



AAFCO

Proficiency Testing Program



Participant Guidebook

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Introduction

The Association of American Feed Control Officials (AAFCO) is a voluntary membership association of local, state, and federal agencies charged by law to regulate the sale and distribution of animal feeds and animal drug remedies.

The AAFCO Collaborative Check Sample Program has been in operation since 1930, and has been under the guidance of a committee of AAFCO members and industry advisors since 1941. The committee works to ensure that the program is meeting the needs of program participants. The original purpose of the program was to evaluate the performance of the analytical methods, and for this reason the program was designed to mimic an AOAC collaborative study. To better meet the needs of program participants and comply with ISO/IEC 17043:2010 [1], significant changes to the program were implemented in 2012, launching a data reporting website, a revised set of AAFCO method codes that include references to AOAC, AOCS, and ISO methods to allow for more accurate reporting of the analytical methods used to complete the testing, and a considerable expansion of scope of the program.

In 2016 the program name was changed to the AAFCO Proficiency Testing Program (PTP). The current programs support laboratories testing feeds, feed ingredients, and pet foods with four unique proficiency testing schemes that provide performance assessment for laboratory test results. Proficiency Testing rounds are distributed to customers on a predetermined schedule and are tested for analytes of interest by each laboratory. Results for individual analytes are reported using specified AAFCO method codes and units to allow for statistical analysis of the performance of individual methods or method types. Laboratory data are reported using the AAFCO Data Reporting Website (DRW). Reported results are analyzed statistically and customers are provided with performance scores for each analyte and method reported. Report cards and consensus reports are downloaded from the DRW. Four unique schemes target different proficiency testing needs. Extra materials from each testing round are offered for purchase as Quality Reference Materials (QRMs).

The management of the AAFCO PTP is composed of the AAFCO Proficiency Testing Program committee chair/program manager, quality manager, grant liaison/technical advisor, preparation facility manager, statistician, AAFCO executive assistant, and IT. The AAFCO Proficiency Testing Program Committee, representing government, industry, and commercial laboratories, acts as an advisory body for the program.

Schemes

Animal Feed Scheme

The Animal Feed Scheme consists of monthly rounds of commercial feed proficiency testing items. The scheme begins in January and includes a variety of feeds and supplements with nutrients, drugs, antibiotics, minerals, and vitamins at levels typically encountered in commercial products and drugs and antibiotics at residue levels. At least once annually, a

dry pet food is distributed, and once annually the round comprises a feed ingredient and a mineral pre-mix supplement (two items).

Pet Food Scheme

The Pet Food Scheme consists of quarterly rounds of a pet food ingredient and includes ingredients derived from animal or plant sources. The scheme also distributes a fifth round of dry pet food coinciding with the Animal Feed Scheme. Customers subscribed to both the Animal Feed Scheme and the Pet Food Scheme will be distributed a single unit in the dry pet food round.

Minerals Scheme

The Minerals Scheme consists of quarterly rounds of animal feed, pet food, and food materials with both naturally occurring and spiked minerals at concentrations of health/toxicological significance. Minerals present may include aluminum, arsenic, boron, cadmium, chromium, cobalt, copper, fluorine, iodine, lead, mercury, molybdenum, nickel, selenium, sulfur and vanadium.

Mycotoxin Contaminants Scheme

The Mycotoxin Contaminants Scheme consists of quarterly rounds of animal feed or pet food that has been contaminated with naturally incurred mycotoxins. Mycotoxins that may be present include aflatoxins, fumonisins, deoxynivalenol, zearalenone, ochratoxin A, T-2 toxin, and HT-2 toxin.

Organization of Schemes

I. Administration

Day-to-day administration of the program is overseen by the committee chair/program manager and section managers.

The AAFCO Proficiency Testing Program advisory committee meets at least twice annually. The committee is consulted and provides feedback on the PT schemes for the upcoming year. Additional meetings via the web can be scheduled as needed.

II. Confidentiality sections

All information held by AAFCO PTP about customers and participants is confidential and will not be disclosed to anyone unless explicitly agreed by the customer for a particular purpose. To preserve confidentiality and conceal the identity of participants, each customer is assigned a unique identifier that is used on final reports in place of the customer's contact information.

III. Schedules

Proficiency test items are shipped around the first of the month. The participants are notified by email when the test item has shipped. The last day that results are accepted is the 15th of the following month, Midnight, US Central Time Zone. Results are reported by the last day of that month. Refer to Tables 1 and 2 for detailed schedules.

Note: Scheme schedules are available on the AAFCO website at <http://www.aafco.org/Laboratory/Proficiency-Testing-Program>.

Table 1: Schedule of events for monthly Animal Feed Scheme

Round	1	2	3	4	5	6	7	8	9	10	11	12
ID ^a	YYYY21	YYYY22	YYYY23	YYYY24	YYYY25	YYYY26	YYYY27	YYYY28	YYYY29	YYYY30	YYYY31	YYYY32
Ships by	Jan 1	Feb 1	Mar 1	Apr 1	May 1	Jun 1	Jul 1	Aug 1	Sep 1	Oct 1	Nov 1	Dec 1
Results due	Feb 15	Mar 15	Apr 15	May 15	Jun 15	Jul 15	Aug 15	Sep 15	Oct 15	Nov 15	Dec 15	Jan 15
Reports issued	Feb 28	Mar 31	Apr 30	May 31	Jun 30	Jul 31	Aug 31	Sep 30	Oct 31	Nov 30	Dec 31	Jan 31

^aYYYY designates the calendar year.

Table 2: Schedule of events for quarterly schemes: Pet Food, Minerals, and Mycotoxin Contaminants Schemes

Round	1	2	3	4
ID ^a	YYYYX1	YYYYX2	YYYYX3	YYYYX4
Ships by	Mar 1	Jun 1	Sep 1	Dec 1
Results due	Apr 15	Jul 15	Oct 15	Jan 15
Reports issued	Apr 30	Jul 31	Oct 31	Jan 31

^aYYYY designates the calendar year, X = 4 for Pet Food, X = 5 for Minerals, and X = 6 for Mycotoxin Contaminants.

IV. Subcontractors

Various aspects of the PT schemes may be subcontracted. When subcontracting occurs, it is placed with a competent subcontractor and the PT provider is responsible for this work.

Participation in Schemes

I. Enrollment and subscriptions

Annual enrollment is open from October to December of the prior year. Late enrollment is available at full price with previous rounds provided as available.

Enrollment and payment for any of the AAFCO PTP schemes are done online at <http://www.aafco.org/PT/Dashboard>. Payment can be made by credit card, wire transfer or check. If needed, quotes can be automatically generated. A receipt is generated for credit card transactions only. Check and wire transfers receive a notice that the order has been received.

A receipt for checks and wire transfers can be requested. Shipment of proficiency test items commences by the shipping mechanism designated by the customer after receipt of payment.

II. Shipment and receipt of proficiency test items

Proficiency test items will be shipped primarily through the US Postal Services.

- US Domestic shipments are by First Class Package Service. Delivery confirmation is available.
- Most International shipments are by First Class Package International Service or Priority Mail International. Delivery confirmation is available in some locations, but not all. All packages carry a Customs Declaration number that also functions as a tracking number where available.
- Optional use of Priority Mail Express International is available at additional cost to customers, and in some locations provides better tracking and more prompt delivery.
- Use of courier services (e.g., UPS, FedEx, DHL, TNT) paid by the customer is available for better tracking and prompt delivery on International shipments.

A product label with *estimated* analyte concentration accompanies each proficiency test item. It is up to the customer to decide in which analyte(s)/method(s) they will participate.

If a test item is not received or is received damaged, contact the PTP to request a replacement using the Missing Item Form at https://secure.fass.org/AAFCO_Missing_Check_Sample_Form.asp.

III. Proficiency test item preparation and homogeneity testing

The test item may be prepared from a single commercial product or a blend of commercial products to achieve desired concentration ranges. Where desired concentration ranges are not achievable in the commercial product, the analyte of interest may be added to the commercial product.

IV. Homogeneity

Indicator analytes are reviewed with each round by the statistician.

V. Stability of proficiency test items

Proficiency test items are stored and stable under ambient conditions.

VI. Stability under transportation conditions

Proficiency test items are shipped and stable under ambient conditions.

Analysis of Proficiency Test Item

The participant will handle the proficiency test item as it would any laboratory sample [2]. Comminution or mixing is acceptable. Please transfer to a suitable airtight container to prevent a loss or gain of moisture.

To provide a true measure of intermediate laboratory repeatability, two independent measurements are required.

1. Perform two independent tests for each method code that you are reporting.
2. Replicates must be performed on different days. No two weighing or determinations by any method are to be made on the same day. Wait several days if possible.
3. Do not perform more than two determinations unless you are aware of an error.

Submission of Results and Methods

- I. Analytical results are reported using the **AAFCO Data Reporting Website**, accessed through the AAFCO website, <http://www.aafco.org/PT/DRW>. Current participants are provided with a unique login and password for access to the Data Reporting Website. Each customer may authorize any number of users. Each user may have his/her own unique login and password. Report any issues with the Data Reporting Website to pt@aafco.org.
Refer to the Data Reporting Manual for step-by-step instruction for data entry. The website address is http://www.aafco.org/Portals/0/SiteContent/Laboratory/Check_Sample_Programs/2014_New_Data_Reporting_Website_manual.pdf.
- II. Make no corrections for moisture basis. Report results on an “as received” basis.
- III. Report two replicate results for each method code; however, no result should be discarded once the analysis is complete and the result has been calculated. Do not report averages for any values.
- IV. Refer to the AAFCO Method Codes spreadsheets in assigning the proper 5-digit method codes and determining the proper reporting units. For example, Phosphorus-photometric (AOAC 965.17) is 031.01 and the reporting unit is %. Phosphorus-GQMP (AOAC 962.02) is 031.02 and the reporting unit is %.
 - Method Codes listed alphabetically by analyte: <http://www.aafco.org/PT/alpha-codes>
 - Method Codes listed numerically: <http://www.aafco.org/PT/num-codes>

Collusion and Falsification of Results: Participants will be required to adhere to a code of conduct by acknowledging the following statements each time data is entered:

By submitting these results, I affirm that:

- 1) the submitted data are entirely a work product of the subscribing laboratory;*
- 2) the data have not been falsified;*
- 3) the proficiency testing was not subcontracted to another organization/ laboratory;*
- 4) the data are kept confidential until the final study report is published; and*
- 5) no person outside this laboratory was consulted as to the accuracy or validity of the data, nor was any other collaboration or collusion made.*

Note: Submitted data cannot be altered or corrected after the reporting deadline.

Report Distribution

Final reports are released on the last day of the month following the closing date of the round. An email is sent to the participant/customer that the reports are available on the Data Reporting Website for download using their secure login and password. The reports available to the laboratory for each scheme are:

- Individual participant's report cards for individual methods and proficiency testing.
- Analyte Proficiency Testing Report—By analyte group.
- Method Proficiency Testing Report—By individual method code.
- Analyte Summary Report.
- Method Performance and Summary Report.

Copyright to all reports remains with the Association of American Feed Control Officials, Inc. Electronic report files may be printed for internal quality control or regulatory purposes. Copies for other purposes requires permission of the AAFCO program manager (pt@aaftco.org).

Follow-up service

Customers may direct questions, complaints, or suggestions to pt@aaftco.org. Responses to email inquiries are generally completed within the week.

Surplus test items are available for purchase from the AAFCO PTP web page as Quality Reference Materials (QRM). The QRM are not Certified Reference Materials, but are excellent quality control materials. The current inventory and pricing information is available on the web page https://secure.fass.org/AAFCO_Past_Check_Sample_Order_Form.asp.

Past general reports (not lab specific) are archived on the AAFCO PTP web page and available to the public. These serve as reports for the QRMs and also provide information on performance of specific analytical methods.

Performance Assessment

The statistical methods used by the AAFCO PTP are based on “The International Harmonized Protocol for the proficiency testing of analytical chemistry laboratories” 2006 (IHP), by Michael Thompson, Stephen L. R. Ellison, and Roger Wood [3].

The program model is in harmony with

- AMC (Analytical Methods Committee of the Royal Society of Chemistry) [4].
- ISO statistical models—ISO 13528:2015, ISO 13528:2005, and ISO 5725-2:1994.
 - ISO 13528:2015, Statistical methods for use in proficiency testing by interlaboratory comparisons [5].
 - ISO 13528:2005, Statistical methods for use in proficiency testing by interlaboratory comparisons [6].
 - ISO 5725-2, Accuracy (trueness and precision) of measurement methods and results—Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method [7].
- Thompson M., Ellison S.L.R., Wood R., “The International Harmonized Protocol for the proficiency testing of analytical chemistry laboratories” (IUPAC Technical Report), in *Pure and Applied Chemistry*, Vol. 78, No. 1, pp. 145–196, 2006 [3].
- Duplicate analysis supports method precision calculations.
- Web based data transfer.

The proficiency testing schemes for this program use the consensus values formed from the results reported by the participants in the round and calculated using robust statistics.

I. Statistical analysis and evaluation

The consensus of the participant data is used as the assigned value based on the statistical design. The statistical analysis and evaluation calculates the assigned value as the robust mean as recommended by the IHP and according to algorithm A of ISO 13528 [6].

The robust mean and its associated robust standard deviation will be calculated using the average lab value, that is, the average of the Day 1 and Day 2 results. The average lab values are screened for replicate outliers using Mandel’s *k* statistic as described in ISO 5725-2 [7] of measurement methods and results. The absolute average range will be reported as \bar{R} , as a measure of within-laboratory variability.

II. Reports

The following notations apply to the reports:

Interpreting Z scores (normal distribution statistical design):

$> \pm 3$	Action required
$2 < Z < 3$ or $-2 > Z > -3$	Warning
$< \pm 2$	OK (at 95% confidence interval)

Data usage flags:

- 0 = Used
- 1 = Rejected for duplicates too far apart
- 2 = Rejected as outlier
- 3 = Not included in statistical evaluation
- 4 = Zeros submitted as values (participant results)
- 5 = (Reserved for future use)
- 6 = (Reserved for future use)
- 7 = (Reserved for future use)
- 8 = Analyst data exempt
- 9 = Indicates no statistics calculated for this data set

Robust statistics are not used if <6 labs reporting; in this case the Z scores may be included for information only.

Estimates of laboratory bias are made using a Z score (named the AAFCO PTP Z score), defined as the number of standard deviations by which the laboratory result differs from the assigned value. To calculate this score, the robust mean and robust standard deviation calculated in the round of testing are used. A Z score above 3.0 or below -3.0 requires corrective action, and appears in red on the report. A Z score above 2.0 or below -2.0 is considered to give a warning signal and appears in orange on the report. Any Z score less than 2.0 and greater than -2.0 is considered acceptable performance and is in green on the report. An example report is shown in Figure 1.

To provide a benchmark of performance and additional information for individual methods, the AAFCO PTP reports a **Threshold %RSD**. For the data, this is the highest relative standard deviation that results in an acceptable Z score (≤ 2.0 and ≥ -2.0) relative to the assigned value for an individual lab on a given method. If the method being used has a low bias and the participant's Z score is acceptable, the Threshold %RSD will be relatively low.

However, if the method has a high bias and the Z score is acceptable, the Threshold %RSD may be too high for other purposes. While this performance measure is not strictly defined in the IHP, it is derived from the "fitness for purpose" sigma principle using %RSD as the predefined "fitness for purpose" criteria described in section 3.5.1 of the IHP. For example, if a client requires that analysis conforms to a specified minimum error, for example $\sigma = \pm 4\%$ RSD, then a Threshold RSD $\leq 4\%$ will be satisfactory. Some labs may find this parameter to be very useful as it does define a method operating criteria relative to the assigned value and detached from the interlaboratory variance.



Sample # 201627:
 Cat Food, Dry
 Report Card for Lab Code 0000



Animal Feed Scheme

Proficiency Testing For 19 Analytes

Issue Date : 08/31/2016

Method Group	Analyte Group (Units)	Lab 0948 Data		Method Values				AAFCO CS Z Score	Lab 0948 Method	Flag
		Value	range	Rob Mean	Rob SD	R-bar	# Labs			
001	Loss on Drying (%)	5.8550	0.03000	5.7903	0.32946	0.09283	75	0.20	001.99	0
002	Protein (%)	33.285	0.01000	33.496	0.45819	0.18320	214	-0.46	002.05	0
002	Protein (%)	35.420	0.14000	33.496	0.45819	0.18320	214	4.20	002.06	0
003	Fat (%)	12.545	0.03000	12.569	0.26446	0.13897	141	-0.09	003.14	0
003	Fat (%)	12.940	0.08000	12.569	0.26446	0.13897	141	1.40	003.09	0
004	Fiber (%)	5.5150	0.13000	5.3823	1.0063	0.21821	117	0.13	004.07	0
004	Fiber (%)	5.6350	0.17000	5.3823	1.0063	0.21821	117	0.25	004.06	0
005	Ash (%)	10.045	0.05000	9.8974	0.13132	0.07424	142	1.12	005.00	0
008	Fiber (%)	6.6600	0.04000	7.7489	1.7854	0.40985	60	-0.61	008.02	0
009	Fiber (%)	15.660	0.24000	17.944	3.8828	0.56919	42	-0.59	009.09	0
010	Moisture (%)	5.8550	0.03000	5.8396	0.43853	0.09121	32	0.04	010.99	0
012	Starch (%)	20.890	0.08000	22.799	1.4138	0.45416	33	-1.35	012.04	0
013	Fat (%)	14.905	0.17000	15.061	0.58648	0.15308	79	-0.27	013.00	0
019	Calcium (%)	2.3950	0.03000	2.4259	0.11073	0.04882	131	-0.28	019.31	0
031	Phosphorus (%)	1.1850	0.01000	1.4826	0.07869	0.02896	130	-3.78	031.01	0
032	Potassium (%)	0.78000	0.02000	0.78370	0.04832	0.01657	98	-0.08	032.31	0
033	Salt as chloride (%)	0.83000	0.00000	0.82295	0.06498	0.01283	51	0.11	033.01	0
035	Sodium (%)	0.54500	0.01000	0.49517	0.03797	0.01141	102	1.31	035.31	0
042	Chloride (%)	0.51000	0.00000	0.49988	0.02672	0.01140	5	0.38	042.00	0

Notes: 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, 8 = Analyst data exempt and 4 = zeros submitted as values. Robust statistics not used if < 6 labs reporting, in this case the Z Scores may be included for information only (Grey, No Action!). Flag 3 indicates not used in statistics.

Figure 1: Analytes Report Card



Sample # 201627:
 Cat Food, Dry
 Report Card for Lab Code 0000



Animal Feed Scheme

Proficiency Testing For 19 Individual Methods

Issue Date : 08/31/2016

Method Code	Analyte Name and Method (Units)	Lab 0948 Data		Method Values				AAFCO CS Z Score	Threshold %RSD	Flag
		Value	range	Rob Mean	Rob SD	R-bar	# Labs			
001.99	Loss on Drying, Miscellaneous (%)	5.8550	0.03000	5.7486	0.38603	0.06564	20	0.28	1%	0
002.05	Protein, Copper, Boric Acid (%)	33.285	0.01000	33.243	0.34569	0.17308	31	0.12	0%	0
002.06	Protein, Combustion Nitrogen Analyzer (%)	35.420	0.14000	33.640	0.35250	0.17685	129	5.05	3%	0
003.09	Fat, Soxtec, Eth Ext (%)	12.940	0.08000	12.635	0.21963	0.07631	15	1.39	1%	0
003.14	Fat, Ankom (%)	12.545	0.03000	12.459	0.18426	0.16765	37	0.47	0%	0
004.06	Fiber, Fibertec (%)	5.6350	0.17000	5.7436	0.41043	0.16568	23	-0.26	1%	0
004.07	Fiber, ANKOM (%)	5.5150	0.13000	5.2977	1.1929	0.24239	56	0.18	2%	0
005.00	Ash, 2h @ 600°C (%)	10.045	0.05000	9.8773	0.11530	0.06572	96	1.45	1%	0
008.02	Fiber, Acid Detergent (%)	6.6600	0.04000	8.0025	1.2344	0.35219	14	-1.09	8%	0
009.09	Fiber, Neutral Detergent, ANKOM (%)	15.660	0.24000	18.340	4.2949	0.54587	31	-0.62	7%	0
010.99	Moisture, Miscellaneous (%)	5.8550	0.03000	5.8316	0.31131	0.09050	20	0.08	0%	0
012.04	Starch, YSI Analyzer (%)	20.890	0.08000	21.387	0.85161	0.44500	4	-0.58	1%	0
013.00	Fat, Acid hydrolysis (%)	14.905	0.17000	15.031	0.40294	0.13601	26	-0.31	0%	0
019.31	Calcium, AAS, Dry ash (%)	2.3950	0.03000	2.3785	0.04986	0.07991	21	0.33	0%	0
031.01	Phosphorus, Photometric (%)	1.1850	0.01000	1.4564	0.06556	0.02440	43	-4.14	9%	0
032.31	Potassium, AAS, Dry ash (%)	0.78000	0.02000	0.76443	0.07488	0.01929	16	0.21	1%	0
033.01	Salt as chloride, Poten Cl (%)	0.83000	0.00000	0.85570	0.02915	0.00764	24	-0.88	2%	0
035.31	Sodium, AAS, Dry ash (%)	0.54500	0.01000	0.49880	0.04250	0.01391	16	1.09	5%	0
042.00	Chloride, Titrimetric (%)	0.51000	0.00000	0.51150	0.00212	0.00175	4	-0.71	0%	0

Notes: 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, 8 = Analyst data exempt and 4 = zeros submitted as values. Robust statistics not used if < 6 labs reporting, in this case the Z Scores may be included for information only (Grey, No Action!). Flag 3 indicates not used in statistics.

Figure 2: Individual Methods Report Card

III. Appeals

Any concerns, suggestion, or errors should immediately be communicated to pt@aaftco.org. A timely investigation will occur in accordance with the AAFCO PTP quality management system. The participant will be advised of the outcome. Errors made by the participant in data entry cannot be changed after the reporting deadline, and these errors are not grounds for appeal.

References

- [1] ISO/IEC 17043:2010(E), Conformity assessment – General requirements for proficiency testing.
- [2] GOODSamples: Guidance on Obtaining Defensible Samples, October 2015.
- [3] Thompson M., Ellison S. L. R., Wood R., “The International Harmonized Protocol for the proficiency testing of analytical chemistry laboratories” (IUPAC Technical Report), in Pure and Applied Chemistry, Vol. 78, No. 1, pp. 145–196, 2006.
- [4] AMC Technical Brief No. 4, Royal Society of Chemistry, M. Thompson, Editor Representing data distributions with kernel density estimates
- [5] ISO 13528:2015, Statistical methods for use in proficiency testing by interlaboratory comparisons
- [6] ISO 13528:2005, Statistical methods for use in proficiency testing by interlaboratory comparisons
- [7] ISO 5725-2, Accuracy (trueness and precision) of measurement methods and results—Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method

Glossary of Terms

AAFCO

Association of American Feed Control Officials.

Assigned Value

Value attributed to a particular property of a proficiency test item.

Comminution

Reduction of particle size by crushing, chopping, blending, and grinding, among others.

Consensus Value

Value derived from a collection of results in an interlaboratory comparison.

FASS

FASS Inc., Champaign, Illinois, publisher of this guidebook.

Interlaboratory Comparisons

Organization, performance, and evaluation of measurements or tests on the same or similar items by two or more laboratories in accordance with predetermined conditions.

Laboratory Sample

The material received by the laboratory.

Outlier

Member of a set of values which is inconsistent with other members of that set.

Proficiency Test Item

Sample, product, artifact, reference material, piece of equipment, measurement standard, data set, or other information used to assess participant performance in proficiency testing.

PTP

Proficiency Testing Program.

Proficiency Testing Round

Single complete sequences of distribution of proficiency test items, and the evaluation and reporting of results to the participants.

QRM

Quality Reference Material.