

Alaska Scientific Crime Detection Laboratory

Forensic Alcohol Estimate of the Uncertainty of Measurement - Update

Issued: 4/27/2015

Beverage Ethanol

Changes to previous uncertainty components

Replicate Agreement Requirement (Std Unc_{Replicates})

No changes were made for this component.

Certificate of Analysis - Calibration Reference Standards (Std Unc_{stds cals})

No changes were made for this component.

Certificate of Analysis - Control Reference Standards (Std Unc_{stds ctrls})

No changes were made for this component.

Addition of new uncertainty components

Beverage QC Reproducibility Data (%RSD)

A beverage check standard (Barefoot[®] Moscato with a labeled concentration of 9% abv) was analyzed using the currently approved method during the timeframe of 1/13/15 to 3/24/15. This data was collected to better address the uncertainty associated with pre-dilution of beverage alcohol samples.

A total of 17 replicate analyses were made. These analyses were performed by all approved analysts on both headspace gas chromatographs. The same dilutor (Wilma) was used for beverage pre-dilution (100 times dilution) and the same dilutor (ML600-1) was used for final sample preparation in each of these analyses.

The replicate values (truncated to 4 decimal places) were averaged and the result was truncated to 3 decimal places. The data is provided on Table 1. This value (g/100 mL) was then converted to ethanol concentration in % (v/v) by multiplying by 100 (the dilution factor) and dividing by 0.789 g/mL (the density of ethanol). Finally, this concentration was truncated to one decimal place. Note that this is the same procedure used when determining beverage alcohol concentrations in case work.

The percent relative standard deviation of the calculated beverage alcohol concentrations was used for the uncertainty component:

N	17
Mean (% v/v)	8.49
Std. Dev. (% v/v)	0.10
RSD (%)	1.2114

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Removal of previous uncertainty components

Aqueous (0.025 g/100 mL) QC Reproducibility Data (%RSD)

The new Beverage QC Reproducibility Data addresses all individual uncertainty components listed in the 2013 uncertainty report that were originally addressed by the Aqueous (0.025 g/100 mL) QC Reproducibility Data.

Dilutor Calibration (Std Unc_{left} and Std Unc_{right})

Because the new Beverage QC Reproducibility Data includes any variability from the pre-dilution process, addressing that component with dilutor calibration certificates is no longer needed.

Combined standard uncertainty using component updates

The following table summarizes changes made to component values and the new estimated combined uncertainty (items that changed are highlighted).

Uncertainty Component	2014	2015
%RSD (Aqueous 0.025 g/100 mL)	2.1868	Removed
%RSD (Beverage Working Standard)	Not Used	1.2114
Std Unc _{Replicates}	1.7321	1.7321
Std Unc _{stds cals}	0.175	0.175
Std Unc _{stds ctrl}	0.175	0.175
Std Unc _{left}	0.5774	Removed
Std Unc _{right}	0.5774	Removed
Combined Uncertainty (k=2)	5.8343	4.2562

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Reported uncertainty

The expanded combined standard uncertainty rounded to 2 significant figures is:

$$\text{Expanded Combined Standard Uncertainty} = \pm 4.3\%$$

This is a decrease when compared to last year's estimated measurement uncertainty.

Beverage cases will now be analyzed along with the beverage check standard to continue monitoring this method's measurement uncertainty.

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Table 1

Date	Analyst	Instrument	Diluter	Control	Lot	Value	Average	ABV
1/13/2015	CRF	HS2	ML600-1	Beverage	1	0.0679		
1/13/2015	CRF	HS2	ML600-1	Beverage	1	0.0683	0.068	8.6
1/13/2015	CRF	HS2	ML600-1	Beverage	1	0.0682		
1/13/2015	CRF	HS2	ML600-1	Beverage	1	0.0685	0.068	8.6
1/20/2015	COB	HS1	ML600-1	Beverage	1	0.0676		
1/20/2015	COB	HS1	ML600-1	Beverage	1	0.0681	0.067	8.4
1/20/2015	COB	HS1	ML600-1	Beverage	1	0.0680		
1/20/2015	COB	HS1	ML600-1	Beverage	1	0.0683	0.068	8.6
1/27/2015	BMB	HS2	ML600-1	Beverage	1	0.0676		
1/27/2015	BMB	HS2	ML600-1	Beverage	1	0.0679	0.067	8.4
1/27/2015	BMB	HS2	ML600-1	Beverage	1	0.0681		
1/27/2015	BMB	HS2	ML600-1	Beverage	1	0.0673	0.067	8.4
2/6/2015	CRF	HS2	ML600-1	Beverage	1	0.0681		
2/6/2015	CRF	HS2	ML600-1	Beverage	1	0.0677	0.067	8.4
2/6/2015	CRF	HS2	ML600-1	Beverage	1	0.0687		
2/6/2015	CRF	HS2	ML600-1	Beverage	1	0.0688	0.068	8.6
2/6/2015	BMB	HS1	ML600-1	Beverage	1	0.0669		
2/6/2015	BMB	HS1	ML600-1	Beverage	1	0.0675	0.067	8.4
2/6/2015	BMB	HS1	ML600-1	Beverage	1	0.0679		
2/6/2015	BMB	HS1	ML600-1	Beverage	1	0.0681	0.068	8.6
2/17/2015	COB	HS2	ML600-1	Beverage	1	0.0684		
2/17/2015	COB	HS2	ML600-1	Beverage	1	0.0680	0.068	8.6
2/17/2015	COB	HS2	ML600-1	Beverage	1	0.0687		
2/17/2015	COB	HS2	ML600-1	Beverage	1	0.0682	0.068	8.6
2/23/2015	COB	HS2	ML600-1	Beverage	1	0.0674		
2/23/2015	COB	HS2	ML600-1	Beverage	1	0.0679	0.067	8.4
2/23/2015	COB	HS2	ML600-1	Beverage	1	0.0684		
2/23/2015	COB	HS2	ML600-1	Beverage	1	0.0675	0.067	8.4
3/18/2015	COB	HS1	ML600-1	Beverage	1	0.0687		
3/18/2015	COB	HS1	ML600-1	Beverage	1	0.0682	0.068	8.6
3/24/2015	bmb	HS1	ML600-1	Beverage	1	0.0666		
3/24/2015	bmb	HS1	ML600-1	Beverage	1	0.0679	0.067	8.4
3/24/2015	bmb	HS1	ML600-1	Beverage	1	0.0682		
3/24/2015	bmb	HS1	ML600-1	Beverage	1	0.0670	0.067	8.4