

TEXAS A&M UNIVERSITY Lab Quality Systems

## Proficiency Testing

Inter-laboratory comparisons are widely used for a number of purposes

ISO 17043:2010

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## Proficiency Testing

*One of the big 3 – along with uncertainty and traceability*

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APTECA Proficiency Testing Program  
Corn Meal Sample #4

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## Purposes of Proficiency Testing

- a) Evaluation of the performance of laboratories for specific tests or measurements and monitoring laboratories' continuing performance
- b) Identification of problems in laboratories and initiation of actions for improvement which may be related to inadequate test or measurement procedures, effectiveness of staff training and supervision or calibration of equipment
- c) Establishment of the effectiveness and comparability of test and measurement methods

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## Purposes of Proficiency Testing (cont'd)

- d) Provision of additional confidence to laboratory customers
- e) Identification of inter-laboratory differences
- f) Education of participating laboratories based on the outcomes of such comparisons
- g) Validation of uncertainty claims

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**Proficiency Provider**

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Proficiency testing

July 2015 APTECA Sample

COMESA Laboratories Survey Results

Laboratory	Mean Result	NA	Bias	Z value
1	32	NA	+2	7.84
2	NA	NA	NA	NA
3	NA	NA	NA	NA
4	91	NA	-62	-0.81
5	22.6	NA	-6.4	-0.81
6	16.2	NA	-12.8	-1.62
7	35	NA	+6	0.76
8	71	NA	+42	5.31
9	44	NA	+15.1	1.91
10	36	NA	+7	0.88
11	14	NA	-14.9	-1.88
12	NA	NA	NA	NA
13	38	NA	+7	0.88
14	38.3	NA	+9.3	1.16
15	1.3	NA	-27.7	-3.56

Participant

$Z = (x - x_{\mu}) / \sigma_p$

$RSD = 67\%$

$RSD_R = 2^{(1-0.5\log C)}$

Assigned value  
Calculated standard deviation

The assigned value is determined by the mean of the mean results of the laboratories that participated in the proficiency testing. The assigned standard deviation was determined by the standard deviation of the mean results of the laboratories that participated in the proficiency testing.

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## Harmonized Protocol for Proficiency Testing

"It is important to emphasize that the interpretation of z-scores is not generally based on summary statistics that describe the observed participant results." (3.1.2 p 157)

A score of zero implies a perfect result.

Approximately 95% of z-scores fall between -2 and +2.

A score outside the range from -3 to 3 should be investigated.

A score in the ranges -2 to -3 and 2 to 3 would be expected about 1 in 20.

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## Harmonized Protocol for Proficiency Testing

<u>Assigned Value</u>	<u>Consensus – Disadvantages</u>
<ul style="list-style-type: none"> <li>□ An assigned value and uncertainty may be obtained by a suitably qualified measurement laboratory using a method with sufficiently small uncertainty</li> <li>□ Certified reference material</li> </ul>	<ul style="list-style-type: none"> <li>□ Not independent of participant results           <ul style="list-style-type: none"> <li>▪ Bias for the population may not be detected</li> <li>▪ Participants whose results are unbiased may unfairly receive extreme z-scores</li> </ul> </li> <li>□ Their uncertainty may be too large when the number of labs is small</li> </ul>

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## Assigned Mean – OTSC AAS

APTECA Proficiency #4 (N2013-001095)

	B1	B2	G1	G2	Total
24.3	2.0	0.0	0.0		26
26.1	2.3	0.0	0.0		28
28.8	2.4	0.0	0.0		31
24.9	2.2	0.0	0.0		27
24.5	2.7	0.0	0.0		27
23.8	2.4	4.0	0.0		30
26.7	2.8	0.0	0.0		30
27.3	2.7	4.2	0.0		34
33.9	2.9	0.0	0.0		37
27.3	2.7	0.0	0.0		30
22.3	2.3	0.0	0.0		25
21.8	2.2	0.0	0.0		24
Average	26.0	2.5	0.7	0.0	29
sd	3.3	0.3	1.6	0.0	3.8
RSD (%)	12.6	12.0	233.6		12.9

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## Horwitz Function to Calculation Standard Deviation

aflatoxin (ppb)	Mass fraction	Log	Expected RSD (%)	Standard Deviation
10	0.00000001	-8.0	32.0	3.2
29	0.00000029	-7.5	27.3	7.9
100	0.00000001	-7.0	22.6	22.6
300	0.00000003	-6.5	19.2	57.5

*The Horwitz function is often regarded as defining fitness-for-purpose in the food sector Harmonized Protocol for proficiency testing p 163*

Reference laboratory standard deviation = 3.8  
COMESA laboratories' consensus standard deviation = 24.0

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## Office of the Texas State Chemist

Laboratory Proficiency Program Results for the 2013-2014 Proficiency Testing Program

July 2014, APTCA Sample # COMESA Laboratories

Laboratory	Mass fraction	Range	Mean	Z value
1	20.4	2	-1.4	0.18
2	1.0	0	-2.8	-0.54
3	12.5		-16.5	-0.98
4	60.0	4	-31	3.82
5	19.0	0.2	-10	-1.26
6	13.3	0.8	-15.7	-1.98
7	25.0	2	-4.2	-0.51
8	50.5	7	-21.5	2.72
9	23.05	0.8	-10.5	-0.11
10	23.4	1.2	-6.1	-0.43
11	23.9	4.0	-8.8	-0.89
12	23.8	3.0	-3.17	-0.46
13	96	0	-67	0.47
14	42.7	9	-13.7	1.73
15	6.05	1.8	-22.85	-2.80

This assigned value was determined by the OTSC reference laboratory using an HPLC method. All laboratories were asked to use the same method for proficiency testing. The assigned value is the mean of the reference laboratory's mean and the mean of the other laboratories' mean. The assigned value is the mean of the reference laboratory's mean and the mean of the other laboratories' mean.

Assigned Mean: 29  
Assigned RSD: 3.8  
Average Range of Duplicate: 4.1

RSD 78%

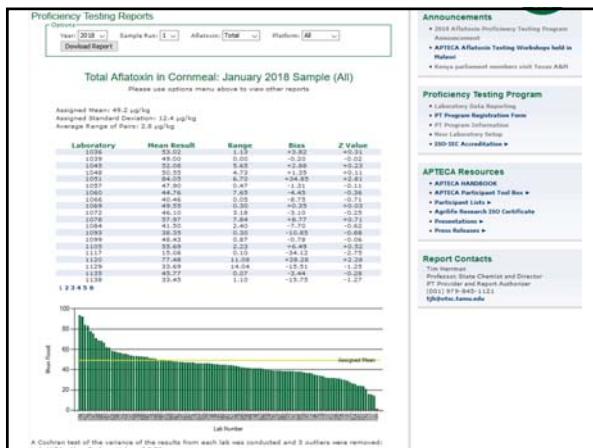
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## Kenya Milling Industry Performance

Proficiency Sample Number	RSD (%)
APTECA 1	37%
APTECA 2	25%
APTECA 3	15%
APTECA 4	15%

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## Summary

- Proficiency testing for aflatoxin testing in Kenya improved accuracy of laboratories
- Assigned mean and standard deviation is used by the Texas A&M Aflatoxin Proficiency Testing and Control in Africa, Asia, Americas and Europe (APTECA) program
- The ISO 17043 standard for proficiency testing provides a common format and requirements for this program along with the International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry Laboratories
- Preparation of proficiency testing material should follow the same protocol for developing reference material

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