Radio Frequency Interference (RFI) Threshold: (Top of R8 is ground)

- 1) Antenna must be installed.
- 2) Activate MTR on keyboard.
- 3) Left side of L2. If reading is 4-6 VDC, adjust R18 clockwise (CW) to read 0-1 VDC. If reading is at 0-1 VDC, adjust R18 counter clockwise (CCW) to read 4-6 VDC. When the R18 turning point is

reached, turn R18 one turn clockwise. When the voltage is between 4-6 VDC the MTR should display "RADIO INTERFERENCE".

2. CALIBRATION PROCEDURE

- A. Reagents to be used include the certified 0.08 QAP solution and tap water. The 0.08 QAP solution should be a fresh transfer to the simulator or have been transferred on the date of calibration as noted on the simulator label. The maximum use for any QAP solution transferred to a simulator is a single day.
- B. Record the batch number of the solution used on the QAP Worksheet and Datamaster Calibration Certificate.
- C. Use only Guth Model 34C or 2100 simulators with a thermometer that has been certified according to the Simulator Thermometer Certification procedure (see Chapter 15).
- D. The simulator inlet port should be attached to the pump via the "Calibrate" port on the instrument and the simulator outlet port to the breath tube.
- E. Set the "ETHANOL CONCENTRATION" in the supervisory options to the equivalent vapor concentration of the 0.08 QAP solution. Round the four digit equivalent vapor concentration to three digits using the common rounding method.
- F. Ensure that the simulator thermometer indicates 34.0 ± 0.2 °C.
- G. Use the F1-F2 keys on the keyboard to initiate the calibration procedure.
- H. Follow the displayed instructions.
 - 1) When the display reads "BLOW WATER VAPOR", introduce water vapor into the breath tube. Push NOVOL (NV) if necessary to accept the sample.
 - 2) When the display reads "BLOW ETHANOL", introduce the known ethanol solution vapor into the breath tube until a stable reading is obtained. Push NOVOL (NV) to accept the sample if necessary.
- I. Printout the calibration (CAL) factors and retain the document in the QAP file.
- J. The technician shall be allowed to perform the calibration procedure as often as they determine to be necessary in order to achieve optimum instrument performance. Only the final breath test document needs to be retained.

3. CERTIFICATION PROCEDURE

The following steps shall be performed using certified QAP 0.04, 0.08, 0.10, and 0.15 solutions. The order in which the solutions are examined is left to the

discretion of the Technician. Each QAP solution should be a fresh transfer to its simulator or have been transferred on the date of certification as noted on the simulator label. The maximum use for any QAP solution transferred to a simulator is a single day.

- A. Use only Guth Model 34C or 2100 simulators which contain a certified QAP solution.
- B. Set the supervisory test option for ten tests.
- C. Set keyboard and data collection to off.
- D. Simulator check to off.
- E. Use a thermometer which has been certified according to the Simulator Thermometer Certification procedure (see Chapter 15). Verify that the thermometer indicates that the temperature of the simulator solution is 34.0 ± 0.2 °C. Indicate this on the QAP Worksheet.
- F. Insert the document (except on DataMaster CDM) and push the SUP key.
- G. When the ten tests are completed indicate if temperature is 34.0 ± 0.2 °C on the QAP Worksheet.
- H. Use the mean (arithmetic mean) and standard deviation values that are printed out by the Datamaster instrument to compute the % bias and the % CV. The mean and standard deviation have been rounded to four decimal places.

- 1) Determine the percent bias and ensure that it is within $\pm 5.00\%$ according to the following equation:

$$Bias(\%) = \left[\frac{\bar{Y} - R}{R} \right] \times 100$$

where:

\bar{Y} = arithmetic mean

R = reference value

- 2) Determine the coefficient of variation according to the following equation and ensure that the result is within 3.00%:

$$CV(\%) = \left[\frac{SD}{\bar{Y}} \right] \times 100$$

where:

SD = Standard deviation

- 3) The % bias and % CV shall both be rounded to two decimal places and recorded on the QAP Worksheet and the Datamaster Calibration Certificate along with the mean and standard deviation.

- 4) The Combined Standard Uncertainty for each of the QAP solutions shall be recorded on the Datamaster Calibration Certificate. These values are obtained from the corresponding solution batch number of the QAP Test Report Calculation Record.
 - 5) The results of the certification procedure will be examined to ensure they comply with the stated criteria for accuracy (% bias) and precision (%CV). If the data is found to be outside the stated criteria the Technician may, at any time during the certification procedure, terminate the QAP and repeat it in total.
4. PERFORM A COMPLETE BREATH TEST
 - A. Set supervisory test to one. Set keyboard, Simulator Check, and Sample Check to "ON". Conduct a complete breath test on the instrument using a live subject's breath sample. Use a certified external standard solution or 0.08 QAP solution.
 - B. Retain the breath test document.
 5. PERFORM THE INTERFERENCE TEST
 - A. With the keyboard set to "OFF" use a simulator containing approximately 0.08 g/210L of ethanol to which approximately 0.5 ml of acetone has been added.
 - B. Verify the simulator thermometer indicates the temperature is 34.0 ± 0.2 °C and conduct one supervisory test.
 - C. Verify that the instrument displays INTERFERENCE DETECTED
 - D. Push the ABT key and then push the COPY key and retain document in the QAP file
 6. PERFORM THE MOUTH ALCOHOL / INVALID SAMPLE TEST
 - A. Set the instrument up to perform a breath test
 - B. A human subject is to exhale into the instrument during the PLEASE BLOW phase shortly after introducing into the mouth a substance containing ethyl alcohol (i.e., mouthwash, beverage alcohol, etc.)
 - C. Verify that instrument displays INVALID SAMPLE
 - D. Push the ABT key and then push the copy key and retain the document in the QAP file
 7. PERFORM THE RADIO FREQUENCY INTERFERENCE (RFI) DETECTOR TEST
 - A. Set the instrument up to display PLEASE BLOW

- B. Transmit a hand held (portable) police radio in the proximity of the instrument
 - C. Verify that instrument displays RADIO INTERFERENCE
 - D. Push the ABT key and then push the COPY key and retain the document in the QAP file
8. PERFORM A DIAGNOSTIC TEST AND RETAIN THE DOCUMENT IN THE QAP FILE.
9. THE Datamaster Calibration Certificate shall be filled out when the above steps have been successfully performed as described. The Certificate will be transferred for technical and administrative review as described in 5.0.4.

The results of the certification procedure will be examined to ensure they comply with the stated tolerances of accuracy (% bias) and precision (%CV).

The entire QAP shall be repeated if one of the following conditions exists during the QAP:

- A. Readjustment of voltages that are outside of tolerances.
- B. Any replacement of parts or components.

5.4 QAP REVIEW AND CERTIFICATE ISSUANCE

Prior to installing the instrument in the field, the results of the QAP must be reviewed by a Breath Test Technician who has been authorized by the Appointing Authority to conduct reviews and issue Calibration Certificates. This technical and administrative review may be accomplished based on faxed or e-mailed copies of all relevant pages of documentation in the instrument record. This will include the Datamaster Calibration Certificate, the QAP Worksheet, and all instrument printouts. The Datamaster Calibration Certificate will be made available to the reviewer in electronic format.

The technical and administrative review will be documented on the QAP Review Form. The reviewer will check the Technician's computations for agreement using the Excel QAP computation program. Any discrepancies identified in the review process will be brought to the attention of the Technician performing the calibration who will resolve them as soon as possible. Discrepancies not resolved at this level will be brought to the attention of a BTP Supervisor who may notify the QA Manager and/or Appointing Authority as appropriate.

Once the review is complete and deemed acceptable, the reviewer will sign and date the QAP Review Form, print and sign the Datamaster Calibration Certificate and notify the Technician that the instrument can be installed for use. The instrument will be considered authorized for field installation when the Datamaster Calibration Certificate has been signed by the reviewer and that fact communicated to the Technician.

The following original, signed documents will be transferred to the Technician who performed the calibration: Datamaster Calibration Certificate, and QAP Review Form. The Technician will sign the original certificate and transfer these along with, the original QAP

Review Form, the original QAP Worksheet and copies of all instrument printouts to the BTP Headquarters. The Technician will retain copies of the Datamaster Calibration Certificate, QAP Worksheet, QAP Review Form and copies of original instrument printouts for their records.

5.5 FIELD INSTALLATION

Prior to re-installing the instrument in the field, complete the following:

1. Employ the RESET OPTIONS function with the F1 and F2 keys.
2. Turn "Daylight Savings Time" feature to off using the SET and ADV keys.
3. Ensure the simulator standard is set to 0.080 ± 0.008 .
4. Ensure the INTERFERENCE level is set to 0.010.

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6 EXTERNAL STANDARD SOLUTION CHANGING PROCEDURE

6.1 POLICY

The following protocol shall apply to qualified personnel who change external standard solutions.

6.2 RESPONSIBILITIES

1. Only trained personnel shall change external standard solutions.
2. Trained personnel shall be responsible for monitoring and changing external standard solutions.
3. Solution measurements can be monitored through the host computer or by completing a supervisor test.
4. Ensure that only Guth Model 34C or 2100 simulators are employed for field use.
5. External standard solutions will be stored in secure locations with limited access. Acceptable locations include: the Toxicology Laboratory, satellite calibration facilities and locked containers maintained by solution changers.
6. External standard solutions will be stored in climate-controlled locations under moderate conditions. External standard solutions may not be stored in vehicles other than during transport.

6.3 EXTERNAL STANDARD SOLUTION SUPPLY

1. Only certified external standard solutions are to be used.
2. Only solutions within a sealed container labeled with the batch number and preparation date are to be used.
3. Only non-expired external standard solutions are to be used.

6.4 EXTERNAL STANDARD SOLUTION CHANGING SCHEDULE

1. Solutions shall be changed at least every 60 days regardless of number of tests or measurement value.
2. When the instrument is removed from the facility for a QAP, repair or any other reason and then re-installed.

6.5 PROCEDURE

1. Turn off and disconnect simulator.
2. Discard old solution.
3. Dry the simulator tubing by removing excess moisture, replace tubing if necessary.

4. Check the instrument simulator ports for obvious excess moisture and dry if necessary.
5. The outlet tubing from the simulator should be kept as short as possible.
6. Ensure simulator elements and jar are clean and dry, pour contents of container into jar, tighten jar to simulator, and ensure the appropriate batch # label is attached.
7. Re-attach simulator and turn on.
8. Ensure that the thermometer indicates the correct temperature of: $34.0 \pm 0.2^{\circ}\text{C}$ and that the power and heater lamps are working properly. If the thermometer is not registering within specifications or if the power and heater lamps are not functioning properly, contact a Breath Test Technician immediately.
9. Run one complete breath test entering data according to the steps outlined in Data Entry for BTP Personnel (Chapter 10) and using a live subject's breath sample.
10. Keep the document of the completed test. Complete the form entitled Simulator Solution Change Record recording the results to three digits. The expiration date is one calendar year following the preparation date appearing on the solution container.

6.6 ADDITIONAL RESPONSIBILITIES

1. Ensure that the instrument has adequate supplies: mouthpieces, breath test document, DUI arrest forms, code book and printer supplies.
2. Ensure breath tube is warm or hot to the touch.
3. Check date and time and adjust if necessary.
4. Check RFI antenna and phone connections.
5. Replace "Drinking Location Codes" in code book with updates from the Liquor Control Board.

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7 TRACEABILITY

7.1 POLICY

Traceability is established for measurement results, not for laboratories, methods or personnel. Traceability will be established for the individual measurement results and the mean calculations resulting from all results generated within the TLD. Traceability should establish an unbroken chain of comparisons for these measurement results back to national or international measurement standards such as NIST. Traceability will allow for comparability between different analytical instruments and methods.

7.2 PROCEDURE

1. All measurement results, mean calculations, batch numbers, and reference values will be recorded on the appropriate forms.
2. A copy of the Simulator Solution Test Report issued by the Toxicology Lab will be maintained by the responsible breath test technician. This Report will record the simulator solution batch number along with all measurement results obtained by the analysts in the Toxicology Lab. The Report will also contain the results of control measurements along with the control lot number and reference value. One control measurement shall be performed along with the set of five aliquots of the simulator solution. All control measurements performed shall be within ± 0.01 g/100ml of the control reference value which will ensure the accuracy of the gas chromatograph instrument and the resulting reference value assigned to the simulator solutions.
3. The Toxicology Lab shall obtain and maintain a Certificate of Analysis (COA) from the reference material producer of the controls they purchase to be used during the testing of simulator solutions. The COA shall specify the lot number and reference value assigned to the purchased control solutions. The COA should also specify that the measurements performed by the manufacturer of the controls have been performed by methods and equipment that also measured Standard Reference Materials obtained from NIST.
4. The following three documents shall document and ensure traceability:
 - a. The COA from the commercial manufacturer of the controls
 - b. The Simulator Solution Test Report
 - c. The DataMaster Calibration Certificate
5. The traceability links will be from:
 - a. The measurement results and mean reported on the DataMaster Calibration Certificate to:
 - b. The measurement results and mean reported on the Simulator Solution Test Report to:

- c. The control measurement results along with lot number and reference value for the controls reported on the Simulator Solution Test Report to:
- d. NIST as documented on the Certificate of Analysis from the control manufacturer, where applicable.

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8 ALCO-SENSOR PBT CERTIFICATION PROTOCOL

8.1 POLICY

Qualified PBT Technicians within the BTP shall be responsible for certifying the PBT instruments used only by members of the WSP. Certifying PBT instruments owned and operated by other agencies shall not be the responsibility of members of the BTP. However, this does not preclude the certifying of PBT instruments owned and operated by other agencies. This shall only be done in a limited number of circumstances and only when it is in the best judgment of the PBT Technician.

8.2 PROCEDURE FOR ALCO-SENSOR FST PBT

1. Obtain certified dry gas alcohol standards for which the reference value is known and an Intox Regulator is attached.
2. If using a True-Cal device, the expected value of the standard will be displayed and will be the value that the PBT will be certified and/or calibrated to. If not using a True-Cal device, the altitude chart on the side of the tank will give you the stated value of your tank adjusted for the pressure changes due to the elevation at which you are using the dry gas standard.
3. Attach a new mouthpiece and power the instrument on by first pressing and holding the **OFF** button and then simultaneously pressing the **ON** button.
4. The display should show the **RCL** message, which is the first option in the function menu. Momentarily depress and release the **ON** button until the displayed message reads ACC.
5. With **ACC** on the display, press the **OFF** button to select the Accuracy Check option. The temperature will be displayed. Ensure a Blank Test result of 0.000 g/210L is displayed. A flashing **ACC** message will appear.
6. While the display is flashing **ACC**, make an airtight connection between the delivery tube of the regulator and the open end of the mouthpiece.
7. Depress the regulator control button for approximately seven (7) seconds. At approximately five (5) seconds depress and release the **ON** button (while the gas continues to flow) to manually accept the sample. Some of the newer or modified regulators will dispense the gas at a higher rate enabling the FST to automatically accept the sample and eliminating the need to manually accept the sample.
8. The result will automatically be displayed.
9. If the results are within ± 0.010 g/210L from the reference value for the gas standard, the PBT is properly calibrated and acceptably accurate and only one test is necessary. Proceed to the Record Keeping steps.
10. If the result is not within the acceptable limits, proceed to the Calibration process.

8.3 CALIBRATING THE ALCO-SENSOR FST PBT INSTRUMENT

1. To calibrate the instrument its temperature must be between 20 °C and 35 °C. If the temperature is not within the range, the unit will display **E09** or **E10** and block the calibration procedure.
2. Attach a new mouthpiece and power the instrument **ON** by first pressing and holding the **OFF** button and then simultaneously pressing the **ON** button.
3. The display should show the **RCL** message, which is the first option in the function menu. Momentarily depress and release the **ON** button until the displayed message reads **CAL**.
4. Once **CAL** is displayed, depress the **OFF** button, this will initiate calibration sequence.
5. The temperature will be displayed, ensure a Blank Test result of 0.000 g/210L is also displayed. A flashing **CAL** message will appear.
6. While the display is flashing **CAL**, make an airtight connection between the delivery tube of the regulator and the open end of the mouthpiece.
7. Depress the regulator control button for approximately seven (7) seconds. At approximately five (5) seconds depress and release the **ON** button (while the gas continues to flow) to manually accept the sample.
8. The result will automatically be displayed. If the result equals the expected value of the standard depress the **OFF** button. You will see that each time you depress the **OFF** button, the cursor moves from the left most digit of the number to the right. After depressing the button three times, the value displayed will be accepted as the calibration value and will flash three times before the instrument will power down.
9. If the result **does not** match the expected value of the standard gas, you will need to adjust the displayed result to the proper value. The result displayed will have the digit furthest to the left flashing. If the flashing digit is incorrect, press and release the **ON** button as many times as it is necessary to cycle the displayed digit to the correct number. When the digit is correct, press the **OFF** button to move the flashing highlight to the digit to the right. After you have adjusted the furthest to the right digit and the **OFF** button is depressed, the new calibration value will be flashed on the display three times. If you need to adjust this number further, pressing the **OFF** button again, while the entire calibration number is flashing, will provide you this option by displaying the most recently entered number with the digit furthest to the left flashing. If the calibration value is correct and you have not pressed the **OFF** button a second time, after the third flash the new calibration value will be accepted.
10. Cycle the power on the instrument **OFF** and **ON** and repeat the certification process to verify the accuracy of the instrument.

8.4 PROCEDURE FOR ALCO-SENSOR III PBT

1. Obtain certified dry gas alcohol standards for which the reference value is known and an Intox Regulator is attached.

2. If using a Tru-Cal device, this will determine the concentration and will be the value that the PBT will be certified and/or calibrated to. If not using a Tru-Cal device, refer to the altitude chart on the side of the tank for the correct reference value.
3. Verify the PBT temperature is between 20.0 °C and 36.0 °C.
4. Push **SET** button. Push and hold the **READ** button.
5. The digits should go to 0.003 or less within 10 seconds. If the digits do not go to 0.003 or less, push **SET**, wait one minute and push and hold the **READ** button again.
6. Attach the mouthpiece in one of the following configurations:
 - a. Attach the straight white tube mouthpiece to the instrument receptacle.
 - b. Attach the straight white mouthpiece with one-way valve so that the air will flow in the proper direction
7. Attach mouthpiece to the gas standard source and provide the sample. Allow approximately three seconds of gas flow.
8. Push and hold the **READ** button while the sample is still being provided. Continue to hold the **READ** button until the result stabilizes.
9. Observe digital reading to determine if acceptably accurate
 - a. If the results are within ± 0.010 g/210L from the reference value for the gas standard, the PBT is properly calibrated and acceptably accurate and only one test is necessary. Proceed to Record Keeping steps.
 - b. If the result is not within the acceptable limits, proceed to step 10
10. Calibrating the PBT Instrument
 - a. If the result is outside ± 0.010 g/210L of the reference value, first zero the instrument to 0.003 or less, then turn the calibration screw clockwise two full turns
 - b. Re-introduce the gas standard and while holding the READ button, turn the calibration screw counter-clockwise slowly to value on gas standard. Avoid adjusting to below the reference gas standard value during this procedure
 - c. Repeat steps 1 through 10 as often as necessary to obtain results within the acceptable range
 - d. If results following calibration are acceptable, only perform one certified test as required in step 9.a
 - e. Where instruments are not outside ± 0.010 g/210L, technicians are authorized to make small calibration adjustments without first turning the calibration screw clockwise two full turns. Following all calibration adjustments, a complete test will be performed according to steps 1 through 9.a. outlined above

8.5 DOCUMENTATION

1. Complete the Alco-Sensor PBT Certification Record.
2. Record results to three decimal places.
3. Note if it was necessary to calibrate the instrument.
4. Documentation will be retained at the satellite laboratories.

8.6 FREQUENCY OF PBT CERTIFICATION

The PBT instruments are to be certified at time intervals corresponding to those outlined in the Washington Administrative Code (WAC) 448-15.

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9 CALCULATIONS FOR DETERMINING ACCEPTABLE AGREEMENT BETWEEN DUPLICATE BREATH ALCOHOL RESULTS

9.1 POLICY

The following summarizes the computational steps involved in determining whether duplicate breath alcohol measurements are within plus or minus ten percent (10%) of their mean as required in RCW 46.61.506 for the admissibility of evidential breath test results. These calculations are also performed automatically by the DataMaster instrument. However, these calculations are not performed within the DataMaster instrument where the mean of the duplicate results are less than 0.010 g/210L. These calculations are to be performed on the three digit breath alcohol results.

9.2 CALCULATION

1. To determine the mean of the two values, add the two results together and divide the sum by two. Round the mean to four decimal places.
2. Determine the lowest acceptable value by multiplying the mean value obtained above by 0.9 and truncate to three decimal places.
3. Determine the highest acceptable value by multiplying the mean value obtained above by 1.1 and truncate to three decimal places.
4. The appropriate equations to employ are as follows:

$$\text{mean} = \bar{X} = \frac{1}{n} \sum_{i=1}^n X_i$$

$$\text{lower limit} = \bar{X} \times 0.9 \qquad \text{upper limit} = \bar{X} \times 1.1$$

5. The range from the low to the high limits must include both sample results if the test is to be presumed valid as defined in RCW 46.61.506.

9.3 CALCULATION EXAMPLE

Assume the following duplicate breath alcohol test results: 0.155 and 0.181 g/210L

$$\text{mean} = \bar{X} = \frac{1}{n} \sum_{i=1}^n X_i = \frac{0.155 + 0.181}{2} = 0.1680 \text{ g/210 L}$$

$$\text{lower limit} = \bar{X} \times 0.9 = 0.1680 \times 0.9 = 0.1512 \rightarrow 0.151 \text{ g/210 L}$$

$$\text{upper limit} = \bar{X} \times 1.1 = 0.1680 \times 1.1 = 0.1848 \rightarrow 0.184 \text{ g/210 L}$$

Since both breath sample results are within the range from 0.151 to 0.184 g/210L, the test has acceptable agreement.

10 DATA ENTRY FOR BREATH TEST PROGRAM PERSONNEL

10.1 POLICY

For uniformity, the following data entry codes are to be used by Breath Test Technicians and Solution Changers when performing breath tests on DataMaster instruments for new solutions, tests, etc. that will appear on the instrument database.

10.2 DATA ENTRY FORMAT

Simulator temp.?	Y
Observation Began	00:00
Citation Number	NEW/SOLUTION, SOLUTION or TEST
Operator	Correct Name
Arresting Agency	WSP1057
Subject's Name	NEW/SOLUTION, TEST, TEST/"TECHNICIAN'S OPTIONS"
Subject's DOB	00/00/0000
Subject's Sex	M
Subject's Ethnic Group	U
D.L. State/Number	OO
County of Arrest	00
Crime Arrested For	00
Collision Involved?	N
Drinking Location	00000000
Batch #	Correct Number
PBT TEST GIVEN? (Y/N):	N

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11 DATAMASTER CODE INTERPRETATION

11.1 POLICY

The DataMaster breath test instrument will record and store in memory the occurrence of several different codes. These are ultimately downloaded to the host computer for storage in the instruments database. The following is a list of the codes generated by the instrument and their interpretation.

11.2 NUMERIC CODE AND INTERPRETATION

CODE NUMBER	MESSAGE CODE	INTERPRETATION
1.*	SYSTEM WON'T ZERO	Unable to zero detector voltage.
2.	TEMPERATURE LOW	Sample chamber temperature at 45 °C or below.
3.	TEMPERATURE HIGH	Sample chamber temperature at 55 °C or above.
5.*	RADIO INTERFERENCE	Radio frequencies detected.
6.	FATAL SYSTEM ERROR (ADDRESS)	Random Access Memory (RAM), Read Only Memory (ROM), or Peripheral Interface Adapter (PIA) not responding properly.
7.*	CALIBRATION ERROR	Internal standard does not read within 10% of the value determined at time of calibration.
8.*	PRINTER ERROR	Printer not responding properly.
9.*	RAM ERROR (ADDRESS)	RAM checksum does not match the value calculated following the last write.
10.	PUMP ERROR	Flow detector does not detect pump operation.
11.	BLANK ERROR	Instrument obtains reading greater than 0.003 g/210L during blank test.
12.	DETECTOR OVERFLOW	Detector output exceeds the 1.999V that is readable by the instruments Analog/Digital converter.
13.	FILTER ERROR	Filter solenoid not activating properly.
15.	SIMULATOR OUT OF RANGE	Simulator reading outside acceptable limits.
17.	DATA MEMORY BATTERY LOW	RAM battery backup failing.
19.	AMBIENT FAIL	Ethanol or other substance detected in sample chamber after purge.
20.	SAMPLES OUTSIDE 10%	

11.3 NON-NUMERIC CODE AND INTERPRETATION

V	INVALID SAMPLE
R	REFUSED TEST
X	INTERFERANT
I	INCOMPLETE TEST
*	

Codes found in the DataMaster instruments prior to 1995

12 DATAMASTER HELPS

12.1 POLICY

The DataMaster will generate several different error messages when specific criteria are not met during a test procedure. These messages are displayed on the instrument for the operator to respond to. The following are the messages that an operator may see and their interpretation. In addition, specific instructions for the operator are given here. This list should be posted on the wall near every DataMaster evidential breath test instrument in field use. The instructions provided here are considered guidelines only. They are not mandatory. Qualified operators may use their own training and discretion in responding to these messages.

MESSAGE DISPLAYED	INTERPRETATION AND INSTRUCTIONS
INVALID SAMPLE	Check Mouth, wait 15 minutes, try one or more tests and then call WSP if fails. TAG instrument "Out of Service"
AMBIENT FAIL	Check for odors, check to see if mouth piece is removed, try one or more tests and then call WSP if fails. TAG instrument "Out of Service"
SYSTEM WON'T ZERO	Unable to zero detector voltage. Try one or more tests and then call WSP if fails. TAG instrument "Out of Service"
DETECTOR OVERFLOW	Try one or more tests and then call WSP if fails. TAG instrument "Out of Service"
RADIO INTERFERENCE	Radio transmission detected, remove source, rerun test.
CALIBRATION ERROR	Try one or more tests and then call WSP if fails. TAG instrument "Out of Service"
INTERFERENCE DETECTED	Try one more test, if interference is noted on the second test, request blood sample under implied consent.
SAMPLES OUTSIDE 10%	Try one or more tests. Coach the subject to provide similar samples to the instrument.
SIMULATOR OUT OF RANGE	Simulator reading outside of 0.072-0.088 inclusive limits. Call WSP and TAG instrument "Out of Service". Go to another instrument to perform the test.
PRINTER ERROR	Call WSP ; TAG the instrument "Out of Service". Go to another instrument.
JAMMED/ILLEGIBLE DOCUMENT	Printer not performing properly. Call WSP ; TAG the instrument "Out of Service". Do not press RUN.
BLANK ERROR	Try one or more tests and then call WSP if fails. TAG instrument "Out of Service"
FILTER ERROR	Try one or more tests and then call WSP if fails. TAG instrument "Out of Service"
TEMPERATURE LOW	Out of service, call WSP and TAG instrument "Out of Service"
TEMPERATURE HIGH	Out of service, call WSP and TAG instrument "Out of Service"

FATAL SYSTEM ERROR	Out of service, call WSP and TAG instrument "Out of Service"
RAM ERROR	Out of service, call WSP and TAG instrument "Out of Service"
PUMP ERROR	Out of service, call WSP and TAG instrument "Out of Service"
DATA MEMORY BATTERY LOW	Out of service, call WSP and TAG instrument "Out of Service"
EXTERNAL STANDARD TEMPERATURE	The simulator temperature must be within 0.2 (two lines above or below) of 34.0 °C.
OUT OF SERVICE	Call WSP at _____ and advise specific problem, serial number and TAG instrument out of service.

** Will not be a displayed message

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13 DIGITAL REFERENCE THERMOMETER CERTIFICATION

13.1 POLICY

Digital reference thermometers are to be certified for compliance with this policy at least once every 12 months.

13.2 PROCEDURE

Digital reference thermometers are to be submitted to a NIST Traceable calibration laboratory for testing. The laboratory is to be capable of providing calibration certificates traceable to NIST or a similar National or International reference standard.

13.3 RECORDS RETENTION

1. Records received from the calibration laboratory shall indicate that the digital reference thermometer was tested, adjusted if necessary and returned properly calibrated.
2. Records received from calibration laboratory are to be maintained as part of the Breath Test Program's regular business records.
3. The BTP Headquarters will maintain the original certificates received from the calibration laboratory.
4. The Breath Test Technician will maintain copies of the certificate received from the calibration laboratory.

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14 MULTI-METER CERTIFICATION

14.1 POLICY

Multi-meters are to be certified for compliance with this policy at least once every 12 months.

14.2 PROCEDURE

Multi-meters are to be submitted to a calibration laboratory for testing. The laboratory is to be capable of providing calibration certificates traceable to NIST or a similar National or International reference standard.

14.3 RECORDS RETENTION

1. Records received from the calibration laboratory shall indicate that the multi-meter was tested, adjusted if necessary and returned properly calibrated.
2. Records received from the calibration laboratory are to be maintained as part of the Breath Test Program's regular business records.
3. The BTP Headquarters will maintain the original certificates received from the calibration laboratory.
4. The Breath Test Technician will maintain copies of the certificate received from the calibration laboratory.

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15 SIMULATOR THERMOMETER CERTIFICATION

15.1 POLICY

All Guth Model 34C or Guth Model 2100 simulators used during the performance of field evidentiary breath tests or the QAP are to employ a thermometer that has been verified for accuracy at least once every 12 months. Following certification, the thermometers are considered suitable for use for a 12 month period.

15.2 PROCEDURE

1. Have the mercury thermometer to be tested placed in a fully warm and equilibrated Guth Model 34C simulator.
2. Install the standard reference thermometer probe in the same simulator in the location designed for this purpose. For the Guth Model 2100, place the probe within the same Guth Model 2100 simulator being evaluated.
3. Ensure that the temperatures of both the tested thermometer and the standard reference thermometer have stabilized.
4. Ensure the tested thermometer indicates a temperature within $\pm 0.1^{\circ}\text{C}$ inclusive of the standard reference thermometer. Record the fully displayed standard reference thermometer results (including all digits) on the record form. Record also the result indicated on the mercury thermometer to the second decimal place which will have to be estimated.
5. If the thermometer results are acceptable, record "Yes" in the thermometer certification record.
6. If the thermometer results are not acceptable record "No" on the thermometer certification record. Depending on the type of thermometer, one of the following steps may be followed:
 - a. Mercury thermometer: check for separation of mercury and attempt to correct
 - b. Digital thermometer: re-calibrate the thermometer
 - c. After performing one of these steps, complete again the above procedure
7. Retain the forms in the appropriate files as part of the laboratory's regular business records. Forms are to be kept by the local responsible technician only.
8. If the thermometer does not comply with the standards outlined above then a new thermometer will be installed (in the case of the mercury thermometer) or re-calibrated (in the case of the digital simulator) and a repair record will be completed. The new thermometer will be certified as outlined in this policy.
9. If a thermometer is ever found to exceed the limits of $34.0 \pm 0.2^{\circ}\text{C}$, then the thermometer must be re-calibrated and certified according to the procedure outlined in this policy.

16 BREATH TEST INSTRUMENT REPAIR/ADJUSTMENT FORM

16.1 POLICY

The following policy shall apply when completing the DataMaster Repair/Adjustment Form. This policy shall apply to those repairs made to field breath test instruments and simulators and not sub-components thereof, which have been replaced. The purpose is to provide guidelines for when it is to be completed and the information it should contain.

16.2 PROCEDURE

1. The form is to be completed only by certified Breath Test Technicians.
2. The form shall be written clearly and concisely to allow others to interpret the information.
3. The form needs to be completed only in the following situations:
 - Following the instrument's initial QAP
 - Replacement of any components or parts not included as exceptions below
 - Repair to any components or parts
 - Adjustments to any potentiometer that is outside of manufacturer's specifications
 - Adjustment of the clock at the instrument that is more than 20 minutes off (See number 4 below)
 - Replacement of the simulator
 - Simulator repairs for the following reasons:
 - i. Replacing the thermometer. When the thermometer is replaced, form will contain the simulator serial number, the serial number of the thermometer replaced, the serial number of the new thermometer installed and the reason the thermometer was replaced. If the thermometer is replaced because it does not comply with the standards outlined in the Simulator Thermometer Certification section (see *Chapter 15*), then the magnitude and direction of deviation will be recorded. The new installed thermometer will have been certified according to the Simulator Thermometer Certification section (see *Chapter 15*).
 - ii. Re-calibration of the Guth Model 2100 Simulator thermometer
 - iii. Temperature adjustment that is outside 34.0 ± 0.2 °C
 - iv. Repairing simulator stirring mechanism
 - Instrument Re-calibration (except where part of the routine QAP)
 - Other necessary repairs or adjustment to restore an instrument to proper working order
 - When a repair is performed requiring the form to be completed, a complete breath test will be conducted according to the procedure outlined in the External Standard Solution Changing Procedure (see *Chapter 6*) and noted on the form. When in the discretion of the technician the particular repair will not influence the analytical performance of the instrument (e.g., correcting the clock time) then a complete breath test is not required
4. The form shall not need to be completed in the following situations:

- Prior to the instrument's initial QAP
 - Powering the instrument off and on to clear a lock-up condition
 - When changing time to correspond to changes in daylight savings time
 - When removing a stuck ticket when there is no apparent problem with the printer
 - When problem is due to operator error
 - Obtaining copies of ticket for operators when there is no apparent printer problem
 - When the display indicates any of the possible error messages and the problem is corrected on the subsequent test. A record of these situations is preserved in the database
 - When the problem is corrected over the phone with an operator or Solution Changer
 - When performing routine purging of the instrument
 - When replacing simulator tubing
 - When an instrument is transferred to a permanent training status
 - When replacing a normally worn or faded printer ribbon or toner cartridge
 - As part of the routine QAP
5. When completed, the original copy shall be sent to and retained by the BTP Headquarters. Copies of the form are to be kept in the office of the Technician having geographical responsibility for a particular instrument. The exception will be when form is completed for a QAP simulator. In this case, the form will be retained only by the responsible technician and not sent to the BTP Headquarters.

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17 PROFICIENCY TEST PROGRAM

17.1 POLICY

Each forensic scientist and breath test technician within the TLD will complete at least one proficiency test per year. All forensic scientists and breath test technicians will be trained on the importance and procedures for proficiency testing as outlined in this policy. The training will include the procedures to be followed as well as forms to be completed. The purpose of proficiency testing will be to ensure the overall program's fitness-for-purpose.

The objectives of the proficiency testing program are to:

- Demonstrate the current competence of the technicians and analysts
- Demonstrate the current competence of the program
- Ensure that quality work is being performed and maintained
- Identify areas where additional training or resources would be beneficial
- Verify the validity of technical procedures

Proficiency test samples (e.g. simulator solutions, blood) will be handled by breath test technicians and/or analysts in a similar manner to those samples routinely received by the TLD for calibration and/or testing purposes. Breath Test Technicians shall conduct proficiency tests using instruments that they have personally calibrated.

The QA Manager will oversee the Proficiency Testing Program for the TLD, including assigning proficiencies to all personnel, submitting results, maintaining records, and notifying individual personnel and the TLD Commander of proficiency test results. Refer to the *TLD Calibration Quality Manual, Chapter 8.02 Proficiency Testing* for further details.

17.2 DEFINITIONS

17.2.1 APPROVED PROFICIENCY TEST PROVIDER

An individual, organization or company which has applied for and obtained approval from ASCLD/LAB to prepare and provide proficiency tests to participating forensic laboratories, in the forensic disciplines, for which the provider has been approved.

17.2.2 PROFICIENCY TEST

A proficiency test is an internal or external test that is provided to evaluate the capability of analysts, technical support personnel and the overall quality performance of a laboratory.

17.2.3 PROFICIENCY TEST REVIEW COMMITTEE (PRC)

A committee of individuals appointed by the Board of ASCLD/LAB, because of their experience and expertise, to give guidance to ASCLD/LAB in the proficiency testing program for specific forensic disciplines.

17.2.4 PROFICIENCY TEST MATERIAL/SAMPLE

For the BTP, proficiency test material includes simulator solutions obtained either from an Approved Proficiency Test Provider or from the Toxicology Lab. For the Toxicology Lab, proficiency test material may include blood or simulator solutions obtained either from an Approved Proficiency Test Provider or from within the Toxicology Lab. The

State Toxicologist and/or the QA Manager may approve other types and sources of proficiency test samples.

17.3 PROCEDURE

1. Breath Test Program

a. Proficiency Testing Process – External proficiency tests

Proficiency test samples will be provided to the breath test technicians. A written protocol and data entry form from the Approved Proficiency Test Provider (or equivalent) will also be provided. The Technician will be directed to follow the protocol and documentation steps as outlined. The testing will be completed within the directed time period and documentation provided back to the QA Manager. Normal procedures for the technical and administrative review of results will apply. The QA Manager or designee will forward the final documentation to the Approved Proficiency Test Provider (or equivalent).

b. Proficiency Testing Process – Internal proficiency tests

Simulator solutions to be used as internal proficiency tests will be prepared by the Toxicology Lab. Protocols for the preparation and certification of Simulator Solutions will be similar to those outlined in Chapter 2. The final equivalent vapor concentration will be the reference value for that proficiency test solution. Records of the test results performed in the Toxicology Lab will be maintained which identify these solutions for proficiency test purposes. The solutions will be placed in evidence sealed 500 mL bottles with a label identifying a unique proficiency identifier and expiration date.

One bottle of each solution will be provided to each breath test technician and/or back-up technician. A written protocol will also be provided. The proficiency test samples will be treated similarly to QAP samples when performing the tests on a selected breath test instrument. Results will be submitted to the Quality Assurance Manager.

c. Results

For external proficiency tests, individual technician results are typically compared to the summary results of all participants provided by the Provider.

For internal proficiency tests, the arithmetic mean and standard deviation of the proficiency samples will be compared to the final equivalent vapor concentration determined by the Toxicology Lab. The mean of each Technician's results should typically be within $\pm 5\%$ of the pre-determined reference value.

Additional statistical criteria may be applied to proficiency tests and will be documented and communicated to the technicians prior to testing.

2. Toxicology Lab

a. Proficiency Testing Process – External proficiency tests

Proficiency test samples will be provided to the analysts. A written protocol and data entry form from the Approved Proficiency Test Provider (or equivalent) will also be provided. The analyst will be directed to follow the protocol and documentation steps as outlined. The testing will be completed within the directed time period and documentation provided back to the QA Manager. Normal procedures for the technical and administrative review of results will apply. The QA Manager or designee will forward the final documentation to the Proficiency Test Provider (or equivalent).

b. Proficiency Testing Process – Internal proficiency tests

Internal proficiency tests may be prepared by the Toxicology Lab, independently to the analyst(s) being proficiency tested. Protocols for the preparation and certification of Simulator Solutions will be similar to those outlined in Chapter 2. The final arithmetic mean will be the reference value for that proficiency test solution. Protocols for the preparation of blood proficiency samples will be documented and retained by the QA Manager. Records of the test results performed in the Toxicology Lab will be maintained which identify these samples for proficiency test purposes.

One bottle, blood vial/tube or aliquot of the proficiency test sample will be provided to the analyst(s). A written protocol and data collection form will also be provided. Five aliquots of a simulator solution proficiency will be tested, while blood proficiency samples will be tested in duplicate. The results will be recorded on the collection form provided. The forms will be signed and dated by the responsible analyst and sent along with the corresponding documents to a technical reviewer. Normal procedures for the technical and administrative review of results will apply prior to sending the results to the QA Manager.

c. Results

For external proficiency tests, individual analyst results are typically compared to the summary results of all participants provided by the Provider.

For internal proficiency tests, the arithmetic mean of the proficiency samples shall be compared to the arithmetic mean determined independently by the Toxicology Lab. The mean of each analyst's results should typically be within ± 5 % of the pre-determined mean.

Additional statistical criteria may be applied to proficiency tests and will be documented and communicated to the technicians prior to testing.

3. Discrepancies and Non-Conformities

Procedures for proficiency test discrepancies and non-conformities are outlined in the TLD Calibration Quality Manual (see *Chapters 3 and 8.02*).

18 ESTIMATION OF UNCERTAINTY OF MEASUREMENT

18.1 POLICY

Uncertainty of measurement will be estimated for the values assigned to breath alcohol reference materials and for the results obtained during calibration of the breath alcohol measuring instruments. The TLD has attempted to identify all the components of uncertainty contributing to each of these calibration categories and has made reasonable estimates of each component for inclusion in their respective uncertainty budgets. The estimation of uncertainty does not replace any existing policies established for the maintenance of quality control nor does it supersede any established legal, statutory or regulatory guidance on breath alcohol testing or breath alcohol measuring instrument calibration.

Uncertainty is not synonymous with error, inaccuracy or bias. Restrictions on measurement error have been integrated into the procedures for reference material certification and instrument calibration. Refer to chapters 4 and 5 of the Calibration Technical Manual for a description of these restrictions.

This policy applies only to the functions of the TLD's breath alcohol calibration program as defined in its scope of accreditation. The application of measurement uncertainty to individual breath alcohol tests is not covered by this policy and any such calculations should not be construed as having either been reviewed or endorsed by representatives of any accrediting organization.

18.2 UNCERTAINTY BUDGET

An uncertainty budget describes those components that have been identified as contributing to the overall measurement uncertainty for a given calibration activity. These components include contributions from reference standards, inexact values of reference materials, equipment used, approximations in the measurement procedure, inexact values of constants and variations in repeated observations (repeatability). Multiple sources may contribute to a single uncertainty component. When a component is estimated from a source external to the TLD, it is first converted to its standard uncertainty based on the reported coverage factor.

Figure 1 is a cause and effect diagram showing the uncertainty sources incorporated into the budget for the breath alcohol reference materials. It applies to both the external standard solution and the quality assurance procedure solutions. There are four major components that contribute to the overall uncertainty and they are broadly categorized as: analytical, repeatability, reference materials and external constants.

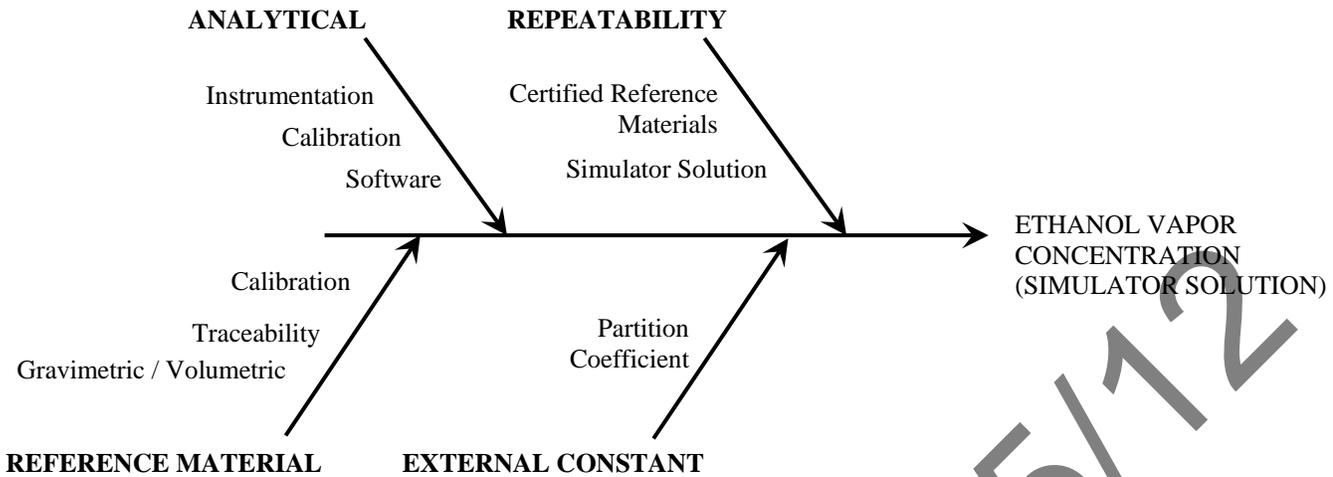


Figure 1: Cause and effect diagram for the breath alcohol calibration reference materials

Figure 2 is the cause and effect diagram for the uncertainty sources contributing to the breath alcohol measuring instrument's calibration uncertainty. It includes all the components in figure 1 and adds the variability of repeated measurements of the QAP solution measured using the Datamaster.

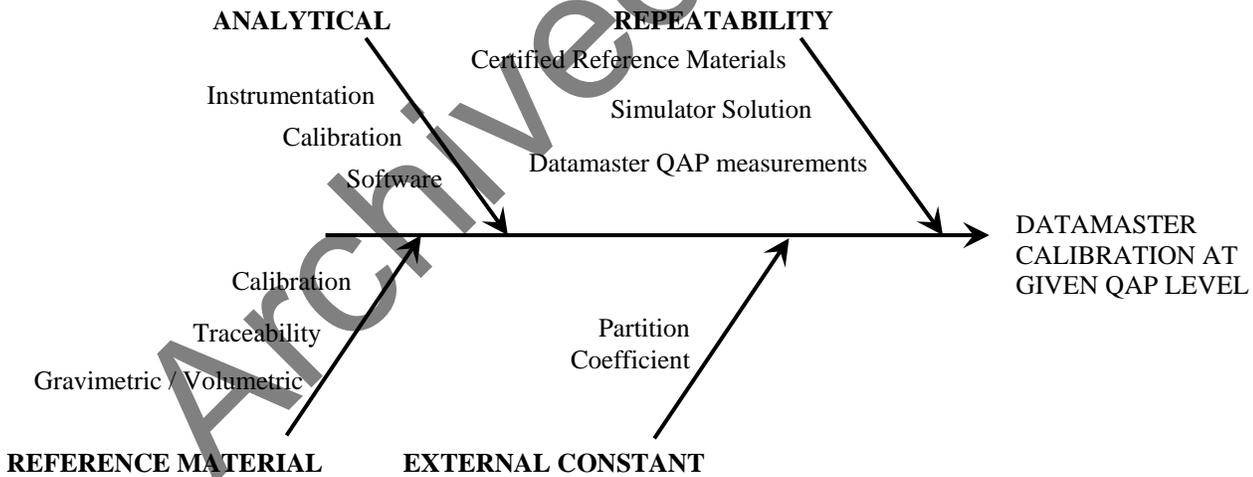


Figure 2: Cause and effect diagram for the calibration of the breath alcohol measuring instrument

18.3 MEASUREMENT UNCERTAINTY OF BREATH ALCOHOL CALIBRATION REFERENCE MATERIALS

18.3.1 UNCERTAINTY OF ETHANOL REFERENCE MATERIAL VALUE

Multiple ethanol reference materials are measured alongside a simulator solution during certification. The reference materials contain ethanol at a reference concentration which is reported, along with the reference value's uncertainty, in the manufacturer's Certificate of Analysis (CoA) for the material. The reference material uncertainty is derived from its preparation by gravimetric and volumetric means and it includes the uncertainty in its analysis against a calibration curve generated using NIST certified reference materials. The gravimetric preparation of the reference material inherently contains uncertainty associated with the equipment used in the weighing, its calibration and the reference standards used in the process.

The CoA for the 0.100 g/100 mL ethanol control analyzed after each set of 5 simulator solution replicates is used to source this uncertainty. The CoA lists the relative (%), expanded uncertainty for the material ($k=2$, 95% confidence level). This is converted to the absolute, standard uncertainty through the following equation.

$$CV_{CoA}^2 = \left(\frac{u_{RM}}{1000/0.100} \right)^2$$

where:

CV_{CoA}^2 = the uncertainty in the value of the reference material

u_{RM} = the relative standard uncertainty of the reference material from the CoA

18.3.2 UNCERTAINTY FROM REPEATABILITY MEASUREMENTS (SIMULATOR SOLUTION)

Variations in repeated measurements of the simulator solution are derived under reproducibility conditions. These conditions consist of multiple factors including: the analyst, the headspace instrument calibration, instrument operation, environmental conditions, solution sampling and software calculations against the calibration curve. The variations in these results include uncertainty contributions from each of these factors.

This variability is represented through calculation of the relative standard deviation, or percent coefficient of variation, of the simulator solution concentration. First the average solution concentration is calculated using the following equation.

$$\bar{X} = \frac{1}{n} \sum_{i=1}^n X_i$$

where:

\bar{X} = the average simulator solution concentration

- n = the number of measurements (e.g. 40 for external standard solutions, 15 for QAP solutions)
- X_i = each individual simulator solution measurement result
- i = incremental measurement results, first through last

The standard deviation (SD) of the simulator solution measurements is calculated using the following equation.

$$SD = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n - 1}}$$

The uncertainty from repeatability measurements of an external standard solution (CV_{ESS}^2) is calculated using the following equation.

$$CV_{ESS}^2 = \left(\frac{SD}{\bar{X}}\right)^2$$

The uncertainty from repeatability measurements of a QAP solution (CV_{QAP}^2) is calculated using the following equation. The standard deviation of the mean of 15 measurements is used in this equation.

$$CV_{QAP}^2 = \left(\frac{SD}{\sqrt{15}/\bar{X}}\right)^2$$

18.3.3 UNCERTAINTY FROM REPEATABILITY MEASUREMENTS (REFERENCE MATERIAL)

Variations in repeated measurements of the ethanol reference material are produced from the same uncertainty sources described in 18.3.2. The uncertainty for reference material repeatability ($CV_{Control}^2$) is calculated for external standard solution certification using the following equation.

$$CV_{Control}^2 = \left(\frac{SD}{\bar{X}}\right)^2$$

The uncertainty for the reference material repeatability ($CV_{Control}^2$) is calculated for QAP solution certification using the following equation.

$$CV_{Control}^2 = \left(\frac{SD}{\sqrt{3}/\bar{X}}\right)^2$$

18.3.4 UNCERTAINTY FROM INEXACT VALUES OF CONSTANTS

The uncertainty associated with the constant used to convert ethanol solution concentrations (g/100 mL) to ethanol vapor concentrations (g/210 L) is determined from fitting data to the exponential model describing the relationship between the water/air partition coefficient and temperature. The uncertainty for this constant ($CV_{Part\ Coef}^2$) is calculated using the following equation.

$$CV_{Part\ Coef}^2 = \left(\frac{0.0124}{1.23} \right)^2$$

18.3.5 COMBINED UNCERTAINTY FOR THE EXTERNAL STANDARD SOLUTION

The combined standard uncertainty of the external standard solution (u_{ESS}) is calculated using the following equation.

$$u_{ESS} = EVC \times \sqrt{CV_{CoA}^2 + CV_{ESS}^2 + CV_{Control}^2 + CV_{Part\ Coef}^2}$$

where:

EVC = equivalent vapor concentration of the solution

This calculation is done using the spreadsheet application, ESS Test Report Calculation Record. The expanded uncertainty for the external standard solution is obtained through multiplication by a coverage factor (k) of 2 which is equivalent to a 95% confidence level. The expanded uncertainty of the external standard solution is reported on the External Standard Solution Test Report with this confidence level.

18.3.6 COMBINED UNCERTAINTY FOR THE QAP SOLUTION

The combined standard uncertainty of a QAP solution (u_{QAP}) is calculated using the following equation.

$$u_{QAP} = EVC \times \sqrt{CV_{CoA}^2 + CV_{QAP}^2 + CV_{Control}^2 + CV_{Part\ Coef}^2}$$

This calculation is done using the spreadsheet application, QAP Test Report Calculation Record. An expanded uncertainty is not reported for the QAP solution and as such the uncertainty on this record can be understood to have a coverage factor (k) of 1. The QAP solution uncertainty is left as the combined standard uncertainty to facilitate its use directly in uncertainty calculations related to the instrument calibration and for use in any subsequent breath alcohol test uncertainty calculations. The QAP solution uncertainty is reported on the Quality Assurance Procedure Solution Test Report.

18.4 MEASUREMENT UNCERTAINTY OF INSTRUMENT CALIBRATION

18.4.1 UNCERTAINTY FROM REPEATABILITY MEASUREMENTS OF QAP SOLUTIONS ON THE DATAMASTER/DATAMASTER CDM

The variability in repeated measurements of the QAP solution during instrument calibration comes from a combination of instrumental, software and simulator uncertainty sources. This uncertainty from repeatability measurements on the instrument (CV_{DM}^2) is calculated using the following equation.

$$CV_{DM}^2 = \left(\frac{SD}{\sqrt{10} \bar{X}} \right)^2$$

Each of the four calibration levels has an associated CV_{DM}^2 uncertainty component.

18.4.2 COMBINED UNCERTAINTY FOR THE INSTRUMENT CALIBRATION

The uncertainty sources for the QAP solutions and the uncertainty from repeatability measurements of these solutions on the breath alcohol measuring instrument are combined for the uncertainty of the instrument calibration (u_{DM}).

$$u_{DM} = \sqrt{CV_{CoA}^2 + CV_{QAP}^2 + CV_{Control}^2 + CV_{Part Coef}^2 + CV_{DM}^2}$$

The calculation is done when the technician has entered all of the applicable data into the Datamaster Calibration Certificate. The instrument calibration uncertainty is calculated at each of the four QAP levels and expanded uncertainties are produced for each with a coverage factor (k) of 2 which is equivalent to a 95% confidence interval. Technical and administrative review of these uncertainty calculations is performed and documented on the Datamaster Calibration Certificate by the reviewer signing as the "Technician Reviewing & Issuing Certificate".

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19 LIST OF CHANGES

Since Revision 3 (12/10/10)

Revision Date	Procedure	Change	Page Number
06/13/11	Overall format	Reformatted header & footer. Adopted new pagination for revisions to individual chapters. Included Chapter 19, List of Changes, to track chapter revisions. Total page count now appears in footer of Chapter 19.	All
06/13/11	Chapter 2	Procedure now allows the use of different volume flasks for preparation.	2-1 to 2-2
06/13/11	Chapter 5	Added second paragraph to include language about "as found" test.	5-2
06/13/11	Chapter 5	Added section 3.H.4 describing the inclusion of combined standard uncertainty on the Calibration Certificate.	5-6
06/13/11	Chapter 5 & 18	Removed reference to Datamaster Uncertainty Calculation Record (retirement).	5-6 to 5-7 & 18-6
06/13/11	Chapter 5	Added language to section 5.5.2 dealing with daylight savings time setting.	5-8
06/13/11	Chapter 17	Added language to 17.1 requiring BTT's to perform PT's on instruments they have personally calibrated.	17-1
10/10/11	Chapter 4	Modified balance description and GC column descriptions. Referenced separate ethanol calibrator procedure.	4-1, 4-2

4 CERTIFICATION OF SIMULATOR SOLUTIONS

4.1 POLICY

Each external standard and QAP solution must be certified by forensic scientists prior to its distribution to breath test technicians. The forensic scientists must have a valid Blood Alcohol Analyst Permit issued by the State Toxicologist.

A minimum of three (3) analysts shall test each solution before the average solution concentration can be calculated. Typically, three (3) analysts certify each set of QAP solutions, and seven to eight (7-8) analysts certify the external standard solution. Each analyst who has results included in the final computation of the average solution concentration has certified the batch.

Batches that do not certify as specified below are not approved for use and a Test Report is not generated. However, a batch record and batch file are still produced, including documentation of why the batch did not certify.

Any adjustments or deviations from the procedures below must be approved by the State Toxicologist or the QA Manager, and appropriately documented in the batch file.

4.2 EQUIPMENT

- Balance: Denver Instrument P-203, or equivalent
- Volumetric glassware
- Class A Pipettes
- Storage bottles/containers
- Microlab 500 Autopipette, Hamilton Automatic Diluter, or equivalent
- Headspace autosampler vials, 10 mL
- Headspace autosampler crimp tops
- Cap crimper
- Cap de-crimper
- Agilent (Hewlett Packard) 7694/G1888 Headspace Autosampler or equivalent
- Agilent (Hewlett Packard) 6890 gas chromatograph; equipped with a J&W DBALC1 megabore (0.53 mm) 30 meter capillary column and/or with a J&W DBALC2 megabore (0.53 mm) 30 meter capillary column or equivalent
- Computer System equipped with Agilent (Hewlett Packard) ChemStation Software

4.3 REAGENTS

- 1-Propanol
- Sodium chloride
- 200 proof absolute ethanol (USP Grade)
- Laboratory grade deionized water (d.H₂O)
- Compressed air, helium and hydrogen

4.3.1 INTERNAL STANDARD

The Internal Standard (ISTD) is prepared as follows:

ISTD Fill a 2000 mL volumetric flask to approximately 80 % with d.H₂O. Add 20 gm sodium chloride and 0.30 mL 1-propanol to the flask. Fill to the 2000 mL line with d.H₂O. Mix thoroughly. Larger volumes of internal standard may be prepared as needed provided that the preparation details are documented.

Transfer to clean, labeled storage bottles. The internal standard can be stored at room temperature. Verification of the Internal Standard is documented on the Alcohol Standard Preparation Log and the Combined Ethanol Verification Worksheet. Verification is required prior to use. The Internal Standard expires 30 days after preparation.

4.3.2 ETHANOL CALIBRATORS

Three ethanol calibrators (CAL) are used, at concentrations of: 0.079, 0.158, and 0.316 g/100 mL

Using volumetric glassware, prepare the following:

CAL1	0.079 g/100 mL	Mix 1.0 mL absolute ethanol in 1000 mL d.H ₂ O
CAL2	0.158 g/100 mL	Mix 1.0 mL absolute ethanol in 500 mL d.H ₂ O
CAL3	0.316 g/100 mL	Mix 1.0 mL absolute ethanol in 250 mL d.H ₂ O

Transfer to clean, labeled storage bottles. Store refrigerated when not in use. Calibrators shall be brought to room temperature before use.

Verification of the Ethanol Calibrators is documented on the Alcohol Standard Preparation Log and the Combined Ethanol Verification Worksheet. Ethanol calibrators are considered approved for use when quantifying within the following, inclusive ranges.

CAL1	0.075 – 0.082 g/100 mL
CAL2	0.150 – 0.165 g/100 mL
CAL3	0.300 – 0.331 g/100 mL

Verification is required prior to use. The Ethanol Calibrators expire 30 days after preparation.

4.4 CONTROLS

Commercially prepared ethanol controls (CTRL) are purchased for use with each assay. The source and lot number of each control is documented in the Alcohol Control Log. The ethanol controls are verified according to the instructions on the Combined Ethanol Verification Worksheet. Verification is required prior to use. Controls are stored per manufacturer specifications.

Three ethanol controls are used, at concentrations of:

CTRL1	0.04 g/100 mL
CTRL2	0.10 g/100 mL
CTRL3	0.20 g/100 mL

Controls other than the aforementioned may be approved for use by the State Toxicologist or QA Manager, with appropriate documentation.

Ethanol controls are considered approved for use when quantifying within the following, inclusive ranges.

- CTRL1 0.038 – 0.042 g/100 mL
- CTRL2 0.095 – 0.105 g/100 mL
- CTRL3 0.190 – 0.210 g/100 mL

4.5 PROCEDURE FOR THE ANALYSIS OF SIMULATOR SOLUTIONS

The analyst who prepared the solution(s), and each subsequent analyst, will analyze five samplings of the aliquot taken from the original mixture (either 18 or 52 L).

External Standard Solution batches should be set up using the following sequence:

1. Blank (d.H2O, no Internal Standard added)	9. Negative Control
2. CAL 1 (0.079 g/100 mL)	10. Solution aliquot #1
3. CAL 2 (0.158 g/100 mL)	11. Solution aliquot #2
4. CAL 3 (0.316 g/100 mL)	12. Solution aliquot #3
5. Negative Control (d.H2O plus Internal Standard)	13. Solution aliquot #4
6. Control 1 (0.04 g/100 mL)	14. Solution aliquot #5
7. Control 2 (0.10 g/100 mL)	15. Control 0.10 g/100 mL
8. Control 3 (0.20 g/100 mL)	16. Negative Control

QAP Solution batches should be set up using the following sequence:

1. Blank (d.H2O, no Internal Standard added)	20. QAP 0.08 aliquot #4
2. CAL 1 (0.079 g/100 mL)	21. QAP 0.08 aliquot #5
3. CAL 2 (0.158 g/100 mL)	22. Control 0.10 g/100 mL
4. CAL 3 (0.316 g/100 mL)	23. Negative Control
5. Negative Control (d.H2O plus Internal Standard)	24. QAP 0.10 aliquot #1
6. Control 1 (0.04 g/100 mL)	25. QAP 0.10 aliquot #2
7. Control 2 (0.10 g/100 mL)	26. QAP 0.10 aliquot #3
8. Control 3 (0.20 g/100 mL)	27. QAP 0.10 aliquot #4
9. Negative Control	28. QAP 0.10 aliquot #5
10. QAP 0.04 aliquot #1	29. Control 0.10 g/100 mL
11. QAP 0.04 aliquot #2	30. Negative Control
12. QAP 0.04 aliquot #3	31. QAP 0.15 aliquot #1
13. QAP 0.04 aliquot #4	32. QAP 0.15 aliquot #2
14. QAP 0.04 aliquot #5	33. QAP 0.15 aliquot #3
15. Control 0.10 g/100 mL	34. QAP 0.15 aliquot #4
16. Negative Control	35. QAP 0.15 aliquot #5
17. QAP 0.08 aliquot #1	36. Control 0.10 g/100 mL
18. QAP 0.08 aliquot #2	37. Negative Control
19. QAP 0.08 aliquot #3	

1. Using the Auto-pipetter, extract 200 μ L of the calibrators, controls or simulator solution and 2 mL of the internal standard solution.
2. Elute the aliquot/extract into a clean, labeled 10 mL headspace vial.
3. Seal the vial tightly.
4. Between each aliquot/extract, rinse and wash the pipette tip appropriately (e.g. rinse pipette tip with diluted bleach and/or d.H₂O. Repeat if necessary). It is not necessary to rinse and wash the pipette tip in-between repeated aliquots from a single simulator solution.
5. Load and edit a sequence on the headspace gas chromatograph. Enter the blank, calibrators, controls and simulator solutions into the sequence table, and identify them appropriately under Sample Type.
6. Place each headspace vial in the appropriate position on the headspace autosampler and verify this placement against the sequence log.
7. Run sequence under method SIMALC. [Note: The method may contain a numeric suffix to differentiate between instruments; for example SIMALC1 for headspace instrument 1. All certification testing for a given simulator solution will take place on a single instrument.]
8. Upon completion of testing, analysts will initial their chromatograms and sequence table.

If two or more separate external standard solution batches are prepared close together, each batch may be certified using the same calibration and controls. For the analysis of multiple external standard solution batches and QAP solution batches, each set of 5 aliquots should be separated by a 0.10 g/100 mL control and a negative control. It is the 0.10 g/100 mL control run at the end of each set of 5 aliquots that is entered into the database.

4.6 ACCEPTANCE PARAMETERS

If the analysis of the batch meets the criteria listed below, the results for the simulator solution(s) are accepted.

- Ensure that the blank is devoid of any significant peaks
- Ensure that the negative control is devoid of any significant peaks other than the internal standard. Should the negative control read above 0.005 g/100 mL for ethanol, the analyst re-aliquots and reanalyzes their sequence
- Verify that each calibrator and control quantifies to within $\pm 10\%$ of the target values. Should one of the calibrators or controls read outside $\pm 10\%$ for ethanol, the analyst re-aliquots and reanalyzes their sequence

- Each individual external standard solution result must be within the range 0.096-0.106 g/100 mL, inclusive.
- Each individual QAP solution result must be within the ranges specified in Table 2

Table 2:	Target Vapor Concentration	Equivalent Solution Concentration	Acceptable Range (inclusive)
	0.04	0.049	0.047 - 0.051
	0.08	0.098	0.093 - 0.103
	0.10	0.123	0.117 - 0.129
	0.15	0.185	0.176 - 0.194

- Should any individual value be outside of the specified range, the analyst re-aliquots and reanalyzes their sequence. The original testing results will be retained but not used in calculations. If, in the course of testing a batch, two or more individual values are outside of the specified range, either during original analysis or re-analysis, then the batch will not be certified.

4.7 CERTIFICATION, DOCUMENTATION AND REVIEW

1. Analysts will place their chromatograms and sequence tables in the batch file. When all batch testing has been completed, a supervisor will generate the appropriate Solution Test Report which includes the average solution concentration (arithmetic mean) rounded to four decimal places, the standard deviation rounded to five decimal places, and the percent coefficient of variation rounded to two decimal places.
2. The solution meets the standards required by the State Toxicologist if:
 - i. For the external standard solution, the average solution concentration (final arithmetic mean) is within the range 0.096 – 0.106 g/100mL, inclusive
 - ii. For the QAP solutions, the average solution concentration (final arithmetic mean) is within the ranges specified in Table 3

Table 3:	Target Vapor Concentration	Equivalent Solution Concentration	Acceptable Range (inclusive)
	0.04	0.049	0.047 - 0.051
	0.08	0.098	0.093 - 0.103
	0.10	0.123	0.117 - 0.129
	0.15	0.185	0.176 - 0.194

- iii. The CV is 5% or less

3. The equivalent vapor concentration is calculated by dividing the final average solution concentration by 1.23 and rounding to four decimal places.

4. For an external standard solution, the expanded uncertainty is calculated based on the Division's policy for estimating the combined uncertainty of external standard solutions.
5. The batch file will be forwarded to a Toxicology Lab supervisor or designee for technical review. At this stage, the batch file should contain the printed Test Report, the chromatograms and sequence tables, and the Solution Preparation Worksheet.

The supervisor or designee will verify all preparation and testing dates are correctly documented, the ethanol control expiration dates have not been exceeded, individual chromatograms are initialed, all pages of the record are labeled with the batch number, the correct ethanol concentrations were entered into the Test Report, and the calibrators and controls were within the acceptable range. The appropriate QAP or ESS Test Report Calculation Record will be produced to document performance of calculations and technical review of the entire batch file.

6. Upon completion of the technical review, the batch file is returned to the analysts.

Each analyst should again verify that the preparation/testing dates and the data from their chromatograms correctly appear on the printed Test Report before signing on the corresponding signature line. Their signature will also reflect that the results are the results of tests that they personally performed.

Each analyst who certified the batch will also sign an affidavit as described in CrRLJ 6.13(c)(1), certification of simulator solution. Affidavits are placed in the batch file.

7. A technical and administrative review of the batch file will be performed by the Quality Assurance Manager or designee. The Quality Assurance Manager or designee will verify all preparation and testing dates are correct, chromatogram data is entered correctly, all chromatograms are included, accuracy and precision requirements are met, affidavits are signed and properly dated, etc. This review will be documented on the Simulator Solution Data Entry Review form, which will be added to the batch file.
8. Final solution calculations will be independently verified by the Quality Assurance Manager or designee and this verification documented on the Simulator Solution Data Entry Review form. Solution uncertainty calculations will also be verified at this time and the verification documented on the QAP or ESS Test Report Calculation Record.
9. A Toxicology Lab supervisor or designee will then perform a final administrative review and will sign and date the bottom of the Test Report indicating that the batch file is complete and the above procedures have been reviewed. The final review date will be the issue date of the Test Report and the batch. Simulator Solutions must not be distributed for use prior to this issue date.

10. The final batch file should contain:

- i. The original QAP or External Standard Test Report, signed by each analyst
- ii. The Solution Certificate Review form

- iii. Analyst's affidavits
- iv. All relevant sequence tables and chromatograms
- v. The Solution Preparation Worksheet
- vi. The QAP or ESS Test Report Calculation Record
- vii. The Simulator Solution Data Entry Review Form

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