

Cannabis Proficiency Testing: Design, Issues and Implementation

Ty Garber

Director, Business Development

Phenova, Inc.

Phenova, Inc

- Golden, CO
- Established 2001
- ISO 17043, ISO 17034, ISO 17025 and TNI Chapt 3 accredited
- First accredited 17043 PT provider to have Cannabis accredited on scope
- Core business – Environmental PTs as dictated by TNI
- Certified Reference/Calibrant Provider

PT Programs: What they should look like to participants/AA's.....

- Independent, third party
- Designed specifically to the regulatory requirements labs are accredited to or have to meet
- Best effort for matrix matching or duplication
- Evaluations applicable to the analyte, method, matrix, and regulatory specifics
- Qualitative *and* Quantitative approach
- Ease of use for analysis and reporting
- Responsive to participants and accrediting agencies, dynamic to changing requirements

What a PT Program looks like to a Provider.....

- Standards Manufacture – Step #1
 - Meeting ISO 17043 requirements
 - Verification/Homogeneity/Stability testing
 - Packaging and lot traceability
- Report Generation – Step #2
 - Ease of Data Entry for Customers
 - Reviewing of Results, valid evaluations
 - Reporting to participants and AA's
 - Participant support (corrective action)

Cannabis PT Roadblocks

Illegal to ship matrix

**State specific
analytes/action levels**

Stability of standards

**Lack of Historical Data
for Evaluations**

Roadblock Solution: Matrix

- Oregon – began in-state manufacturing in real matrices early 2016
- Currently manufacturing in-matrix PTs where matrix is critical in analysis (ie Pests, Potency)
- Manufacture PTs in alternative matrices where matrix does not create an analytical challenge (ie Metals, RSO, WA, Terpenes)

Roadblock Solution: Matrix

- Oregon – OHA authorizes larger purchase of material
- Utilize licensed host lab facility for manufacturing and PT analytical validation (timeframe for all activities ~5 days)
- ORELAP assumes custody of in matrix PTs, stores appropriately, does distribution from their facility at study opening
- Labs travel to ORELAP for in matrix PT pickup

Roadblock Solution: State Specificity

- Internal database system allows for analyte classification based on state action levels and evaluation criteria
- State specific PT programs can be created using regulated analyte lists, action levels and evaluation criteria
- Manufactured PTs represent the specific state regulatory requirements.

Roadblock Solution: State Specificity



info@phenova.com • www.phenova.com • 1-866-942-2978

ADDITIONAL INFORMATION

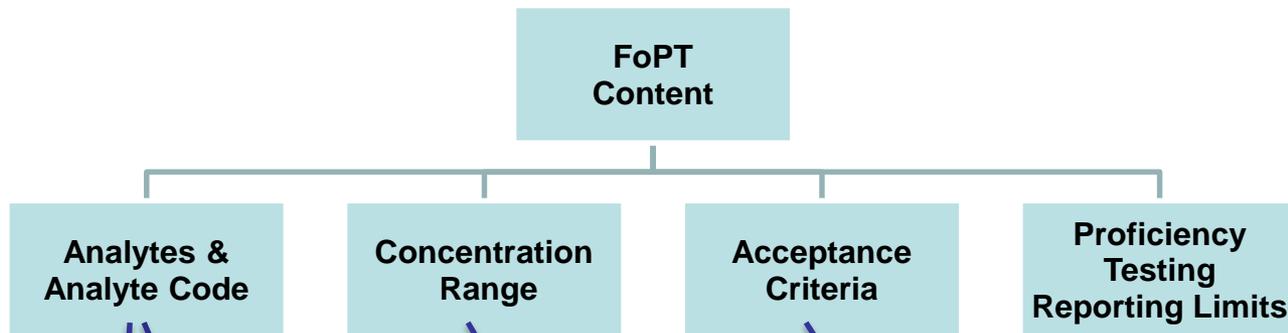
The PT sample will contain a subset of the following analytes:

Analyte ¹	PTRL ²	Range ³	Analyte ¹	PTRL ²	Range ³	Analyte ¹	PTRL ²	Range ³
1,4-Dioxane	380	50 - 500	Ethyl Acetate	5000	50 - 6000	Total Pentanes ⁵	5000	50 - 6000
2-Ethoxyethanol	160	50 - 200	Ethylbenzene ⁷	2170	50 - 2600	Methanol	5000	50 - 6000
Acetone	5000	50 - 6000	Ethyl Ether	5000	50 - 6000	Tetrahydrofuran	720	50 - 900
Acetonitrile	410	50 - 500	Ethylene Glycol	620	50 - 800	Toluene	890	50 - 1000
Benzene	2	1 - 20	Ethylene Oxide	50	50 - 100	Total Xylenes ⁶	2170	50 - 2600
Cumene	70	50 - 100	n-Heptane	5000	50 - 6000	2-Butanol	5000	50 - 6000
Cyclohexane	3880	50 - 5000	Total Hexanes ⁴	290	50 - 400	2-Propanol (IPA)	5000	50 - 6000
Dichloromethane	600	50 - 800	Isopropyl Acetate	5000	50 - 6000			

Footnotes: **1-** Analytes in this list are specified in the Oregon Medical Marijuana Dispensary Program Rules and Statutes. However, due to technical challenges of analyte inclusion, the following analytes have been left off of this list: Propane isomers and Butane isomers; **2-** "PTRL" refers to the Action Level specified in the Oregon Medical Marijuana Dispensary Program Rules and Statutes in ug/g; **3-** "Range" refers to concentration potentially spiked in PT sample, ug/g; **4-** "Total Hexanes" include the sum of isomers n-Hexane, 2-Methylpentane, 3-Methylpentane, 2,2-Dimethylpentane and 2,3-Dimethylpentane; **5-** "Total Pentanes" include the sum of isomer n-Pentane, iso-Pentane and neo-Pentane (2,2-Dimethylpropane); **6-** Total Xylenes include the sum of 1,2-Dimethylbenzene (o-Xylene), 1,3-Dimethylbenzene (m-Xylene), 1,4-Dimethylbenzene (p-Xylene); **7-** Ethylbenzene per OAR requirements should be reported separately from Total Xylenes but considered in combination with Total Xylenes against the published action limit. For this reason and for the purpose of this PT, Ethylbenzene has been given the same Action Level ("PTRL") and potentially spiked concentration range as Total Xylenes.

Lack of Historical Data Roadblock

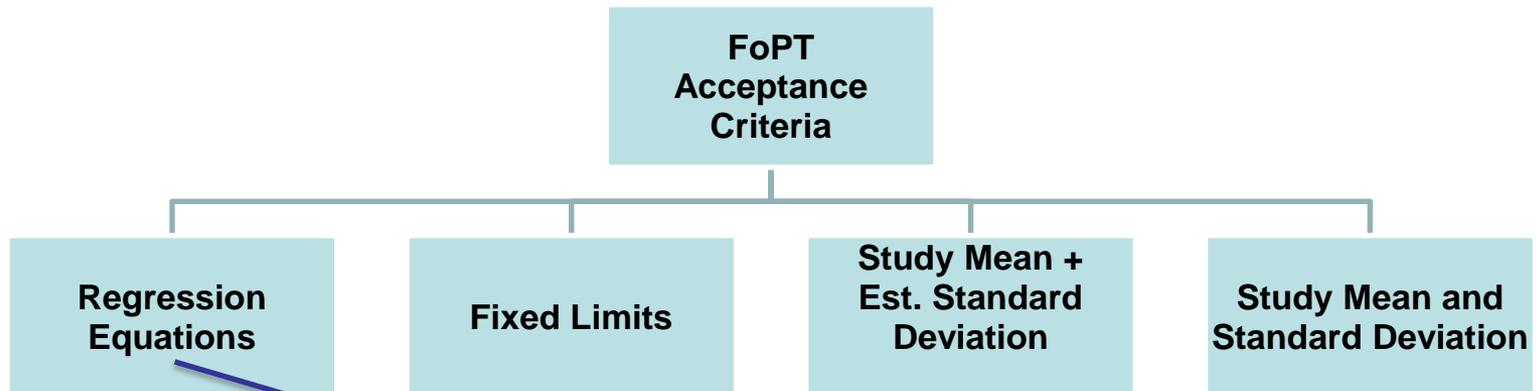
Field of Proficiently Testing (FoPT) Tables: PT Blueprint



NELAC PT for Accreditation									
Fields of Proficiency Testing with PTRLs									
Drinking Water									
Effective: November 03, 2017									
		Red = Previous Experimental Analytes		Blue = New Analyte/Header/Footer		Magenta = Changes			
Matrix	EPA Analyte Code	NELAC Analyte Code	Analyte ^{1,2}	Conc Range	Acceptance Criteria ^{3,4,5,6}		NELAC PTRL ⁷		
					a	b	c	d	
			Volatile Organic Compounds (VOCs) ¹	µg/L					µg/L
Drinking Water	0039	4375	Benzene ¹	2 to 20	± 40% at < 10 ± 20% ≥ 10 fixed acceptance limit				1.2
Drinking Water	0037	4455	Carbon Tetrachloride ¹	2 to 20	± 40% at < 10 ± 20% ≥ 10 fixed acceptance limit				1.2
Drinking Water	0049	4475	Chlorobenzene ¹	2 to 20	± 40% at < 10 ± 20% ≥ 10 fixed acceptance limit				1.2

PT Acceptance Criteria

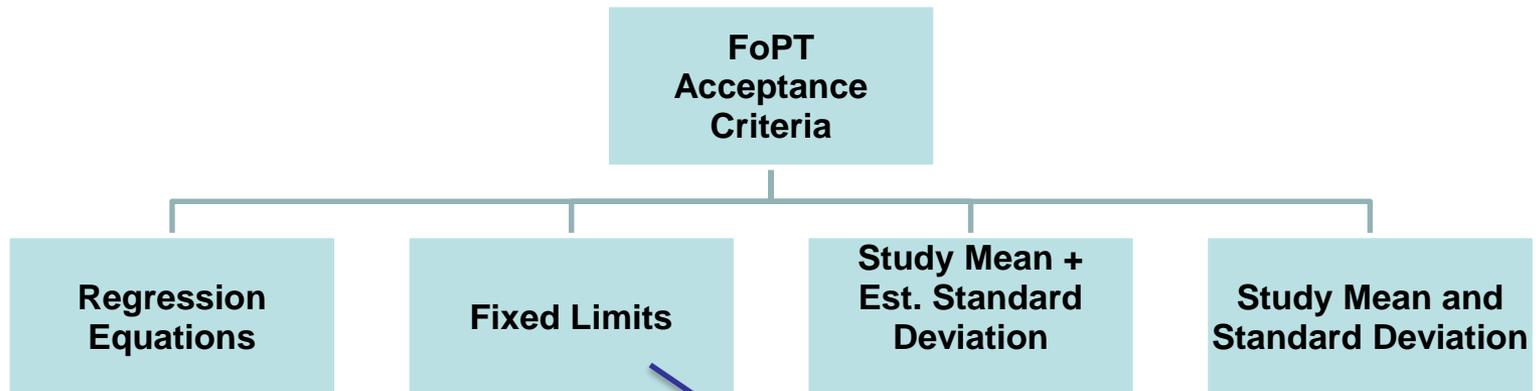
PT Providers determine Acceptance
Criteria w/ FoPT Tables



Matrix	EPA Analyte Code	NELAC Analyte Code	Analyte ^{1,2}	Conc Range	Acceptance Criteria ^{3,4,5,6}				NELAC PTRL ⁷ µg/L
					a	b	c	d	
			Herbicides ¹	µg/L					µg/L
NPW	0257	8545	2,4-D	2 to 10	0.7204	0.2995	0.2543	0.0297	0.20
NPW	0258	8595	Dicamba	2 to 10	0.7848	0.2788	0.1754	0.1455	0.40

PT Acceptance Criteria

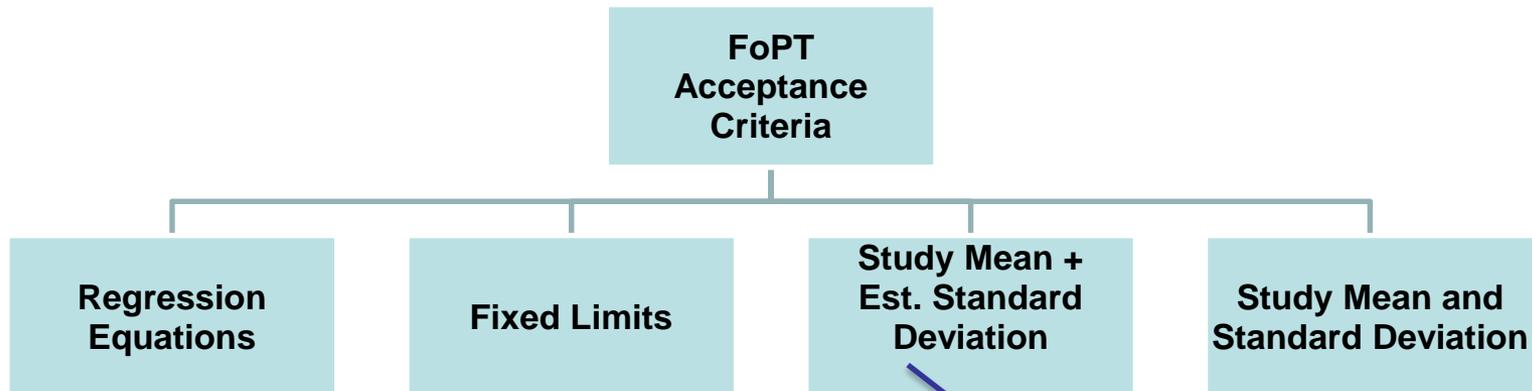
PT Providers determine Acceptance Criteria w/ FoPT Tables



Matrix	EPA Analyte Code	NELAC Analyte Code	Analyte ^{4,2}	Conc Range	Acceptance Criteria ^{3,4,5,6}				NELAC PTRL ⁷
					a	b	c	d	
			Volatile Organic Compounds (VOCs) ⁺	µg/L	µg/L				
Drinking Water	0039	4375	Benzene ¹	2 to 20	± 40% at < 10 ± 20% ≥ 10 fixed acceptance limit				1.2
Drinking Water	0037	4455	Carbon Tetrachloride ¹	2 to 20	± 40% at < 10 ± 20% ≥ 10 fixed acceptance limit				1.2
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PT Acceptance Criteria

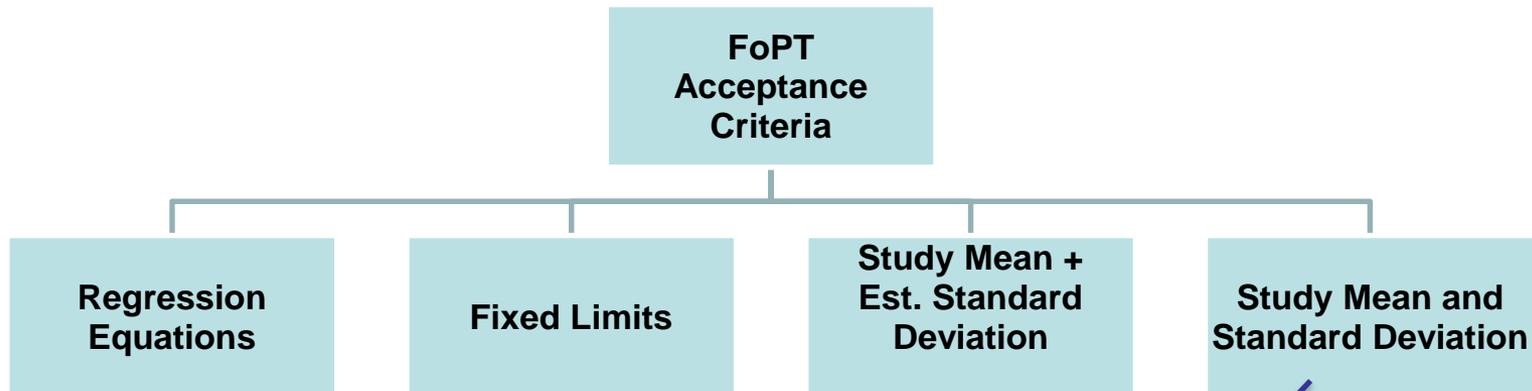
PT Providers determine Acceptance
Criteria w/ FoPT Tables

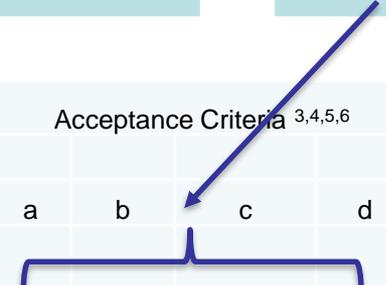


Matrix	EPA Analyte Code	NELAC Analyte Code	Analyte ^{1,2}	Conc Range	Acceptance Criteria ^{3,4,5,6}				NELAC PTRL ⁷
					a	b	c	d	
			Organochlorine Pesticides ¹	µg/kg					µg/kg
SOLIDS		7025	Aldrin	50 to 500	Study Mean	0.2024	1.8529		5.0
SOLIDS		7110	alpha-BHC	50 to 500	Study Mean	0.2004	3.1776		5.0

PT Acceptance Criteria

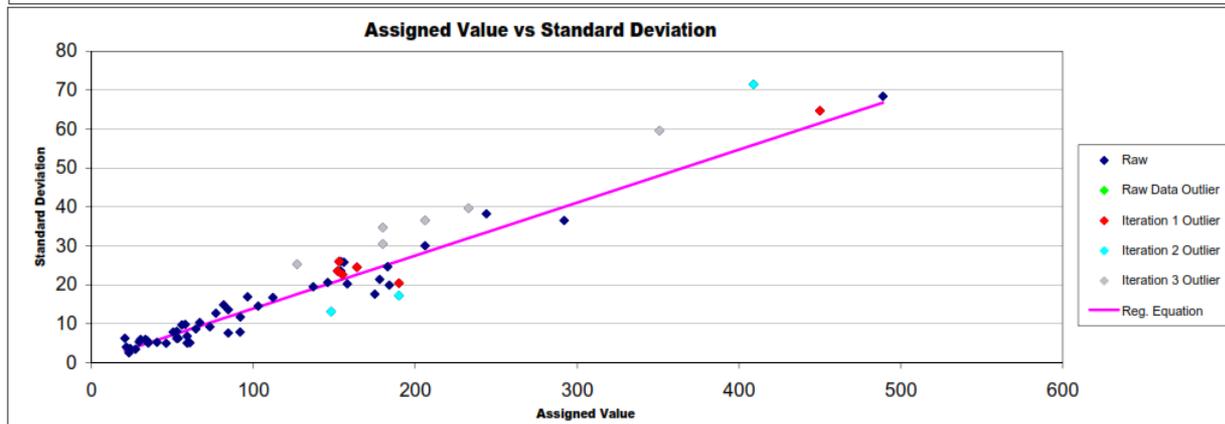
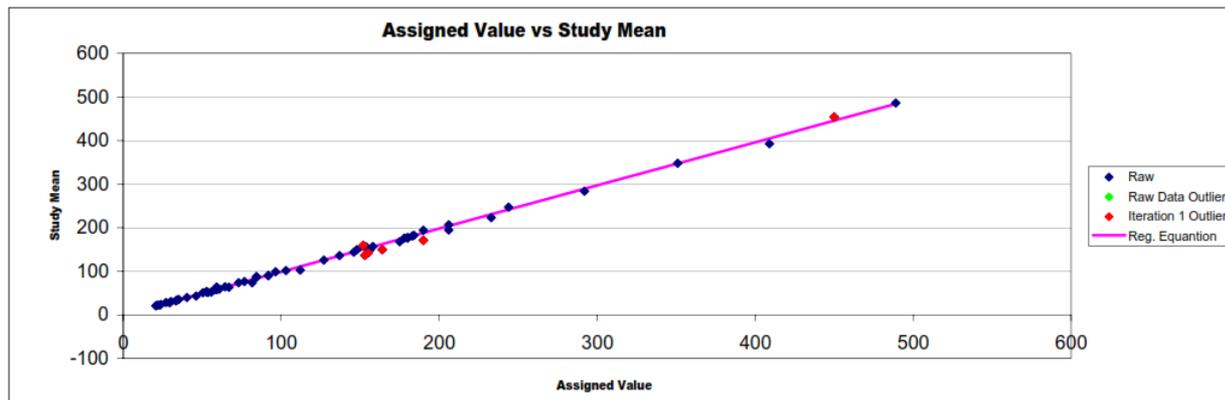
PT Providers determine Acceptance
Criteria w/ FoPT Tables



Matrix	EPA Analyte Code	NELAC Analyte Code	Analyte ^{1,2}	Conc Range	Acceptance Criteria ^{3,4,5,6}				NELAC PTRL ⁷
					a	b	c	d	
			Herbicides ¹	µg/kg					µg/kg
SOLIDS		8545	2,4-D	100 to 1000	Study Mean ±3SD				10
SOLIDS		8560	2,4-DB	100 to 1000	Study Mean ±3SD				10
SOLIDS		8595	Dicamba	100 to 1000	Study Mean ±3SD				10

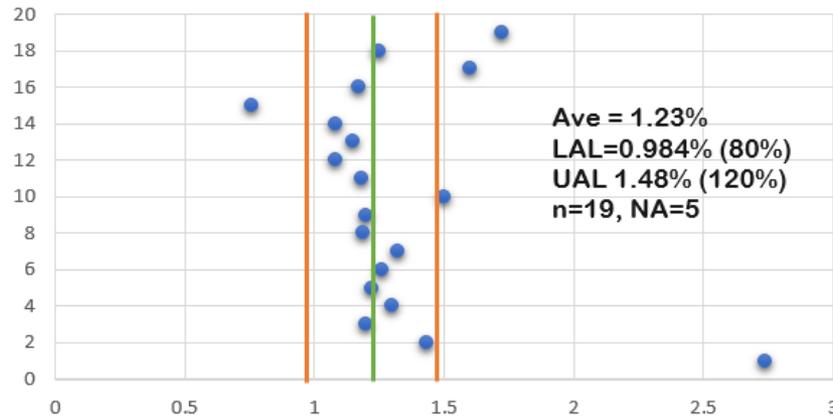
Constructing a FoPT Table – Predicted Recoveries and Standard Deviations

Analyte #	Parameter	a	b	c	d	Mean R ²	StdDev R ²	Min	Max	Units
5140	Toluene	0.9904	-0.0276	0.1360	0.2781	0.9989	0.9543	20.6	489	ug/Kg

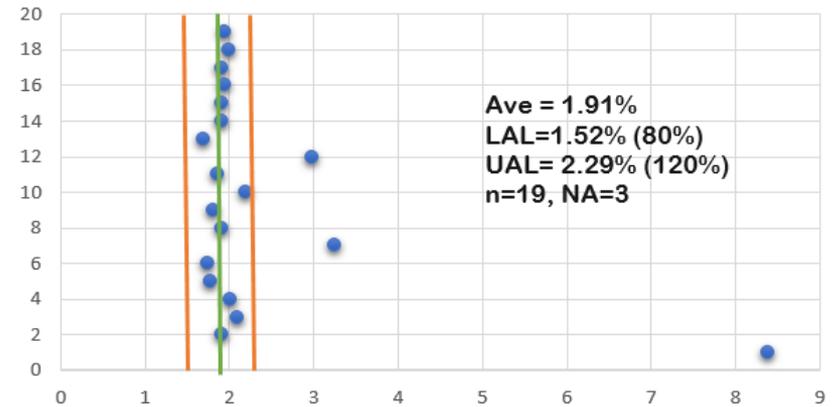


Cannabinoids in Flower - OR

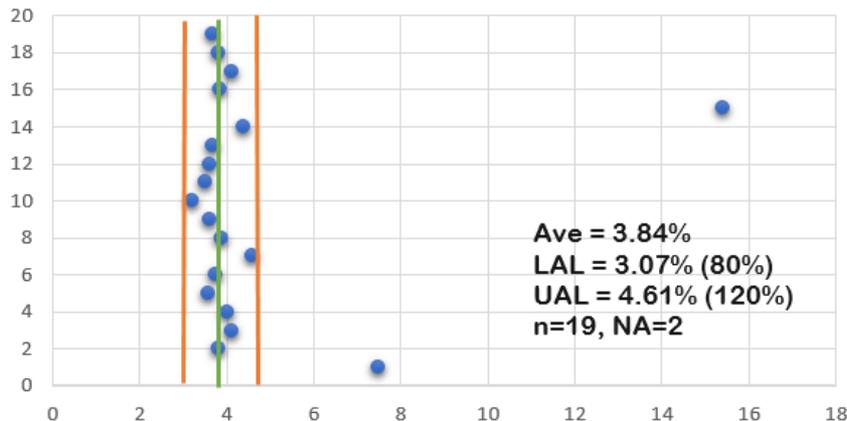
CBD in Flower, August 2016



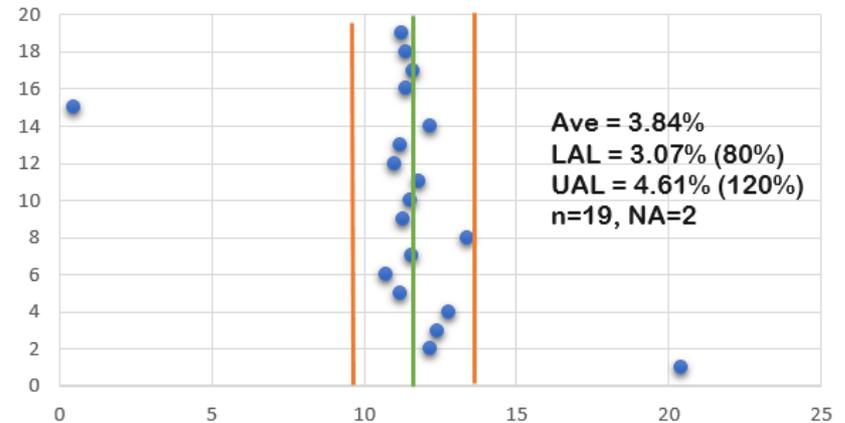
CBDA in Flower, August 2016



THC in Flower, August 2016

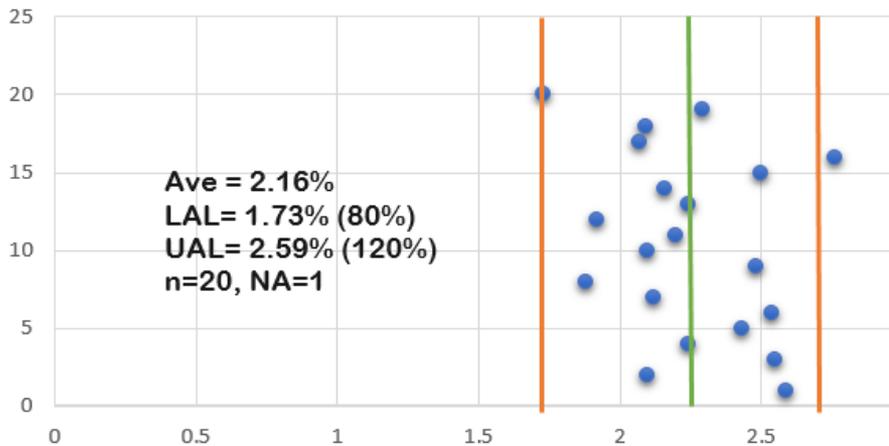


THCA in Flower, August 2016

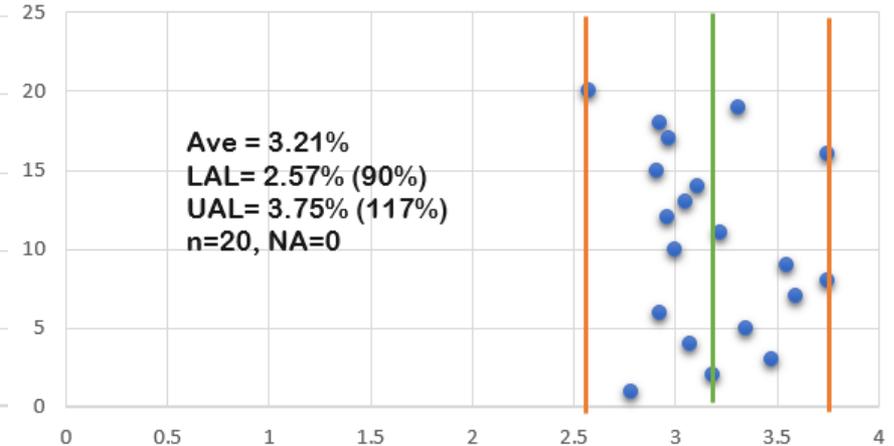


Cannabinoids in Flower - OR

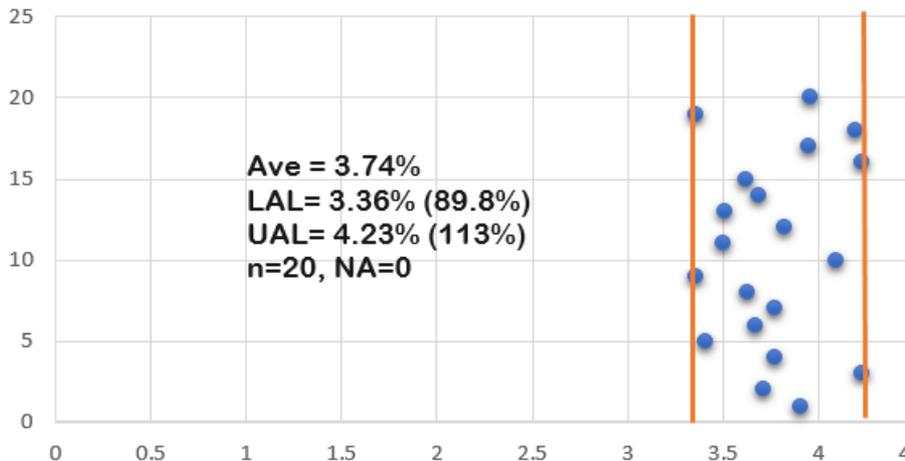
CBD in Flower, August 2017



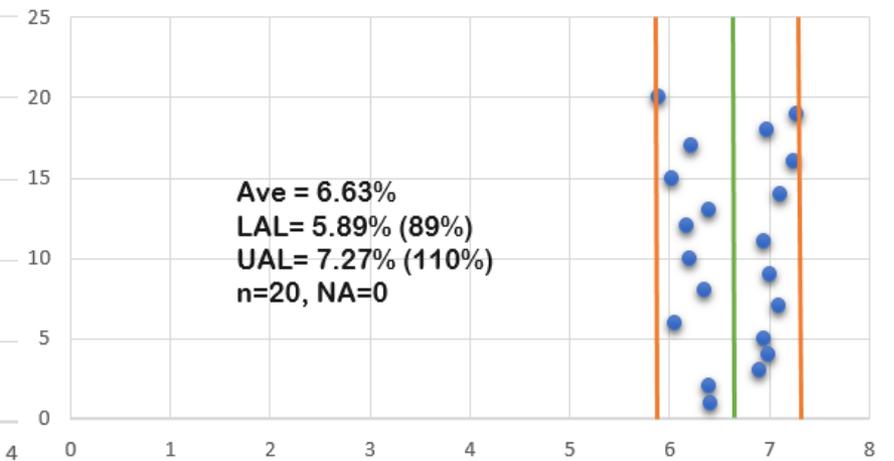
CBDA in Flower, August 2017



THC in Flower, August 2017



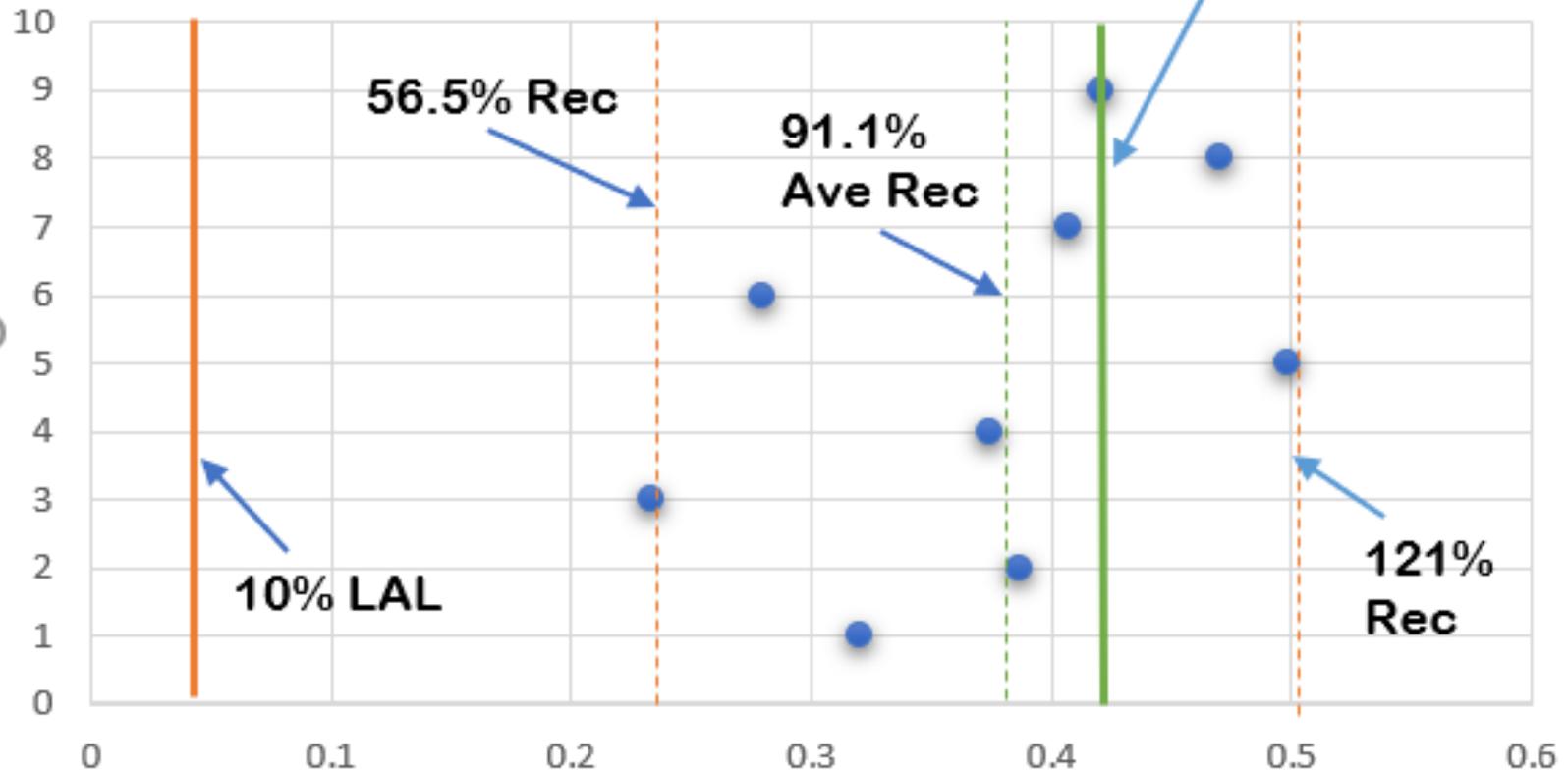
THCA in Flower, August 2017



Pesticides - OR

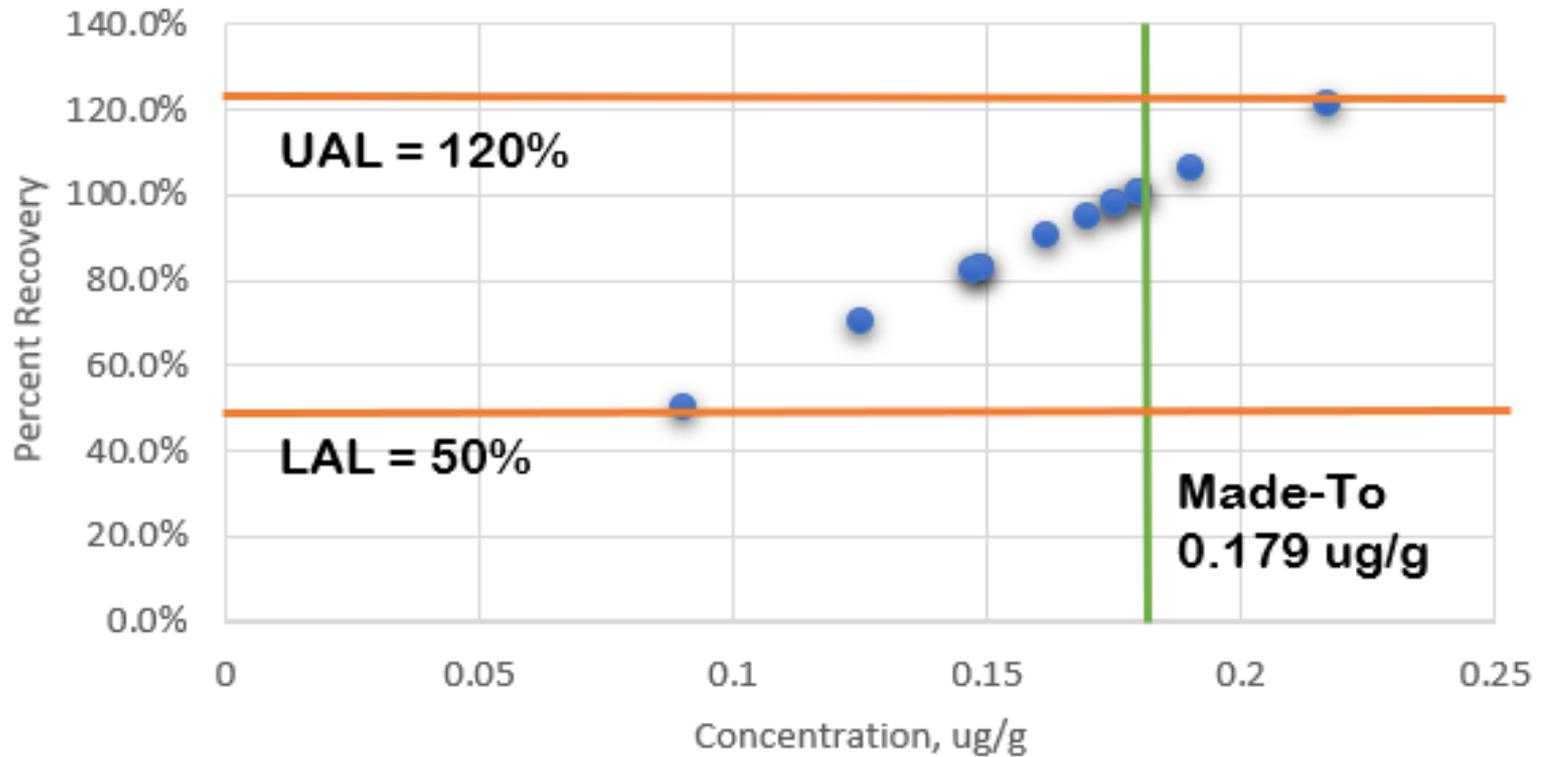
Fipronil

Made-To 0.413 ug/g



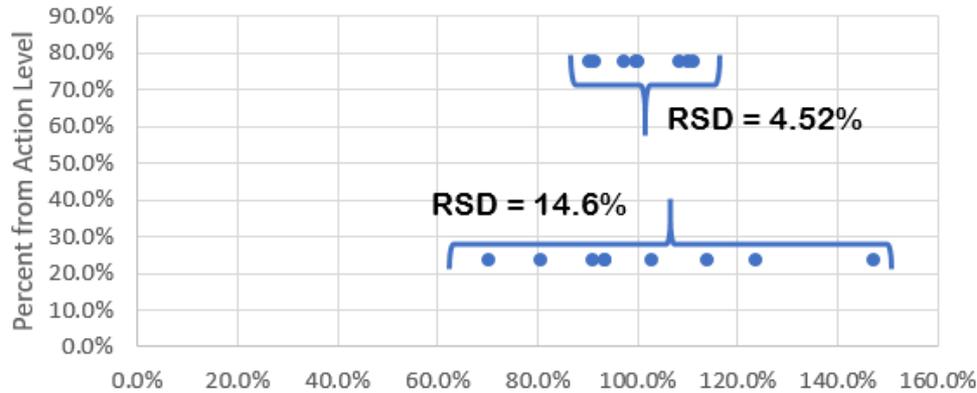
Pesticides - OR

Chlorpyrifos

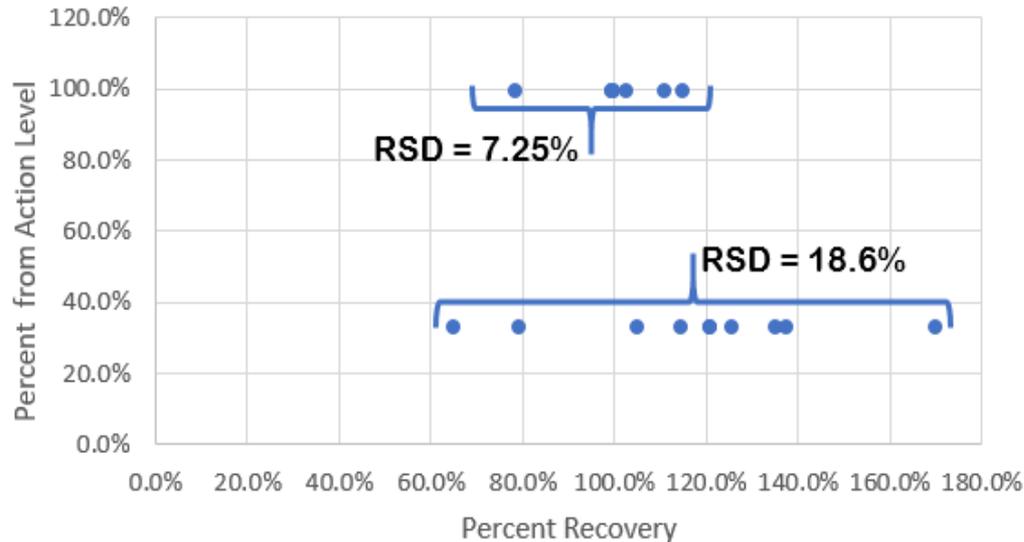


Residual Solvents - OR

Acetone



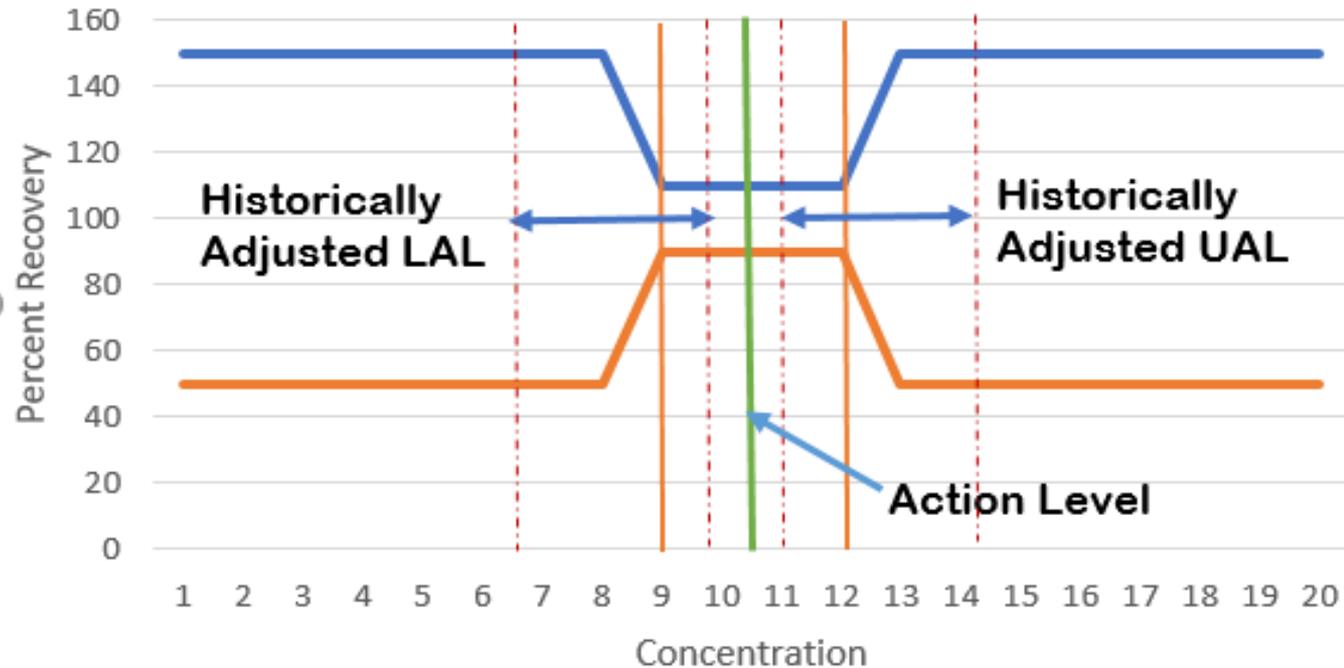
Methylene Chloride



**Closer to Action Level:
Tighter Standard Deviations**

Action Level vs. Eval Criteria

LAL/UAL "Tightness" Based on Historical Stats



Benefits of a Phenova Cannabis PT Program

Benefits of a Phenova Cannabis PT Program - Participants

- Well developed and robust lab user interface and Dashboard
 - ✓ Account management and privilege rights
 - ✓ Ease of Data Entry/Upload
 - ✓ Historical study review and custom report creation

Benefits of a Phenova Cannabis PT Program - Participants

Study: MMJ0216

To avoid losing any data entered, you must save your data at least every 15 minutes

GC/MS Pesticide Residues (Part #: PT-GCPEST-MMJ) Lot #: MMJ1-02

Method Number: 1 OF 1 Add New Method + Delete Method - Copy Method + Autofill Empty Rows

Autofill Default Values Copy previous row

Press 'Enter' After Typing Result To Use Autofill ?

Analyte	Result	Unit	PTRL	Conc. Range	NELAC/Agency Method Code	Method Description	Analysis Date	Analyst	Prep Method
Acephate	2.36	µg/g	0.400	0.800 - 8.00	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>
Acequinocyl	<input type="text"/>	µg/g	2.00	4.00 - 40.0	<input type="text"/> ?	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Bifenthrin	1.88	µg/g	0.200	0.400 - 4.00	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>
Chlorfenapyr	<0.5	µg/g	1.00	2.00 - 20.0	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>
Chlorpyrifos	3.95	µg/g	0.200	0.400 - 4.00	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>
Cyfluthrin	15.2	µg/g	1.00	2.00 - 20.0	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>
Cypermethrin	6.54	µg/g	1.00	2.00 - 20.0	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>
Ethoprophos	<0.1	µg/g	0.200	0.400 - 4.00	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>
Etofenprox	<input type="text"/>	µg/g	0.400	0.800 - 8.00	<input type="text"/> ?	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Fipronil	<0.25	µg/g	0.400	0.800 - 8.00	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>
Fludioxonil	<0.1	µg/g	0.400	0.800 - 8.00	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>
Methyl parathion	1.87	µg/g	0.200	0.400 - 4.00	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>
MGK-264	3.22	µg/g	0.200	0.400 - 4.00	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>
Permethrins, Total	3.98	µg/g	0.200	0.400 - 4.00	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>
Pyrethrins, Total	11.6	µg/g	1.00	2.00 - 20.0	<input type="text"/> ?	SOP 54-43 GC/MS	04/04/2016	THG	<input type="text"/>

Standards List Cancel Previous Standard Next Standard Save

Benefits of a Phenova Cannabis PT Program - Participants

- Concise and complete study documentation
 - ✓ Introductory information
 - ✓ Instructions
 - ✓ Reference Data Reporting Sheets

Benefits of a Phenova Cannabis PT Program - Participants



ADDITIONAL BENEFITS OF THE PT PROGRAM
The PT sample is provided by Phenova Certified Reference Materials Company



6390 Joyce Drive Phone 303-940-0033
100 Fax 866-283-0269
Golden, CO 80403 www.phenova.com

Instruction

SAMPLE DESCRIPTION

- Provided a homogenized design according to MMJ requirements with no dilution for up to 1 and 1 gram

GENERAL INFORMATION

- The blank is provided
- It is suggested that you report matrix is equal to the matrix
- For this PT program, the matrix sample size extraction is 1 gram
- IMPORTANT: please report matrix is equal to the matrix

INSTRUCTION

- Warm the sample
- Carefully concentrate the sample
- If you concentrate the sample into a smaller mass is 50 mg
- Transfer the sample into a vial
- Rinse the vial with the solvent
- The sample is reported as is
- Due to the

Analyte	PTL
Abamectin ³	0.5
Acephate	0.4
Acequinocyl	2
Acetamiprid	0.2
Aldicarb	0.4
Azoxystrobin	0.2
Bifenazate	0.2
Bifenthrin	0.2
Boscalid	0.4
Carbaryl	0.2
Carbofuran	0.2
Chlorantraniliprole	0.2
Chlorfenapyr	1
Chlorpyrifos	0.2
Clofentazine	0.2
Cyfluthrin	1
Cypermethrin	1
Daminozide	1
DDVP (Dichlorvos)	1
Diazinon	0.2
Dimethoate	0.2
Ethoprophos	0.2

Data Reporting Sheet - Oregon Cannabis Proficiency Study

Study ID: ORMJ1118
Opening Date: November 14, 2018 - Closing Date: December 6, 2018
Laboratory: Anova Laboratory Contact: Jeff Fetkenhour
1885 Tucker Rd 541-388-0249
Hood River, OR 97031 EPA Lab ID:
USA

OR MMJ Pesticides in Flower Matrix (PT-ORPEST-MMJ)					Lot #: ORMJ11-01		
NELAC Code	Analyte	< / >	Result	NELAC / Agency Method Code	Method Description	Analysis Date	Analyst (Optional)
7305	Abamectin		µg/g				
7000	Acephate		µg/g				
-	Acequinocyl		µg/g				
-	Acetamiprid		µg/g				
7010	Aldicarb		µg/g				
-	Azoxystrobin		µg/g				
7116	Bifenazate		µg/g				
7117	Bifenthrin		µg/g				
-	Boscalid		µg/g				
7195	Carbaryl		µg/g				
7205	Carbofuran		µg/g				
-	Chlorantraniliprole		µg/g				
-	Chlorfenapyr		µg/g				
7300	Chlorpyrifos		µg/g				
-	Clofentazine		µg/g				
7345	Cyfluthrin		µg/g				
7346	Cypermethrin		µg/g				
-	Daminozide		µg/g				
8610	DDVP (Dichlorvos)		µg/g				
7410	Diazinon		µg/g				
7475	Dimethoate		µg/g				
7570	Ethoprophos		µg/g				
-	Etofenprox		µg/g				
-	Etoxazole		µg/g				
-	Fenoxycarb		µg/g				
-	Fenpyroximate		µg/g				
-	Fipronil		µg/g				
-	Flocicamid		µg/g				

Footnotes:
1- "PTL" refers to the Pesticide Tolerance Limit
2- "Range" refers to the concentration range of the sample
3- Abamectin equivalent to Avermectin-B1a and Avermectin-B1b combined

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Benefits of a Phenova Cannabis PT Program - Participants

- Quick results turnaround and support
 - ✓ Reports issued no more than 5 days after study closing
 - ✓ Readily accessible pre and post study support
 - ✓ Advisement on study outcome/corrective action

Benefits of a Phenova Cannabis PT Program - Participants

Final Report - Oregon Cannabis Proficiency

Study: ORMJ1118

Opening Date: November 14, 2018 - Closing Date: December 7, 2018

Laboratory: Cascadia Labs
7405 SW Tech Center Drive
Suite A160
Portland, OR 97223
USA

Contact: Mr. Evan Mohr, Quality Manager
5037438587

EPA Lab ID:

OR MMJ Pesticides in Flower Matrix (PT-ORPEST-MMJ)										Lot #: ORMJ11-01
NELAC Code	Analyte	Analysis Date	Analyst	Method Code	Method Description	Units	Assigned Value	Result	Acceptance Limits	Evaluation
7366	Abamectin	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.8	<0.20		Acceptable
7000	Acephate	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	0.352	0.33	0.0352 - 0.563	Acceptable
-	Acequinocyl	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<3	<0.39		Acceptable
-	Acetamiprid	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.3	<0.10		Acceptable
7010	Aldicarb	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.6	<0.20		Acceptable
-	Azoxystrobin	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.3	<0.10		Acceptable
7116	Bifenazate	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	0.221	0.17	0.0928 - 0.278	Acceptable
7117	Bifenthrin	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.3	<0.10		Acceptable
-	Boscalid	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	0.429	0.42	0.270 - 0.571	Acceptable
7195	Carbaryl	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.3	<0.10		Acceptable
7205	Carbofuran	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.3	<0.10		Acceptable
-	Chlorantranilprole	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.3	<0.10		Acceptable
-	Chlorfenapyr	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	1.47	1.37	0.632 - 2.18	Acceptable
7300	Chlorpyrifos	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	0.183	0.17	0.0183 - 0.292	Acceptable
-	Clofentezine	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.3	<0.10		Acceptable
7345	Cyfluthrin	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	1.02	0.81	0.428 - 1.60	Acceptable
7346	Cypermethrin	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<2	<0.39		Acceptable
-	Daminozide	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	3.11	4.09	0.497 - 4.98	Acceptable
8610	DDVP (Dichlorvos)	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<2	<0.39		Acceptable
7410	Diazinon	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.3	<0.10		Acceptable
7475	Dimethoate	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	0.259	0.25	0.186 - 0.365	Acceptable
7570	Ethoprophos	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	0.162	0.15	0.115 - 0.217	Acceptable
-	Etofenprox	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.6	<0.10		Acceptable
-	Etoxazole	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.3	<0.10		Acceptable
-	Fenoxycarb	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	0.195	0.18	0.146 - 0.238	Acceptable
-	Fenpyroximate	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.6	<0.10		Acceptable
-	Fipronil	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<0.6	<0.20		Acceptable
-	Flonicamid	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<2	<0.39		Acceptable
-	Fludioxonil	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	0.590	0.65	0.354 - 0.785	Acceptable
-	Hexythiazox	11/19/2018	HMS	805	AOAC 2007.01 Rev.1 2007	µg/g	<2	<0.39		Acceptable

Benefits of a Phenova Cannabis PT Program – AA's

- Complete PT program management
- In matrix programs are no cost to AA agreements/contracts
- Dynamic and immediate response to changing program requirements and criteria
- Receipt of participant reports no later than 5 days after study closing
- Optional EDD formats, ie state database uploads
- Provides a valuable program risk management piece, especially when using real matrix PTs

Thank you for your attention!