Compendium of Analytical Laboratory Methods for Food and Feed Safety: Chemical Analytical Manual (CAM)

METHOD NUMBER: C-005.02

POSTING DATE: 2/1/2019

POSTING EXPIRATION DATE: **1/31/2021**

PROGRAM AREA: Chemical Contaminants and Toxins

METHOD TITLE: Determination of Pentobaribital in Tallow, Wet Dog Food, Dry Dog Food and Horsemeat Using Liquid Chromatography Tandem Mass Spectrometry

VALIDATION STATUS: Level 2, Single laboratory validation

AUTHOR(S): Tara J. Nickel and Christine R. Casey, US FDA Office of Regulatory Affairs/Office of Regulatory Science/Office of Food and Feed Laboratory Operations/ Denver Laboratory

METHOD SUMMARY/SCOPE:
Identification and quantitative determination of pentobarbital in tallow and other grease products of animal origin using Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS), using the negative electrospray ionization (ESI) mode. Pentobarbital is extracted from a homogenous portion of tallow, wet dog food, dry dog food, or horsemeat using acetonitrile. After centrifugation, the supernatant is diluted 1:1 with water and analyzed via LC-MS/MS using a solvent standard curve. Deuterated pentobarbital (pentobarbital-D5) is used as an internal standard (I.S.) to correct for sample matrix suppression and/or loss of analyte. Identification of pentobarbital in a sample is based on both correlation of pentobarbital chromatographic retention time (RT) with that of a standard and ion ratio match.

Analytes(s): Pentobarbitol

Matrices: tallow and other grease products of animal origin, horsemeat, wet (canned) dog food, and dry dog food.

REVISION HISTORY: Revised 7/18/2019. Revision expanded the scope of method from tallow and grease products to include horsemeat, wet (canned) dog food, and dry dog food.

1. Purpose & Scope

The objective of this work instruction is to provide direction on the routine quantitative determination of pentobarbital as described in LIB 4648 for use in samples of tallow, horsemeat, wet (canned) dog food, and dry dog food using LC-MS/MS. Complete method performance details and validation data is summarized in the FDA QMiS Denver Lab (DENL) validation summary reports (RPRT- 00055, RPRT- 000060, RPRT-00089).

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2. Procedure

2.1 Summary of Method

Pentobarbital is extracted from a homogenous portion of tallow, wet dog food, dry dog food, or horsemeat using acetonitrile. After centrifugation, the supernatant is diluted 1:1 with water and analyzed via LC-MS/MS using a solvent standard curve. Deuterated pentobarbital (pentobarbital-D5) is used as an internal standard (I.S.) to correct for sample matrix suppression and/or loss of analyte. Identification of pentobarbital in a sample is based on both correlation of pentobarbital chromatographic retention time (RT) with that of a standard and ion ratio match.

2.2 Sample Preparation

2.2.1 For tallow, at minimum a 25 g sample portion is necessary. If sample appears heterogeneous, stir the 25 g manually with a spatula or spoon to ensure homogeneity.

2.2.2 For horsemeat, at minimum a 50 g sample portion is necessary. Horsemeat should be cut into small pieces, trying to avoid including any overly fatty white portions, and then ground with dry ice in an appropriate blender.

2.2.3 For canned wet dog good, an entire can (approximately 300 grams or more) of the canned dog food is necessary. Wet pet food should ground and mixed in in an appropriate blender. Do not add water. Dry ice may be used if necessary.

2.2.4 For dry kibble type dog food, approximately 150 grams is necessary. Dry kibble type dog food should be ground and mixed in an appropriate blender. Dry ice may be used if necessary (effective for products containing chewy ‘bits’).

2.2.5 If dry ice is used in sample preparation, allow carbon dioxide gas to sublime in a freezer prior to removing aliquot for analysis.

2.2.6 If a sample appears heterogeneous, it should be mixed manually, or via a blender to ensure a homogenous sample prior to removing a portion for analysis.

2.2.7 A 2.00-gram portion is used for each analysis. Two portions of each sample should be analyzed.

2.3 Preparation of Standards

2.3.1 Pentobarbital and pentobarbital-D5 are ordered premade with concentration 1000 µg/mL (1 mg/mL) in methanol.

2.3.2 Prepare a pentobarbital standard at 2,500 ng/mL with 25 µL of the 1000 µg/mL stock diluted to 10.0 mL with acetonitrile.

2.3.3 Prepare a pentobarbital ICV standard at 2,500 ng/mL with 25 µL of the 1000 µg/mL stock, from a different source or different ampoule, diluted to10.0 mL with acetonitrile.

2.3.4 Prepare a pentobarbital-D5 internal standard spiking solution at 5,000 ng/mL with 50 µL of the 1000 µg/mL pentobarbital-D5 stock diluted to 10.0 mL with acetonitrile.

2.3.5 All prepared solutions have an expiration date of one year when stored at 4°C.

2.3.6 Table 2.3.8 and 2.3.9 are examples of the preparations of working solutions and the solvent calibrants. Table 2.3.10 demonstrates the equivalent concentrations of the calibrants to the concentration in the samples for use in the processing method.

2.3.7 All eight calibration standards shown in Table 2.3.10 are not required for regulatory sample analysis; however, a minimum of 5 calibration standards are used with every batch of samples with a 10.0 ng/g standard (in sample amount), which is equivalent to an in vial concentration of 1.0 ng/mL as the lower limit of quantitation (LLOQ).

2.3.8 Working Solution Preparation (in acetonitrile)

Standard Name	starting conc (µg/mL)	Standard added (mL)	Final vol (mL)	Final conc (ng/mL)
Pentobarbital-2500	1,000	0.025	10.0	2,500
Pentobarbital ICV	1,000	0.025	10.0	2,500
Pent-D5 Spiking (ISTD)	1,000	0.050	10.0	5,000

2.3.9 Solvent Calibration Standard Preparation (in 50:50 acetonitrile:water)

Calibration Curve	Initial conc pentobarbital (ng/mL)	volume of pentobarbital std added (mL)	Volume D5-ISTD Added (5000 ng/mL)	Final Volume (mL)	Final Conc pentobarbital (ng/mL)	Final Conc d5-Pent (ng/mL)
Cal-1	2,500	0.020	0.050	50.0	1.00	5.00
Cal-2	2,500	0.010	0.020	20.0	1.25	5.00
Cal-3	2,500	0.010	0.010	10.0	2.50	5.00
Cal-4	2,500	0.020	0.010	10.0	5.00	5.00
Cal-5	2,500	0.040	0.010	10.0	10.00	5.00
Cal-6	2,500	0.100	0.010	10.0	25.00	5.00
Cal-7	2,500	0.200	0.010	10.0	50.00	5.00
Cal-8	2,500	0.400	0.010	10.0	100.00	5.00
ICV	2,500	0.040	0.010	10.0	10.00	5.00

2.3.10 Conversion of Solvent Standards to In Sample Concentration

Calibration Curve	In Vial Final Conc (ng/mL)	Sample wt. (g)	Vol ACN extraction (mL)	Dilution	Equivalent pentobarbital In matrix concentration (ng/g)	Equivalent d5-pent (ISTD) In matrix concentration (ng/g)
Cal-1	1.00	2.00	10	2.00	10.0	50.0
Cal-2	1.25	2.00	10	2.00	12.5	50.0
Cal-3	2.50	2.00	10	2.00	25.0	50.0
Cal-4	5.00	2.00	10	2.00	50.0	50.0
Cal-5	10.0	2.00	10	2.00	100	50.0
Cal-6	25.0	2.00	10	2.00	250	50.0
Cal-7	50.0	2.00	10	2.00	500	50.0
Cal-8	100.0	2.00	10	2.00	1000	50.0
ICV	10.0	2.00	10	2.00	100	50.0

2.3.11 Fortified (spiked) sample preparation (demonstrates typical fortification levels for pentobarbital in sample)

Spike Level (ng/g)	initial concentration (ng/mL)	volume used (mL)	sample weight (g)	final concentration in sample (ng/g)
12.5 ng/g	2500	0.010	2.00	12.5
50 ng/g	2500	0.040	2.00	50.0
250 ng/g	2500	0.200	2.00	250
475 ng/g	2500	0.380	2.00	475

2.3.12 Example spiking calculation:

40 µL	2500 ng	= 50.0 ng
2.00 grams of negative control	mL	g

2.3.13 Example calculation of in vial versus in sample concentration

50 ng	2 g sample amount	0.500 mL extract	= 5.00 ng in vial
g	10 mL extraction volume	1.000 mL final volume	mL

2.4 Reagents

2.4.1 Water, Fisher, LC-MS grade

2.4.2 Acetonitrile, Fisher, LC-MS Grade

2.4.3 Pentobarbital, Cerilliant, 1.000 ± 0.005 mg/mL in methanol, 1 mL ampoule, part # P-010

2.4.4 Pentobarbital-D_5, Cerilliant, 1.000 ± 0.005 mg/mL in methanol, 1 mL ampoule, part #: P-013

2.4.5 Diluent for standards, 50/50 water/acetonitrile (v/v), 500 mL. Combine 250 mL water + 250 mL acetonitrile in a 500 mL graduated cylinder. Cap and invert to mix.

2.5 Equipment (equivalent equipment may be substituted)

2.5.1 Vortexer/ Mixer, Troemner, (500-2500 rpm)

2.5.2 SPEX Geno/Grinder 2000 (500 rpm)

2.5.3 Sonicator (Branson 2510 or 8510)

2.5.4 Appropriate mixers, blenders, food processors, etc. used to homogenize sample matrix if necessary

2.5.5 Centrifuge capable of 6000 rpm with refrigeration (4 °C) for 50 mL tubes

2.5.6 Plastic centrifuge tubes with caps, 15 mL and 50 mL

2.5.7 Microcentrifuge tubes, at least 1 mL capacity

2.5.8 Nylon syringe filters, PALL Life Science Acrodisc 13 mm Syringe Filters 0.2 µm

2.5.9 Luer slip 1 mL syringes

2.5.10 2 mL glass amber autosampler vials and pre-slit snap caps (#66030-608)

2.5.11 Calibrated pipettes and volumetric glassware

2.6 Instrumentation (equivalent instrumentation may be substituted)

2.6.1 Agilent 1200 HPLC system, Combi Pal autosampler, with an AB SCIEX 5500 QTRAP MS instrument operated in the negative mode with an ESI source using Multiple Reaction Monitoring (MRM). AB SCIEX 1.6.2 software was used for instrument control and MultiQuant 3.0 was used for data processing.

2.6.2 AB SCIEX QTRAP 5500 source/parameter settings:

2.6.2.1.1 Curtain gas: 30 psi

2.6.2.1.2 GS1: 50 psi

2.6.2.1.3 GS2: 60 psi

2.6.2.1.4 Collision gas: medium

2.6.2.1.5 Ion spray voltage (IS): -3500V

2.6.2.1.6 Source temperature: 400˚C

2.6.2.1.7 Entrance Potential (EP): -10V

2.6.3 Pentobarbital MS parameters: Retention times (RT), transitions, declustering potential (DP), collision energy (CE), cell exit potential (CXP), and the resulting typical ion ratios for the product ions of each analyte from the ABI SCIEX 5500 QTRAP analysis.

Analyte	Typical RT (min)	Transition (m/z)			ISTD	DP (V)	CE (V)	CXP (V)	Average ion ratio, qual/quant %
pentobarbital	4.20	225	→	182 85 138	Pent-D5	-100	-19 -18 -21	-13 -9 -10	100 15 7
pentobarbital-D5	4.20	230	→	187		-100	-17	-10	N/A

2.6.4 Combi Pal autosampler settings

2.6.4.1.1 sample injection volume: 5 µL

2.6.4.1.2 autosampler tray temperature: 15˚C

2.6.4.1.3 Combi Pal Injector wash solution 1: 95% water/5% acetonitrile

2.6.4.1.4 Combi Pal Injector wash solution 2: 95% acetonitrile/5% water

2.6.5 Agilent 1200 HPLC settings

2.6.5.1.1 HPLC column – Agilent Zorbax Eclipse Plus C18, 2.1 x 50 mm, 1.8 micron size column (part # 959757-902)

2.6.5.1.2 A divert valve directed column effluent to waste before (0-0.5 minutes), and during the system re-equilibration time (5.0-8.50)

2.6.5.1.3 Column temperature was 40°C

2.6.5.1.4 LC flow rate was 0.350 mL/min.

2.6.5.1.5 The mobile phase was water (A) and acetonitrile (B), and the LC gradient is described in Table 2.6.5.1.6 below

2.6.5.1.6 LC gradient for pentobarbital

@Step	Total Time (min)	Flow Rate (µl/min)	A (%) (Water)	B (%) (Acetonitrile)
0	0.00	350	95.0	5.0
1	3.50	350	5.0	95.0
2	4.50	350	95.0	5.0
4	8.50	350	95.0	5.0

2.7 Extraction

2.7.1 Weigh 2.00± 0.05 g of each homogenized sample into a 50 mL centrifuge tube. For each unknown sample, weigh out two portions.

2.7.2 For each batch, include an empty tube to serve as Reagent Blank (RB).

2.7.3 Weigh out three portions of negative control material to serve as negative control (NC), matrix spike (SPK), and matrix spike duplicate (DUP).

2.7.4 If samples of varying matrices are being analyzed together in the same batch, a negative control, spike, and duplicate must be analyzed for each matrix type.

2.7.5 For all samples in the batch, including RB, NC, SPK, and DUP, add 20 µL of 5000 ng/mL pentobarbital-D5.

2.7.6 Fortify spike (SPK) and duplicate (DUP) portions with 40 µL of 2500 ng/mL pentobarbital spiking standard, resulting in a 50 ng/g in sample spike. (Fortification level may be adjusted as necessary, as long as the samples fall within the calibration curve).

2.7.7 If a sample appears to be significantly different than an available control matrix, an additional portion of sample should be spiked to assess extraction efficiency and matrix effects compared to the most similar control matrix.

2.7.8 Add 10 mL of acetonitrile to each sample tube.

2.7.9 Cap tubes tightly and shake @ 500 rpm for 5 minutes.

2.7.10 Sonicate sample tubes for 30 minutes.

2.7.11 Vortex sample tubes for 30 seconds.

2.7.12 Centrifuge sample tubes at 6000 x g and 4°C for 10 minutes.

2.7.13 Combine 500µL of sample supernatant with 500µL of water in a microcentrifuge tube; vortex to mix, then filter using a 0.2 µm Nylon syringe filter into a 2 mL amber LC vial and cap.

2.7.14 Analyze via LC-MS/MS.

2.8 Data Analysis and Quality Acceptance

2.8.1 Calibration curves are established from a multi-point solvent calibrant standard curve, ranging from 1-100 ng/mL in vial, equivalent 10-1000 ng/g in sample, with the concentration on the x-axis and internal standard corrected peak response on the y-axis. Suggested eight point curve for routine sample analysis is 1.00, 1.25, 2.5, 5.0, 10.0, 25.0, 50.0, 100 ng/mL (equivalent to 10.0, 12.5, 25, 50, 100, 250, 500, 1000 ng/g in sample).

2.8.2 Quantitative results will be reported for samples with responses that fall within the standard curve range and meet identity confirmation criteria.

2.8.3 The calculated method limit of detection (MDL) and calculated method limit of quantitation (LOQ), measurement of uncertainty, and typical linearity (r^2) are indicated in Table 2.8.4 below.

2.8.4 MDL, LOQ, Uncertainty, Linearity Table

Matrix	MDL using (5 ng/g, n=7)	LOQ using (10 ng/g, n=7)	Measurement of Uncertainty (%) (using 10 ng/g spikes, n=7)	Avg. Linearity (r^2) n=3
Dry Food with ISTD	2.49	9.32	22.5	0.9989
Wet food with ISTD	0.67	7.84	19.6	0.9994
Horse meat with ISTD	0.75	2.92	7.05	0.9991
Tallow with ISTD	2.77	11.6	29.0	0.9991

2.8.5 The tallow MDL and LOQ data in LIB 4648 were originally calculated from 12.5 ng/g spikes (n=9), resulting in calculated MDL of 2.4 ng/g and LOQ of 8.2 ng/g). Additional tallow spikes (n=7) were analyzed at 5 ng/g and 10 ng/g – and the MDL and LOQ were re-calculated using that data, which is in Table 2.8.4 above.

2.8.6 All calibration curves were generated with the AB SCIEX MultiQuant software. A linear fit with 1/x weighting (not forced through zero) was used for all recovery calculations. If a smaller dynamic range is used, a linear curve with no weighting may be used. All calibration curves should have $r^2 \geq 0.995$.

2.8.7 Precision and accuracy general guidance (performance may vary with sample matrix, especially for different tallow/animal fat matrices):

2.8.7.1 The FDA OFVM specifies that analyte recovery should be within the range 60%-115% corresponding to concentration from 10-100 mg/kg (ppb), with $RSD_r \leq 22\%$.

2.8.7.2 The aforementioned ranges are for guidance on data acceptability. Ranges for precision and accuracy should be determined in house after a sufficient number of data points are obtained.

2.8.7.3 Reagent blank (RB) and negative control (NC) should have responses below the lowest calibration standard.

2.8.7.4 Validation data demonstrated satisfactory quantitative analysis for pentobarbital determined in tallow at spiking levels 5, 10, 12.5, 50, and 250 ng/g, with method accuracy generally ranging from 97-110%, with $RSD_r \leq 18\%$.

2.8.7.5 Validation data demonstrated satisfactory quantitative analysis for pentobarbital determined in dry dog food at spiking levels 5, 10, 50, 250, and 475 ng/g with method accuracy generally ranging from 97-117% with RSDr ≤ 16%.

2.8.7.6 Validation data demonstrated satisfactory quantitative analysis for pentobarbital determined in wet dog food at spiking levels 5, 10, 50, 250, and 475 ng/g with method accuracy generally ranging from 93-109% with RSDr ≤ 9%.

2.8.7.7 Validation data demonstrated satisfactory quantitative analysis for pentobarbital determined in horsemeat at spiking levels 5, 10, 12.5, 50, and 250 ng/g with method accuracy generally ranging from 93-107% with RSDr ≤ 6%.

2.8.7.8 Any QC failures must be investigated prior to reporting results.

2.8.7.9 If a sample demonstrates a response above the highest calibration point the sample can be further diluted with the 50:50 acetonitrile:water diluent to approximately the midpoint of the solvent curve. The data can then be processed without the internal standard correction. Care must be taken to ensure the concentration range of the solvent curve reflects the dilution of the sample. (Data was evaluated with and without the use of internal standard during validation). It is advised to use the internal standard correction for extracts that fall within the routine calibration curve range.

2.8.8 Positive confirmation of identity for positive samples, and spiked samples

2.8.8.1 Signal to noise must be >3:1 (The AB SCIEX MultiQuant software is used to calculate signal to noise, if required.)

2.8.8.2 Retention time must match the comparison standard(s) within 5%.

2.8.8.3 Ion ratios must match the comparison standard(s) by an absolute value of ±20%. (MultiQuant software uses the average ion ratio of all standards in the calibration curve). If the ratio of either of the qualifier transitions fails due to instrument sensitivity, the other two transitions may be used with a ± 10% tolerance (absolute) on the ratio when compared to the average standard ratio.

2.8.9 Sample Result Reporting

2.8.9.1 Numerical sample results greater than the lower limit of quantitation (LLOQ) of 10 ng/g shall be reported.

2.8.9.2 Samples with calculated amounts less than the lower limit of quantitation (LLOQ) of 10 ng/g, but greater than the MDL shall be reported as “pentobarbital detected at <10 ng/g, but greater than MDL”, along with the value for the MDL.

2.8.9.3 Samples with calculated amounts < MDL shall be reported as “pentobarbital not detected at or above MDL”.

3. Glossary/Definitions

A. RB: Reagent Blank. Used to verify reagents are uncontaminated by interfering components, the reagent blank is an extract that contains no sample matrix. Carried thorough the extraction as if it were a sample, one must be extracted with each batch and display no interference peaks at the reference times of interest at or above lowest calibration.

B. NC: Negative Control. Used to verify the lack of matrix effects, the control is an aliquot of matrix material known to contain no analytes of interest. One must be extracted with each batch for each matrix type, and must display no interference peaks at reference times of interest at or above lowest calibration.

C. SPK/DUP: Matrix spike/matrix spike duplicate. Used to demonstrate effective and reproducible extraction, the matrix spike and duplicate are two aliquots of negative control matrix material, each fortified at a level near the midpoint of the curve. A pair of matrix spikes must be extracted and analyzed with each batch for each matrix type.

D. ICV: Independent Calibration Verification. Used to assure the accuracy of the calibration curve, the ICV is a solvent standard prepared from a secondary standard source.

E. CCV: Continuing Calibration Verification. Used to check the calibration during a run, the CCV is a re-injection of a midpoint solvent standard curve. A CCV is injected after every ten sample extracts and at the end of the analytical sequence.

F. MDL = Method Detection Limit = $\sigma(t_{(df=N-1,1-\propto=0.99,one\ sided)}$

Where: σ = standard deviation (of 5 ng/g spikes, N=7)
t = Student's T value for df = N-1 at the 99% confidence level, one sided

G. LOQ = Limit of Quantitation = $\sigma(10)$

Where: σ = standard deviation (of 10 ng/g spikes, N=7)

H. LLOQ = Lower Limit of Quantitation, lowest standard in calibration curve. For this analysis, the LLOQ should be equal to 10 ng/g in sample (or lower).

4. References & Supporting Documents

A. Determination of Pentobarbital in Pet Food Using Liquid Chromatography Tandem Mass Spectrometry, Tuner, James A., Mohrhaus, Angie S., FCC SOP T064 Version 1, 3/1/2018.

B. LC-HRMS Screen CALIFORNIA ANIMAL HEALTH &FOOD SAFETY LABORATORY, DTOX-02-877 Rev. 6. November 3, 2017.

C. Pentobarbital in Beef Tallow March 2018, Personnel Correspondence with UC Davis, "Pentobarbital in Beef Tallow March 2018 (004) UC Davis extraction march 2018" location: H:\ALL_LAB\1_Chemistry\1. Chemistry Unit A\Pentobarbital in dog food 2018\Tallow\References

D. U.S. Food and Drug Administration, Office of Foods, Guidelines for the Validation of Chemical Methods for the FDA Foods Program, 2nd Edition 2015. https://www.fda.gov/downloads/scienceresearch/fieldscience/ucm273418.pdf

E. ORA Laboratory Manual, Volume II-Methods, Method Verification and Validation ORA-LAB.5.4.5 https://www.fda.gov/downloads/ScienceResearch/FieldScience/LaboratoryManual/UCM092147.pdf

F. DENL QMS # 18-3 and QMiS RPRT-000060 (Determination of pentobarbital in Tallow, wet pet food, and dry pet food using liquid chromatography tandem mass spectrometry).

G. DENL QMS #18-4 and QMiS RPRT-000055 (determination of pentobarbital in tallow, wet pet food, and dry pet food using liquid chromatography tandem mass spectrometry).

H. U.S. Food and Drug Administration (2003) Guideline for Industry: Mass Spectrometry for Confirmation of the Identity of Animal Drug Residues, Fed. Regist. 68, 25617–25618.

https://www.fda.gov/downloads/AnimalVeterinary/GuidanceComplianceEnforcement/GuidanceforIndustry/ucm052658.pdf

I. CVM # GFI 118. Guidance for Industry Mass Spectrometry for Confirmation of the Identity of Animal Drug Residues http://www.fda.gov/downloads/AnimalVeterinary/GuidanceComplianceEnforcement/GuidanceforIndustry/UCM052658.pdf

J. DENL QMS #18-4a and QMiS RPRT-000089 (determination of pentobarbital in horsemeat, wet pet food, and dry pet food using liquid chromatography tandem mass spectrometry).\

K. LIB 4648: Determination of pentobarbital in tallow using liquid chromatography tandem mass spectrometry (LC-MS/MS) CARTS: IR01702

http://inside.fda.gov:9003/downloads/PolicyProcedures/Laboratories/LaboratoryInformationBulletins/UCM632922.pdf

5. Document History

Version #	Status* (D, I, R, C)	Date	Author Name and Title	Approving Official Name and Title
00	I	11/30/2018	Tara Nickel, Chemist Christine Casey, Chemist	R. Stadtmuller, Quality System Manager
01	R	12/4/18	Tara Nickel, Chemist	R. Stadtmuller, Quality System Manager
02	R	03/06/19	Tara Nickel, Chemist	R. Stadtmuller, Quality System Manager
03	R	5/1/2019	Tara Nickel, Chemist	R. Stadtmuller, Quality System Manager
* - D: Draft, I: Initial, R: Revision, C: Cancel				

6. Change History

Version	Change
00	*Original*
01	Change 10 uL to 20 uL on 2.7.2. Add reporting statement on 2.8.9.3 for amounts below 10ng/g and >MDL.
02	Minor corrections for spelling, grammar, and formatting
03	Add dry dog food, wet dog food, horsemeat information throughout document

Appendix A: Representative chromatograms

The result summary table states the analyte peak precursor name, observed analyte retention time (RT), expected analyte retention time (RT) time, calculated concentration (ng/g), analyte response (peak area), calculated Ion Ratio (ration of qualifier ion peak area to quantifier ion peak area), and Ratio Confirmation (a checkmark indicates the ratio matches the comparison standards ±20%).

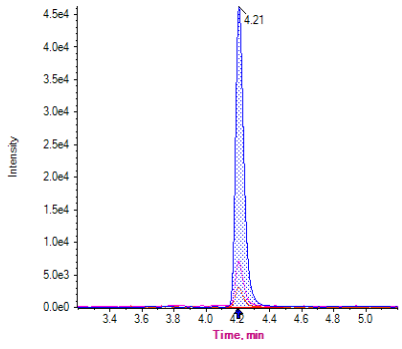
The chromatograms are graphical images are generated in the SCIEX MultiQuant software summary report. There is a chromatogram for each of the pentobarbital transitions. The first column is the pentobarbital quantitation ion transition (most abundant ion) chromatogram (m/z 225→182), identified as Pentobarbital 1. The second column is the chromatogram for the second most abundant ion transition (m/z 225→85), identified as Pentobarbital 2 and is used as a qualifier ion transition. The third column is the least abundant ion (m/z 225→ 138), identified as Pentobarbital 3 and is used as a qualifier transition.

Figure A1 Result Summary for: Solvent Cal 3- equivalent to ng/g in sample (In vial concentration: 5.0 ng/mL pentobarbital, 5.0 ng/mL d5-pent)

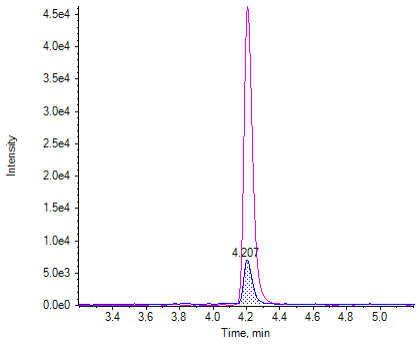
Analyte Peak Name	Analyte RT	Expected RT	Calculated Concentration (ng/g)	Analyte Response	Calculated Ion Ratio (Expected Value)	Ratio Confirms
Pentobarbital 1 (225->182.0)	4.21	4.20	52.50	170000.0		
Pentobarbital 2 (225->85.0)	4.21	4.20		26600	15.6% (15.8%)	✓
Pentobarbital 3 (225->138.0)	4.21	4.20		11500	6.8% (7.2%)	✓

Chromatograms – Bars on peaks are expected ion ratio ± 20% of comparison standards

Pentobarbital 1



Pentobarbital 2



Pentobarbital 3

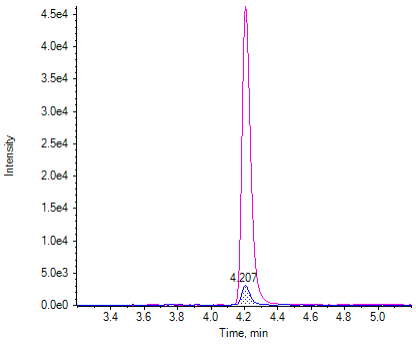


Figure A2: Result Summary for Tallow Negative Control, Source T1

Analyte Peak Name	Analyte RT	Expected RT	Calculated Concentration (ng/g)	Analyte Response	Calculated Ion Ratio (Expected Value)	Ratio Confirms
Pentobarbital 1 (225->182.0)	3.90	4.20	< 0	3190.0		
Pentobarbital 2 (225->85.0)	4.22	4.20		1920	60.1% (15.8%)	
Pentobarbital 3 (225->138.0)	4.06	4.20		395	12.4% (7.2%)	✓

Chromatograms – Bars on peaks are expected ion ratio ± 20% of comparison standards

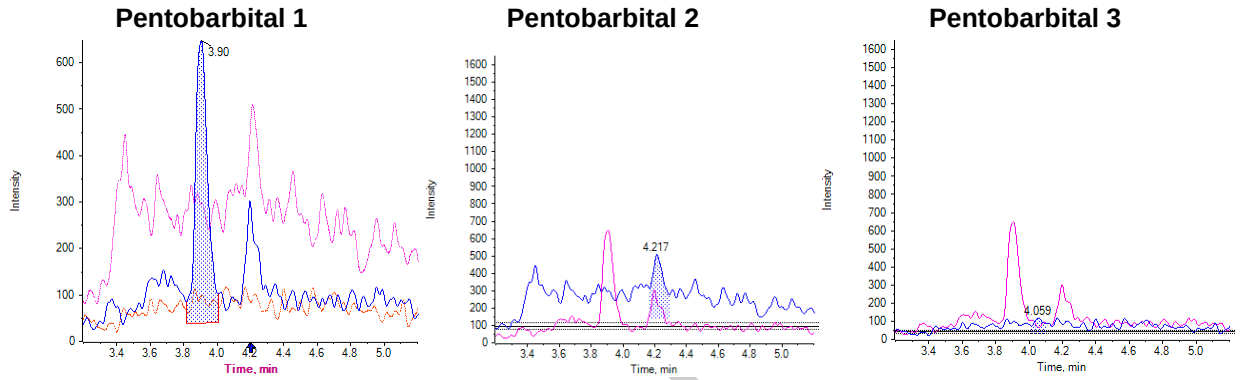


Figure A3: Result Summary for Tallow - Fortified at 50 ng/g

Analyte Peak Name	Analyte RT	Expected RT	Calculated Concentration (ng/g)	Analyte Response	Calculated Ion Ratio (Expected Value)	Ratio Confirms
Pentobarbital 1 (225->182.0)	4.21	4.20	51.65	129000.0		
Pentobarbital 2 (225->85.0)	4.21	4.20		20500	15.8% (15.8%)	✓
Pentobarbital 3 (225->138.0)	4.21	4.20		8930	6.9% (7.2%)	✓

Chromatograms – Bars on peaks are expected ion ratio ± 20% of comparison standards

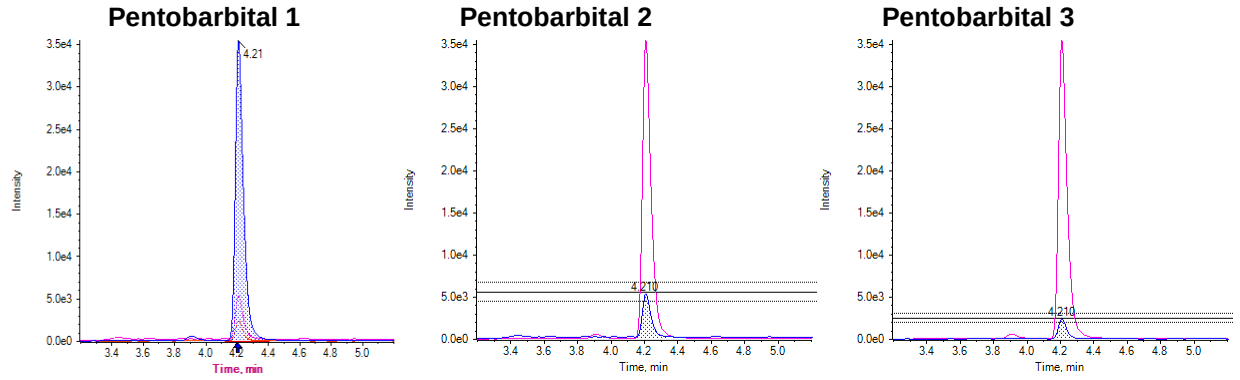


Figure A4: Result Summary for Wet Dog Food Negative Control, Source W2

Analyte Peak Name	Analyte RT	Expected RT	Calculated Concentration (ng/g)	Analyte Response	Calculated Ion Ratio (Expected Value)	Ratio Confirms
Pentobarbital 1 (225->182.0)	3.90	4.20	<0	1326.0		
Pentobarbital 2 (225->85.0)	3.85	4.20		824	62.2% (14.3%)	
Pentobarbital 3 (225->138.0)	4.29	4.20		243	18.4% (6.8%)	✓

Chromatograms – Bars on peaks are expected ion ratio ± 20% of comparison standards

Pentobarbital 1 **Pentobarbital 2** **Pentobarbital 3**

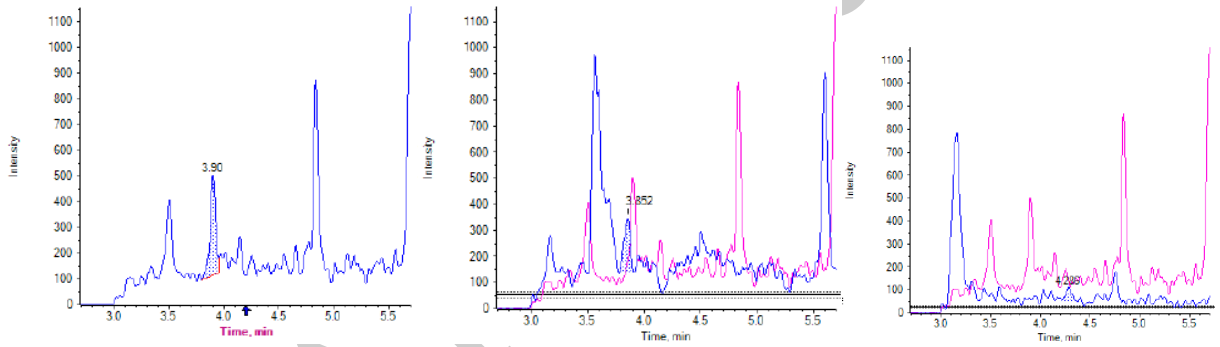


Figure A5: Result Summary for Wet Dog Food Fortified at 50 ng/g, Source W2

Analyte Peak Name	Analyte RT	Expected RT	Calculated Concentration (ng/g)	Analyte Response	Calculated Ion Ratio (Expected Value)	Ratio Confirms
Pentobarbital 1 (225->182.0)	4.19	4.20	56.02	53007.0		
Pentobarbital 2 (225->85.0)	4.19	4.20		6812	12.9% (14.3%)	✓
Pentobarbital 3 (225->138.0)	4.19	4.20		3619	6.8% (6.8%)	✓

Chromatograms – Bars on peaks are expected ion ratio ± 20% of comparison standards

Pentobarbital 1 **Pentobarbital 2** **Pentobarbital 3**

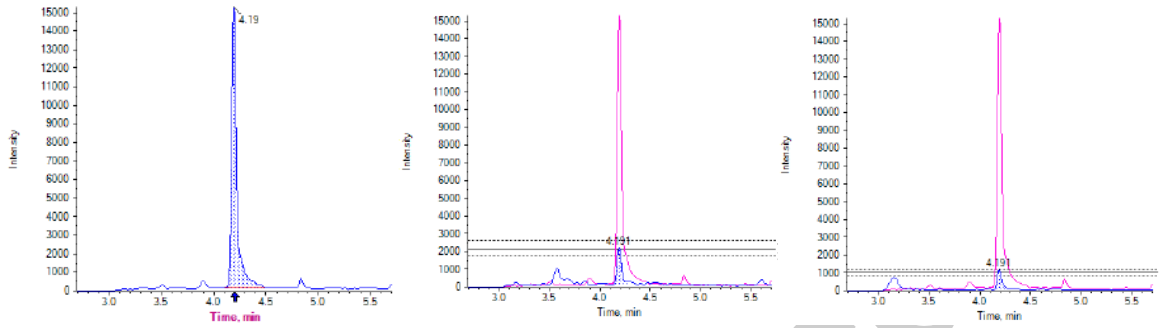


Figure A6: Result Summary for Dry Dog Food Negative Control, Source D3

Analyte Peak Name	Analyte RT	Expected RT	Calculated Concentration (ng/g)	Analyte Response	Calculated Ion Ratio (Expected Value)	Ratio Confirms
Pentobarbital 1 (225->182.0)	N/A	4.20	N/A	1326.0	N/A	
Pentobarbital 2 (225->85.0)	3.95	4.20		824	0.0% (14.3%)	
Pentobarbital 3 (225->138.0)	3.92	4.20		243	0.0% (6.8%)	

Chromatograms – Bars on peaks are expected ion ratio ± 20% of comparison standards

Pentobarbital 1 **Pentobarbital 2** **Pentobarbital 3**

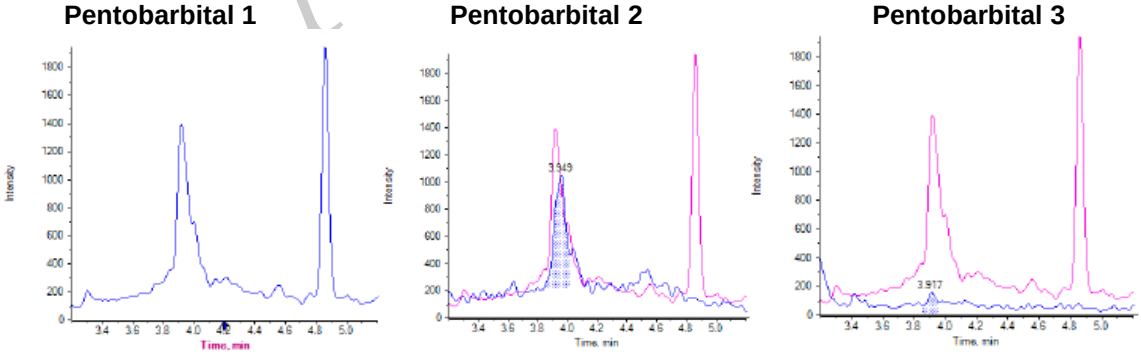


Figure A7: Result Summary for Dry Dog Food Fortified at 50 ng/g, Source D3

Analyte Peak Name	Analyte RT	Expected RT	Calculated Concentration (ng/g)	Analyte Response	Calculated Ion Ratio (Expected Value)	Ratio Confirms
Pentobarbital 1 (225->182.0)	4.22	4.20	51.26	68852.0		
Pentobarbital 2 (225->85.0)	4.22	4.20		9158	13.3% (14.3%)	✓
Pentobarbital 3 (225->138.0)	4.22	4.20		5022	7.3% (6.9%)	✓

Chromatograms – Bars on peaks are expected ion ratio ± 20% of comparison standards

Pentobarbital 1 **Pentobarbital 2** **Pentobarbital 3**

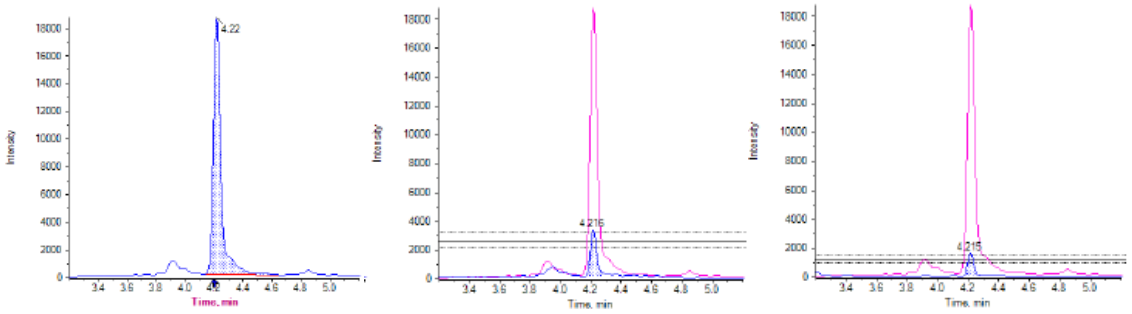


Figure A8: Result Summary for Horsemeat Negative Control

Analyte Peak Name	Analyte RT	Expected RT	Calculated Concentration (ng/g)	Analyte Response	Calculated Ion Ratio (Expected Value)	Ratio Confirms
Pentobarbital 1 (**225->182.0**)	N/A	4.69	N/A	N/A		
Pentobarbital 2 (**225->85.0**)	**4.53**	**4.69**		2165	**0.0% (14.9%)**	
Pentobarbital 3 (**225->138.0**)	**4.54**	**4.69**		780	**0.0% (6.9%)**	

Chromatograms – Bars on peaks are expected ion ratio ± 20% of comparison standards

Pentobarbital 1 **Pentobarbital 2** **Pentobarbital 3**

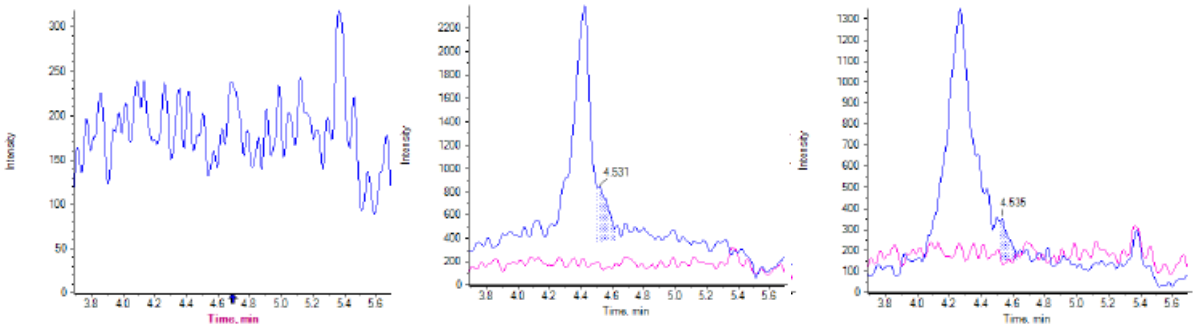
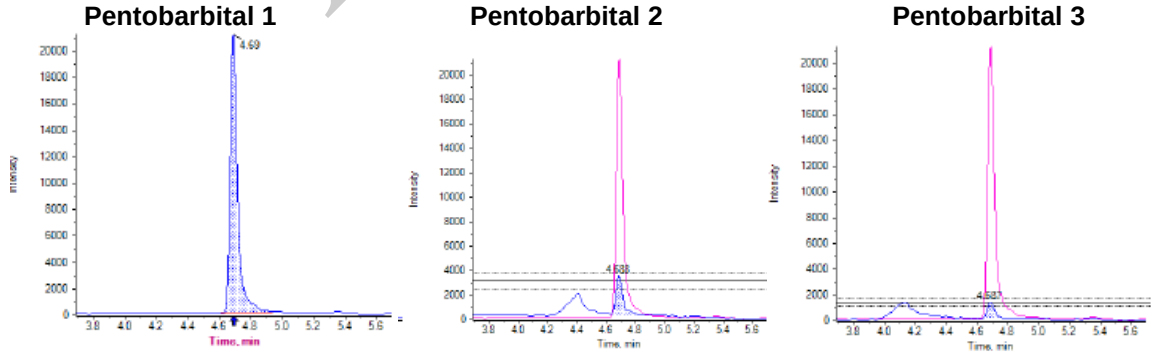


Figure A9: Result Summary for Horsemeat Fortified at 50 ng/g

Analyte Peak Name	Analyte RT	Expected RT	Calculated Concentration (ng/g)	Analyte Response	Calculated Ion Ratio (Expected Value)	Ratio Confirms
Pentobarbital 1 (**225->182.0**)	4.69	4.69	50.29	70189.0		
Pentobarbital 2 (**225->85.0**)	**4.53**	**4.69**		11187	**15.9% (14.9%)**	✓
Pentobarbital 3 (**225->138.0**)	**4.54**	**4.69**		4374	**6.2% (6.9%)**	✓

Chromatograms – Bars on peaks are expected ion ratio ± 20% of comparison standards

Pentobarbital 1 **Pentobarbital 2** **Pentobarbital 3**



Appendix B: AB SCIEX QTRAP 5500 data acquisition method

HPLC column – Agilent Zorbax Eclipse Plus C18, 2.1 x 50 mm, 1.8 micron size column
M.P. A: Water
M.P. B: Acetonitrile

Synchronization Mode: LC Sync
Auto-Equilibration: Off
Acquisition Duration: 8min31sec
Number Of Scans: 2318
Periods In File: 1
Acquisition Module: Acquisition Method
Software version Analyst 1.6.2

MS Method Properties:
Period 1:

Scans in Period: 2318
Relative Start Time: 1000.00 msec
Experiments in Period: 1

Period 1 Experiment 1:

Scan Type: MRM (MRM)
Scheduled MRM: No
Polarity: Negative
Scan Mode: N/A
Ion Source: Turbo Spray
Resolution Q1: Unit
Resolution Q3: Unit
Intensity Thres.: 0.00 cps
Settling Time: 0.0000 msec
MR Pause: 5.0070 msec
MCA: No
Step Size: 0.00 Da

@Q1 Mass (Da)	Q3 Mass (Da)	Dwell(msec)	Param	Start	Stop	ID
225.000	182.000	50.00	CE	-19.00	-19.00	Pentobarbital 1
			CXP	-13.00	-13.00	

@Q1 Mass (Da) Q3 Mass (Da) Dwell(msec) Param Start Stop ID
225.000 85.000 50.00 CE -18.00 -18.00 Pentobarbital 2
CXP -9.00 -9.00

@Q1 Mass (Da) Q3 Mass (Da) Dwell(msec) Param Start Stop ID
225.000 138.000 50.00 CE -21.00 -21.00 Pentobarbital 3
CXP -10.00 -10.00

@Q1 Mass (Da) Q3 Mass (Da) Dwell(msec) Param Start Stop ID
230.000 187.000 50.00 CE -17.00 -17.00 Pentobarbital-D5
CXP -10.00 -10.00

Parameter Table(Period 1 Experiment 1):
CAD: Medium
GS1: 50.00
GS2: 60.00
CUR: 30.00
TEM: 400.00
IS: -3500.00
DP -100.00
EP -10.00

Valco Valve Diverter

Total Time (min) Position
1 0.0 B
2 0.5 A
3 8.0 B
Agilent LC Pump Method Properties
Pump Model: Agilent 1260 Binary Pump
Minimum Pressure (psi): 0.0
Maximum Pressure (psi): 8702.0
Dead Volume (µl): 40.0
Maximum Flow Ramp (ml/min²): 100.0
Maximum Pressure Ramp (psi/sec): 290.0
Max Flow Ramp Up (ml/min²): 100.0
Max Flow Ramp Dn (ml/min²): 100.0

Step Table:

@Step	*Total Time(min)*	*Flow Rate(µl/min)*	*A (%)*	*B (%)*
0	*0.00*	*350*	*95.0*	*5.0*
1	*3.50*	*350*	*5.0*	*95.0*
2	*4.50*	*350*	*95.0*	*5.0*
4	*8.50*	*350*	*95.0*	*5.0*

Left Compressibility: 50.0
Right Compressibility: 115.0
Left Dead Volume (µl): 40.0
Right Dead Volume (µl): 40.0
Left Stroke Volume (µl): -1.0
Right Stroke Volume (µl): -1.0
Left Solvent: A1
Right Solvent: B1

Agilent LC Pump Method Properties
Pump Model: Agilent 1260 Binary Pump
Minimum Pressure (psi): 0.0
Maximum Pressure (psi): 8702.0
Dead Volume (µl): 40.0
Maximum Flow Ramp (ml/min²): 100.0
Maximum Pressure Ramp (psi/sec): 290.0
Max Flow Ramp Up (ml/min²): 100.0
Max Flow Ramp Dn (ml/min²): 100.0

Step Table:

@Step	*Total Time(min)*	*Flow Rate(µl/min)*	*A (%)*	*B (%)*
0	*0.00*	*0*	*50.0*	*50.0*
1	*8.50*	*0*	*50.0*	*50.0*

Left Compressibility: 50.0
Right Compressibility: 115.0
Left Dead Volume (µl): 40.0
Right Dead Volume (µl): 40.0
Left Stroke Volume (µl): -1.0
Right Stroke Volume (µl): -1.0
Left Solvent: A2
Right Solvent: B2

Agilent Column Oven Properties
Left Temperature (°C): 40.00
Right Temperature (°C): 40.00
Temperature Tolerance +/- (°C): 1.00
Start Acquisition Tolerance +/- (°C): 1.00
Time Table (Not Used)

Column Switching Valve Installed 10Port2Pos
Position for first sample in the batch: Left
Use same position for all samples in the batch

CTC PAL Autosampler Method Properties
Loop Volume1 (µl): 20
Loop Volume2 (µl): 20
Injection Volume (µl): 5.000
Barcode Reading: Disabled

Method Description:

Syringe: 100ulDLW

Cycle date: 9/9/2010 3:26:06 PM

Cycle name: Analyst LC-Inj DLW Fast_Rev05

Airgap Volume (µl)	*3*
Front Volume (µl)	*5*
Rear Volume (µl)	*5*
Filling Speed (µl/s)	*5*
Pullup Delay (ms)	*3*
Inject to	*LC Vlv1*
Injection Speed (µl/s)	*5*
Pre Inject Delay (ms)	*500*
Post Inject Delay (ms)	*500*
Needle Gap Valve Clean (mm)	*3*
Valve Clean Time Solvent 2 (s)	*3*
Valve Clean Time Solvent 1 (s)	*4*
Post Clean Time Solvent 1 (s)	*3*