FORENSIC CHEMISTRY UNIT

ALCOHOL ANALYSIS METHOD MANUAL

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1.0 INTRODUCTION

1.1 Description of the Analysis

A gas chromatographic method is utilized for the analysis of ethanol in blood and urine collected from living subjects only. The method includes the use of an automatic headspace sampler, flame ionization detector, and a gas chromatography data handling system. The gas chromatograph is calibrated with alcohol standards providing a calibration curve for quantitative analysis of the ethanol content in unknown samples. To obtain the analytical results, each sample is diluted with an aqueous internal standard solution. A headspace aliquot of the sample is injected into the column that separates the ethanol, the internal standard, and other volatile substances. The components pass into the flame ionization detector at different times where each is burned causing an electronic signal that is amplified and transported to the integrator. The data handling software compares the areas under the ethanol and internal standard peaks in order to quantitate the ethanol present in the sample.

1.2 Standards of Performance

1.2.1   The method is capable of the analysis of a reference sample of known alcohol concentration within accuracy and precision limits determined by the uncertainty of measurement, and Title 17.

1.2.2   The method is free from interference from anticoagulants and preservatives added to the sample.

1.2.3   The method gives test results that are always less than 0.010 grams % when living subjects free of alcohol are tested.

1.2.4   The method is capable of analyzing ethanol with a specificity that is adequate and appropriate for traffic law enforcement.

Alcohol Analysis Method Manual July 2017

2.0 EQUIPMENT

Alcohols and other volatile organic solvents will not be used to wash or rinse glassware used for alcohol analysis. All instruments used for alcohol analysis shall be in good working order and routinely checked for accuracy and precision.

2.1 Instrumentation

2.1.1   A Perkin-Elmer Clarus 500 Gas Chromatograph, with the following:
  2.1.1.1 One flame ionization detector
  2.1.1.2 One capillary column, 30m x 0.32 mm ID; 8.1 df; Restek Rtx®- BAC1
  2.1.1.3 A Perkin-Elmer headspace autosampler, Turbomatrix 110, labeled
       GCHS3
  2.1.1.4 Desktop computer with software appropriate for blood alcohol analysis and a
       printer, and one Symbol barcode reader.

2.1.2   A Shimadzu GC-2010 Plus Gas Chromatograph with the following:
  2.1.2.1 Two flame ionization detectors
  2.1.2.2 Two capillary columns, 30m x 0.32 mm ID; 8.1 df; Restek Rtx®- BAC1 and
       BAC2
  2.1.1.3 A Shimadzu HS-20 headspace autosampler
  2.1.2.4 Desktop computer with software appropriate for blood alcohol analysis and a
       printer

2.2 Laboratory Glassware

2.2.1   Volumetric Flasks, class A with matching stoppers; 100 mL, 1-liter, 2-liter.

2.2.2   Pipettes, miscellaneous.

2.2.3   Glass headspace vials suitable for use with the GC instrumentation.

2.3 Other Equipment and Supplies

2.3.1   Micropipettes: assorted sizes, hand-held.

2.3.2   Disposable tips, assorted sizes for hand-held micropipettes.

2.3.3   Dilutor/Dispenser: Capable of accurately and precisely delivering 50.0 microliters of sample and 1.00 mL of internal standard solution.

2.3.4   Refrigerator.

2.3.5   Crimping tools.

2.3.6   Aluminum crimp caps.

2.3.7   Butyl septa.

2.3.8   Tube rockers.

2.3.9   Small disposable sample cups.

2.3.10 Specimen bottles 125 mL, Nalgene or equivalent.

2.3.11 Miscellaneous items: printer paper, applicator sticks, Kimwipes®, tape, pens, markers and biohazard/sharps containers, face shields, gloves.

2.3.12 Glass stoppered bottles.

2.3.13 Sizing cylinder.

2.3.14 Gas regulators.

2.3.15 10-mL Grey stoppered Vacutainer® vials, B-D or equivalent containing 100mg NaF and 20mg Potassium Oxalate.

2.3.16 10-mL Red stoppered Vacutainer® vials, B-D or equivalent.

2.4 Gases

2.4.1   Helium, ultra-high purity (99.999%). Replace when gas pressure drops below 100 PSI.

2.4.2   Hydrogen, zero grade (99.995%). Replace when the gas pressure drops below 100 PSI.

2.4.3   Compressed Air, zero grade, flame support gas. Replace when pressure drops below 100 PSI.

2.4.4   High capacity hydrocarbon trap filters. Replace as needed.

Alcohol Analysis Method Manual July 2017

3.0 SOLUTIONS

3.1 Labeling

Solutions shall be labeled with the following information:

Name of Solution
Concentration
Lot Number (Date prepared, Ex. 8/9/16 = Lot # 080916)
Expiration Date

3.2 Solutions

3.2.1   Internal Standard Solution 0.01g%

N-Propanol Internal, Certified (Internal Standard, Fisher Scientific or equivalent)

Partially fill a class a 2-liter volumetric flask with deionized H_2O. Add 0.25 mL of n-propanol with an adjustable micropipettor. Stopper and mix. Bring to the mark with deionized H_2O. Stopper and mix thoroughly again. Label appropriately and store in the flask at room temperature.

3.2.2   Specificity Check Solution

Acetone, Certified A.C.S. Reagent, Fisher Scientific or equivalent
Methanol, GC Grade Reagent, Fisher Scientific or equivalent
Isopropanol, Spectral Grade 99.8 %, EM Industries or equivalent
Acetaldehyde, ACS reagent, Mallinckrodt or equivalent
Ethanol, 200 proof, Roseville or equivalent

Label five 2-liter volumetric flasks with the following: acetaldehyde, methanol, isopropanol, acetone, and ethanol.   Partially fill each with deionized H_2O. With an adjustable micropipettor and clean disposable tips for each solution, pipette 0.25 mL each of acetaldehyde, methanol, isopropanol, acetone, and 0.40 mL absolute ethanol into the appropriately labeled flask. Stopper and mix each flask. Bring the contents of each flask to the mark with deionized H_2O. Stopper and mix each flask thoroughly again. Analyze the solutions to determine the retention time of each analyte. The solution can be stored in labeled, capped glass bottles at Room Temperature indefinitely. Analyze the solutions when necessary to determine the retention time of each volatile. This information is used to determine the identities of the peaks in the mixed specificity check solution.

Partially fill a 2-liter volumetric flask with deionized H_2O. With an adjustable micropipettor and clean disposable tips for each reagent, pipette 0.50 mL each of acetaldehyde, methanol, isopropanol, acetone, and 0.80 mL absolute ethanol into the flask. Stopper and mix. Bring contents of the flask to the mark with deionized H_2O. Stopper and mix thoroughly again. Transfer the solution to red stopper vials using a winged infusion set. Label vials appropriately. The approximate ethanol concentration in the mixture is 0.030 grams %. Store at 2 to 8°C indefinitely after transferring to glass vials (see 3.2.3).

3.2.3   Procedure to Transfer Solutions from Flasks to Vacutainers®

Equipment Required
Two winged infusion sets
Two Vacutainer® holders
Metal weight covered with parafilm
Two Leur adapters
Each winged infusion set is connected to a Vacutainer® holder by means of a Leur adapter. The tubing is cut just above the needles and the needles are disposed of in a sharps container. The tubing is held together in three places with Parafilm. The weight is attached near the cut end of the tubing with Parafilm. The tubing of the specially adapted winged infusion sets are dropped into the container containing the solution. One Vacutainer® tube is pushed into each of the adapters in the Vacutainer® holder. The suction created by the vacuum draws the solution until the tubes are full. The use of two holders allow two Vacutainer® tubes to be filled with the solution at the same time. The first two tubes filled with the solution will be discarded as they serve the purpose of flushing the transfer equipment. After the tube fills, another tube is used repeating Step C and Step D. See Figure 1.

Figure 1

WINGED INFUSION SET ADAPTED FOR TRANSFER OF ALCOHOL SOLUTIONS INTO VACUTAINER® TUBES
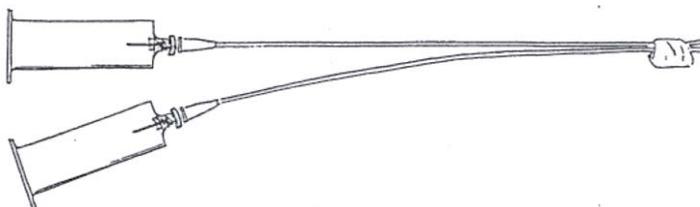
3.2.4   Purchased Calibration Standards:

Alcohol Analysis Method Manual July 2017

Purchased standards from Radian, Cerilliant, or equivalent, at various concentrations including 0.100g%, 0.200g%, and 0.300g% ethanol. Standards must be Certified Reference Material (CRM) with values traceable to NIST Standardized Reference Material (SRM).

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4.0 INSTRUMENT PREPARATION AND SAMPLE ANALYSIS

4.1 Calibration Procedure

This method is calibrated with a minimum of three levels of secondary alcohol standards, analyzed in duplicate, with the calibration forced through zero. The standards are purchased as Certified Reference Material (CRM) with values traceable to NIST Standardized Reference Material (SRM).

The software calculates the calibration of the gas chromatograph from the analysis of the secondary alcohol standards. The results are reported to four decimal places for each standard, and the mean of the duplicate result defines one point on the calibration line.

The Fit Analysis Output report is shown on the calibration curve. See Figure 2.

Examination of the reported approximate values of the 0.050%, 0.080%, and 0.400% CRM controls will show whether the secondary alcohol standards were calibrated correctly. A whole blood ethanol control analyzed in duplicate will demonstrate no matrix effects on the method. All of the controls will be tracked to monitor trends and possible effects of materials on the method.

Alcohol Analysis Method Manual July 2017

Figure 2

Page 1 of 1

Fit Analysis Output For Method File: C:\TC\METHOD\NISTFORCEGC3
Reprocess Number : sdpd-com1: 14713
Component Name : Ethanol
Date : 6/30/2017 10:11:48 AM

Curve Type

Curve Parameters:

Curve #1: 1st Order - Force Origin
Weighting Factor = 1 (No Weighting)   R-Squared = 0.999798
Calibration Curve : Y = (2.681712) X

Curve #1 :

Level Name	Observed X-Value	Calculated X-Value	Delta	%Diff.	Observed Y-Value	Calculated Y-Value	Delta	%Diff.
1	0.100000	0.099273	0.000727	0.732	0.266223	0.268	-0.002	-0.727
1	0.100000	0.099269	0.000731	0.736	0.266212	0.268	-0.002	-0.731
2	0.200000	0.200025	-2.514e-05	-0.013	0.536410	0.536	0.000	0.013
2	0.200000	0.200428	-4.279e-04	-0.213	0.537490	0.536	0.001	0.214
3	0.300000	0.301946	-0.001946	-0.644	0.809731	0.805	0.005	0.649
3	0.300000	0.2	0.001762	0.591	0.799788	0.805	-0.005	-0.587

Ethanol

~0.30% standard

~0.20 standard

~0.10% standard

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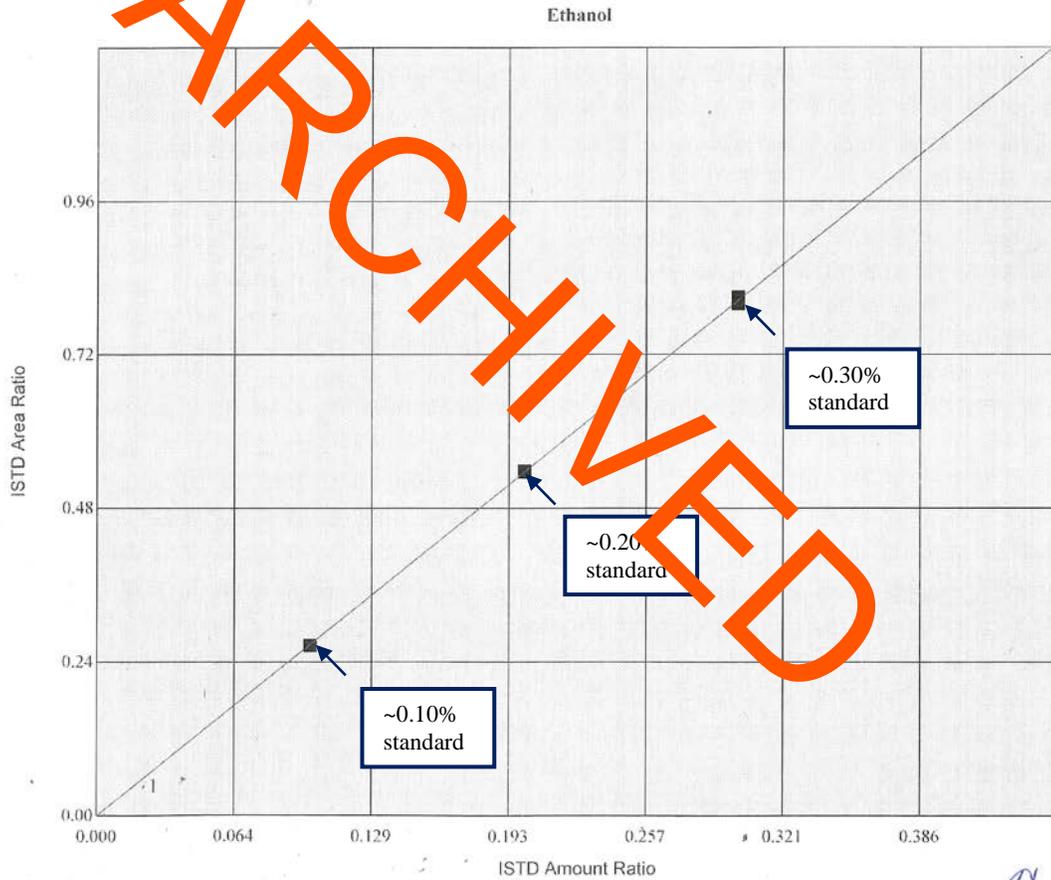
4.2.1   Purchased Control Solutions
The 0.050g%, 0.080g%, and 0.400g% controls are purchased as Certified Reference Material (CRM) with values traceable to NIST Standardized Reference Material (SRM), and are of different lots than those of the alcohol standards. A whole blood ethanol control purchased from Cliniqa or similar, or prepared in-house with a mid-range ethanol content of 0.05g% to 0.10g%. The whole blood ethanol control will be in the same grey top tubes as subject samples.

4.2.2   Frequency of Analysis of Controls
For each day of analysis, and on any runs performed on that analysis day, the instrument shall be calibrated. With _each_ batch of samples, controls including 0.050g%, 0.080g%, 0.400g%, and a whole blood ethanol control will be analyzed. The controls will be run prior to the samples, and the 0.080g% will be run at the end of the batch of samples.

4.2.3   Acceptable Limit of Variation of Controls:
The range of acceptable results for sample at 0.100g% and above is the value of the control +/- the Uncertainty of Measurement at a 95% confidence interval not to exceed +/- 5% of the known value. The range of acceptable results for samples under 0.100g% is +/- 0.005 of the known value. If the result of a control is outside the range of acceptable results, the method shall be regarded to be in error. No samples shall be analyzed and reported until this error has been corrected as shown by the return of the controls to values within acceptable limits.

4.2.4   Internal Standard Blank:
A reagent blank containing only the internal standard solution will be included on the run prior to the subject samples.

The blank is used to verify that there is no ethanol contamination of the vials, internal standard solution, or process. If any discernable, well-formed peak other than the n-propanol peak is noted, the run will be rejected. The analyst must determine the cause and take corrective action.

4.2.5   Specificity Check Solution (SCS)

A specificity check solution containing a mixture of acetone, ethanol, methanol, acetaldehyde, and isopropanol will be analyzed with every run. The instrument must be capable of detecting all five components of the specificity check solution. If any of the five components, in addition to the internal standard, are not detected, determine the cause and take corrective action.

4.3 Obtaining Samples for Analysis

Samples are obtained from the Narcotics Vault located in the laboratory on the 5th floor. The samples are signed out by the analyst from vault personnel using the FileOnQ system.

4.4 Order of Sample Analysis

Subject samples are generally analyzed in the order of their assigned barcode numbers. Felony or special request samples may be run out of order.

4.5 Preparation of a Sample Worksheet

Samples must be imported into the Narcotics and Alcohol database from FileOnQ, and subsequently exported into an analysis worksheet using the following procedure.

Open the Narcotics and Alcohol Database and click the "Scan Barcodes" button. A window will appear. Scan each of the barcodes from each of the sample labels or type the numbers. The sample numbers will appear in the larger window.

Click the "Import" button. There will be no changes to the appearance of the window at this point. After waiting a few seconds, click the "Export" button. An Excel sheet will automatically populate with the Barcode Number, Blood Draw Date, and Subject Name from each of the exported samples. Close the Import/Export window.

Highlight all samples in the Excel file and copy then paste them into the alcohol analysis worksheet template located on the G drive. Type or hand-write in the charge, and number of vials. Use the worksheet to prepare the sequence list for the gas chromatograph computer set-up and as the notes page(s).

4.6 Preparation of the Gas Chromatograph for Analysis

4.6.1 The current validated or verified methods for each instrument along with the settings will be maintained in a binder in the Forensic Chemistry Unit.

Note: Before making any GC parameter changes on the Perkin Elmer instruments, you must release control of the instrument from the computer. Do this on the main computer screen with the TurboChrom Navigator program. **Release Control** is under **RUN** on the toolbar. You must regain control after making changes by choosing **SEIZE** under **RUN** on the toolbar prior to starting a run.

4.6.2 Lighting the GC Detector PE Clarus 500
Before lighting the detector, verify that the gas tanks have a minimum gas pressure of 200 psi of gas.

Ensure that the hydrogen, and helium tanks are open by checking that the valves attached to the copper tubing are parallel. Turn the air valve about ¼ turn and press light on the headspace screen until the flame lights. Open the air valve all the way.

Alcohol Analysis Method Manual July 2017

At the completion of analysis release control, turn off the gasses by turning the air and hydrogen perpendicular to the tubing.

| 4.7 | Preparation of the Perkin Elmer Gas Chromatograph Computer for Analysis |

Desktop Computer with TotalChrom Workstation Software Version 6.3.2

4.7.1 Setting up a DATA Pathway

If TotalChrom Navigator is open, click the "x" button in the top right corner. Icons on the windows desktop should now be displayed.

Double click on the **Shortcut to Data Folder**
Make a folder for your name if you don't already have one (Click **File** and then Select the **New** option and another menu will appear.) Select the **Folder** option. A brand new folder will appear on the screen. It will have no name. Right click on this new unnamed folder. Select **rename folder** from the options. Type in your name and then click to side of the folder to activate the new name. Double click on your name folder to create a new folder for the analysis you are doing To close, click the "x" button in the top right corner. You should now be back on the desktop.

Double click on the **Shortcut to Sequence Folder.**
Repeat the same steps listed above to create a name folder, then save your current sequence.
To close, click the "x" button in the top right corner. You should now be back on the desktop.

4.7.2 Building a Run

Double click on **TC Nav**.
The <TotalChrom screen will appear.
Click on **Build Sequence**; this will bring up the <Start up Screen.

Select **Load Recently Edited Sequence**. Click on **Sequence** from the list in the text box and click **OK**. Alternatively, you can choose **Load Seq Stored on Disk** (the hard drive). This will lead you to the templates folder. Select a NISTFORCE template as is appropriate.

The <Sequence Information > screen will now appear. Enter your run information on this template by scanning in the sample barcodes using the barcode reader, or by typing them. After you have finished entering your run information, delete the unused portions by highlighting the gray numbers on the left of the screen and pressing **Delete**.

4.7.3 Saving a Sequence

Alcohol Analysis Method Manual July 2017

After you have deleted the unused portion of your sequence template, go to the top tool bar and select **File**, then **Save As**. Under **Descriptions**, Click **OK.** Click on the pull down arrow next to **Save In.**   Select **Sequence** and double click on your name followed by the analysis folder. Name your sequence and click **Save**. Print out the sequence file. Make sure to deselect **Process Information** so that only the sequence sample descriptions are printed.

4.7.4   Setting up the Instrument for a Run

Click on **Actions** at the top of the screen, and then click on **Set Up**.
Click the square box in the middle of the screen marked **Store Data in the above Paths**. This will allow you to edit the Raw and Results file pathways.

First the pathway box marked **Sequence** should have your pathway showing (Example: c:\sequence\your name\today's date\ today's date with either an a, b, or c.) Click on the folder icon next to the side of the box where the Raw Pathway is written. This will bring up an explorer window. Go to C: Data. Click on your name, click on the month, today's date, and then click OK. This brings you back to the <Setup Instrument> screen. Do the same for the Result Pathway. Then click OK at the bottom of the <set up instrument> panel. This will bring you back to the <TotalChrom GCHS3 screen. You are now finished setting up the computer for the run.

The Status box will turn from red to green indicating the instrument is ready for analysis.

4.8 Preparation of the Samples for Analysis

4.8.1   Non-Compliant Samples

4.8.1.1 Clotted whole blood samples in red top tubes will be homogenized as best as possible, then the blood will be analyzed as a regular blood sample.

4.8.1.2 Add sodium fluoride/potassium oxalate to unpreserved samples. If the sample is a serum/plasma sample or a whole blood sample, which has been collected in a vial with no anticoagulant/preservative or the incorrect anticoagulant/preservative, add the sodium fluoride/potassium oxalate from a new gray stoppered Vacutainer tube directly into the unpreserved sample vial, or transfer the sample to a new grey top tube. Indicate the addition of preservative or tube transfer in the analysis notes.

4.8.1.3 If the sample is urine that was not collected with a preservative, add a scoop (weighing approximately 0.9 grams) of sodium fluoride from the sodium fluoride reagent container, directly into the sample.

4.8.2   Prior to sampling, gently mix the samples on a tube rocker for at least 10 minutes, allowing the samples to mix thoroughly.

4.8.3   For the Perkin Elmer instrument check the headspace vials with a sizing cylinder prior to use. See Figure 3. They must fit easily without protruding out the bottom of the cylinder. Size enough vials for the entire run.

Figure 3

4.8.4   The dilutor settings should be set to add 50 µL of the sample followed by 1000 µL of internal standard.

4.8.5   Ensure that enough internal standard is in the reservoir to prepare all the calibration and subject samples for the entire run.

4.8.6   Prime the internal standard solution through the dilutor a minimum of five times. This will remove all air bubbles and add fresh solution in the syringe and tubes.

4.8.7   If necessary, wipe the pipette tip clean with a tissue to remove excess liquid. Be careful to avoid touching the end of the pipette tip.

4.8.8   Only one subject sample will be open at any time during the sampling procedure. Universal biohazard precautions should be taken at all times.

4.8.9   Remove the blood vials from the chain of custody tubes. Use the "Safe Needle" guard with a syringe on blood and control vials to extract the vial contents and dispense the sample into a small disposable sample cup (0.5 mL).

4.8.10 Use a plastic transfer pipette to transfer urine samples into a small disposable sample cup. Samples for duplicate analysis will be taken from the aliquot in the cup. Ensure the cup is discarded prior to obtaining the next sample.

4.8.11 Place the pipette tip into the sample to be analyzed. Push the button on the handle to activate the dilutor sampling. Remove the pipette tip from the solution and wipe the sides of the pipette with a tissue. Be careful to avoid touching the end of the pipette tip.

Alcohol Analysis Method Manual July 2017

4.8.12 Place the pipette tip into the appropriate headspace vial. Push the button on the pipette handle again to dispense the liquid into the vial. Both the sample and the internal standard are expelled into the test vial for analysis. Do not let the tip contact the liquid as the vial fills.

4.8.13 Stopper the headspace vial with a gray butyl stopper and aluminum crimp cap. Seal the vial with the electronic crimper.

4.8.14 Ensure the vial bottle or cap is labeled to correspond with the sample being analyzed.

4.8.15 Wipe the pipette tip clean and repeat the steps for duplicate samples.

4.8.16 Immediately before or after dispensing into a headspace vial, the analyst will do the following: Verify the laboratory number and sample name on the worksheet against the sample and write a unique identifier on the headspace cap or vial. Initial and date the sample barcode label in the appropriate space.

4.8.17 Following the order listed on the worksheet or sample sequence table, use the diluter/dispenser to aspirate the sample, then dispense internal standard along with the sample into a sample vial.

4.9 Preparation of the Perkin Elmer Autosampler for the Sample Run

Mix the samples by swirling the contents of the headspace vials. Load the vials into the autosampler carousel according to the identifying numbers on the vials, and corresponding to the worksheet or sequence list, careful not get liquid near the crimp cap

4.9.1 Using the pen stylus, press the RUN icon at the top of the screen on the autosampler. The screen will display the range of vials to be analyzed, e.g., 1 to 50. Touch the + or – icons on the screen until the number of vials matches the number of samples to be analyzed. The screen will also display the method used. Load the autosampler with vials. Use the rotate key to facilitate loading the tray. Once loaded touch the **Run** key. You may check the autosampler parameters by touching the status key at the top of the screen.

4.10 Returning Samples after Analysis

Discard the headspace vials at the completion of the run.

The blood vials are returned to their chain of custody tubes and re-sealed. Urine containers are re-sealed. The seals are initialed and dated, with the initials and/or date crossing the tape onto the container. The samples are returned to the vault for storage.

Alcohol Analysis Method Manual July 2017

5.0 Preparation and Calculation of Analytical Results

5.1 Preparation of Results

Each run packet is placed in a file folder labeled with the analyst's initials and date of analysis. The packet consists of the following:

5.1.1 Notes pages and alcohol analysis report plus any other reports or administrative documents generated during analysis.

(The following printouts are recovered from the software)

5.1.2 Sequence table

5.1.3 Chromatograms of the calibration set, quality controls, and the samples, including concentrations, retention times, and names of component peaks.

5.1.4 Fit Analysis Output reports for the method file (calibration curve), i.e., duplicate secondary alcohol standards at 0.100g%, 0.200g% and 0.300g% grams %.
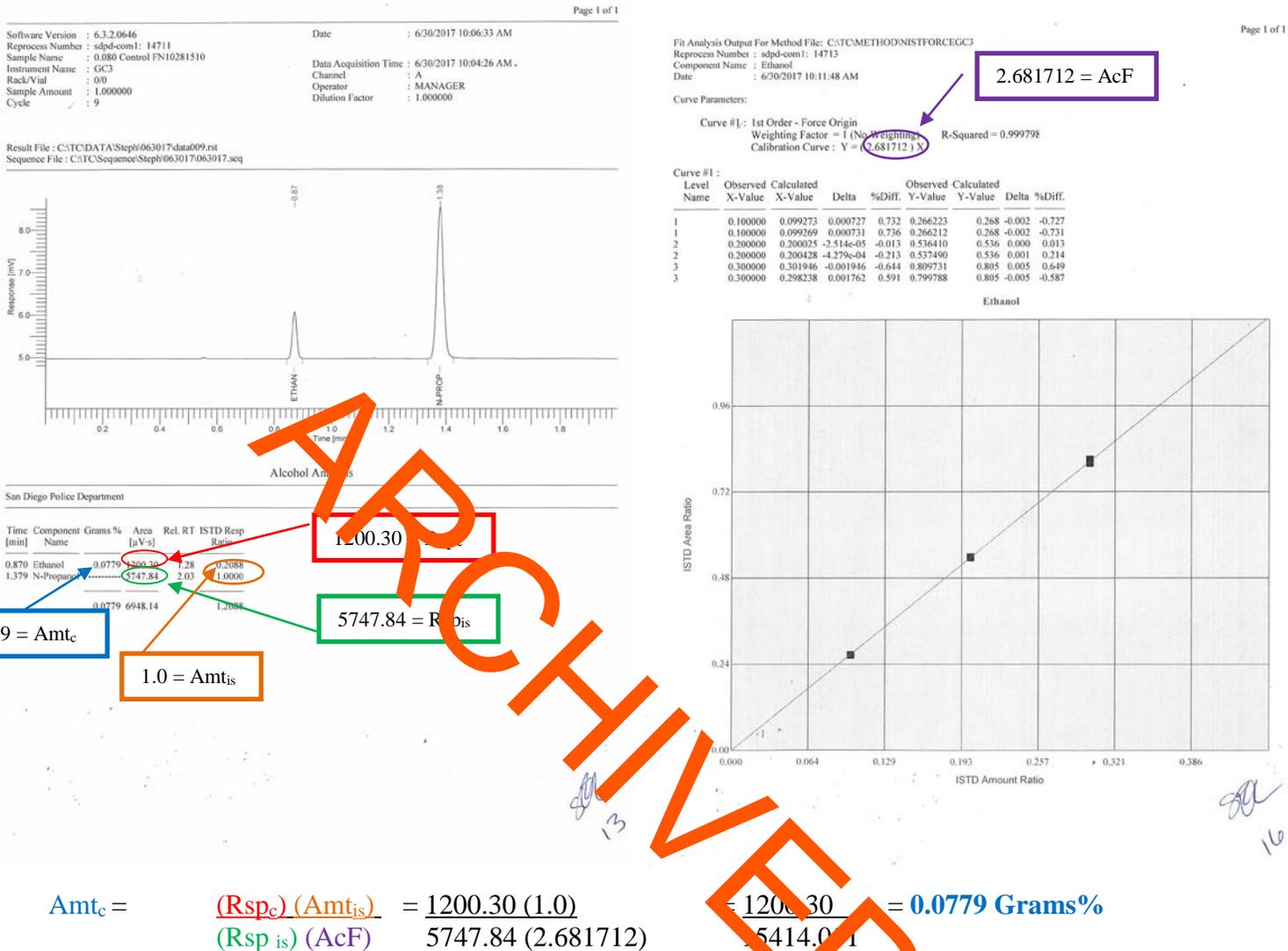
5.2 Perkin Elmer Calculations

5.2.1 The calculations below are performed by the software.
To calculate the raw results for the concentration of the unknown (ethyl alcohol) by way of an internal standard (n-propanol); the following equation is used.

$$Amt_c = \frac{(Rsp_c)(Amt_{is})}{(Rsp_{is})(AcF)}$$

Amt$_c$ =	Unknown concentration of the component (grams %)
Rsp$_c$ =	peak area of the ethyl alcohol peak.
Rsp$_{is}$ =	peak area of the internal standard.
Amt$_{is}$ =	concentration of the internal standard grams %
AcF =	average calibration factor for the run.

Alcohol Analysis Method Manual July 2017

Figure 4

$$\text{Amt}_c = \frac{(\text{Rsp}_c)\,(\text{Amt}_{is})}{(\text{Rsp}_{is})\,(\text{AcF})} = \frac{1200.30\,(1.0)}{5747.84\,(2.681712)} = \frac{1200.30}{15414.001} = \mathbf{0.0779\ Grams\%}$$

5.3 Documentation of Data by the Analyst

The following data is recorded on the worksheet by the analyst.

5.3.1   Control Results
Record the 4-decimal place control results (Amt_c – see example in Figure 4) from the chromatograms onto the notes pages. Truncate the result to 3 decimal places.

If the control results do not fall within established limits, the run is invalid and must be repeated.

5.3.2   Subject Results

Record the 4-decimal place subject results from the chromatograms onto the notes pages. Determine the average of duplicate results, truncate to 3 decimal places, then apply the uncertainty percentage to calculate the high and low value. Verify that the duplicate results are within the range.

If the subject results are not within the required range, the results will not be reported. In place of a result, the analyst will write "repeat" in the results column. Repeat analyses will be noted on the notes on the subsequent run.

Report the average of the duplicate results to 3 decimal places.

Second void final urine results are divided by 1.3. The numerical results are reported as the "Blood Alcohol Result" in grams%. If the urine sample collected was from a first void, or if the void is unknown, the result will be reported as positive or negative only, with no numerical result included in the "Blood Alcohol Results" column. Document the void in notes.

Serum or plasma results are divided by 1.1. The results are reported as the "Blood Alcohol Result" in grams%.

Blood alcohol concentrations less than 0.0100 grams% in living subjects are reported as negative (0.000 grams %) per Title 17 requirements.

Indicate in the notes any discrepancies and/or irregularities regarding the sample or sample conditions, such as the addition of sodium fluoride.

Indicate the date of analysis and initial notes pages. Number and initial all remaining pages, initial and date all other analysis components. The Alcohol Analysis report must have the 3 decimal results, date of testing, and signature.

5.4 Additional Forms

5.4.1   Toxicology Forms

DUI alcohol sample results less than .100 g% will be submitted for drug testing. If a toxicology request form has not already been submitted by the arresting officer, the analyst will prepare one using FileOnQ, checking the boxes labeled "Drug Testing," "Prescription Drugs," and the box "OK to stop further testing if general panel is positive." The form is printed in FileOnQ by selecting "Reports" from the menu bar, then "External Reports" from the drop down menu, then "Bio Tox Lab."

If the alcohol results are $\geq$ 0.100g%, and no justification was provided to test for drugs other than alcohol, the sample will not be sent for toxicology testing.   If the alcohol

results are > 0.100g%, and there are charges **other** than 23152, depending on the BAC level, and the charges, the officer's request will be evaluated before sending the sample to toxicology. These forms will be sent by vault personnel along with relevant samples to the contract toxicology laboratory.

5.4.2   Sex Crimes Forms

Information from the sex crimes request form and/or sample is recorded on the Alcohol Analysis Results form. Include the alcohol results on the form. This form is included in the alcohol packet with a copy sent to the appropriate detective.

5.4.3   Non-Compliance Forms (DUI related arrests only)

Information from the FileOnQ system and/or sample is used to generate this form. Incorrect blood sample vials and unmarked urine voids are examples for the use of the non-compliance form. Include the alcohol results on this form if feasible. This form is forwarded to the detective, city or District Attorney's office, and included in the alcohol packet.

5.4.4   Proficiency Test Forms

Proficiency sample results are reported as required by the proficiency provider, or following laboratory reporting procedures. Forms that were provided by the testing agency are filled out as appropriate, and turned in to the quality assurance manager via the supervisor.

5.5 Distribution of Results

The entire packet (reports and run packet) is scanned and retained electronically. The hardcopy of the entire packet is retained according to the General Laboratory Quality Assurance Policies.

The Clerical Unit disseminates the results/packet as appropriate, to:

City Attorney's Discovery Desk		Entire Packet
South Bay District Attorney's Office Reception		Entire Packet
Department of Motor Vehicles		Alcohol Analysis Report except non-DUI subjects
Individual Requestors		Original Request with the Report Page

6.0 ADDITIONAL ANALYSES

6.1 Beverage Sample Analysis

Beverage samples are analyzed by the same heated headspace chromatographic method as used for blood and urine alcohol analysis, with at least one additional dilution step in the sample preparation when necessary.

6.1.1   Preparation of Beverage Samples

Samples of suspected alcoholic beverages are submitted through the property room along with completed Beverage Analysis Request Forms.

Requests from the vice unit for beverage analysis, and from homicide and other units for analysis of unknown liquids are entered into the FileOnQ system by the requestor. Beverage samples are retrieved from, and returned to the property room. Unknown liquids are retrieved from and returned to the 6th floor vault.

Beverage samples are analyzed in duplicate. Duplicate values must be within 5% of each other.

Samples are diluted using the dilutor in the same manner as performed for blood and urine samples, and dispensed into a clean headspace vial. The diluted sample should be again diluted into another headspace vial to produce a 1:21 dilution.
The 1:21 diluted sample/s is carried through the remainder of the analysis procedure for blood and urine samples.

6.1.2   Calculations

The analytical result is treated the same as a blood result, with the exception that the final answer is multiplied by 21 to account for the dilution factor, and converted to v/v % for alcoholic beverages. Further dilutions may be required for some samples.

The gram% result is converted to percent by volume as it is defined in the Business and Professions Code #23004 which states:

> "Alcoholic Beverage" includes alcohol, spirits, liquor,
> wine, beer, and every liquid or solid containing alcohol,
> spirits, wine, or beer, and which contains one-half of 1
> percent or more of alcohol by volume and which is fit for
> beverage purposes whether alone or when diluted, mixed,
> or combined with other substances.

Alcohol Analysis Method Manual July 2017

The beverage sample calculations are based on this definition:

The relationship between the beverage percent unit (v/v) and the forensic blood alcohol concentration percent unit (w/v) is as follows:

Conversion Formula: **% (v/v) = g% / density,**

or

% (v/v) equals the gram % (w/v) divided by the density (0.789).

Example: if the GC result is 0.500g/100ml x 21 = 10.500g/ml, divide this result by 0.789 for the density (10.5 g/ml÷0.789 g), which gives the result 13.308 % (v/v).

Alcohol by volume is approximately 13.3% v/v, consistent with an alcoholic beverage. Results should be reported to one decimal place.

6.1.3   Reporting of Beverage Sample Results to the Vice Unit

For the vice unit, the results will also be reported as follows:

- No ethyl alcohol was detected in the sample, or,
- Ethyl alcohol is present in the sample in a concentration less than 0.50% ethanol by volume, or,
- The sample contains ethyl alcohol in a concentration of 0.50% or more ethanol by volume.

Following technical and administrative review, reports will be sent to the detective. The case packet will include a copy of the report, and all printouts and information related to the case.

The Forensic Chemistry Supervisor will enter the case completion information into the laboratory database.

7.0 GAS CHROMATOGRAPH/HEADSPACE INSTRUMENT MAINTENANCE AND REPAIR

7.1 Out of Service instruments

7.1.1 When an instrument is not functioning properly and requires repair, the instrument is to be taken out of service for casework analysis. An "out of service" sign will be attached to the instrument until the problem is rectified and the instrument is proven to be functioning correctly.

7.1.2 After the instrument problem has been repaired, a set of standards and controls, consistent with the habitual samples normally run at the beginning of all casework analysis, will be independently run. These samples will be assessed to ensure that the instrument is functioning properly. Casework samples may not be included on this assessment run. The verification of instrument performance will be noted on the instrument maintenance log.

7.2 Forensic Chemistry Unit criminalists will perform general maintenance on the Gas Chromatograph Headspace instruments. This maintenance will be recorded on the instrument maintenance log.

7.3 The Forensic Chemistry Unit (FCU) has a contracted service provider for instrument service and repair.

7.3.1 Check with the Forensic Chemistry Supervisor or the Clerical Administrator for the current contract provider.

7.3.2 Approval for service is required through the Clerical Administrator prior to scheduling a service call with the contracted provider.

7.3.3 Service performed is recorded in the instrument maintenance log.