

STRIVING FOR EXCELLENCE IN ANALYSIS

# The Magruder Program for evaluating and improving laboratory performance in Fertilizer Analysis

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ASFFPCO – Lexington, KY

June 21-23, 2016

# Topics to cover

• Web site



• Z scores



Robust Statistics

capable of performing without failure under a wide range of conditions

Lab Report Cards

Proficienc	cy Testing For 16 Analytes							Issue Dat	e : 09/30/2	2015
Analyte	Analyte	Lab 04	Lab 0494 Data Analyte Values M					Magruder	Lab 0494	
Group	Group (Units)	Value	range	Rob Mean	Rob SD	R-bar	# Tests	Z Score	Method	Flag
010	Total Nitrogen (25%)	24.43	0.0100	23.68	0.9339	0.2910	66	0.79	010.60	0
050	Soluble Potassium as K2O (15%)	14.83	0.9200	15.08	0.6334	0.2445	80	-0.39	050.00	0
101	Acid Soluble Calcium (%)	0.0177	0.0025	0.0227	0.0113	0.0122	13	-0.45	101.33	0
121	Acid Soluble Magnesium (0.1%)	0.3326	0.0651	0.3601	0.0211	0.0185	50	-1.31	121.33	0
148	Total Sulfur (0.13%)	0.3504	0.0599	0.2921	0.0654	0.0222	29	0.89	148.07	0

Control Charts



# www.magruderchecksample.org



# INTERNATIONAL STANDARD

# ISO 13528

Second edition 2015-08-01

Statistical methods for use in proficiency testing by interlaboratory comparison

### **Determining Z score**



#### Sample # 150711: Grade 3-8-8 Analyte Report Card for Lab Code 0494

#### STRIVING FOR EXCELLENCE IN ANALYSIS

magruder fertilizer

check sample program

#### Proficiency Testing For 18 Analytes

Issue Date : 08/31/2015

Analyte	Analyte	Lab 049	94 Data	Ar	alyte Value	s		Magruder	Lab 0494	
Group	Group (Units)	Value	range	Rob Mean	Rob SD	R-bar	# Tests	Z Score	Method	Flag
010	Total Nitrogen (3%)	4.350	0.0000	4.299	0.1060	0.0529	72	0.48	010.60	0
041	Direct Available Phosphorus as P2O5 (8%)	11.08	0.0700	10.53	1.469	0.1047	43	0.37	041.10	0
050	Soluble Potassium as K2O (8%)	[7.380]	0.2800	8.324	0.4679	0.1240	82	-2.02	050.00	0
101	Acid Soluble Calcium (%)	11.33	0.2791	11.64	0.4103	0.2752	15	-0.76	101.33	0
121	Acid Soluble Magnesium (3%)	3.974	0.6061	3.738	0.1995	0.0826	51	1.19	121.33	1
148	Total Sulfur (%)	8.233	0.3881	7.993	0.6911	0.1541	15	0.35	148.07	0
151	Acid Soluble Arsenic (ppm)	0.6762	0.0687	0.4662	0.4109	0.0357	5	0.51	151.33	0
181	Acid Soluble Cadmium (ppm)	0.0338	0.0004	0.5290	0.9309	0.2616	4	-0.53	181.33	0
191	Acid Soluble Chromium (ppm)	106.4	3.580	104.3	10.99	4.984	18	0.20	191.33	0
202	Acid Soluble Cobalt (ppm)	2.490	0.1183	2.231	0.4601	0.1670	13	0.56	202.33	0
221	Acid Soluble Copper (%)	0.0005	0.0000	0.0009	0.0005	0.0019	18	-0.75	221.33	0
241	Acid Soluble Iron (%)	0.0743	0.0041	0.0679	0.0117	0.0028	16	0.54	241.33	0
251	Acid Soluble Lead (ppm)	0.2561	0.0405	13.92	27.25	8.218	4	-0.50	251.33	0
261	Acid Soluble Manganese (%)	0.0032	0.0001	0.0029	0.0003	0.0002	10	0.96	261.35	0
289	Acid Soluble Molybdenum (ppm)	9.177	0.3245	8.798	1.302	0.5209	13	0.29	289.33	0
291	Acid Soluble Nickel (ppm)	57.47	2.179	57.58	5.413	2.587	19	-0.02	291.33	0
311	Sodium (%)	0.5072	0.0020	0.5238	0.0264	0.0077	6	-0.63	311.33	0
321	Acid Soluble Zinc (%)	0.0074	0.0005	0.0072	0.0019	0.0017	30	0.08	321.33	0

Interpreting Z Scores: Red indicates a normally distributed Z value >3 or <-3 (requires action), Orange = Z between 2 and 3 or -2 and -3 (warning) and Green = Z < 2 and >-2 (OK at 95%). Flags indicate data usage: 0 = Used, 1 = rejected for duplicates too far apart, 2 = rejected as extreme outlier and a 4 flag indicates rejected due to 0 value/s submitted. Robust statistics not used if < 6 labs reporting, in this case the Z Scores are included for information only (Grey). Square brackets indicate that [your value] is lower than the Robust Analyte value less the Investigational Allowance. Method or Analyte codes in light green indicate a guaranteed analyte. Individual lab values may be below detection limits but are reported solely for the purpose of this Proficiency Testing program.

# • **Robust:** capable of performing without failure under a wide range of conditions



capable of PROVIDING good estimate of population data distribution ( $\mu$  and  $\sigma$ ) with wide a range of data from a sample set

### Data for all methods, sample 150111







Not keep: Trimming Keep: Winsorize

Does the datum belong to the population distribution being estimated?

## **Keep : Winsorize**

Data points

< 5 percentile and > 95 percentile

are adjusted.







### **Robust Statistics**



### **Robust Statistics**



# www.magruderchecksample.org





# **Lab Proficiency**

# Two yard sticks for measuring

# Analyte Proficiency and Method Proficiency

### Analyte Report Cards





#### 2015 Regular Check Sample Program 150311 - 6-9-22

#### Reports

Analyte All Tests Report Method All Tests Report Analyte Statistical Summary Individual Method Performance Summary

#### **Report Cards**

Method Report Cards

Analyte Report Cards

#### 2015 Regular Check Sample Program 150311 - 6-9-22

Reports

Analyte All Tests Report Method All Tests Report Analyte Statistical Summary Individual Method Performance Summary

#### **Report Cards**

#### Method Report Cards

#### Analyte Report Cards

RCS150311AnalyteL0007.pdf RCS150311AnalyteL0009.pdf RCS150311AnalyteL0023.pdf RCS150311AnalyteL0025.pdf RCS150311AnalyteL0027.pdf RCS150311AnalyteL0028.pdf RCS150311AnalyteL0029.pdf RCS150311AnalyteL0034.pdf RCS150311AnalyteL0035.pdf RCS150311AnalyteL0037.pdf RCS150311AnalyteL0040.pdf RCS150311AnalyteL0041.pdf RCS150311AnalyteL0042.pdf RCS150311AnalyteL0043.pdf RCS150311AnalyteL0049.pdf RCS150311AnalyteL0055.pdf RCS150311AnalyteL0073.pdf RCS150311AnalyteL0086.pdf RCS150311AnalyteL0090.pdf RCS150311AnalyteL0095.pdf RCS150311AnalyteL0096.pdf RCS150311AnalyteL0102.pdf RCS150311AnalyteL0105.pdf RCS150311AnalyteL0114.pdf RCS150311AnalyteL0117.pdf RCS150311AnalyteL0136.pdf RCS150311AnalyteL0157.pdf RCS150311AnalyteL0169.pdf RCS150311AnalyteL0177.pdf RCS150311AnalyteL0185.pdf RCS150311AnalyteL0220.pdf RCS150311AnalyteL0230.pdf RCS150311AnalyteL0231.pdf RCS150311AnalyteL0233.pdf RCS150311AnalyteL0234.pdf RCS150311AnalyteL0258.pdf RCS150311AnalyteL0275.pdf RCS150311AnalyteL0291.pdf RCS150311AnalyteL0292.pdf RCS150311AnalyteL0307.pdf RCS150311AnalyteL0322.pdf RCS150311AnalyteL0324.pdf RCS150311AnalyteL0325.pdf RCS150311AnalyteL0351.pdf RCS150311AnalyteL0354.pdf RCS150311AnalyteL0356.pdf RCS150311AnalyteL0360.pdf RCS150311AnalyteL0368.pdf RCS150311AnalyteL0371.pdf RCS150311AnalyteL0377.pdf RCS150311AnalyteL0389.pdf RCS150311AnalyteL0390.pdf RCS150311AnalyteL0394.pdf RCS150311AnalyteL0397.pdf RCS150311AnalyteL0402.pdf RCS150311AnalyteL0405.pdf RCS150311AnalyteL0406.pdf RCS150311AnalyteL0415.pdf RCS150311AnalyteL0416.pdf RCS150311AnalyteL0420.pdf RCS150311AnalyteL0421.pdf RCS150311AnalyteL0423.pdf RCS150311AnalyteL0428.pdf RCS150311AnalyteL0433.pdf RCS150311AnalyteL0443.pdf RCS150311AnalyteL0444.pdf RCS150311AnalyteL0451.pdf RCS150311AnalyteL0452.pdf RCS150311AnalyteL0455.pdf RCS150311AnalyteL0456.pdf RCS150311AnalyteL0470.pdf RCS150311AnalyteL0472.pdf RCS150311AnalyteL0474.pdf RCS150311AnalyteL0481.pdf RCS150311AnalyteL0482.pdf RCS150311AnalyteL0483.pdf RCS150311AnalyteL0485.pdf RCS150311AnalyteL0486.pdf RCS150311AnalyteL0487.pdf RCS150311AnalyteL0493.pdf RCS150311AnalyteL0494.pdf RCS150311AnalyteL0498.pdf RCS150311AnalyteL0500.pdf RCS150311AnalyteL0501.pdf RCS150311AnalyteL0506.pdf RCS150311AnalyteL0510.pdf RCS150311AnalyteL0513.pdf

### **Analyte Report Cards**



Sample # 150111: Grade 18-46-0 (DAP) Analyte Report Card for Lab Code 0325

Issue Date : 02/28/2015

#### STRIVING FOR EXCELLENCE IN ANALYSIS

#### Proficiency Testing For 3 Analytes

									4	
Analyte	Analyte	Lab 03	25 Data	Analyte Values			Magruder	Lab 0325		
Group	Group (Units)	Value	range	Rob Mean	Rob SD	R-bar	# Labs	Z Score	Method	Flag
010	Total Nitrogen (18%)	17.60	0.0000	17.74	0.2353	0.0857	66	-0.60	010.60	0
041	Direct Available Phosphorus as P2O5 (46%)	[44.75]	1.500	46.55	0.7703	0.2989	36	-2.34	041.50	0
050	Soluble Potassium as K2O (%)	0.2300	0.2200	0.2191	0.0414	0.0606	14	0.26	050.99	0

Interpreting Z Scores: Red indicates a normally distributed Z value >3 or <-3 (requires action), Orange = Z between 2 and 3 or -2 and -3 (warning) and Green = Z < 2 and >-2 (OK at 95%). Flags indicate data usage: 0 = Used, 1 = rejected for duplicates too far apart, 2 = rejected as extreme outlier and a 4 flag indicates rejected due to 0 value/s submitted. Robust statistics not used if < 6 labs reporting, in this case the Z Scores are included for information only (Grey). Square brackets indicate that [your value] is lower than the Robust Analyte value less the Investigational Allowance. Method or Analyte codes in light green indicate a guaranteed analyte. Individual lab values may be below detection limits but are reported solely for the purpose of this Proficiency Testing program.

### **Analyte Report Cards**



Sample # 150111: Grade 18-46-0 (DAP) Analyte Report Card for Lab Code 0325

Issue Date : 02/28/2015

#### STRIVING FOR EXCELLENCE IN ANALYSIS

#### Proficiency Testing For 3 Analytes

Analyte	Analyte	Lab 0325 Data Analyte Values				Magruder	Lab 0325			
Group	Group (Units)	Value	range	Rob Mean	Rob SD	R-bar	# Labs	Z Score	Method	Flag
010	Total Nitrogen (18%)	17.60	0.0000	17.74	0.2353	0.0857	66	-0.60	010.60	0
041	Direct Available Phosphorus as P2O5 (46%)	[44.75]	1.500	46.55	0.7703	0.2989	36	-2.34	041.50	0
050	Soluble Potassium as K2O (%)	0.2300	0.2200	0.2191	0.0414	0.0606	14	0.26	050.99	0

Interpreting Z Scores: Red indicates a normally distributed Z value >3 or <-3 (requires action), Orange = Z between 2 and 3 or -2 and -3 (warning) and Green = Z < 2 and >-2 (OK at 95%). Flags indicate data usage: 0 = Used, 1 = rejected for duplicates too far apart, 2 = rejected as extreme outlier and a 4 flag indicates rejected due to 0 value/s submitted. Robust statistics not used if < 6 labs reporting, in this case the Z Scores are included for information only (Grey). Square brackets indicate that [your value] is lower than the Robust Analyte value less the Investigational Allowance. Method or Analyte codes in light green indicate a guaranteed analyte. Individual lab values may be below detection limits but are reported solely for the purpose of this Proficiency Testing program.

#### magruder fertilizer check sample program

STRIVING FOR EXCELLENCE IN ANALYSIS

#### Proficiency Testing For 3 Analytes

Z-Score Box and Whisker Plots for Lab # 0325

<guaranteed analyte>



Sample # 150111: Grade 18-46-0 (DAP) Analyte Report Card for Lab Code 0325 Z-Score Box Plot and Guarantees

# Guaranteed in This Sample Analyte Code Value\* IA N 010 17.741 0.696 P205 041 46.552 1.008

\* Value is the Robust Analyte Value estimated using the primary Analyte Codes for this sample.

Notes: The Methods you used are indicated above and the # Labs involved are below the Box and Whisker. Your Z-Score is indicated by the Dot. If you do not see a Dot your score is off the chart. Dots between the Green lines are acceptable Z-Scores. Dots outside the Red lines are actionable. The Bar, Box and Whisker represent Median, 25% to 75% percentile and 5% to 95% percentile respectively.

#### Issue Date : 02/28/2015

### magruder fertilizer check sample program

#### Sample # 150811: Grade 25-5-15 Method Report Card for Lab Code 0494

STRIVING FOR EXCELLENCE IN ANALYSIS

#### Proficiency For 16 Methods

#### Issue Date : 09/30/2015

Method	Analyte	Lab 04	Lab 0494 Data Method Values I			Magruder	Threshold			
Code	Name and Method (Units)	Value	range	Rob Mean	Rob SD	R-bar	# Tests	Z Score	%RSD	Flag
010.60	Total Nitrogen, Combustion (25%)	24.43	0.0100	23.56	1.110	0.2830	51	0.78	2%	0
050.00	Soluble Potassium as K2O, STPB Oxalate (15%)	14.83	0.9200	15.20	0.5261	0.2075	12	-0.70	1%	0
101.33	Acid Soluble Calcium, ICP, test portion 2006 (%)	0.0177	0.0025			0.0025	1			0
121.33	Acid Soluble Magnesium, ICP, test portion 200 (0.1%)	0.3326	0.0651	0.3638	0.0175	0.0108	6	-1.78	4%	1
148.07	Total Sulfur, ICP, test portion as in 2006.03 (0.13%)	0.3504	0.0599	0.3138	0.0515	0.0322	9	0.71	6%	0
165.30	Acid Soluble Boron , ICP, test portion in 98 (0.025%)	0.0286	0.0001	0.0298	0.0027	0.0018	14	-0.49	2%	0
191.33	Acid Soluble Chromium , ICP, 2006.03 modifie (ppm)	3.617	0.0101	2.858	1.073	0.4151	2	0.71	13%	0
202.33	Acid Soluble Cobalt , ICP, 2006.03 modified (ppm)	16.54	0.8849	14.75	1.571	0.9602	3	1.14	6%	0
221.33	Acid Soluble Copper , ICP, test portion 2006 (0.0125%)	0.0154	0.0000	0.0139	0.0019	0.0003	7	0.79	6%	0
241.33	Acid Soluble Iron , ICP, test portion 2006.03 (0.125%)	0.1265	0.0037	0.1200	0.0220	0.0042	7	0.29	3%	0
251.33	Acid Soluble Lead , ICP, 2006.03 modified w/ (ppm)	2.326	0.0809	2.072	0.3590	1.116	2	0.71	6%	0
261.35	Acid Soluble Manganese , ICP, test portion 2 (0.063%)	0.0669	0.0024	0.0646	0.0024	0.0013	5	0.96	2%	0
289.33	Acid Soluble Molybdenum , ICP, 2006.03 modif (125ppm)	149.4	10.17	111.4	53.67	20.16	2	0.71	17%	0
291.33	Acid Soluble Nickel , ICP, 2006.03 modified (ppm)	22.65	1.462	0.7675	0.4984	1.462	1	43.90	1425%	0
311.33	Sodium, ICP, 2006.03 modified w/9:3 HNO3:HCI (%)	0.2306	0.0213	0.2478	0.0244	0.0137	2	-0.71	3%	0
321.33	Acid Soluble Zinc , ICP, test portion 2006.0 (0.063%)	0.0753	0.0015	0.0760	0.0089	0.0030	7	-0.09	0%	0

Interpreting Z Scores: Red indicates a normally distributed Z value >3 or <-3 (requires action), Orange = Z between 2 and 3 or -2 and -3 (warning) and Green = Z < 2 and >-2 (OK at 95%). Flags indicate data usage: 0 = Used, 1 = rejected for duplicates too far apart, 2 = rejected as extreme outlier and a 4 flag indicates rejected due to 0 value/s submitted. Robust statistics not used if < 6 labs used in calculations, in this case the Z Scores are included for information only (Grey). Square brackets indicate that [your value] is lower than the Robust Analyte value less the Investigational Allowance. Method or Analyte codes in light green indicate a guaranteed analyte. Individual lab values may be below detection limits but are reported solely for the purpose of this Proficiency Testing program.



The Association of American Plant Food Control Officials AAPFCO

The Association of Fertilizer and Phosphate Chemists AFPC

**The Fertilizer Institute TFI** 

AOAC, Intl.







## **Questions**?





Association of American Plant Food Control Officials

Fertilizer Check Sample Program

Striving for Excellence in Analysis

With

Inter-Laboratory

Statistical Evaluation

www.magruderchecksample.org

\$300 per year

1 to 2 samples per month **EXTRA** 



### **Determining Z score**



### **Determining Z score**







# Robust statistics



ICP

■ citrate-EDTA



capable of performing without failure under a wide range of conditions

# Robust Statistics



SRS = Simple Random Sample Data set obtained for a Magruder sample

 $\overline{\mathbf{x}}$  and  $\mathbf{s}$ 

capable of PROVIDING good estimate of population data distribution ( $\mu$  and  $\sigma$ ) with wide a range of data from a SRS

### Accuracy vs Precision



### Accuracy vs Precision



### magruder fertilizer check sample program

#### Sample # 150811: Grade 25-5-15 Method Report Card for Lab Code 0494

STRIVING FOR EXCELLENCE IN ANALYSIS

#### Proficiency For 16 Methods

#### Issue Date : 09/30/2015

Method	Analyte	Lab 04	Lab 0494 Data Method Values I			Magruder	Threshold			
Code	Name and Method (Units)	Value	range	Rob Mean	Rob SD	R-bar	# Tests	Z Score	%RSD	Flag
010.60	Total Nitrogen, Combustion (25%)	24.43	0.0100	23.56	1.110	0.2830	51	0.78	2%	0
050.00	Soluble Potassium as K2O, STPB Oxalate (15%)	14.83	0.9200	15.20	0.5261	0.2075	12	-0.70	1%	0
101.33	Acid Soluble Calcium, ICP, test portion 2006 (%)	0.0177	0.0025			0.0025	1			0
121.33	Acid Soluble Magnesium, ICP, test portion 200 (0.1%)	0.3326	0.0651	0.3638	0.0175	0.0108	6	-1.78	4%	1
148.07	Total Sulfur, ICP, test portion as in 2006.03 (0.13%)	0.3504	0.0599	0.3138	0.0515	0.0322	9	0.71	6%	0
165.30	Acid Soluble Boron , ICP, test portion in 98 (0.025%)	0.0286	0.0001	0.0298	0.0027	0.0018	14	-0.49	2%	0
191.33	Acid Soluble Chromium , ICP, 2006.03 modifie (ppm)	3.617	0.0101	2.858	1.073	0.4151	2	0.71	13%	0
202.33	Acid Soluble Cobalt , ICP, 2006.03 modified (ppm)	16.54	0.8849	14.75	1.571	0.9602	3	1.14	6%	0
221.33	Acid Soluble Copper , ICP, test portion 2006 (0.0125%)	0.0154	0.0000	0.0139	0.0019	0.0003	7	0.79	6%	0
241.33	Acid Soluble Iron , ICP, test portion 2006.03 (0.125%)	0.1265	0.0037	0.1200	0.0220	0.0042	7	0.29	3%	0
251.33	Acid Soluble Lead , ICP, 2006.03 modified w/ (ppm)	2.326	0.0809	2.072	0.3590	1.116	2	0.71	6%	0
261.35	Acid Soluble Manganese , ICP, test portion 2 (0.063%)	0.0669	0.0024	0.0646	0.0024	0.0013	5	0.96	2%	0
289.33	Acid Soluble Molybdenum , ICP, 2006.03 modif (125ppm)	149.4	10.17	111.4	53.67	20.16	2	0.71	17%	0
291.33	Acid Soluble Nickel , ICP, 2006.03 modified (ppm)	22.65	1.462	0.7675	0.4984	1.462	1	43.90	1425%	0
311.33	Sodium, ICP, 2006.03 modified w/9:3 HNO3:HCI (%)	0.2306	0.0213	0.2478	0.0244	0.0137	2	-0.71	3%	0
321.33	Acid Soluble Zinc , ICP, test portion 2006.0 (0.063%)	0.0753	0.0015	0.0760	0.0089	0.0030	7	-0.09	0%	0

Interpreting Z Scores: Red indicates a normally distributed Z value >3 or <-3 (requires action), Orange = Z between 2 and 3 or -2 and -3 (warning) and Green = Z < 2 and >-2 (OK at 95%). Flags indicate data usage: 0 = Used, 1 = rejected for duplicates too far apart, 2 = rejected as extreme outlier and a 4 flag indicates rejected due to 0 value/s submitted. Robust statistics not used if < 6 labs used in calculations, in this case the Z Scores are included for information only (Grey). Square brackets indicate that [your value] is lower than the Robust Analyte value less the Investigational Allowance. Method or Analyte codes in light green indicate a guaranteed analyte. Individual lab values may be below detection limits but are reported solely for the purpose of this Proficiency Testing program.



Sample # 150811: Grade 25-5-15 Method Report Card for Lab Code 0494

Issue Date

#### STRIVING FOR EXCELLENCE IN ANALYSIS

#### Proficiency For 16 Methods

Toneicik	Sy lot lo methods							155uc But	
Method	Analyte	Lab 04	94 Data	M	ethod Value	es		Magruder	Γ
Code	Name and Method (Units)	Value	range	Rob Mean	Rob SD	R-bar	# Tests	Z Score	

050.00	Soluble Potassium as K2O, STPB Oxalate (15%)	14.83	0.9200	15.20	0.5261	0.2075	12	-0.70



#### Sample # 150811: Grade 25-5-15 Method Report Card for Lab Code 0494

Issue Date : 09/30/2015

STRIVING FOR EXCELLENCE IN ANALYSIS

#### roficiency For 16 Methods

Method	Analyte	Lab 049	Lab 0494 Data		Method Values				Threshold	
Code	Name and Method (Units)	Value	range	Rob Mean	Rob SD	R-bar	# Tests	Z Score	%RSD	Flag

121.33         Acid Soluble Magnesium, ICP, test portion 200 (0.1%)         0.3326         0.0651         0.3638         0.0175         0.0108         6         -1.78         4%	1
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### Control Charts



# 2 excel file versions in beta testing

🗙   🛃 🤊 - (° -	Rev3_MyControlChart_Phosphor	us.xlsm - Mic	rosoft		x				
File Home	Insert Page Lay Formulas Data Re	view View	Develope 🔗	<b>?</b> -	23 %	ŧ			
Paste Clipboard	libri × 11 × <i>I</i> <u>U</u> × A <sup>*</sup> A <sup>*</sup> × <u>A</u> × Font □	ber Styles	Edit	Â7 - AA - ing		c 1			
D1	▼ (= <i>f</i> x				~	5			
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1 2 Enter Dat	ta					1			
3 4 5	nalyte Proficiency			<b>X</b>	le Hom	Rev3_MyContr e Insert Page Layout	rolChart_Phosphorus.xlsm - Formulas Data Review	Microsoft E View Deve	xcel 🗖 🗖 💌 🗙
6 Sample A	nalyte Name	Z Score S	ample Nar		<b>X</b>	Calibri - 11 -			$\Sigma = \frac{A}{Z} \nabla =$
7 151211 Dir	rect available P as P2O5	0.74 1	10-10-10		1 🕞 - 🛛	B I U - A A		•	□ 🖳 - 🗛 -
8 151112 Dir	rect available P as P2O5	-1.63 N	AP	Past	te 🍶		via sin and a sin a s	ber Styles	Cells
9 151011 Dir	rect available P as P2O5	0.13 1	15-5-10	Clink	voard E	Eant I	Alignment 5		Editing
10 150912 Dir	rect available P as P2O5	0.30 8	3-4-8	Cipt		-	Augument is		Luting
11 150811 Dir	rect available P as P2O5	-0.86 2	25-5-15		D1	• ("	Ĵx:		×
12 150711 Dir	rect available P as P2O5	-1.76 3	3-8-8		Α		В	С	D 🗖
13 150611 Dir	ect available P as P205	-2.21 N	IAP plus m	1	Enter	Data			
14 150311 Dir	ect available P as P205	1./5 6	o-9-22	2	Linter	Data			
Ready Caraph	analyte / method / Admin /	ੴI ◀	·····	3 4 5		Method Profi	ciency		
				6	Sample	Analyte Name and	Method	Z Score	Sample Name
				7	151211	Direct Available P as P20	5, ICP, citrate-extraction	0.41	10-10-10
				8	151112	Direct Available P as P20	5, ICP, citrate-extraction	-1.11	MAP
				9	151011	Direct Available P as P2O	5, ICP, citrate-extraction	-0.62	15-5-10
				10	150912	Direct Available P as P2O	5, ICP, citrate-extraction	0.11	8-4-8
				11	150811	Direct Available P as P2O	5, ICP, citrate-extraction	-1.30	25-5-15
				12	150711	Direct Available P as P2O	5, ICP, citrate-extraction	-2.28	3-8-8
				13	150611	Direct Available P as P20	5, ICP, citrate-extraction	-0.94	MAP plus micros
				13 14	150611 150311	Direct Available P as P20 Direct Available P as P20	5, ICP, citrate-extraction 5, ICP, citrate-extraction	-0.94 0.90	MAP plus micros 6-9-22
				13 14 15	150611 150311 ▶ ▶ gra	Direct Available P as P20 Direct Available P as P20 phs / analyte / met	5, ICP, citrate-extraction 5, ICP, citrate-extraction hod Admin	-0.94 0.90	MAP plus micros 6-9-22

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