



Two New IA Based Metrics

for Magruder Reports

- ❖ IA Ratio
- ❖ IA Status

Investigational Allowance aka IA

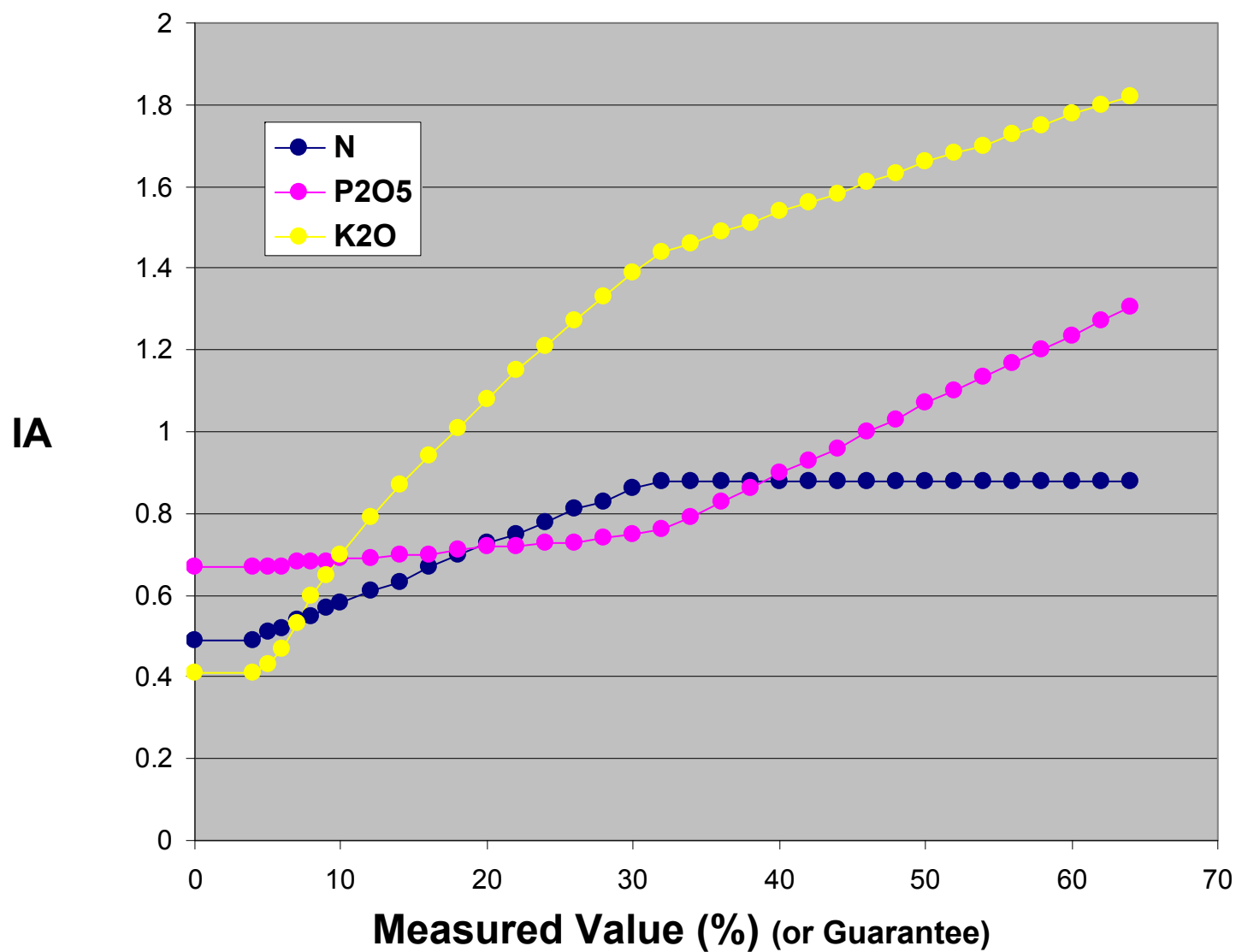
- The IA is calculated to statistically represent 99% of the analytical data from labs running the same analyte.
- NPK IA's follow a specified Table in the OP.
- Other guaranteed mineral nutrient IA's follow specified equations, also in the OP.

The IA comes from industry and represents a **fixed allowed variability about a result value.**

This is highly recommended for Proficiency Testing!



N-P-K IA Table Values (Plotted)





Micronutrient IA Calculation

IA is based on Guarantee or Measured Value

$$\text{IA} = \text{Unit} + \% \text{ of Value}$$

Analyte	Unit	%
Ca	0.2	5
Mg	0.2	5
S	0.2	5
B	0.003	15
Co (ppm)	1	30
Cl	0.005	10
Cu	0.005	10
Fe	0.005	10
Mn	0.005	10
Mo (ppm)	1	30
Na	0.005	10
Zn	0.005	10

Maximum IA = 1 (% point)
Or 10,000 ppm

Not all Elements have been assigned an IA value!

Investigational Allowance aka IA

- It was discovered that the IA represents 99% of the measurements (R. C. Rund, OP # 28, 1975). Or as Rund optimistically quotes, “one chance in a 100 of making an error”.
- Then **IA/2.33** would represent 68% of the measurements under a Normal curve or 1 standard deviation.
- By substituting Assigned Value for Guarantee in the above Tables we calculate an **IA at the Assigned Value** from which is calculated an **IA %RSD** as follows:

First calculate the $IA_{SD} = \frac{IA_{AV}}{2.33}$

$$IA \%RSD = \frac{IA_{SD}}{\text{Robust Mean}} \times 100$$

New Dispersion Metric for Individual Methods and Analytes Performance Reports

$$\text{IA Ratio} = \frac{\text{Robust \%RSD}}{\text{IA \%RSD}}$$

- Both %RSD's represent ~68% of data.
- This factor should be less than 1.
- Lower implies more precision relative to IA.
- Values ≤ 1 will appear in **Green**.
- Values > 1 may appear in **Green**, **Orange** if marginally significant and **Red** if Significant (f ratio).
- No color is applied where the number of labs contributing to the robust %RSD is < 6 .

Let's look at this new metric in Magruder Summary Reports

magruder fertilizer check sample program



STRIVING FOR EXCELLENCE IN ANALYSIS

Method Proficiency For All Labs (Lab Values)

Sample # 171211

Grade 5-15-30

Statistical Summary

Methods: 149

Labs Reporting: 91

Issue Date : 01/31/2018

Method Code	Analyte & Method Sample #171211	# Tests Submitted	# Tests in Robust Calculations	Raw Mean	Raw SD	Assigned Value Robust Mean	IA at Method Value	Robust sd	Robust Uncertainty (U)	Robust % R SD	Method IA Ratio	Average Range (R-bar)	Horwitz %RSD
001.10	Ammoniacal Nitrogen, Magnesium Oxide Method (%)	12	12	4.270	0.1068	4.270		0.1211	0.0437	2.84%		0.0404	3.21%
001.99	Ammoniacal Nitrogen, Other (%)	21	21	4.395	0.1598	4.383		0.1391	0.0379	3.17%		0.0444	3.20%
002.20	Nitrate Nitrogen, Jones Modified (%)	1		4.445									
002.99	Nitrate Nitrogen, Other (%)	17	17	0.7412	0.0969	0.7302		0.0826	0.0250	11.32%		0.0410	4.19%
009.10	Ammoniacal Plus Nitrate Nitrogen, Devarda (%)	4	4	5.118	0.0814	5.118		0.0814	0.0509	1.59%		0.0725	3.13%
009.99	Ammoniacal Plus Nitrate Nitrogen, Other (%)	2	2	5.295	0.0636								
010.11	Total Nitrogen, Modified Comprehensive (5%)	6	6	4.953	0.2272	4.968	0.5094	0.2215	0.1130	4.46%	1.01	0.0536	3.14%
010.12	Total Nitrogen, Salicylic (5%)	2	2	5.173	0.0180								
010.16	Total Nitrogen, Raney (5%)	1		4.760									
010.60	Total Nitrogen, Combustion (5%)	54	52	5.161	0.1713	5.160	0.5116	0.1335	0.0231	2.59%	0.61	0.0700	3.12%
010.99	Total Nitrogen, Other (5%)	6	6	5.120	0.2614	5.120	0.5112	0.2964	0.1512	5.79%	1.35	0.0430	3.13%
020.10	Total Phosphorus as P2O5, Gravimetric Quinolinium ...	4	4	15.69	0.1322	15.69		0.1322	0.0826	0.84%		0.1450	2.64%
020.20	Total Phosphorus as P2O5, Spectrophotometric Molyk	17	16	15.72	0.6043	15.76		0.4983	0.1557	3.16%		0.1087	2.64%
020.40	Total Phosphorus as P2O5, Automated (%)	2	2	15.36	0.1237								
020.50	Total Phosphorus as P2O5, ICP (%)	19	17	15.60	0.6775	15.58		0.7381	0.2238	4.74%		0.2275	2.65%
020.99	Total Phosphorus as P2O5, Other (%)	6	5	15.92	2.340	15.92		2.340	1.308	14.70%		0.0720	2.64%
030.40	Citrate Insoluble Phosphorus as P2O5, Automated, t...	1		0.1700									
040.20	Indirect Available Phosphorus as P2O5, Spectrophot...	2	2	15.78	0.3076								
040.40	Indirect Available Phosphorus as P2O5, Automated (1:	1		15.11									
040.99	Indirect Available Phosphorus as P2O5, Other (15%)	1		15.32									
041.10	Direct Available Phosphorus as P2O5, Gravimetric Q...	4	4	15.14	0.4647	15.14	0.7000	0.4647	0.2904	3.07%	1.55	0.3624	2.66%
041.11	Direct Available Phosphorus as P2O5, Gravimetric Q...	2	2	15.20	0.2121								
041.20	Direct Available Phosphorus as P2O5, Spectrophotom	1		14.63									
041.21	Direct Available Phosphorus as P2O5, Spectrophotom	5	5	15.08	0.4960	15.08	0.7000	0.4960	0.2773	3.29%	1.65	0.1900	2.66%
041.40	Direct Available Phosphorus as P2O5, Automated (15'	1		15.82									
041.50	Direct Available Phosphorus as P2O5, ICP (15%)	2	2	15.13	0.2475								
041.51	Direct Available Phosphorus as P2O5, ICP, Citrate-...	9	9	15.12	0.2059	15.12	0.7000	0.2250	0.0937	1.49%	0.75	0.2163	2.66%
041.60	Direct Available Phosphorus as P2O5, Citrate-EDTA ...	13	13	15.09	0.3216	15.09	0.7000	0.3647	0.1264	2.42%	1.21	0.1117	2.66%
041.99	Direct Available Phosphorus as P2O5, Other (15%)	11	11	15.11	0.2449	15.11	0.7000	0.1439	0.0542	0.95%	0.48	0.1173	2.66%
048.10	Water Soluble Phosphorus as P2O5, Gravimetric Quin	1		12.91									
048.20	Water Soluble Phosphorus as P2O5, Spectrophotome	2	2	12.81	0.3829								

Method Code	Analyte & Method Sample # 171211	# Tests Submitted	# Tests in Robust Calculations	Raw Mean	Raw SD	Assigned Value Robust Mean	IA at Method Value	Robust sd	Robust Uncertainty (U)	Robust % RSD	Method IA Ratio	Average Range (R-bar)	Howitz %RSD
048.40	Water Soluble Phosphorus as P2O5, Automated (%)	1		12.93									
048.50	Water Soluble Phosphorus as P2O5, ICP (%)	1		13.17									
048.99	Water Soluble Phosphorus as P2O5, Other (%)	2	2	12.87	0.0389								
050.00	Soluble Potassium as K2O, STPB Oxalate (30%)	9	9				1.4010	0.4027	0.1678	1.32%	0.67	0.1660	2.39%
050.30	Soluble Potassium as K2O, AA (Oxalate) (30%)	6	6				1.4097	1.678	0.8563	5.45%	2.77	1.040	2.39%
050.31	Soluble Potassium as K2O, AA (Citrate) (30%)	1											
050.50	Soluble Potassium as K2O, ICP (Oxalate) (30%)	8	8	30.34	0.7594	30.26	1.3965	0.6669	0.2947	2.20%	1.11	0.7126	2.39%
050.51	Soluble Potassium as K2O, ICP (Citrate) (30%)	3	3	25.77	8.520	25.77	1.2631	8.520	6.149	33.06%	15.72	0.4067	2.45%
050.52	Soluble Potassium as K2O, ICP (Citrate-EDTA) (30%)	10	10	30.84	0.7952	30.84	1.4111	0.8899	0.3518	2.89%	1.47	0.3836	2.39%
050.60	Soluble Potassium as K2O, Flame Photometric (Oxala	5	5	28.39	7.530	28.39	1.3417	7.530	4.209	26.52%	13.08	0.0341	2.42%
050.61	Soluble Potassium as K2O, Flame Photometric (Citra..	2	2	30.94	0.0566								
050.62	Soluble Potassium as K2O, Flame Photometric (Citra..	2	2	30.54	0.3168								
050.99	Soluble Potassium as K2O, Other (30%)	36	35	30.24	1.291	30.41	1.4003	0.6747	0.1426	2.22%	1.12	0.3845	2.39%
060.00	Water (Free), Vacuum Oven (%)	2	2	0.6775	0.1096								
060.30	Water (Free), AFPC No. 2B (105°C oven for 2 hours,...	1		1.150									
060.99	Water (Free), Other (%)	5	5	1.214	0.5529	1.214		0.5529	0.3091	45.54%		0.0612	3.88%
101.00	Acid Soluble Calcium, AA, inorganic 965.09 (1%)	4	4	0.3687	0.0239	0.3687	0.2184	0.0239	0.0150	6.49%	0.26	0.0168	4.65%
101.30	Acid Soluble Calcium, ICP, test portion inorganic ... (1%	16	15	0.3922	0.1049	0.3700	0.2185	0.0582	0.0188	15.74%	0.62	0.0131	4.65%
101.32	Acid Soluble Calcium, ICP, test portion 2006.03A-C...	5	5	0.3875	0.0486	0.3875	0.2194	0.0486	0.0272	12.55%	0.52	0.0212	4.61%
101.33	Acid Soluble Calcium, ICP, test portion 2006.03A-C...	10	10	0.3459	0.0453	0.3531	0.2177	0.0238	0.0094	6.75%	0.26	0.0139	4.68%
101.70	Acid Soluble Calcium, Titrimetric (1%)	4	4				0.2469	0.2996	0.1872	31.93%	2.83	0.0800	4.04%
101.99	Acid Soluble Calcium, Other (1%)	6	6				0.2240	0.1950	0.0995	40.62%	2.03	0.0242	4.47%
121.00	Acid Soluble Magnesium, AA, inorganic 965.09 (1.2%)	8	8	1.200	0.2099	1.200	0.2604	0.1543	0.0682	12.77%	1.38	0.0502	3.89%
121.30	Acid Soluble Magnesium, ICP, test portion inorgani... (18	18	1.189	0.1019	1.186	0.2593	0.1084	0.0319	9.14%	0.97	0.0280	3.90%
121.32	Acid Soluble Magnesium, ICP, test portion 2006.03A...	6	6	1.196	0.1685	1.155	0.2577	0.0837	0.0427	7.25%	0.76	0.0183	3.91%
121.33	Acid Soluble Magnesium, ICP, test portion 2006.03A...	12	12	1.176	0.0627	1.177	0.2589	0.0686	0.0248	5.83%	0.62	0.0348	3.90%
121.70	Acid Soluble Magnesium, Titrimetric (EDTA) (1.2%)	1		1.650									
121.99	Acid Soluble Magnesium, Other (1.2%)	9	9	1.182	0.1401	1.198	0.2599	0.0777	0.0324	6.48%	0.70	0.0291	3.89%
131.00	Water Soluble Magnesium, AA (%)	2	2	1.061	0.0906								
131.30	Water Soluble Magnesium, ICP (%)	1		0.9850									
131.70	Water Soluble Magnesium, Titrimetric (EDTA) (%)	3	3	1.008	0.3840	1.008		0.3840	0.2771	38.11%		0.0791	4.00%
143.00	Elemental Sulfur, Gravimetric Sulfur - carbon disu... (%)	2	2	1.352	0.4634								
143.99	Elemental Sulfur, Other (%)	3	3	5.622	0.5777	5.622		0.5777	0.4169	10.28%		0.1133	3.08%
145.00	Sulfate Sulfur, HCl soluble, Gravimetric Sulfur - ... (%)	6	6	4.189	0.1779	4.189		0.2017	0.1029	4.82%		0.0862	3.22%
145.99	Sulfate Sulfur, HCl soluble, Other (%)	2	2	4.518	1.107								
148.00	Total Sulfur, Combustion (5%)	5	5	5.940	0.2083	5.940	0.4970	0.2083	0.1164	3.51%	0.98	0.1818	3.06%
148.01	Total Sulfur, Gravimetric - sulfate and elemental... (5%)	10	9				0.4584	1.069	0.4456	20.69%	5.44	0.1293	3.12%
148.07	Total Sulfur, ICP, test portion as in 2006.03 modi... (5%)	11	11				0.4637	1.154	0.4350	21.88%	5.80	0.0692	3.11%
148.99	Total Sulfur, Other (5%)	12	12				0.4808	0.6252	0.2256	11.13%	3.03	0.2017	3.08%
149.04	Sulfur - HNO3 soluble, ICP (%)	2	2	5.981	0.0333								
151.30	Acid Soluble Arsenic , ICP (ppm)	7	7	154.2	36.09	157.3		33.63	15.89	21.39%		3.651	7.47%
151.32	Acid Soluble Arsenic , ICP, 2006.03 (ppm)	1		206.8									

Method Code	Analyte & Method Sample # 171211	# Tests Submitted	# Tests in Robust Calculations	Raw Mean	Raw SD	Assigned Value Robust Mean	IA at Method Value	Robust sd	Robust Uncertainty (U)	Robust % RSD	Method IA Ratio	Average Range (R-bar)	Howitz %RSD
151.33	Acid Soluble Arsenic , ICP, 2006.03 modified w/9:3...	5	5	206.2	16.51	206.2		16.51	9.229	8.01%		5.192	7.17%
151.34	Acid Soluble Arsenic , ICP, EPA 3050B/6010C (ppm)	2	2	189.3	8.734								
151.99	Acid Soluble Arsenic , Other (ppm)	2	2	134.0	34.72								
165.00	Acid Soluble Boron , Spectrophotometric (0.3%)	11	11	0.2285	0.0346	0.2342	0.0381	0.0193	0.0073	8.24%	1.18	0.0157	4.98%
165.30	Acid Soluble Boron , ICP, test portion in 982.01 (0.3%)	11	11				3	0.0259	0.0098	10.43%	1.50	0.0073	4.93%
165.99	Acid Soluble Boron , Other (0.3%)	20	19				2	0.0318	0.0091	12.51%	1.80	0.0107	4.91%
171.10	Water Soluble Boron , Spectrophotometric (%)	11	11					0.0491	0.0185	33.35%		0.0115	5.34%
171.99	Water Soluble Boron , Other (%)	2	2	0.2450	0.0141								
181.30	Acid Soluble Cadmium , ICP (ppm)	10	9	146.8	48.47	148.8		50.51	21.05	33.95%		4.281	7.53%
181.32	Acid Soluble Cadmium , ICP, 2006.03 (ppm)	1		176.9									
181.33	Acid Soluble Cadmium , ICP, 2006.03 modified w/9:3...	5	5	173.0	19.53	173.0		19.53	10.92	11.29%		5.319	7.37%
181.34	Acid Soluble Cadmium , ICP, EPA 3050B/6010C (ppm)	2	2	167.8	15.14								
181.99	Acid Soluble Cadmium , Other (ppm)	3	3	148.2	24.75	148.2		24.75	17.86	16.71%		0.3700	7.54%
191.30	Acid Soluble Chromium , ICP (ppm)	9	9	346.9	74.42	349.0		79.62	33.18	22.82%		15.14	6.63%
191.32	Acid Soluble Chromium , ICP, 2006.03 (ppm)	1		421.2									
191.33	Acid Soluble Chromium , ICP, 2006.03 modified w/9:...	5	5	415.3	28.54	415.3		28.54	15.96	6.87%		5.936	6.46%
191.34	Acid Soluble Chromium , ICP, EPA 3050B/6010C (ppm)	2	2	401.3	12.32								
191.99	Acid Soluble Chromium , Other (ppm)	3	3	303.8	22.72	303.8		22.72	16.40	7.48%		11.19	6.77%
202.30	Acid Soluble Cobalt , ICP (ppm)	5	5	271.5	57.55	271.5	82.4440	57.55	32.17	21.20%	1.63	9.200	6.88%
202.32	Acid Soluble Cobalt , ICP, 2006.03 (ppm)	2	2	297.8	20.93								
202.33	Acid Soluble Cobalt , ICP, 2006.03 modified w/9:3 ... (I	5	5	310.0	26.39	310.0	94.0105	26.39	14.75	8.51%	0.65	5.820	6.75%
202.34	Acid Soluble Cobalt , ICP, EPA 3050B/6010C (ppm)	3	3	251.4	85.25	251.4	76.4077	85.25	61.52	33.91%	2.60	25.82	6.96%
202.99	Acid Soluble Cobalt , Other (ppm)	4	4	278.9	35.43	278.9	84.6713	35.43	22.15	12.70%	0.98	9.350	6.85%
221.00	Acid Soluble Copper , AA, inorganic 965.09 (0.1%)	4	4	0.0351	0.0131	0.0351	0.0085	0.0131	0.0082	37.35%	3.59	0.0018	6.62%
221.30	Acid Soluble Copper , ICP, test portion inorganic ... (0.	17	16	0.0261	0.0037	0.0263	0.0076	0.0039	0.0012	14.76%	1.18	0.0010	6.92%
221.32	Acid Soluble Copper , ICP, test portion 2006.03A-C...	4	4	128.8	257.5	128.8	1.0000	257.5	160.9	199.96%	599.95	7.500	1.93%
221.33	Acid Soluble Copper , ICP, test portion 2006.03A-C...	8	8	0.0254	0.0021	0.0251	0.0075	0.0011	0.0005	4.21%	0.33	0.0010	6.96%
221.99	Acid Soluble Copper , Other (0.1%)	8	8	0.0351	0.0265	0.0272	0.0077	0.0039	0.0017	14.44%	1.18	0.0059	6.88%
241.00	Acid Soluble Iron , AA, inorganic 965.09 (0.5%)	7	7				0.0558	0.0683	0.0322	13.44%	2.85	0.0149	4.43%
241.30	Acid Soluble Iron , ICP, test portion inorganic 965...	18	17				0.0617	0.0452	0.0137	7.97%	1.71	0.0149	4.36%
241.32	Acid Soluble Iron , ICP, test portion 2006.03A-C (0.5%)	4	4				0.0620	0.1077	0.0673	18.89%	4.05	0.0161	4.35%
241.33	Acid Soluble Iron , ICP, test portion 2006.03A-C, w... (C	12	11	0.5585	0.0293	0.5583	0.0608	0.0327	0.0123	5.85%	1.25	0.0097	4.37%
241.99	Acid Soluble Iron , Other (0.5%)	9	9	0.5202	0.0717	0.5260	0.0576	0.0674	0.0281	12.82%	2.73	0.0236	4.41%
251.30	Acid Soluble Lead , ICP (ppm)	10	10	753.4	205.3	757.4		223.9	88.51	29.57%		33.03	5.90%
251.32	Acid Soluble Lead , ICP, 2006.03 (ppm)	1		906.9									
251.33	Acid Soluble Lead , ICP, 2006.03 modified w/9:3 HN...	5	5	957.6	112.6	957.6		112.6	62.92	11.75%		38.07	5.69%
251.34	Acid Soluble Lead , ICP, EPA 3050B/6010C (ppm)	2	2	1,027	89.87								
251.99	Acid Soluble Lead , Other (ppm)	3	3	760.8	206.9	760.8		206.9	149.3	27.20%		6.107	5.89%
261.12	Acid Soluble Manganese , AA, inorganic 965.09 (0.3%)	4	4	0.0272	0.0025	0.0272	0.0077	0.0025	0.0016	9.27%	0.76	0.0040	6.88%
261.30	Acid Soluble Manganese , ICP, test portion 972.02a...	9	9	0.0344	0.0285	0.0258	0.0076	0.0044	0.0018	17.19%	1.36	0.0006	6.93%
261.31	Acid Soluble Manganese , ICP, test portion 972.02b...	3	3	0.0269	0.0028	0.0269	0.0077	0.0028	0.0020	10.45%	0.85	0.0013	6.89%
261.32	Acid Soluble Manganese , ICP, test portion inorgan...	5	5	32.75	73.09	32.75	1.0000	73.09	40.86	223.18%	170.30	2.656	2.37%

Method Code	Analyte & Method Sample # 171211	# Tests Submitted	# Tests in Robust Calculations	Raw Mean	Raw SD	Assigned Value Robust Mean	IA at Method Value	Robust sd	Robust Uncertainty (U)	Robust % RSD	Method IA Ratio	Average Range (R-bar)	Howitz %RSD
261.33	Acid Soluble Manganese , ICP, test portion organic...	1		0.0263									
261.34	Acid Soluble Manganese , ICP, test portion 2006.03...	4	4	0.0253	0.0021	0.0253	0.0075	0.0021	0.0013	8.21%	0.64	0.0006	6.96%
261.35	Acid Soluble Manganese , ICP, test portion 2006.03...	8	8	0.0557	0.0887	0.0260	0.0076	0.0047	0.0021	18.09%	1.44	0.0082	6.93%
261.99	Acid Soluble Manganese , Other (0.3%)	8	7	0.0246	0.0025	0.0247	0.0075	0.0025	0.0012	10.19%	0.79	0.0032	6.98%
271.00	Water Soluble Manganese , AA (%)	1		0.0140									
271.30	Water Soluble Manganese , ICP, Ext. 972.03 (%)	2	2	0.0133	0.0004								
281.00	Acid Soluble Mercury , AA (ppm)	1		25.59									
281.30	Acid Soluble Mercury , ICP (ppm)	4	4	15.94	16.90	15.94		16.90	10.56	106.01%		0.9650	10.55%
281.99	Acid Soluble Mercury , Other (ppm)	2	2	18.95	14.38								
289.30	Acid Soluble Molybdenum , ICP (100ppm)	10	10	572.0	126.7	594.6	179.3680	79.65	31.48	13.40%	1.03	24.50	6.12%
289.32	Acid Soluble Molybdenum , ICP, 2006.03 (100ppm)	2	2	613.8	30.79								
289.33	Acid Soluble Molybdenum , ICP, 2006.03 modified w/..	8	8	653.5	86.68	653.5	197.0542	98.30	43.44	15.04%	1.16	29.45	6.03%
289.34	Acid Soluble Molybdenum , ICP, EPA 3050B/6010C (1	3	3	558.9	239.2	558.9	168.6698	239.2	172.6	42.80%	3.30	65.66	6.17%
289.99	Acid Soluble Molybdenum , Other (100ppm)	3	3	504.1	452.5	504.1	152.2320	452.5	326.6	89.77%	6.93	6.331	6.27%
291.30	Acid Soluble Nickel , ICP (ppm)	7	7	20.64	5.070	20.64		5.749	2.716	27.85%		0.6114	10.14%
291.32	Acid Soluble Nickel , ICP, 2006.03 (ppm)	1		23.68									
291.33	Acid Soluble Nickel , ICP, 2006.03 modified w/9:3 ... (p	5	5	26.14	2.230	26.14		2.230	1.247	8.53%		6.555	9.79%
291.34	Acid Soluble Nickel , ICP, EPA 3050B/6010C (ppm)	3	3	22.50	12.85	22.50		12.85	9.271	57.10%		3.586	10.01%
291.99	Acid Soluble Nickel , Other (ppm)	4	4	19.05	7.950	19.05		7.950	4.969	41.72%		3.113	10.27%
301.30	Acid Soluble Selenium , ICP (ppm)	3	3	207.4	148.8	207.4		148.8	107.4	71.73%		10.75	7.17%
301.32	Acid Soluble Selenium , ICP, 2006.03 (ppm)	1		381.3									
301.33	Acid Soluble Selenium , ICP, 2006.03 modified w/9:...	4	4	388.9	25.70	388.9		25.70	16.06	6.61%		5.350	6.52%
301.34	Acid Soluble Selenium , ICP, EPA 3050B/6010C (ppm)	2	2	347.3	36.36								
301.99	Acid Soluble Selenium , Other (ppm)	4	4	250.6	109.6	250.6		109.6	68.51	43.73%		3.925	6.97%
311.32	Sodium, ICP, 2006.03 test portion (%)	2	2	0.6893	0.0004								
311.33	Sodium, ICP, 2006.03 modified w/9:3 HNO3:HCl test .	4	4	0.7350	0.0751	0.7350	0.0785	0.0751	0.0470	10.22%	2.23	0.0102	4.19%
311.99	Sodium, Other (%)	3	3	0.7458	0.0413	0.7458	0.0796	0.0413	0.0298	5.53%	1.21	0.0303	4.18%
321.00	Acid Soluble Zinc , AA, inorganic 965.09 (1.3%)	13	13	1.187	0.0676	1.177	0.1227	0.0525	0.0182	4.46%	1.00	0.0272	3.90%
321.30	Acid Soluble Zinc , ICP, test portion inorganic 96...	18	17				0.1212	0.0546	0.0165	4.69%	1.05	0.0358	3.91%
321.32	Acid Soluble Zinc , ICP, test portion 2006.03A-C ... (1.	5	5				0.1202	0.1235	0.0690	10.72%	2.39	0.0116	3.92%
321.33	Acid Soluble Zinc , ICP, test portion 2006.03A-C, ... (1.	13	13				0.1231	0.0718	0.0249	6.08%	1.36	0.0785	3.90%
321.99	Acid Soluble Zinc , Other (1.3%)	9	9	1.185	0.2020	1.168	0.1218	0.1209	0.0504	10.35%	2.31	0.0462	3.91%
325.00	Water Soluble Zinc , AA (%)	5	5	0.4798	0.1382	0.4798		0.1382	0.0773	28.80%		0.0284	4.47%
325.30	Water Soluble Zinc , ICP (%)	2	2	0.8650	0.6152								

Zn Methods

The Method IA Ratio = 2.33 * Robust SD / IA at the Method Assigned Value. IA ratios of 1 and less indicate participant data dispersion is as good or less than the IA. Red indicates the IA ratio is significantly greater than 1, Green indicates IA ratio is not significantly greater than 1 and Orange indicates marginally greater than 1.

magruder fertilizer check sample program

STRIVING FOR EXCELLENCE IN ANALYSIS

Analyte Proficiency From All Labs

Sample # 171211

Grade 5-15-30

Analyte Statistical Summary

Analytes: 36

Labs Reporting: 91

Issue Date : 01/31/2018

Analyte Code	Analyte Sample #171211	# Tests Submitted	# Tests in Robust Calculations	Raw Mean	Raw SD	Assigned Value Robust Mean	IA at Analyte Value	Robust sd	Robust Uncertainty (U)	Robust % R SD	Analyte IA Ratio	Average Range (R-bar)	Horwitz %RSD
001	Ammoniacal Nitrogen (%)	33	33	4.349	0.1537	4.339		0.1410	0.0307	3.25%		0.0430	3.21%
002	Nitrate Nitrogen (%)	12	12	0.7413	0.0668	0.7303		0.0672	0.0050	11.32%		0.0410	4.19%
009	Ammoniacal Plus Nitrate Nitrogen (%)									1.51%		0.0684	3.12%
010	Total Nitrogen (5%)									1.81%	0.66	0.0665	3.13%
020	Total Phosphorus as P2O5 (%)									0.05%		0.2011	2.64%
030	Citrate Insoluble Phosphorus as P2O5 (%)												
040	Indirect Available Phosphorus as P2O5 (15%)									1.46%	1.27	0.1213	2.65%
041	Direct Available Phosphorus as P2O5 (15%)									0.99%	1.00	0.1559	2.66%
048	Water Soluble Phosphorus as P2O5 (%)									0.93%		0.0508	2.72%
050	Soluble Potassium as K2O (30%)									1.40%	1.21	0.4096	2.39%
060	Water (Free) (%)									9.01%		0.0995	3.99%
101	Acid Soluble Calcium (1%)									7.03%	0.70	0.0195	4.62%
121	Acid Soluble Magnesium (1.2%)									1.07%	0.86	0.0332	3.90%
131	Water Soluble Magnesium (%)	6	6	1.022	0.2483	1.046		0.2217	0.1131	21.19%		0.0572	3.97%
143	Elemental Sulfur (%)	5	5	3.914	2.385	3.914		2.385	1.333	60.94%		0.1900	3.26%
145	Sulfate Sulfur, HCl soluble (%)	8	8	4.271	0.4698	4.197		0.3413	0.1508	8.13%		0.1109	3.22%
148	Total Sulfur (5%)	38	37	5.436	0.8249	5.467	0.4734	0.8675	0.1783	15.87%	4.27	0.1420	3.10%
149	Sulfur - HNO3 soluble (%)	2	2	5.981	0.0333								
151	Acid Soluble Arsenic (ppm)	17	16	173.0	38.64	175.8		37.26	11.64	21.19%		3.850	7.35%
165	Acid Soluble Boron (0.3%)	42	41	0.2455	0.0387	0.2470	0.0400	0.0270	0.0053	10.94%	1.57	0.0111	4.94%
171	Water Soluble Boron (%)	13	13	0.1783	0.0913	0.1658		0.0675	0.0234	40.72%		0.0112	5.24%
181	Acid Soluble Cadmium (ppm)	21	20	157.1	36.16	160.6		32.08	8.967	19.98%		4.913	7.45%
191	Acid Soluble Chromium (ppm)	20	19	364.4	66.41	367.2		68.41	19.62	18.63%		10.90	6.58%
202	Acid Soluble Cobalt (ppm)	19	18	281.3	49.61	287.6	87.2847	40.54	11.94	14.10%	1.08	7.342	6.82%
221	Acid Soluble Copper (0.1%)	41	39	0.0286	0.0130	0.0264	0.0076	0.0035	0.0007	13.30%	1.07	0.0020	6.91%
241	Acid Soluble Iron (0.5%)	50	49	0.5480	0.0579	0.5500	0.0600	0.0459	0.0082	8.35%	1.78	0.0163	4.38%
251	Acid Soluble Lead (ppm)	21	21	836.4	195.0	843.9		202.9	55.35	24.05%		28.86	5.80%
261	Acid Soluble Manganese (0.3%)	42	41	0.0431	0.0584	0.0262	0.0076	0.0034	0.0007	12.78%	1.02	0.0097	6.92%
271	Water Soluble Manganese (%)	3	3	0.0135	0.0005	0.0135		0.0005	0.0004	3.70%		0.0010	7.65%
281	Acid Soluble Mercury (ppm)	7	7	18.17	13.78	18.17		15.63	7.382	85.97%		1.047	10.34%
289	Acid Soluble Molybdenum (100ppm)	26	25	588.4	180.2	617.9	86.3773	103.6	25.91	16.77%	1.30	23.71	6.08%

In addition to Method variability, over time the Analyte IA Ratio can highlight discrepancies between Methods for the same Analyte.

Analyte Code	Analyte Sample # 171211	# Tests Submitted	# Tests in Robust Calculations	Raw Mean	Raw SD	Assigned Value Robust Mean	IA at Analyte Value	Robust sd	Robust Uncertainty (U)	Robust % RSD	Analyte IA Ratio	Average Range (R-bar)	Horwitz %RSD
291	Acid Soluble Nickel (ppm)	20	20	22.13	6.611	22.21		6.996	1.956	31.51%		3.062	10.03%
301	Acid Soluble Selenium (ppm)	14	14	304.0	111.5	309.4		14.7	38.31	37.06%		7.257	6.75%
311	Sodium (%)	9	9	0.7284	0.0553	0.7262	0.0776	0.0575	0.0240	7.92%	1.73	0.0213	4.20%
321	Acid Soluble Zinc (1.3%)	58	57	1.172	0.1037	1.172	0.1222	0.0674	0.0112	5.76%	1.29	0.0431	3.91%
325	Water Soluble Zinc (%)	7	7	0.5899	0.3334	0.5190		0.1491	0.0704	28.73%		0.0260	4.41%

The Analyte IA Ratio = $2.33 * \text{Robust SD} / \text{IA at the Analyte Assigned Value}$. IA ratios of 1 and less indicate participant data dispersion is as good or less than the IA. Red indicates the IA ratio is significantly greater than 1, Green indicates IA ratio is not significantly greater than 1 and Orange indicates marginally greater than 1.

IA Takes on a New Role!

- It is important to remember that, in this case IA is no longer fixed to “Guarantee”.
- IA is now seen as a fixed and industry defined measure of dispersion about a true value.
- IA does not rely on participant dispersion as does the Magruder Z Score!

This is the Added Value!

Location Metric for Method Report Cards

Method IA Status In Report Cards

- First, the IA is calculated at the Assigned Value.
- If your lab result is less than, Assigned Value $- IA_{AV}$
- The word “**Low**” will appear in **Red**.
- If your result is greater than, Assigned Value $+ IA_{AV}$
- The word “**High**” will appear in **Red**.
- The “Goldilocks” result will appear as “**OK**” in **Green**.

Replaces Threshold %RSD – perhaps a
less well understood fit-for-purpose metric!

magruder fertilizer check sample program

STRIVING FOR EXCELLENCE IN ANALYSIS

Sample # 171211: Grade 5-15-30
Method Report Card for Lab Code 0000

Example Report Card

Proficiency For 12 Methods

Issue Date: 01/31/2018

Method Code	Analyte Name and Method (Units)	Lab 0000 Data		Method Values				Magruder Z Score	Method IA Status	Flag
		Value	range	Rob Mean	Rob SD	R-bar	# Tests			
010.60	Total Nitrogen, Combustion (5%)	5.690	0.0800	5.160	0.1335	0.0700	52	3.97	High	0
041.21	Direct Available Phosphorus as P2O5, Spectrop... (15%)	14.63	0.5900	15.08	0.4960	0.1900	5	-0.91		0
050.50	Soluble Potassium as K2O, ICP (Oxalate) (30%)	29.79	0.4300	30.26	0.6669	0.7126	8	-0.65	OK	0
101.33	Acid Soluble Calcium, ICP, test portion 2006.... (1%)	0.2308	0.0391	0.3531	0.0238	0.0139	10	-4.77	OK	0
121.33	Acid Soluble Magnesium, ICP, test portion 200... (1.2%)	1.060	0.0130	1.177	0.0686	0.0348	12	-1.70	OK	0
143.00	Elemental Sulfur, Gravimetric Sulfur - carbon... (%)	1.680	0.4800				2			0
145.00	Sulfate Sulfur, HCl soluble, Gravimetric Sulf... (%)	4.050	0.0400	4.189	0.2017	0.0862	6	-0.61	No IA	0
221.33	Acid Soluble Copper, ICP, test portion 2006.... (0.1%)	0.0255	0.0003	0.0251	0.0011	0.0010	8	0.28	OK	0
241.33	Acid Soluble Iron, ICP, test portion 2006.03A... (0.5%)	0.5510	0.0550	0.5583	0.0327	0.0097	11	-0.22	OK	1
261.35	Acid Soluble Manganese, ICP, test portion 20... (0.3%)	0.0232	0.0011	0.0260	0.0047	0.0082	8	-0.56	OK	0
289.33	Acid Soluble Molybdenum, ICP, 2006.03 modifi... (100ppm)	784.5	81.00	653.5	98.30	29.45	8	1.22	OK	0
321.33	Acid Soluble Zinc, ICP, test portion 2006.03... (1.3%)	0.9053	0.2525	1.181	0.0718	0.0785	13	-3.84	Low	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). 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.

IA Status describes where your result is relative to the Assigned Value \pm IA. Red indicates Higher or Lower, Green indicates within the IA range.

Method IA Status compares the Location of your result with the Rob Mean Relative to:

$$\text{Rob Mean}^* \pm \text{IA.}$$

The Investigational Allowance is calculated at the Robust Mean.

*The Rob Mean is the Assigned Value

magruder fertilizer check sample program

STRIVING FOR EXCELLENCE IN ANALYSIS

Sample # 171211: Grade 5-15-30
Method Report Card for Lab Code 0000

Example Report Card

Proficiency For 12 Methods

Issue Date : 01/31/2018

Method Code	Analyte Name and Method (Units)	Lab 0000 Data		Method Values				Magruder Z Score	Method IA Status	Flag
		Value	range	Rob Mean	Rob SD	R-bar	# Tests			
010.60	Total Nitrogen, Combustion (5%)	5.690	0.0800	5.160	0.1335	0.0700	52	3.97	High	0
041.21	Direct Available Phosphorus as P2O5, Spectrop... (15%)	14.63	0.5900	15.08	0.4960	0.1900	5	-0.91	OK	0
050.50	Soluble Potassium as K2O, ICP (Oxalate) (30%)	29.79	0.4300	30.26	0.6669	0.7126	8	-0.65	OK	0
101.33	Acid Soluble Calcium, ICP, test portion 2006.... (1%)	0.2308	0.0391	0.353	0.0238	0.0139	10	-4.77	OK	0
121.33	Acid Soluble Magnesium, ICP, test portion 200... (1.2%)	1.060	0.0130	1.177	0.0686	0.0348	12	-1.70	OK	0
143.00	Elemental Sulfur, Gravimetric Sulfur - carbon... (%)	1.680	0.4800				2			0
145.00	Sulfate Sulfur, HCl soluble, Gravimetric Sulf... (%)	4.050	0.0400	4.189	0.2017	0.0862	6	-0.61	No IA	0
221.33	Acid Soluble Copper, ICP, test portion 2006.... (0.1%)	0.0255	0.0003	0.0251	0.0011	0.0010	8	0.28	OK	0
241.33	Acid Soluble Iron, ICP, test portion 2006.03A... (0.5%)	0.5510	0.0550	0.5583	0.0327	0.0097	11	-0.22	OK	1
261.35	Acid Soluble Manganese, ICP, test portion 20... (0.3%)	0.0232	0.0011	0.0260	0.0047	0.0082	8	-0.56	OK	0
289.33	Acid Soluble Molybdenum, ICP, 2006.03 modifi... (100ppm)	784.5	81.00	653.5	98.30	29.45	8	1.22	OK	0
321.33	Acid Soluble Zinc, ICP, test portion 2006.03... (1.3%)	0.9053	0.2525	1.181	0.0718	0.0785	13	-3.84	Low	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). 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.

IA Status describes where your result is relative to the Assigned Value \pm IA. Red indicates Higher or Lower, Green indicates within the IA range.

Method	Your Value	Robust Mean	IA	Allowed Range		Z Score	IA Status
				Low	High		
Acid Soluble Calcium	0.231	0.353	0.218	0.135	0.517	-4.77	OK
Total Nitrogen	5.690	5.160	0.511	4.649	5.671	3.97	High
Acid Soluble Zinc	0.905	1.181	0.123	1.058	1.304	-3.84	Low
Sulfate Sulfur	4.050	4.189	There is no IA for this.			-0.61	NA

Remember a High or Low IA Status does NOT refer to Guarantee.

Method Code	Analyte Name and Method (Units)	Lab Code	Lab Data		Method Values			# Tests	Magruder CS Z Score	Method IA Status	Flag
			Value	Range	Rob Mean	Rob SD	R-bar				
121.99	Acid Soluble Magnesium, Other (1.2%)	0027	1.227	0.0170	1.198	0.0777	0.0291	9	0.34	OK	0
121.99	Acid Soluble Magnesium, Other (1.2%)	0519	1.275	0.0500	1.198	0.0777	0.0291	9	0.91	OK	0
121.99	Acid Soluble Magnesium, Other (1.2%)	0515	1.387	0.0014	1.198	0.0777	0.0291	9	2.24	OK	0
131.00	Water Soluble Magnesium, AA (%)	0029	0.9970	0.0661				2			0
131.00	Water Soluble Magnesium, AA (%)	0309	1.125	0.0100				2			0
131.30	Water Soluble Magnesium, ICP (%)	0444	0.9850	0.0300				1			0
131.70	Water Soluble Magnesium, Titrimetric (EDTA) (%)	0476	0.5654	0.0366	1.008	0.3840	0.0791	3	-1.15		0
131.70	Water Soluble Magnesium, Titrimetric (EDTA) (%)	0518	1.200	0.2000	1.008	0.3840	0.0791	3	0.50		0
131.70	Water Soluble Magnesium, Titrimetric (EDTA) (%)	0510	1.257	0.0007	1.008	0.3840	0.0791	3	0.65		0
143.00	Elemental Sulfur, Gravimetric Sulfur - carbon... (%)	0405	1.025	0.1302				2			0
143.00	Elemental Sulfur, Gravimetric Sulfur - carbon... (%)	0106	1.680	0.4800				2			0
143.99	Elemental Sulfur, Other (%)	0255	4.991	0.3300	5.622	0.5777	0.1133	3	-1.09		0
143.99	Elemental Sulfur, Other (%)	0472	5.750	0.0000	5.622	0.5777	0.1133	3	0.22		0
143.99	Elemental Sulfur, Other (%)	0389	6.125	0.0100	5.622	0.5777	0.1133	3	0.87		0
145.00	Sulfate Sulfur, HCl soluble, Gravimetric Sulf... (%)	0106	4.050	0.0400	4.189	0.2017	0.0862	6	-0.61	No IA	0
145.00	Sulfate Sulfur, HCl soluble, Gravimetric Sulf... (%)	0405	4.065	0.0100	4.189	0.2017	0.0862	6	-0.55	No IA	0
145.00	Sulfate Sulfur, HCl soluble, Gravimetric Sulf... (%)	0522	4.075	0.0100	4.189	0.2017	0.0862	6	-0.50	No IA	0
145.00	Sulfate Sulfur, HCl soluble, Gravimetric Sulf... (%)	0444	4.125	0.2100	4.189	0.2017	0.0862	6	-0.28	No IA	0
145.00	Sulfate Sulfur, HCl soluble, Gravimetric Sulf... (%)	0397	4.336	0.0072	4.189	0.2017	0.0862	6	0.65	No IA	0
145.00	Sulfate Sulfur, HCl soluble, Gravimetric Sulf... (%)	0027	4.480	0.2400	4.189	0.2017	0.0862	6	1.29	No IA	0
145.99	Sulfate Sulfur, HCl soluble, Other (%)	0444	3.735	0.1700				2			0
145.99	Sulfate Sulfur, HCl soluble, Other (%)	0518	5.300	0.2000				2			0
148.00	Total Sulfur, Combustion (5%)	0451	5.674	0.0240	5.940	0.2083	0.1818	5	-1.28		0
148.00	Total Sulfur, Combustion (5%)	0136	5.820	0.0800	5.940	0.2083	0.1818	5	-0.58		0
148.00	Total Sulfur, Combustion (5%)	0157	5.915	0.2500	5.940	0.2083	0.1818	5	-0.12		0
148.00	Total Sulfur, Combustion (5%)	0025	6.110	0.2530	5.940	0.2083	0.1818	5	0.81		0
148.00	Total Sulfur, Combustion (5%)	0029	6.183	0.3020	5.940	0.2083	0.1818	5	1.17		0
148.01	Total Sulfur, Gravimetric - sulfate and elem... (5%)	0513	4.095	0.0900	5.168	1.069	0.1293	9	-0.93	Low	0
148.01	Total Sulfur, Gravimetric - sulfate and elem... (5%)	0476	4.103	0.0641	5.168	1.069	0.1293	9	-0.92	Low	0
148.01	Total Sulfur, Gravimetric - sulfate and elem... (5%)	0324	4.265	0.2900	5.168	1.069	0.1293	9	-0.78	Low	0
148.01	Total Sulfur, Gravimetric - sulfate and elem... (5%)	0444	4.525	0.1500	5.168	1.069	0.1293	9	-0.56	Low	0
148.01	Total Sulfur, Gravimetric - sulfate and elem... (5%)	0405	5.090	0.1400	5.168	1.069	0.1293	9	-0.07	OK	0
148.01	Total Sulfur, Gravimetric - sulfate and elem... (5%)	0055	5.985	0.0700	5.168	1.069	0.1293	9	0.71	High	0
148.01	Total Sulfur, Gravimetric - sulfate and elem... (5%)	0534	6.055	0.1100	5.168	1.069	0.1293	9	0.77	High	0
148.01	Total Sulfur, Gravimetric - sulfate and elem... (5%)	0040	6.100	0.2000	5.168	1.069	0.1293	9	0.80	High	0
148.01	Total Sulfur, Gravimetric - sulfate and elem... (5%)	0157	6.295	0.0500	5.168	1.069	0.1293	9	0.97	High	0
148.01	Total Sulfur, Gravimetric - sulfate and elem... (5%)	0114	4.660	0.7800	5.168	1.069	0.1293	9	-0.44	Low	1
148.07	Total Sulfur, ICP, test portion as in 2006.03... (5%)	0541	3.695	0.0100	5.275	1.154	0.0692	11	-1.28	Low	0
148.07	Total Sulfur, ICP, test portion as in 2006.03... (5%)	0394	3.775	0.0700	5.275	1.154	0.0692	11	-1.22	Low	0
148.07	Total Sulfur, ICP, test portion as in 2006.03... (5%)	0444	3.990	0.0200	5.275	1.154	0.0692	11	-1.04	Low	0
148.07	Total Sulfur, ICP, test portion as in 2006.03... (5%)	0515	4.937	0.2278	5.275	1.154	0.0692	11	-0.27	OK	0
148.07	Total Sulfur, ICP, test portion as in 2006.03... (5%)	0486	5.400	0.0000	5.275	1.154	0.0692	11	0.10	OK	0
148.07	Total Sulfur, ICP, test portion as in 2006.03... (5%)	0102	5.548	0.0532	5.275	1.154	0.0692	11	0.22	OK	0

Summary

- New IA metrics launched with the first 180111 sample as discussed in Washington.
 - The Dispersion Metric “**IA Ratio**” introduced into Method Summary reports.
 - The Location Metric “**IA Status**” introduced into Report Cards and All Tests Reports.
 - Minimizing changes in data structure to preserve reasonable continuity from past sample data.
 - I will post updated complete 2017 Cumulative Excel Data Downloads (not pdf reports!).
-



Questions?