AOAC Official Methods Board
February 5-6, 2015
Meeting

AOAC INTERNATIONAL
2275 Research Blvd, Suite 300
Rockville, MD 20850
1.301.924.7077

OFFICIAL METHODS BOARD MEETING

Thursday - Friday, February 5-6, 2015

9:00 AM – 5:00 PM ET **(Day 1)**
8:30 AM – 5:00 PM ET **(Day 2)**

Table of Contents

AOAC BOARD OF DIRECTORS MEETING Rockville, MD
Mar. 16, 2015
Jun. 22-23, 2015

AOAC SPADA MEETING
Rockville, MD
February 3-4, 2015

AOAC OFFICIAL METHODS BOARD MEETING
Rockville, MD
February 5-6, 2015

AOAC MID-YEAR MEETING
Rockville, MD
March 16-20, 2015

AOAC ANNUAL MEETING
Los Angeles, CA
Sept. 27 – 30, 2015

**** Items that require or may require a vote***

AOAC INTERNATIONAL
OFFICIAL METHODS BOARD
2014 –2015

Chair	**Shauna Roman** Reckitt Benckiser, Inc. Shauna.Roman@reckittbenckiser.com Term: August 29, 2013 – September 21, 2016	*Member*	**Joe Boison** Canadian Food Inspection Agency Joe.Boison@inspection.gc.ca Term: August 29, 2013 – September 21, 2016
Member	**Doug Abbott** Independent Consultant dabbott2@bresnan.net Term: September 11, 2014 - September 27, 2017	*Member*	**Perry Anthony Martos** University of Guelph pmartos@uoguelph.ca Term: October 4, 2012 - September 30, 2015
Member	**Sneh Bhandari** Silliker, Inc. Sneh.Bhandari@Silliker.com Term: August 29, 2013 – September 21, 2016	*Member*	**Shang-Jing Pan** Abbott Nutrition shang-jing.pan@abbott.com Term: October 4, 2012 - September 30, 2015
Member	**Jo Marie Cook** Florida Department of Agriculture and Consumer Services JoMarie.Cook@freshfromflorida.com Term: August 29, 2013 – September 21, 2016	*Member*	**Tom Phillips** Maryland Department of Agriculture phillitd@mda.state.md.us Term: August 29, 2013 – September 21, 2016
Member	**Erin Sutphin Crowley** Q Laboratories, Inc. ecrowley@qlaboratories.com Term: October 4, 2012 - September 30, 2015	*Member*	**Victoria Siegel** Office of the Indiana State Chemist - Purdue University vsiegel@purdue.edu Term: September 11, 2014 - September 27, 2017
Member	**Qian Graves,** US FDA *AOAC Committee on Statistics, Chair* Qian.graves@fda.hhs.gov Term: August 29, 2013 – September 21, 2016	*Member*	**Bradley Stawick** Microbac Laboratories, Inc. brad.stawick@microbac.com Term: October 4, 2012 - September 30, 2015
Member	**Yvonne Salfinger,** Independent Consultant *AOAC Committee on Safety, co-Chair* Yhale@aol.com Term: August 29, 2013 – September 21, 2016	*Past Chair (Ex-officio Member)*	**John Szpylka** Silliker, Inc. John.Szpylka@Silliker.com Term: August 29, 2013 – September 21, 2016

AOAC Staff Liaisons

Deborah McKenzie Sr. Director- Standards Development Sr. Director- AOAC Research Institute dmckenzie@aoac.org	Delia Boyd Program Manager – Standards Development dboyd@aoac.org

AOAC INTENATIONAL Terms begin following the AOAC Business Meeting. Terms expire at the AOAC Business Meeting.

AOAC INTERNATIONAL
BYLAWS

As Amended September 26, 2010

ARTICLE I
Name

The name by which this Association shall be known is "AOAC INTERNATIONAL" (hereinafter referred to as the "Association").[1]

ARTICLE II
Purpose

The primary purpose of the Association is to promote methods validation and quality measurements in the analytical sciences.

ARTICLE III
Membership

Section 1. Types of Membership

There shall be three (3) types of membership in the Association: Individual Members, Sustaining Member Organizations, and Organizational Affiliates.

A. Individual Members

There shall be four (4) categories of Individual Members in the Association: Members, Retired Members, Student Members, and Honorary Members.

B. Sustaining Member Organizations

There shall be one (1) category of Sustaining Member Organizations.

C. Organizational Affiliate

There shall be one (1) category of Organizational Affiliate.

Section 2. Qualifications for Membership

A. Individual Members

[1] Members

Qualifications for Members shall be a degree in science, or equivalent as approved by the Board of Directors, and interest in supporting and furthering the purpose and goals of the Association. Such scientists shall be eligible for membership provided they are engaged, or have been engaged, directly or indirectly, in a field relevant to the purpose of the Association.

[2] Retired Members

[1] AOAC INTERNATIONAL was incorporated in the District of Columbia on January 20, 1932, as the Association of Official Agricultural Chemists. On November 10, 1965, the name of the corporation was changed to the Association of Official Analytical Chemists, and on September 12, 1991, the current name was adopted.

A current Member who is no longer actively engaged, directly or indirectly, in a field relevant to the purpose of the Association but who has served the Association as a Member for at least ten (10) years shall be eligible for Retired Member status upon written request and payment of the annual Retired Member dues. Any special benefits accorded Retired Members shall be determined by the Executive Director.

[3] Student Members

Any full-time student working toward an undergraduate or graduate degree in the areas of chemistry, microbiology, food science or other related science shall be eligible for Student Membership in AOAC INTERNATIONAL.

[4] Honorary Members

Honorary Members shall be persons recognized for their substantial contribution toward the achievement of the objectives of the Association. They shall be nominated by the Board of Directors and may be elected by a two-thirds vote of the Individual Members voting.

B. Sustaining Member Organizations

A Sustaining Member Organization shall be any agency of a local, state, provincial, national, or international government; a university, college, or academic department; or any firm, business, or organization with an interest in supporting and furthering the purpose of the Association. Every Sustaining Member Organization must have a designated representative(s). All such Sustaining Member Organization representatives must meet the qualifications for Members and become Individual Members with all the rights and privileges thereof.

C. Organizational Affiliate

An Organizational Affiliate Organization shall be any agency of a local, state, provincial, national, or international government; a university, college, or academic department; or any firm, business, or organization with an interest in supporting and furthering the purpose of the Association. Every Organizational Affiliate must have a designated representative(s). All such Organizational Affiliate representatives must meet the qualifications for Members and become Individual Members with all the rights and privileges thereof.

Section 3. Application for Membership

Applications or requests for membership shall be submitted to the Association's headquarters office. Membership shall become effective upon approval of the application or request, payment of any required membership dues, entry on the membership rolls, and assignment of a member number.

Section 4. Expulsion

The Board of Directors, at any duly called meeting of the Board, by a two-thirds vote of those holding office, may terminate the membership of any member who in its judgment has violated the Bylaws or has been guilty of conduct detrimental to the best interests of the Association. Any member convicted of a felony is subject to immediate expulsion from the Association. Expulsion of a member by the Board of Directors shall be final and shall cancel all rights, interest, or privileges of such member in the services or resources of the Association. Any member, for whom expulsion is proposed, for reasons other than conviction of a felony, shall be entitled to not less than 60 days advance notice of the charges, the date upon which a hearing will be scheduled, and the right to present evidence in defense. The date and place of any such hearing, if held other than at the headquarters or annual meeting site of the Association, must be reasonable with respect to the location of any individual so charged.

Section 5. Dues, Membership Year, and Waivers

A. Annual dues for membership in the Association shall be fixed by the Board of Directors, subject to approval by the majority of the Individual Members voting by ballot by any of the following means (whichever is deemed appropriate by the Board at the time): mail, telephone call, telegram, cablegram, electronic mail or other means of electronic or telephonic transmission.

B. Honorary Members of the Association shall be exempt from payment of dues and annual meeting registration fees.

C. The membership year and the delinquency date shall be determined by the Board of Directors.

D. The authority to grant waivers of membership dues rests with Executive Director.

E. Student Member dues shall be one-third of regular Member dues, rounded up to the nearest $5.00 increment.

Section 6. Members in Good Standing; Rights and Privileges

All Individual Members who maintain their membership by payment of dues as required under these Bylaws and who otherwise qualify shall be considered in good standing and entitled to full privileges of membership.

ARTICLE IV
Officers

Section 1. Elected Officers

The elected officers of the Association shall be Individual Members and shall consist of a President, President-Elect, Secretary, Treasurer, and Immediate Past President.

A. President

The President shall be the principal elected officer of the Association, shall preside at meetings of the Association and of the Board of Directors and of the Executive Committee, and shall be a member ex-officio, with right to vote, of all committees except the Nominating Committee. He or she shall also, at the annual meeting of the Association and at such other times as he or she shall deem proper, communicate to the Association or the Board of Directors such matters and make such suggestions as may in his or her opinion tend to promote the welfare and further the purpose of the Association and shall perform such other

duties as are necessarily incident to the office of President or as may be prescribed by the Board of Directors.

B. President-Elect

In the absence of the President, or in the event of the President's inability or refusal to act, the President-Elect shall perform the duties of the President, and, when so acting, shall have all the powers of and be subject to all the restrictions upon the President. The President-Elect shall perform such other duties as from time to time may be assigned to him or her by the President or by the Board of Directors.

C. Secretary

The Secretary shall give notice of all meetings of the Association, keep a record of all proceedings, attest documents, and, in general, perform such other duties as are usual of the office of Secretary and such other duties as may be assigned by the President or by the Board of Directors.

D. Treasurer

The Treasurer shall be responsible for the funds and securities of the Association; serve as financial officer of the organization and as Chairperson of the Finance Committee; manage the Board of Director's review of and action related to the Board of Director's financial responsibilities; serve as the chief Board liaison in overseeing and reviewing the annual audit, and in general, perform such other duties as are usual of the office of Treasurer and such other duties as may be assigned by the President or by the Board of Directors.

E. Immediate Past President

The Immediate Past President shall serve as advisor to the President and Directors and perform such other duties as may be assigned from time to time by the President or by the Board of Directors.

Section 2. Appointed Officers

The appointed officers shall include the Executive Director and such other appointed officers as may be designated by the Board of Directors from time to time.

A. Executive Director

The day-to-day administration and management of the Association's offices shall be vested in a salaried manager employed or appointed by, and directly responsible to, the Board of Directors. This manager shall have the title of Executive Director with responsibility for the management and direction of all operations, programs, activities, and affairs of the Association, as approved or delegated by the Board of Directors. The Executive Director shall have direct responsibility for employment and termination of employment and the determination of compensation for staff members within the budgetary framework determined by the Board of Directors. The Executive Director functions as the chief operating officer of the Association within the guidelines established by the policies and procedures of the Board of Directors and, as necessary, with the concurrence of the President. The Executive Director shall have such other duties as may be prescribed by the Board.

B. Other Appointed Officers

Other appointed officers shall have such duties as may be prescribed by the Board.

ARTICLE V
Nominations, Elections, Terms, and Appointments to the Board of Directors

Section 1. Nominating Committee

The Nominating Committee shall annually recommend to the Board of Directors a slate of Individual Members as potential nominees for the elected positions where vacancies will occur. The Nominating Committee shall consist of five (5) members who shall be three (3) immediate Past Presidents, as available, and two (2) Individual Members-at-Large of the Association. If three Past Presidents are not available to serve, other Individual Members-at-Large shall be appointed by the President to the extent necessary to form the five (5)-member committee.

Section 2. Elections and Terms of Office

The President-Elect, the Secretary, Treasurer, and the Directors of the Board of Directors shall be elected by a majority of Individual Members voting, from a slate of nominees recommended annually by the Board of Directors.

Terms of office for all Officers and Directors shall begin with the adjournment of the annual meeting following their election and shall end with the adjournment of the annual meeting occurring nearest the expiration of their term. The six (6) Directors shall be elected to staggered three-year terms with two Directors elected to full three-year terms each year, but not to more than two (2), consecutive, three-year terms. Appointment or election to fill an unexpired term shall not affect the eligibility of a person to subsequently be elected to two (2) full terms. The Secretary shall be elected to a one-year term and may be re-elected to successive one-year terms. The Treasurer shall be elected for a one-year term and may be re-elected to successive one-year terms. The President-Elect shall be elected to a one-year term; whereupon the current President-Elect shall become President and the current President shall become the Immediate Past President, each serving a one-year term.

Section 3. Appointments

Directors-at-Large are appointed by the Board in accordance with Article VI, Section 2. Directors-at-Large are appointed for one (1) year terms, renewable at the discretion of the elected Board.

ARTICLE VI
Board of Directors

Section 1. Composition

The Board of Directors shall consist of eleven (11) elected members to include the President, President-Elect, Secretary, Treasurer, Immediate Past President, six (6) Directors, and up to three (3) appointed Directors-at-Large, all of whom shall be Individual Members of the Association. The elected Board shall reflect the makeup of the Association membership and shall not be dominated by any single interest.

Section 2. Powers and Duties

The Board of Directors shall provide supervision, control, and direction of the affairs of the Association, shall determine the Association's policies or changes therein within the limits of the Bylaws, shall actively prosecute

its purpose, and shall have discretion in the disbursement of its funds. It may adopt such rules and procedures for the conduct of its business as shall be deemed advisable, and may, in the execution of the powers granted, appoint such agents as it may consider necessary. The Board of Directors may appoint up to three (3) Directors-at-Large, if, in their opinion, such appointments advance the purpose of the Association. Directors-at-Large shall be accorded the same voting privileges as elected Directors.

Section 3. Meetings

Except that the Board shall have a regular meeting at the time and place of the annual meeting, the Board shall meet, in person or via telephone conference call, upon call of the President at such times and places as he or she may designate within the policies adopted by the Board, and shall be called to meet upon demand of a majority of its members. Notice of all meetings of the Board of Directors shall be sent by any of the following means (whichever is deemed appropriate by the President at the time): mail, telephone call, telegram, cablegram, electronic mail or other means of electronic or telephonic transmission to each member of the Board at his or her last recorded address or number at least fourteen (14) days in advance of in-person meetings or forty-eight (48) hours in advance of conference call meetings.

Section 4. Quorum

A quorum for any meeting of the Board is six (6) Board members elected in accordance with Article V (1). Any less number may: (1) set a time to adjourn, (2) adjourn, (3) recess, or (4) take measures to obtain a quorum.

Section 5. Absence

Any member of the Board of Directors unable to attend a meeting of the Board shall notify the President and state the reason for his or her absence. If a member of the Board is absent from two (2) consecutive meetings, he or she may be removed by a two-thirds vote of the Board Members then in office.

Section 6. Compensation

Members of the Board of Directors, as such, shall not receive any compensation for their services as Board members, but the Board may, by resolution under policies it may adopt, authorize reimbursement of expenses incurred in the performance of members' duties. Such authorization may prescribe conditions and procedures for approval and payment of such expenses. Nothing herein shall preclude a Board member from serving the Association in any other capacity and receiving compensation for such services, if compensation is customarily paid for such services.

Section 7. Resignation or Removal

Any member of the Board may resign at any time by giving written notice to the President, Secretary, Treasurer, or to the Board of Directors. Such resignation shall take effect at the time specified therein, or, if no time is specified, at the time of acceptance thereof as determined by the President or the Board.

Any member of the Board may be removed by a three-fourths vote of the Board members then in office and present at any regular or special meeting of the Board.

Section 8. Vacancies: Members of the Board

If a vacancy should occur in the membership of the elected Board of Directors, any Past President may be appointed by action of the remaining members of the Board to temporarily fill such vacancy until the next

regularly scheduled election. At the next regularly scheduled election nominations will be presented to fill the vacancy for the unexpired portion of the term remaining.

Section 9. Vacancies: President and Other Officers

If the office of the President shall become vacant, the President-Elect shall thereupon become President of the Association for the unexpired term, followed by his or her duly elected term. In the event the office of President becomes vacant at a time when the office of President-Elect is also vacant, the Presidency shall be filled for the remainder of the term by the action of the Board of Directors. If any other officer position shall become vacant, the office may be filled for the remainder of the term by action of the Board.

ARTICLE VII
Committees

Section 1. Committee Formation

The Board of Directors shall form and adopt terms of reference for such standing or special boards, committees, subcommittees, task forces, or task groups as may be required by these Bylaws or as the Board may determine necessary to carry out the affairs of the Association.

Section 2. Committee Appointments

Subject to the requirements of these Bylaws and the specific terms of reference adopted by the Board, the President shall make the appointments to fill the vacancies occurring in the Association's standing or special boards, committees, subcommittees, task forces, or task groups.

ARTICLE VIII
Official Methods of Analysis

The Board of Directors (BoD) is empowered to develop written policies and procedures for the study, adoption, and change in status of the Official Methods of Analysis of AOAC INTERNATIONAL. Implementation of the policies and procedures shall be delegated to an Official Methods Board (OMB).

Section 1. Composition of the Official Methods Board

The Official Methods Board shall consist of a chair and a vice chair, and members who are recommended by the chair. The chair, vice chair and members are appointed by the President of AOAC INTERNATIONAL. The OMB shall be composed of members representing a balance of government, industry, and academia as appropriate to the scope of the group and shall not be dominated by any single interest.

Section 2. Purpose of the Official Methods Board

The OMB shall serve the Association in a scientific and advisory capacity on methods and the process of their adoption. The OMB shall be responsible for implementation of procedures adopted by the BoD, according to the principles in section 3 below.

Section 3. Principles of the Official Methods Program

A. Adequate records of technical data, discussions, and decisions on the study, adoption, and change of status of Official Methods of Analysis shall be maintained for a reasonable time.

B. Timely notice of proposed method studies, adoption, or change in status shall be published in an Association publication that is circulated to the members.

C. Opportunity shall be provided for materially interested parties to submit input during method study and adoption procedures and to submit comments on the adoption, use of, or change in status of specific methods.

D. Methods submitted to the OMB for inclusion in the OMA shall be thoroughly studied, scientifically reviewed, and available in published form prior to adoption as Final Action by the OMB.

E. The OMB shall adopt methods as Final Action.

ARTICLE IX
Meetings

Section 1. Annual Meeting

The annual business meeting of the Association shall be held at the time and place decided by the Board of Directors. A special meeting of the entire Association may be called by the Board of Directors; announcement thereof shall be made at least thirty (30) days prior to the time of said meeting.

Section 2. Quorum

One hundred Individual Members who are present in person or by proxy and entitled to vote shall constitute a quorum at any meeting of the Association which is duly called pursuant to the provisions of these Bylaws.

ARTICLE X
Voting

Section 1. Voting by Ballot

By direction of the Board of Directors, unless otherwise required by these Bylaws or conducted under alternative procedures established under these Bylaws, voting on any matter, including the election of officers and directors, the election of Honorary Members, amendment of the Bylaws, and the approval of dues, may be conducted by ballot of the voting membership by any of the following means (whichever is deemed appropriate at the time): mail, telephone call, telegram, cablegram, electronic mail or other means of electronic or telephonic transmission, and the question(s) thus presented shall be determined according to the votes received, provided in each case votes of at least five (5) percent of the voting membership shall be received. Any and all action taken in pursuance of a vote by any of the means indicated above (whichever the Board deemed appropriate at the time)

in each case shall be binding upon the Association in the same manner as would be action taken at a duly called meeting and shall become effective, unless otherwise provided for in these Bylaws or otherwise stated in the ballot, on the day following certification of the vote.

Section 2. Voting by Proxy

At any duly called meeting of Individual Members, a member-of-record, as determined thirty (30) days prior to any meeting and who is entitled to vote, may vote by proxy executed in writing by the Individual Member or his or her duly authorized attorney-in-fact. No proxy shall be valid for more than eleven (11) months after the date of its execution unless otherwise provided in the proxy.

ARTICLE XI
Earnings and Assets

Section 1. Non-Profit Status

A. Regardless of any provision of the Bylaws which may be construed otherwise:

[1] No part of the net earnings of the Association shall under any circumstances inure to the benefit of any member or individual.

[2] The Association shall not be operated for a private profit.

B. On lawful dissolution of the Association and after settlement of all just obligations of the Association, the Board of Directors shall distribute all remaining assets of the Association to one (1) or more organizations selected by the Board of Directors which have been held exempt from Federal Income Tax as organizations described in section 501(c)(3) of the Internal Revenue Code of 1954.

Section 2. Political Activities

A. No substantial part of the Association's activities shall consist of carrying on propaganda or otherwise attempting to influence local, state, or national legislation. All activities of the Association shall be determined by the Board of Directors.

B. The Association shall not participate or intervene in any manner in any campaign on behalf of any candidate for a political office.

ARTICLE XII
Sections

Section 1. Sections

The Board of Directors shall set geographic limits and grant authority to groups of Individual Members of the Association residing or working in the same geographical areas for the establishment of Sections.

Section 2. Purpose of Sections

The purpose of Sections shall be to promote and further the purpose of the Association.

Section 3. Membership in Sections

Individuals interested in the purpose of the Section shall be eligible for Section membership. Only Individual Members of the Association shall be eligible for election to the Executive Committee of the Section.

Section 4. Bylaws of Sections

Subject to approval of the Board of Directors, each Section shall adopt, for its own governance, bylaws not inconsistent with these Bylaws.

Section 5. Dissolution of Sections

When any Section shall cease to function as a Section for a period of more than one year, or if its membership shall be less than ten (10) Individual Members of the Association for a period of one (1) year, the Board of Directors may terminate the existence of such Section.

Section 6. Actions of Sections

No act of a Section or its members shall be considered an act of the Association unless expressly authorized, ratified, or affirmed by the Board of Directors.

ARTICLE XIII
Technical Divisions

Section 1. Purpose

Technical Divisions shall represent communities of interest within the Association which have the purpose of furthering the purpose of the Association through the development of the analytical sciences either in a commodity-based or scientific discipline-based field. Their activities shall not duplicate the organizational structure nor conflict with the policies or procedures for the adoption of official methods of analysis by the Association.

Section 2. Creation, Combination, Discontinuance, or Change

Technical Divisions may be created, existing Technical Divisions may be combined or discontinued, or the name of a Technical Division may be changed under policies and procedures adopted by the Board of Directors. Each Technical Division shall adopt bylaws not inconsistent with these Bylaws. The jurisdiction of each Technical Division shall be described in its bylaws. No act of any Technical Division or its members shall be considered an act of the Association unless expressly authorized, ratified, or affirmed by the Board of Directors.

ARTICLE XIV
Indemnification

The Association shall have the power to pay, by indemnity, reimbursement, or otherwise, to or for the use of any person designated by resolution of the Board of Directors who was or is a party or is threatened to be made a party to any threatened, pending, or completed action, suit, or proceeding, whether civil, criminal, administrative, or investigative (other than an action by or on behalf of the Association), by reason of the fact he or she is or was a director, officer, committee member, employee or agent of the Association, or was serving as such for another at the request of the Association, against expenses (including legal, accounting, witness and other), judgments, fines, and amounts paid in settlement so long as such person was not found by a court of competent jurisdiction to have been willfully negligent of the interests of the Association or such person had reasonable cause to believe that his or her conduct was lawful.

ARTICLE XV
Parliamentary Authority

The rules contained in the current edition of *Robert's Rules of Order Newly Revised* shall govern the Association in all cases in which they are applicable and in which they are not inconsistent with these Bylaws or any special rules of order the Association may adopt.

ARTICLE XVI
Amendments to the Bylaws

These Bylaws may be amended, repealed, or altered, in whole or in part, by a three-fourths vote: (a) of the Individual Members at any annual business or duly called special meeting of the Association, provided notice of any amendment proposed for consideration shall be sent by any of the following means (whichever may be deemed appropriate at the time): mail, telephone call, telegram, cablegram, electronic mail or other means of electronic or telephonic transmission to the last recorded address or number of each Individual Member at least thirty (30) days prior to the date of the meeting; or (b) by approval of the Individual Members through ballot sent by any means indicated above in accordance with the provisions of Article X, Voting.

All proposed amendments of these Bylaws shall be presented in writing to the Board of Directors. The Board shall present the proposals to the Association membership, with recommendations. All amendments to the Bylaws, unless otherwise stated, will become effective at the adjournment of the meeting where action is taken or on the day following the certification of a vote by mail ballot.

AOAC INTERNATIONAL
POLICY ON THE USE OF THE ASSOCIATION NAME, INITIALS, IDENTIFYING INSIGNIA, LETTERHEAD, AND BUSINESS CARDS

Introduction

The following policy and guidelines for the use of the name, initials, and other identifying insignia of AOAC INTERNATIONAL have been developed in order to protect the reputation, image, legal integrity and property of the Association.

The name of the Association, as stated in its bylaws, is "AOAC INTERNATIONAL". The Association is also known by its initials, AOAC, and by its logo, illustrated below, which incorporates the Association name and a representation of a microscope, book, and flask. The AOAC logo is owned by the Association and is registered with the U.S. Patent and Trademark Office.

AOAC INTERNATIONAL

The full Association insignia, illustrated below, is comprised of the logo and the tagline, "The Scientific Association Dedicated to Analytical Excellence," shown below. The typeface used is Largo. The AOAC tagline is owned by the Association and is registered with the U.S. Patent and Trademark office.

AOAC INTERNATIONAL

The Scientific Association Dedicated to Analytical Excellence®

Policy

Policy on the use of the Association's name and logo is established by the AOAC Board of Directors as follows:

> "The Board approves and encourages reference to the Association by name, either as AOAC INTERNATIONAL or as AOAC; or reference to our registered trademark, AOAC®, in appropriate settings to describe our programs, products, etc., in scientific literature and other instances so long as the reference is fair, accurate, complete and truthful and does not indicate or imply unauthorized endorsement of any kind.
>
> The insignia (logo) of AOAC INTERNATIONAL is a registered trade and service mark and shall not be reproduced or used by any person or organization other than the Association, its elected and appointed officers, sections, or committees, without the prior written permission of the Association. Those authorized to use the AOAC INTERNATIONAL insignia shall use it only for the purposes for which permission has been specifically granted.
>
> The name and insignia of the Association shall not be used by any person or organization in any way which indicates, tends to indicate, or implies AOAC official endorsement of any product, service, program, company, organization, event or person, endorsement of which, has not been authorized by the Association, or which suggests that membership in the Association is available to any organization."

The Executive Director, in accordance with the above stated policy, is authorized to process, approve, fix rules, and make available materials containing the Association name and insignia.

It should be noted that neither the Association's name nor its insignia nor part of its insignia may be incorporated into any personal, company, organization, or any other stationery other than that of the Association; nor may any statement be included in the printed portion of such stationery which states or implies that an individual, company, or other organization is a Member of the Association.

Instructions

1. Reproduction or use of the Association name or insignia requires prior approval by the Executive Director or his designate.

2. Association insignia should not be altered in any manner without approval of the Executive Director or his designate, except to be enlarged or reduced in their entirety.

3. Artwork for reproducing the Association name or insignia, including those incorporating approved alterations, will be provided on request to those authorized to use them (make such requests to the AOAC Marketing Department). Examples of the types of alterations that would be approved are inclusion of a section name in or the addition of an officer's name and address to the letterhead insignia.

4. When the Association name is used without other text as a heading, it should, when possible, be set in the Largo typeface.

5. Although other colors may be used, AOAC blue, PMS 287, is the preferred color when printing the AOAC insignia, especially in formal and official documents. It is, of course, often necessary and acceptable to reproduce the insignia in black.

6. Do not print one part of the logo or insignia in one color and other parts in another color.

7. The letterhead of AOAC INTERNATIONAL shall not be used by any person or organization other than the Association, its elected and appointed officers, staff, sections, or committees; except by special permission.

   Correspondence of AOAC official business should be conducted using AOAC letterhead. However, those authorized to use AOAC letterhead shall use it for official AOAC business only.

   Copies of all correspondence using AOAC letterhead or conducting AOAC official business, whether on AOAC letterhead or not, must be sent to the appropriate office at AOAC headquarters.

8. AOAC INTERNATIONAL business cards shall not be used by any person or organization other than the Association, its staff, and elected officials, except by special permission.

   Those authorized to use AOAC business cards shall use them for official AOAC business only and shall not represent themselves as having authority to bind the Association beyond that authorized.

Sanctions

1. Upon learning of any violation of the above policy, the Executive Director or a designate will notify the individual or organization that they are in violation of AOAC policy and will ask them to refrain from further misuse of the AOAC name or insignia.

2. If the misuse is by an Individual Member or Sustaining Member of the Association, and the misuse continues after notification, the Board of Directors will take appropriate action.

3. If continued misuse is by a nonmember of the Association or if a member continues misuse in spite of notification and Board action, ultimately, the Association will take legal action to protect its property, legal integrity, reputation, and image.

* * * * * *

Adopted by the AOAC Board of Directors: September 24, 1989
Revised: June 13, 1991; February 26, 1992; March 21, 1995; October 1996

AOAC INTERNATIONAL
ANTITRUST POLICY
STATEMENT AND GUIDELINES

Introduction

It is the policy of AOAC INTERNATIONAL (AOAC) and its members to comply strictly with all laws applicable to AOAC activities. Because AOAC activities frequently involve cooperative undertakings and meetings where competitors may be present, it is important to emphasize the on_going commitment of our members and the Association to full compliance with national and other antitrust laws. This statement is a reminder of that commitment and should be used as a general guide for AOAC and related individual activities and meetings.

Responsibility for Antitrust Compliance

The Association's structure is fashioned and its programs are carried out in conformance with antitrust standards. However, an equal responsibility for antitrust compliance __ which includes avoidance of even an appearance of improper activity __ belongs to the individual. Even the appearance of improper activity must be avoided because the courts have taken the position that actual proof of misconduct is not required under the law. All that is required is whether misconduct can be inferred from the individual's activities.

Employers and AOAC depend on individual good judgment to avoid all discussions and activities which may involve improper subject matter and improper procedures. AOAC staff members work conscientiously to avoid subject matter or discussion which may have unintended implications, and counsel for the Association can provide guidance with regard to these matters. It is important for the individual to realize, however, that the competitive significance of a particular conduct or communication probably is evident only to the individual who is directly involved in such matters.

Antitrust Guidelines

In general, the U.S. antitrust laws seek to preserve a free, competitive economy and trade in the United States and in commerce with foreign countries. Laws in other countries have similar objectives. Competitors (including individuals) may not restrain competition among themselves with reference to the price, quality, or distribution of their products, and they may not act in concert to restrict the competitive capabilities or opportunities of competitors, suppliers, or customers.

Although the Justice Department and Federal Trade Commission generally enforce the U.S. antitrust laws, private parties can bring their own lawsuits.

Penalties for violating the U.S. and other antitrust laws are severe: corporations are subject to heavy fines and injunctive decrees, and may have to pay substantial damage judgments to injured competitors, suppliers, or customers. Individuals are subject to criminal prosecution, and will be punished by fines and imprisonment.
Under current U.S. federal sentencing guidelines, individuals found guilty of bid rigging, price fixing, or market allocation must be sent to jail for at least 4 to 10 months and must pay substantial minimum fines.

Since the individual has an important responsibility in ensuring antitrust compliance in AOAC activities, everyone should read and heed the following guidelines.

1. Don't make any effort to bring about or prevent the standardization of any method or product for the purpose or intent of preventing the manufacture or sale of any method or product not conforming to a specified standard.

2. Don't discuss with competitors your own or the competitors' prices, or anything that might affect prices such as costs, discounts, terms of sale, distribution, volume of production, profit margins, territories, or customers.

3. Don't make announcements or statements at AOAC functions, outside leased exhibit space, about your own prices or those of competitors.

4. Don't disclose to others at meetings or otherwise any competitively sensitive information.

5. Don't attempt to use the Association to restrict the economic activities of any firm or any individual.

6. Don't stay at a meeting where any such price or anti_competitive talk occurs.

7. Do conduct all AOAC business meetings in accordance with AOAC rules. These rules require that an AOAC staff member be present or available, the meeting be conducted by a knowledgeable chair, the agenda be followed, and minutes be kept.

8. Do confer with counsel before raising any topic or making any statement with competitive ramifications.

9. Do send copies of meeting minutes and all AOAC_related correspondence to the staff member involved in the activity.

10. Do alert the AOAC staff to any inaccuracies in proposed or existing methods and statements issued, or to be issued, by AOAC and to any conduct not in conformance with these guidelines.

Conclusion

Compliance with these guidelines involves not only avoidance of antitrust violations, but avoidance of any behavior which might be so construed. Bear in mind, however, that the above antitrust laws are stated in general terms, and that this statement is not a summary of applicable laws. It is intended only to highlight and emphasize the principal antitrust standards which are relevant to AOAC programs. You must, therefore, seek the guidance of either AOAC counsel or your own counsel if antitrust questions arise.

* * * * *

Adopted by the AOAC Board of Directors: September 24, 1989
Revised: March 11, 1991
Revised October 1996

AOAC INTERNATIONAL

POLICY AND PROCEDURES ON

VOLUNTEER CONFLICT OF INTEREST

Statement of Policy

While it is not the intention of AOAC INTERNATIONAL (AOAC) to restrict the personal, professional, or proprietary activities of AOAC members nor to preclude or restrict participation in Association affairs solely by reason of such activities, it is the sense of AOAC that conflicts of interest or even the appearance of conflicts of interest on the part of AOAC volunteers should be avoided. Where this is not possible or practical under the circumstances, there shall be written disclosure by the volunteers of actual or potential conflicts of interest in order to ensure the credibility and integrity of AOAC. Such written disclosure shall be made to any individual or group within the Association which is reviewing a recommendation which the volunteer had a part in formulating and in which the volunteer has a material interest causing an actual or potential conflict of interest.

AOAC requires disclosure of actual or potential conflicts of interest as a condition of active participation in the business of the Association. The burden of disclosure of conflicts of interest or the appearance of conflicts of interest falls upon the volunteer.

A disclosed conflict of interest will not in itself bar an AOAC member from participation in Association activities, but a three-fourths majority of the AOAC group reviewing the issue presenting the conflict must concur by secret ballot that the volunteer's continued participation is necessary and will not unreasonably jeopardize the integrity of the decision-making process.

Employees of AOAC are governed by the provision of the AOAC policy on conflict of interest by staff. If that policy is in disagreement with or mute on matters covered by this policy, the provisions of this policy shall prevail and apply to staff as well.

Illustrations of Conflicts of Interest

1. A volunteer who is serving as a committee member or referee engaged in the evaluation of a method or device; who is also an employee of or receiving a fee from the firm which is manufacturing or distributing the method or device or is an employee of or receiving a fee from a competing firm.

2. A volunteer who is requested to evaluate a proposed method or a related collaborative study in which data are presented that appear detrimental (or favorable) to a product distributed or a position supported by the volunteer's employer.

3. A referee who is conducting a study and evaluating the results of an instrument, a kit, or a piece of equipment which will be provided gratis by the manufacturer or distributor to one or more of the participating laboratories, including his or her own laboratory, at the conclusion of the study.

4. Sponsorship of a collaborative study by an interest (which may include the referee) which stands to profit from the results; such sponsorship usually involving the privilege granted by the investigator to permit the sponsor to review and comment upon the results prior to AOAC evaluation.

5. A volunteer asked to review a manuscript submitted for publication when the manuscript contains information which is critical of a proprietary or other interest of the reviewer.

The foregoing are intended as illustrative and should not be interpreted to be all-inclusive examples of conflicts of interest AOAC volunteers may find themselves involved in.

Do's and Don'ts

Do avoid the appearance as well as the fact of a conflict of interest.

Do make written disclosure of any material interest which may constitute a conflict of interest or the appearance of a conflict of interest.

Do not accept payment or gifts for services rendered as a volunteer of the Association without disclosing such payment or gifts.

Do not vote on any issue before an AOAC decision-making body where you have the appearance of or an actual conflict of interest regarding the recommendation or decision before that body.

Do not participate in an AOAC decision-making body without written disclosure of actual or potential conflicts of interest in the issues before that body.

Do not accept a position of responsibility as an AOAC volunteer, without disclosure, where the discharge of the accepted responsibility will be or may appear to be influenced by proprietary or other conflicting interests.

Procedures

Each volunteer elected or appointed to an AOAC position of responsibility shall be sent, at the time of election or appointment, a copy of this policy and shall be advised of the requirement to adhere to the provisions herein as a condition for active participation in the business of the Association. Each volunteer, at the time of his or her election or appointment, shall indicate, in writing, on a form provided for this purpose by AOAC, that he or she has read and accepts this policy.

Each year, at the spring meeting of the AOAC Board of Directors, the Executive Director shall submit a report certifying the requirements of this policy have been met; including the names and positions of any elected or appointed volunteers who have not at that time indicated in writing that they have accepted the policy.

Anyone with knowledge of specific instances in which the provisions of this policy have not been complied with shall report these instances to the Board of Directors, via the Office of the Executive Director, as soon as discovered.

* * * * * *

Adopted: March 2, 1989
Revised: March 28, 1990
Revised: October 1996

The Scientific Association Dedicated to Analytical Excellence®

AOAC INTERNATIONAL

TERMS OF REFERENCE

I. NAME:

OFFICIAL METHODS BOARD (OMB)

II. MISSION:

To serve the Association in a scientific and advisory capacity on standards and methods with ethical, timely, open and independent scientific oversight for the implementation of standards development and conformity assessment policies and procedures of AOAC INTERNATIONAL.

III. RESPONSIBILITIES:

To provide ethical, timely, open and independent scientific oversight for the policies and procedures of AOAC INTERNATIONAL.

To approve "Final Action" status for First Action Methods (new and revised) following a proactive review;

To repeal methods, if necessary, in accordance with established policies and procedures;

To participate in addressing appeals and requests for action or guidance, and in resolving disputes;

To endorse and monitor all voluntary consensus panels for appropriate representation and balance of stakeholders' perspectives;

To endorse and monitor all volunteer subject matter experts for volunteer conformity assessment activities;

To adopt and monitor scientific and technical guidance and references;

To acknowledge outstanding scientific and technical volunteer activity and achievement within AOAC;

To actively participate in AOAC standards development activities and maintain and communicate explicit knowledge of AOAC standards development and conformity assessment;

IV. COMPOSITION AND ORGANIZATION:

The Official Methods Board shall consist of up to 13 voting members including a Chair, a Vice-chair, the Chair of the Committee on Safety and the Chair of the Committee on Statistics. The Committee on Safety and the Committee on Statistics may contain co-chairs. The co-chairs for these committees represent one vote on the OMB. Members of the OMB may serve in multiple volunteer roles for the benefit of the Association. The Chair of the Official Methods Board shall have previously served as a member of the Official Methods Board. The Chair, Vice-chair, and members of the Official Methods Board including the chairs of standing committees shall be appointed for a term of three years. A member of the OMB may be reappointed upon the recommendation of the Chair of the Official Methods Board with a maximum term of service of six (6) years. Exceptions may be made at the discretion of the President. The Chair of the Official Methods Board is eligible to serve an additional post chair term of up to three (3) years as an *ex-officio* member. Members of the Official Methods Board must be members of AOAC.

All members of the Official Methods Board are recommended by the Chair and appointed by the President. All Official Methods Board members serve at the pleasure of the President.

The Official Methods Board represents the membership of AOAC INTERNATIONAL. It shall be composed of members representing a balance of scientific expertise, government, industry, and academia as appropriate to the scope of the Board. Every effort should be made to include international representation on the Board.

Additional working groups, task forces, and other appropriate subgroups shall be appointed as needs arise by the Chair of the Official Methods Board.

V. STAFF LIAISON:

The Executive Director shall assign a member of the staff to serve as staff liaison.

VI. REVIEW SCHEDULE:

Every three years.

VII. DATE ESTABLISHED:

Renamed in 1981

VIII. DATES REVIEWED

01/08,

IX. DATES REVISED:

9/89; 5/90; 1/91; 8/06;
02/07; 07/07; 2/08; 4/13; 8/13

OFFICIAL METHODS BOARD MEETING

Thursday and Friday, February 5-6, 2015

9:00 AM – 5:00 PM ET **(Day 1)**
8:30 AM – 5:00 PM ET **(Day 2)**

DRAFT MEETING AGENDA

I. PRELIMINARY ITEMS

a. Welcome *(Bradford)*
b. Call to Order /Introductions/Announcements *(Roman)*
c. Review of Policy Documents/Terms of Reference *(Roman)*
d. Review of Draft Agenda* *(Roman)*
e. Update from Executive Office and Board of Directors *(Bradford)*
f. Review of Past Minutes* *(Roman)*
    i. Frequent Review and Approval

II. WORK ITEMS FROM AOAC BOARD OF DIRECTORS

a. Working Group Initiated Pathway *(Hill/Roman)*
b. Sole Source OMA Method Modifications
    i. Board of Directors Document *(Hill/Roman)*
    ii. Methods in Progress *(Roman/McKenzie)*
        1. AOAC 932.14
c. Updating OMA with Fit For Purpose Methods *(Hill/Roman)*
d. AOAC Methods in CCMAS
    i. AOAC 2013.06
e. Alternative Approaches to Determining Reproducibility
    i. "Best Practices" statistics monograph *(Hill/Wehling)*
    ii. November-December ILM article *(Coates/McKenzie)*

III. AOAC MEETING & PANELS UPDATES

a. OMB Liaisons *(Roman /McKenzie)*
b. Standards Development Activities *(McKenzie)*
c. Conformity Assessment Activities *(McKenzie)*

IV. AOAC OFFICIAL METHODS BOARD ACTIVITIES

a. OMB Guidance to Expert Review Panels for First to Final Action *(Roman)*
b. Revised Awards Documentation* *(Roman/McKenzie)*
c. ALACC Document* *(Stawick/Fox)*
d. Selection of New OMB Members *(Roman/Szpylka/McKenzie)*

V. EXPERT REVIEW PANELS

a. Experts for Review* *(McKenzie)*
b. Methods Approved Update *(McKenzie)*
c. Achieving quorum and ERP conduct *(McKenzie)*

VI. OMB MEETINGS FOR 2015

a. Spring /Summer OMB Meeting *(Roman/McKenzie)*

VII. ADJOURNMENT

AOAC BOARD OF DIRECTORS MEETING
Rockville, MD
Mar. 16, 2015
Jun. 22-23, 2015

AOAC SPADA MEETING
Rockville, MD
February 3-4, 2015

AOAC OFFICIAL METHODS BOARD MEETING
Rockville, MD
February 5-6, 2015

AOAC MID-YEAR MEETING
Rockville, MD
March 16-20, 2015

AOAC ANNUAL MEETING
Los Angeles, CA
Sept. 27 – 30, 2015

**** Items that require or may require a vote***

OFFICIAL METHODS BOARD

January 8, 2015 TELECONFERENCE

DATE: Thursday, January 8, 2015
TIME: 1:00pm – 2:00pm ET

DRAFT TELECONFERENCE MINUTES

OMB MEMBERS *(present during all or part of the meeting)*

Shauna Roman	Reckitt Benckiser	Chair
Erin Crowley	Q Laboratories	Member
Doug Abbott	Independent/USDA Retired	Member
Sneh Bhandari	Mérieux NutriSciences	Member
Joe Boison	CFIA	Member
Jo Marie Cook (by proxy)	Florida Department of Agriculture	Member
Perry Martos	University of Guelph	Member
Shang-Jing (Jean) Pan	Abbott Nutrition	Member
Tom Phillips	Maryland Department of Agriculture	Member
Victoria Siegel	Eurofins	Member
Brad Stawick	Microbac	Member
John Szpylka	Mérieux NutriSciences	Past Chair (*ex officio* member)

OMB MEMBERS *(absent with regrets)*

Qian Graves	US FDA CFSAN	Member
Yvonne Salfinger	Independent Consultant	Member

BOARD OF DIRECTORS & INVITED GUESTS

Erik Konings	Nestle	President
Norma Hill	US Treasury (retired)	President - Elect
Darryl Sullivan	Covance Laboratories	Secretary
Jon DeVries	Medallion Labs/General Mills	Treasurer
Paul Wehling	Medallion Labs/General Mills	Committee on Statistics

AOAC STAFF *(present during all or part of the meeting)*

Delia Boyd
Jim Bradford
Scott Coates
Deborah McKenzie
Alicia Meiklejohn

I. INTRODUCTORY ITEMS/REVIEW OF POLICY DOCUMENTS *(Roman)*

a. Call to Order/Introductions/Announcements
   i. Roman called the meeting to order at 1:06pm.

b. Approval of Draft Agenda*****
   i. **MOTION:** For OMB to approve the agenda.
   Bhandari moved and Phillips seconded. Consensus: unanimously in favor.

II. WORK ITEMS FROM AOAC BOARD OF DIRECTORS

a. Hill and other members of the AOAC Board of Directors explained the rationale for requesting

that OMB withdraw its approval of the modification pending development of standard method performance requirements and further investigation. Hill explained the international implications of the OMB having approved the modification. Sullivan explained that CODEX will downgrade the AOAC modified method which is perceived to cast a negative light on AOAC and other methods to be considered within CODEX.

While there is no precedent for this, there was no opinion by the AOAC Board of Directors on the scientific validity of the modified Official Method, but rather, withdrawing the approval of the modification represents "taking a step back" due to lack of adequate procedures and potential negative perception of AOAC methods by other international organizations that incorporate AOAC methods.

MOTION: For OMB to withdraw the approval of the modifications to First Action Official Methods of Analysis, AOAC 2009.01 and AOAC 2011.25, pending further investigation.
Abbott moved and Cook seconded. Consensus: unanimously in favor.

ACTIONS:

- McKenzie to arrange a teleconference with method author within the next day to inform him of decision.
- Notification will follow in AOAC Inside Laboratory Management magazine and revising the OMA will follow the teleconference with the method author.

b. Alternative Approaches to Determining Reproducibility – Developing a "Best Practices" statistics monograph

Hill explained that the a white paper, a best practices document, is being put together for delivery to the Interagency Meeting at Codex in February. The document is a layman's version of the statistical documents detailing alternative options for determination of reproducibility. Hill explained that a working group was formed to participate in this effort that includes, Robert LaBudde, Paul Wehling, Sidney Sudberg, and Norma Hill. From OMB both Graves (Chair of the Committee on Statistics) and Tom Phillips also agreed to participate.

Hill explained that the document will be preliminary and that Wehling would start the document and that it would be presented to the Committee on Statistics and the OMB for their approval.

ACTIONS:

- Hill to hold preliminary with the group to get things started on Friday, January 9, 2015.
- Wehling to develop a draft of the preliminary document, ideally this document could be reviewed by the OMB during their February 2015 meeting.

III. UPDATES

a. Revised Awards Document
ACTIONS: AOAC staff to send out the revised awards document to all OMB members. This document will be discussed at the February 2015 OMB meeting.

b. Upcoming In-Person Meetings
McKenzie provided an update on the upcoming meetings including the February SPADA meeting, the February OMB meeting and the AOAC Mid-Year Meeting.
ACTIONS:

- Abbott and Phillips to attend the AOAC SPADA meeting.
- McKenzie to Include the Mid-Year meeting along with OMB liaisons on the OMB February

agenda.

IV. ADDITIONAL FEBRUARY OMB MEETING AGENDA ITEMS

a. Working Group Initiated Pathway
b. Sole Source OMA Method Modifications
c. Updating OMA with Fit For Purpose Methods
d. Alternative Approaches to Determining Reproducibility
   - Developing a "Best Practices" statistics monograph
   - November-December ILM article
e. December 2014 Expert Review Panels
   - Methods approved
   - Achieving quorum and ERP conduct
f. Methods in Process
   - AOAC 932.14 modification discussion

ACTIONS:

- Add ALACC to the February OMB meeting agenda
- Send Stawick template for memorandum for OMB book.

V. ADJOURNMENT

MOTION: To adjourn the meeting.
Bhandari moved and Cook seconded. Consensus: unanimous in favor.

AOAC INTERNATIONAL

The Scientific Association Dedicated to Analytical Excellence®

MEMORANDUM

Date: **February 5-6, 2015**

To: **AOAC INTERNATIONAL Official Methods Board**

From: **Deborah McKenzie – Staff Liaison, AOAC Official Methods Board**

Subject: **Work Items from AOAC Board of Directors**

This agenda heading includes a number of topics that will be discussed during the February 2015 OMB meeting in Rockville, Maryland. Some of these items have reading materials included in this meeting book in preparation for the February meeting. The complete draft agenda is still under development.

- Working Group Initiated Pathway
- Sole Source OMA Method Modifications
- Updating OMA with Fit For Purpose Methods
- AOAC Methods in CCMAS – AOAC 2013.06
- Alternative Approaches to Determining Reproducibility - Developing a “Best Practices” statistics monograph

Background

It is essential that the methods in the Official Methods of Analysis remain the best solution that addresses the real needs of the AOAC INTERNATIONAL analytical communities and stakeholders. The Board of Directors (BoD) has approved a new Working Group (WG) initiated process(12/9/2014). This process ensures that the methods in OMA are approved in conformance with voluntary consensus standards. It envisions that an individual or entity who expresses a need for a method should form a Working Group with the assistance of AOACINTERNATIONAL's business development office and the assistance of the Chief Scientific Officer to develop those standards. A stakeholder panel (SP) that ratifies the SMPRs would be an existing SP either one under contract that agrees to extend their work product, or one of the panels funded by the Association such as ISPAM or SPSFAM.

Authorities:

Community – These are members of industry, academia and regulatory bodies that need standards or analytical methods to perform their professional duties.

WG – The WG drafts the appropriate Standard Method Performance Requirements.

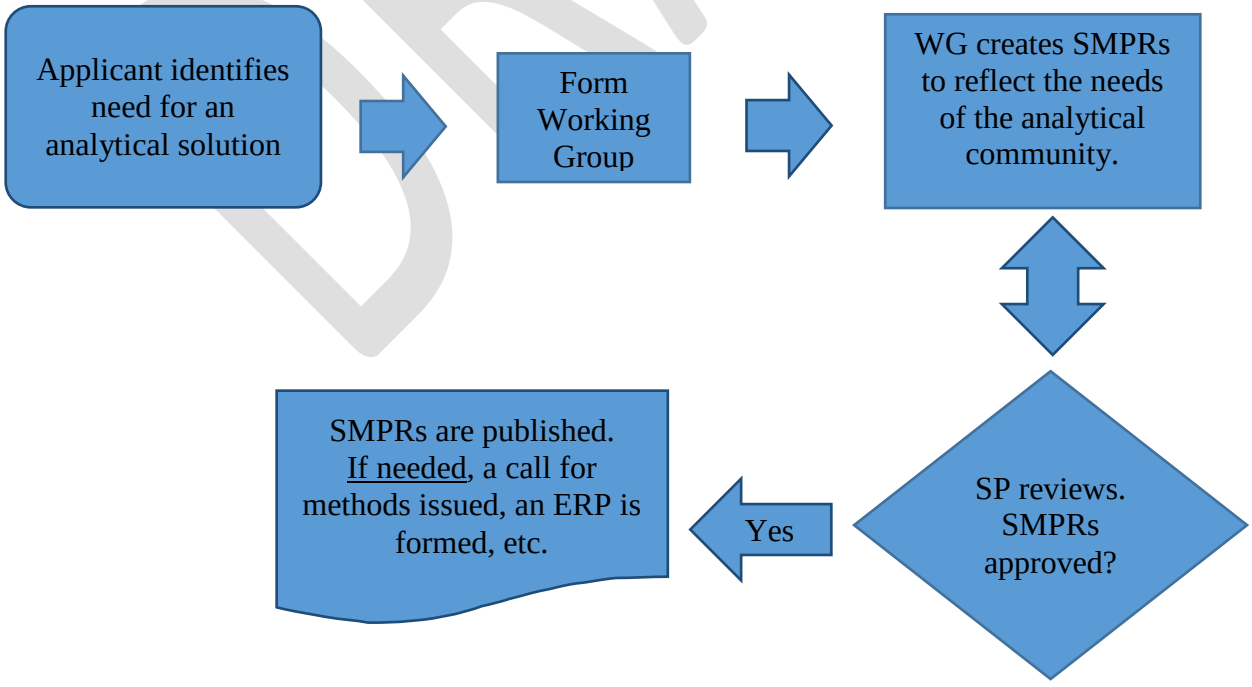
SP- Final decisions on the acceptance of SMPRs remain with the appropriate Stakeholder Panel.

ERP- All methods are reviewed and approved for First Action and recommended for approval for Final Action or repeal by an Expert Review Panel.

OMB- Final decisions on acceptance of Final Action or Repeal for Official Methods of Analysisremains with the Official Methods Board (OMB). All decisions on Official Methods require a minimum2/3 vote of the OMB members.

BoD - The Board of Directors reserves all decisions on Policy and Association responsibility to the Board of Directors.

Flow of Work



Immediately below is the process currently on the books. It relies on a single person/body to make decisions affecting the analytical communities and the Association. A change to the flowchart is proposed as shown on the next page to reflect the Board's new Working Group initiated process approved 12/9/2014. Draft major/minor modification definitions are included for clarification.

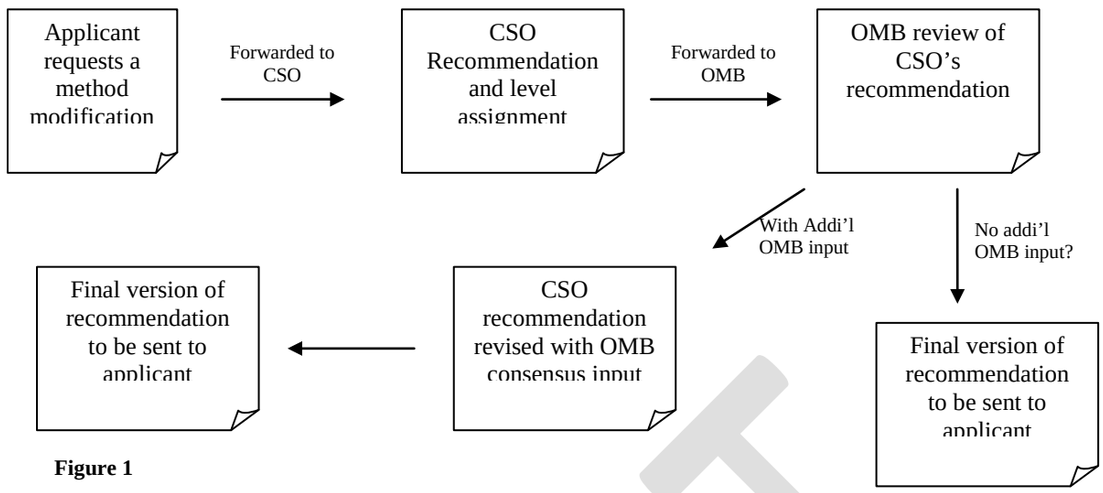


Figure 1

Modification Workflow Concepts:

Any community member may submit a request for a method modification. Modification submissions go to the Chief Scientific Officer and must include the following paperwork.

Editorial Modification:

A written explanation of the reason(s) for the modification is required.

Typos oreditorial corrections or clarifications are forwarded to the OMB for approval then to the editorial board or OMA editor as appropriate.Methods that have undergone an editorial modification will retain the same number. A list of the methods with editorial modifications will be published in *Inside Laboratory Management* and on the Website.

Method Modifications:

Require the submission of data to justify the requested modification. AllMethod Modifications go to a Working Group. The Working Group will review the modification proposal. If the WG determines that a method modification is needed, they will draft the appropriate Standard Method Performance Requirements to reflect the needs of the community.

1.) Minor Modification, no change or a simple modification of the current SMPRs might suffice.There is no significant effect to the results; i.e. new results are within (1 or 2σ) as defined by original study and the needs of the community. Regulatory limits should inform the decision as well. For example, if the compliance limit is +/- 20% and the replicates for the new method are within about half that range (<10%), then it would probably pass regulatory approval.

2.) Major Modification will require drafting new SMPRs.There is a significant effect on the results and/or a significant change to the technology. For example, if the modification requires retraining of technical personnel; or purchase of significantly more expensive equipment; or significant change in sample prep; or changing the chemistry of any step in the process (e.g.a different catalyst, pH change, temperature change) all indicate significant changes to technology.

Authorities:

Community – These are members of industry, academia and regulatory bodies that need standards or analytical methods to perform their professional duties.

WG – The WG drafts the appropriate Standard Method Performance Requirements.

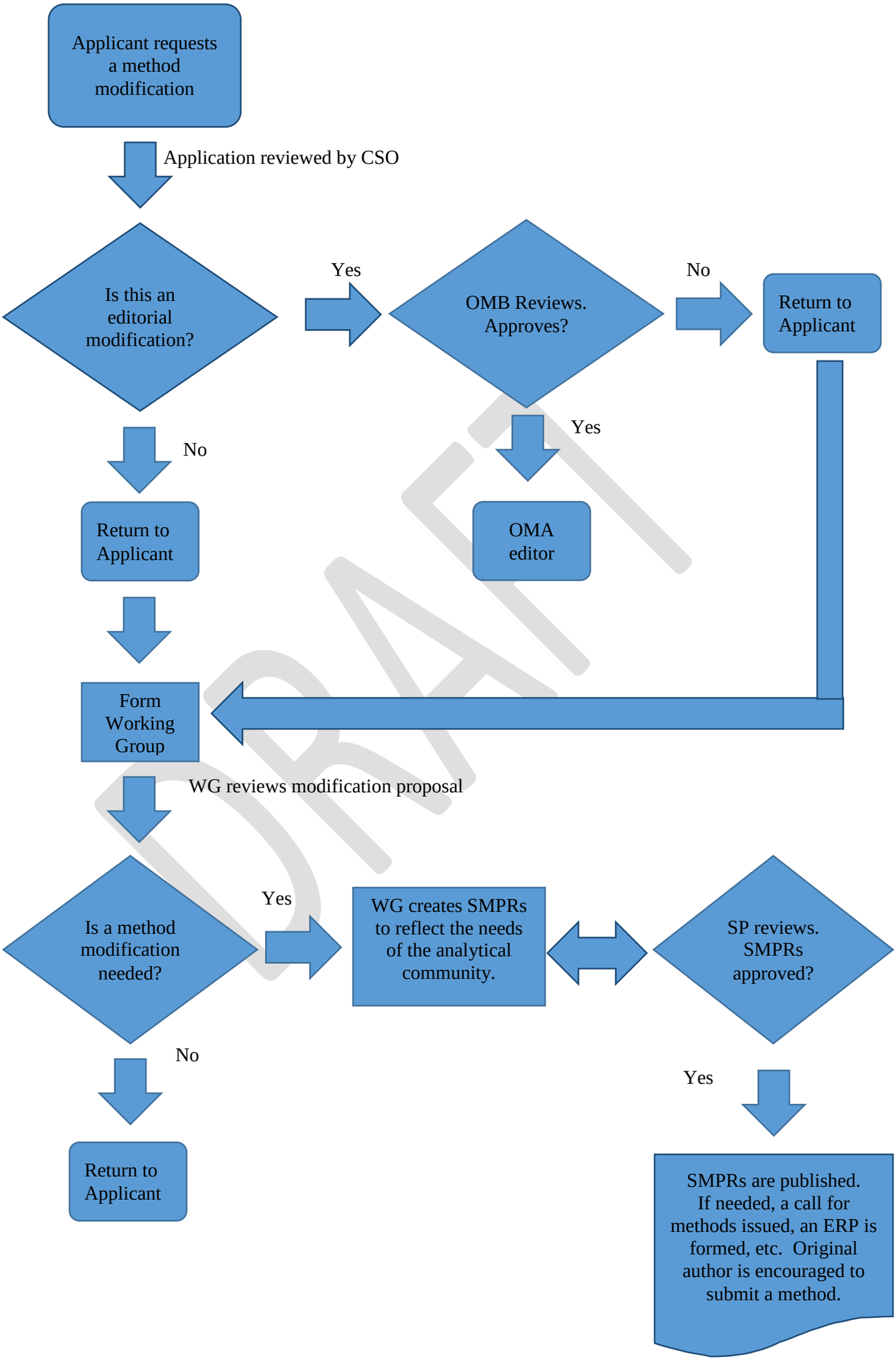
SP- Final decisions on the acceptance of SMPRs remain with the appropriate Stakeholder Panel.

ERP- All methods are reviewed and approved for First Action and recommended for approval for Final Action or repeal by the Expert Review Panel. All methods that have undergone a method modification are defined as First Action and receive their unique OMA number.

OMB- Final decisions on acceptance of Final Action or Repeal for Official Methods of Analysis remains with the Official Methods Board. All decisions on Official Methods require a minimum2/3 vote of the OMB members.

BoD - The Board of Directors reserves all decisions on Policy and Association responsibility to the Board of Directors.

Recommended Flow of Work



This document has been created and reviewed by the A2LA Life-Sciences Advisory Committee (LSAC). It provides a summary of consensus decisions voted on and approved by the LSAC and A2LA Criteria Council for use by CABs and assessors.

Chemistry Methods

(a) *Definitions* of terms used in this section*—

(1) *Method Modification* - a change in stoichiometry, technology, or a change in quality control acceptance criteria.
(2) *Analyst* - the person or laboratory using a test procedure (analytical method).
(3) *Chemistry of the method* - the reagents and reactions used in a test procedure that allows determination of the analyte(s) of interest in an environmental sample.
(4) *Determinative technique* - the way in which an analyte is identified and quantified (*e.g.*, colorimetry, mass spectrometry).
(5) *Equivalent performance* – a determination that the modified method produces results that meet or exceed the QC acceptance criteria of the approved method.
(6) *Method-defined analyte* - an analyte defined solely by the method used to determine the analyte. Such an analyte may be a physical parameter, a parameter that is not a specific chemical, or a parameter that may be comprised of a number of substances. Examples of such analytes include temperature, oil and grease, total suspended solids, total phenolics, turbidity, chemical oxygen demand, and biochemical oxygen demand.
(7) *QC* - quality control.

(b) *Scope Requirements*

(1) Modified methods will be denoted on the Scope of Accreditation with the reference method followed by the word “modified”. The laboratory’s in-house method may or may not accompany the modified method based on the laboratory’s needs.

(2) The laboratory will not be assessed to the original reference method unless the laboratory wishes to include the non-modified, reference method also on their Scope of Accreditation.

(c) *Method modifications.*

(1) *Discussion*

If the underlying chemistry and determinative technique in a modified method are essentially the same a reference method, then the modified method is an equivalent and acceptable alternative to the reference method provided the requirements of this section are met. However, those who develop or use a modification to a reference method must document that the performance of the modified method, in the matrix to which the modified method will be applied, is equivalent to the performance of the reference method. If such a demonstration cannot be made and documented, then the modified method is not an acceptable alternative to the reference method. Supporting documentation must, if applicable, include the routine initial demonstration of capability and ongoing QC including determination of precision and accuracy, detection limits, and matrix spike recoveries. Initial demonstration of capability typically includes analysis of four replicates of a mid-level standard and a method detection limit study. Ongoing quality control typically includes method blanks, mid-level laboratory control samples, and matrix spikes (QC is as specified in the method). The method is considered equivalent if the quality control requirements in the reference method are achieved. The method user’s Standard Operating Procedure (SOP) must clearly document the modifications made to the reference method. Examples of allowed method modifications are listed in this section.

The user must notify their client of the intent to use a modified method in writing. Such notification should be of the form ‘‘Method xxx has been modified within the flexibility allowed in Pxxx Life Sciences LSAC Consensus Document. ’’Specific details of the modification need not be provided to the client, but they must be documented in the Standard Operating Procedure (SOP). The method user must approve the use of the modified method in writing. The CAB must also complete necessary performance checks to verify that acceptable performance is achieved with the method modification *prior* to analyses of compliance samples.

(2) *Requirements*

The modified method must be sufficiently sensitive and must meet or exceed performance of the reference method(s) for the analyte(s) of interest, as documented by meeting the initial and ongoing quality control requirements in the method.

(i) *Requirements for establishing equivalent performance*

If the reference method contains QC tests and QC acceptance criteria, the modified method must use these QC tests and the modified method must meet the QC acceptance criteria with the following conditions:

(A) The analyst may only rely on QC tests and QC acceptance criteria in a method if it includes matrix QC tests and QC acceptance criteria (*e.g.,* matrix spikes) and both initial (start-up) and ongoing QC tests and QC acceptance criteria.

(B) If the reference method does not contain QC tests and QC acceptance criteria or if the QC tests and QC acceptance criteria in the reference method do not meet the requirements of this section, then the analyst must employ QC tests published in the ''equivalent'' method that has such QC, as applicable. If the reference method is from a compendium or VCSB (Voluntary Consensus Standard Body) and the QA/QC requirements are published in other parts of that organization's compendium rather than within the reference method then that part of the organization's compendium must be used for the QC tests.

(C) The analyst must perform ongoing QC tests, including assessment of performance of the modified method on the sample matrix (*e.g.,* analysis of a matrix spike/matrix spike duplicate pair for every twenty samples), and analysis of an ongoing precision and recovery sample (*e.g.,* laboratory fortified blank or blank spike) and a blank with each batch of 20 or fewer samples.

(D) If the performance of the modified method in the matrix or reagent water does not meet or exceed the QC acceptance criteria, the method modification may not be used.

(ii) *Requirements for documentation*

The modified method must be documented in a method write-up or an addendum that describes the modification(s) to the reference method prior to the use of the method for compliance purposes. The write-up or addendum must include a reference number (*e.g.,* method number), revision number, and revision date so that it may be referenced accurately. In addition, the organization that uses the modified method must document the results of QC tests and keep these records, along with a copy of the method write-up or addendum, for review by an auditor.

(3) *Restrictions*

An analyst may not modify an analytical method for a method-defined analyte. In addition, an analyst may not modify a reference method if the modification would result in measurement of a different form or species of an analyte. Changes in method procedures are not allowed if such changes would alter the defined chemistry (*i.e.,* method principle) of the unmodified method.

Notes: For example, phenol method EPA 420.1 or EPA 420.4 defines phenolics as ferric iron oxidized compounds that react with 4-aminoantipyrine (4-AAP) at pH 10 after being distilled from acid solution. Because total phenolics represents a group of compounds that all react at different efficiencies with 4-AAP, changing test conditions likely would change the behavior of these different phenolic compounds. An analyst may not modify any sample collection, preservation, or holding time requirements of an approved method. Such modifications to sample collection, preservation, and holding time requirements do not fall within the scope of the flexibility allowed at § 136.6. Method flexibility refers to modifications of the analytical procedures used for identification and measurement of the analyte only and does not apply to sample collection, preservation, or holding time procedures, which may only be modified as specified in § 136.3(e).

(4) *Allowable changes*

Except as noted under paragraph (D)(3) of this section, an analyst may modify a reference test procedure (analytical method) provided that the underlying reactions and principles used in the approved method remain essentially the same, and provided that the requirements of this section are met. If equal or better performance can be obtained with an alternative reagent, then it is allowed. A laboratory wishing to use these modifications must demonstrate acceptable method performance by performing and documenting all applicable initial demonstration of capability and ongoing QC tests and meeting all applicable QC acceptance criteria.

Some examples of the allowed types of changes, provided the requirements of this section are met include:

(i) Changes between manual method, flow analyzer, and discrete instrumentation.

(ii) Changes in chromatographic columns or temperature programs.

(iii) Changes between automated and manual sample preparation, such as digestions, distillations, and extractions; in-line sample preparation is an acceptable form of automated sample preparation for CWA methods.

(iv) In general, ICP–MS is a sensitive and selective detector for metal analysis; however isobaric interference can cause problems for quantitative determination, as well as identification based on the isotope pattern. Interference reduction technologies, such as collision cells or reaction cells, are designed to reduce the effect of spectroscopic interferences that may bias results for the element of interest. The use of interference reduction technologies is allowed, provided the method performance specifications relevant to ICP–MS measurements are met.

(v) The use of EPA Method 200.2 or the sample preparation steps from EPA Method 1638, including the use of closed-vessel digestion, is allowed for EPA Method 200.8, provided the method performance specifications relevant to the ICP–MS are met.

(vi) Changes in pH adjustment reagents. Changes in compounds used to adjust pH are acceptable as long as they do not produce interference. For example, using a different acid to adjust pH in colorimetric methods.

(vii) Changes in buffer reagents are acceptable provided that the changes do not produce interferences.

(viii) Changes in the order of reagent addition are acceptable provided that the change does not alter the chemistry and does not produce an interference. For example, using the same reagents, but adding them in different order, or preparing them in combined or separate solutions (so they can be added separately), is allowed, provided reagent stability or method performance is equivalent or improved.

(ix) Changes in calibration range (provided that the modified range covers any relevant regulatory limit and the method performance specifications for calibration are met).

(x) Changes in calibration model.

Note: (A) Linear calibration models do not adequately fit calibration data with one or two inflection points. For example, vendor-supplied data acquisition and processing software on some instruments may provide quadratic fitting functions to handle such situations. If the calibration data for a particular analytical method routinely display quadratic character, using quadratic fitting functions may be acceptable. In such cases, the minimum number of calibrators for second order fits should be six, and in no case should concentrations be extrapolated for instrument responses that exceed that of the most concentrated calibrator. Examples of methods with nonlinear calibration functions include chloride by SM4500–Cl–E–1997, hardness by EPA Method 130.1, cyanide by ASTM D6888 or OIA1677, Kjeldahl nitrogen by PAI–DK03, and anions by EPA Method 300.0.

(xi) Changes in equipment such as equipment from a vendor different from the one specified in the method.

(xii) The use of micro or midi distillation apparatus in place of macro distillation apparatus.

(xiii) The use of prepackaged reagents.

(xiv) The use of digital titrators and methods where the underlying chemistry used for the determination is similar to that used in the approved method.

(xv) Use of selected ion monitoring (SIM) mode for analytes that cannot be effectively analyzed in full-scan mode and reach the required sensitivity. False positives are more of a concern when using SIM analysis, so at a minimum, one quantitation and two qualifying ions must be monitored for each analyte (unless fewer than three ions with intensity greater than 15% of the base peak are available). The ratio of each of the two qualifying ions to the quantitation ion must be evaluated and should agree with the ratio observed in an authentic standard within ±20 percent. Analyst judgment must be applied to the evaluation of ion ratios because the ratios can be affected by co-eluting compounds present in the sample matrix. The signal-to-noise ratio of the least sensitive ion should be at least 3:1. Retention time in the sample should match within 0.05 minute of an authentic standard analyzed under identical conditions. Matrix interferences can cause minor shifts in retention time and may be evident as shifts in the retention times of the internal standards. The total scan time should be such that a minimum of eight scans are obtained per chromatographic peak.

(xvi) Changes are allowed in purge and trap sample volumes or operating conditions.

(A) Changes in purge time and purge gas flow rate. A change in purge time and purge-gas flow rate is allowed provided that sufficient total purge volume is used to achieve the required minimum detectible concentration and calibration range for all compounds. In general, a purge rate in the range 20–200 mL/min and a total purge volume in the range 240–880 mL are recommended.
(B) Use of nitrogen or helium as a purge gas provided that the required sensitivities for all compounds are met.
(C) Sample temperature during the purge state. Gentle heating of the sample during purging (*e.g.*, 40 °C) increases purging efficiency of hydrophilic compounds and may improve sample to sample repeatability because all samples are purged under precisely the same conditions.
(D) Trap sorbent. Any trap design is acceptable, provided that the data acquired meet all QC criteria.
(E) Changes to the desorb time. Shortening the desorb time (*e.g.*, from 4 minutes to 1 minute) may not affect compound recoveries, and can shorten overall cycle time and significantly reduce the amount of water introduced to the analytical system, thus improving the precision of analysis, especially for water-soluble analytes. A desorb time of four minutes is recommended, however a shorter desorb time may be used, provided that all QC specifications in the method are met.
(F) Use of water management techniques is allowed. Water is always collected on the trap along with the analytes and is a significant interference for analytical systems (GC and GC/MS). Modern water management techniques (*e.g.*, dry purge or condensation points) can remove moisture from the sample stream and improve analytical performance.

(xvii) Combining extraction fractions

The following example applies: When performing EPA Method 625, the base/neutral and acid fractions may be added together and analyzed as one extract, provided that the analytes can be reliably identified and quantified in the combined extracts; the pH extraction sequence may be reversed to better separate acid and neutral components; neutral components may be extracted with either acid or base components; a smaller sample volume may be used to minimize matrix interferences provided matrix interferences are demonstrated and documented; alternative surrogate and internal standard concentrations other than those specified in the method are acceptable, provided that method performance is not degraded; an alternative concentration range may be used for the calibration other than the range specified in the method; the solvent for the calibration standards may be changed to match the solvent of the final sample extract.

(xviii) If the characteristics of a matrix prevent efficient recovery of organic pollutants and prevent the method from meeting QC requirements, the analyst may attempt to resolve the issue by adding salts to the sample, provided that such salts do not react with or introduce the target pollutant into the sample (as evidenced by the analysis of method blanks, laboratory control samples, and spiked samples that also contain such salts), and that all requirements of section 2of this section are met. Samples having residual chlorine or other halogen must be de-chlorinated prior to the addition of such salts.

(xix) If the characteristics of a matrix result in poor sample dispersion or reagent deposition on equipment and prevent the analyst from meeting QC requirements, the analyst may attempt to resolve the issue by adding an inert surfactant that does not affect the chemistry of the method, such as Brij-35 or sodium dodecyl sulfate (SDS), provided that such surfactant does not react with or introduce the target pollutant into the sample (as evidenced by the analysis of method blanks, laboratory control samples, and spiked samples that also contain such surfactant) and that all requirements of section 2 of this section are met. Add this as a note for environmental: Samples having residual chlorine or other halogen must be dechlorinated prior to the addition of such surfactant.

(xx) The use of gas diffusion (using pH change to convert the analyte to gaseous form and/or heat to separate an analyte contained in steam from the sample matrix) across a hydrophobic semi-permeable membrane to separate the analyte of interest from the sample matrix may be used in place of manual or automated distillation in methods for analysis such as ammonia, total cyanide, total Kjeldahl nitrogen, and total phenols. These procedures do not replace the digestion procedures specified in the approved methods and must be used in conjunction with those procedures.

(xxi) Changes in equipment operating parameters such as the monitoring wavelength of a colorimeter or the reaction time and temperature as needed to achieve the chemical reactions defined in the unmodified method.

For example, molybdenum blue phosphate methods have two absorbance maxima, one at about 660 nm and another at about 880 nm. The former is about 2.5 times less sensitive than the latter. Wavelength choice provides a cost-effective, dilution-free means to increase sensitivity of molybdenum blue phosphate methods.

(xxii) Interchange of oxidants, such as the use of titanium oxide in UV-assisted automated digestion of TOC and total phosphorus, as long as complete oxidation can be demonstrated.

(xxii) Use of an axially viewed torch with EPA Method 200.7

Biological Methods

(a) *Definitions* of terms used in this section*—

(1) *Method Modification* - a change in stoichiometry, technology, science, a change in quality control acceptance criteria, or elimination of steps in the original reference method.
(2) *Method Substitution* - a change from the standard method that does not change the stoichiometry, technology, science or quality control acceptance criteria, and includes all steps in the original reference method.
(3) *Analyst* - the person or laboratory using a test procedure (analytical method) in this Part.
(4) *Determinative technique* - the way in which an analyte is identified and quantified (*e.g.*, cultural, ELISA, PCR, Gel Electrophoresis, etc.).
(5) *Equivalent performance* – a determination that the modified method produces results that meet or exceed the QC acceptance criteria of the approved method.
(6) *QC* - quality control.

(b) *Scope Requirements*

(1) Modified methods will be denoted on the Scope of Accreditation with the reference method followed by the word "modified". The laboratories in-house method may or may not accompany the modified method based on the laboratory's needs.

(2) The laboratory will not be assessed to the original reference method unless the laboratory wishes to include the non-modified, reference method also on their Scope of Accreditation.

(3) Methods with substitutions shall not be identified as such on the Scope of Accreditation.

(c) *Method modifications and substitutions*

(1) *Discussion*

A change in the original reference method is either considered a modification or a substitution.

If the steps in the method are changed such that the science behind the recovery of the organism is different, then this is considered a modification. Examples of method modifications: elimination of one or more confirmation steps of the original reference method, change in incubation times, and change in incubation temperatures.

If the steps in the reference method are not changed, but only equivalent replacements are made, then this is considered a substitution. Examples of method substitution:

i. Different media that perform the same function (PDA vs. SDA, MOX vs. OXA or PALCAM).
ii. Different starting weight from the original reference method, but the ratio of sample to diluent is equivalent (11 g in 99 ml vs 25 g in 225 ml).
iii. Different biochemical confirmation methods (API vs. Enterotube or conventional biochemical).
iv. Commercially prepared media vs. laboratory prepared media.
v. Alternative microorganisms for positive and negative controls which exhibit the same characteristics as those stated in the published method.
vi. Kits (i.e. IDEXX for MPN, Total Coliform, Fecal Coliform, Enterococcus, HPC) where equivalency is demonstrated by the manufacturer.
vii. Automated equipment such as plate readers and robots.

(2) *Requirements*

The modified method must be sufficiently sensitive and must meet or exceed performance of the reference method(s) for the analyte(s) of interest, as documented by meeting the initial and ongoing quality control requirements in the reference method.

(i) *Requirements for establishing equivalent performance of biological methods*

Same as above for chemistry methods.

(ii) *Requirements for documentation of biological methods*

Same as above for chemistry methods.

*Definitions based on U.S. Environmental Protection Agency Clean Water Act (CWA) and memo regarding Flexibility to Modify CWA Methods published November 20, 2007.

DOCUMENT REVISION HISTORY

DATE	DESCRIPTION
12/22/2014	Initial publication of document.

AOAC INTERNATIONAL

The Scientific Association Dedicated to Analytical Excellence®

MEMORANDUM

Date: **February 5-6, 2015**

To: **AOAC INTERNATIONAL Official Methods Board**

From: **Deborah McKenzie – Staff Liaison, AOAC Official Methods Board**

Subject: **AOAC 932.14**

Working group met followed by review of the method author's response. Working group members agreed that they had no further comments.

On February 2, 2015, I spoke with the method author regarding the progress of the review and explained what has happened.

RECOMMENDATION:
OMB to decide what the next steps for this method are based on the discussion regarding Sole Source OMA Method Modifications.

Background

The *Official Methods of Analysis*[SM] (OMA) are the recognized gold standard for dispute resolution methods. *"For over 125 years AOAC INTERNATIONAL has been meeting the needs of its members and scientists throughout the world for confidence in analytical results by delivering AOAC® Official Methods*[SM]*. The Official Methods of Analysis of AOAC INTERNATIONAL (OMA) is an international source of methods and voluntary consensus standards, with many countries and international organizations contributing their expertise. OMA is the most comprehensive and reliable collection of chemical and microbiological methods available in the world and are contained in many of the Codex food standards."*Maintaining the OMA as current is vital to protect the AOAC brand on the international stage.

Stakeholder Panels have been formed as the result of industry or government agencies seeing a need to address an urgent problem. Two panels have been formed by AOAC INTERNATIONAL and the Research Institute in a commitment to invest in the AOAC brand. Once standard method performance requirements have been published and methods are identified to meet those requirements there is one additional task to meet. Industry leaders have come to realize that within the *Official Methods of Analysis*[SM] there remain a number of Official Methods that have been superseded. Either the older technologies are no longer viable or the older methods give significantly different results. This could well engender a costly dispute where one Laboratory has used the newly recognized method and another Laboratory has used the older method. There is no obvious way to alert the customers, the laboratories, regulatory agencies and indeed even the courts to know how to evaluate the differences. This paper proposes a systematic process for dealing with this problem before disputes arise.

Proposal

Stakeholder Panels invest a great deal of capital and time to ensure that the methods identified meet the needs of their analytical community. Additional investment is required to make sure that the methods that remain in OMA are the best methods available. This proposal does not preclude a standing Working Group from proposing the withdrawal of a method from OMA. However the review of that recommendation by a Stakeholder Panel, Expert Review Panel and the Official Methods Board should remain a standard pathway for this process. It does preclude having such decisions arising from a petition from a single individual or interest.

1) Once methods have been chosen to go to final action, the stakeholder panel should send a new task to the original working group or even empanel a new working group.
2) The task of this Working Group would be to identify methods in OMA that no longer meet the new Standard Method Performance Requirements.
3) The list of non-conforming methods would then go to the Stakeholder Panel for ratification.
4) The Expert Review Panel would then recommend to the Official Methods Board one of three options. Accuracy and viability are the factors that need to inform those decisions. Valid technical and/or strategic reasoning should accompany each recommendation.
    a) Retain the method.
    b) Repeal/withdraw the method.
    c) If the method can meet the new standards with some modification, then it must be sent through the method modification pathway.

5) The Official Methods Board accepts or rejects the recommendations of the Expert Review Panel in whole or in part.

AOAC INTERNATIONAL

The Scientific Association Dedicated to Analytical Excellence®

MEMORANDUM

Date: **February 5-6, 2015**

To: **AOAC INTERNATIONAL Official Methods Board**

From: **Deborah McKenzie – Staff Liaison, AOAC Official Methods Board**

Subject: **AOAC 2013.06**

Norma Hill is seeking the OMB's opinion on method, AOAC 2013.06 that is listed for CCMAS. She thinks that the author did some odd things with the method with which she is not comfortable. If there is some individual on the OMB with experience in ICPMS, she would very much appreciate their input.

E

CODEX ALIMENTARIUS COMMISSION

Food and Agriculture Organization of the United Nations

World Health Organization

Viale delle Terme di Caracalla, 00153 Rome, Italy - Tel: (+39) 06 57051 - Fax: (+39) 06 5705 4593 - E-mail: codex@fao.org - www.codexalimentarius.org

Agenda Item 7 **CX/MAS 15/36/7**

JOINT FAO/WHO FOOD STANDARDS PROGRAMME

CODEX COMMITTEE ON METHODS OF ANALYSIS AND SAMPLING

Thirty-sixth Session
Budapest, Hungary
23 - 27 February 2015

REVIEW AND UPDATE OF METHODS IN CODEX STAN 234-1999

Prepared by the Electronic Working Group led by Brazil

BACKGROUND:

1. At the 34thCCMAS Session, in 2013, updating the references of methods of analysis and related texts was discussed. The Committee agreed that a general single document or database with all the methods of analysis allows permanent and dynamic revision. The Committee agreed to establish an eWG to prepare a discussion paper with proposals: on establishing a format for a single source document (database) to capture all methods in the scope of CCMAS; the process for updating references to methods of analysis; and a plan to prioritize the (re)endorsement of current methods in the Recommended Methods of Analysis and Sampling (CODEX STAN 234-1999) and commodity standards.

2. At the 35thCCMAS Session, in 2014,the Committee agreed that the list to be compiled with all methods of analysis would be utilized for internal use of the Committee i.e. for updating the methods and that the mechanism for this process would first be tried before examining the necessity of having it recommended for inclusion in the Procedural Manual.

3. Regarding the information in the list, the Committee noted that the information on performance criteria of an analytical method would be required during endorsement by CCMAS, and agreed that such information would not be necessary at the time of identifying the analytical method that needed review, but agreed that this requirement would remain in the Table 1 (as presented in CRD 22), but that the concerns raised related to proprietary information should be taken into account when developing the single source document.

4. The Committee agreed to establish, an electronic working group, led by Brazil, open to all members and observers, and working in English only, with the following terms of reference:

   a) compile a single workable list for all methods in CODEX STAN 234-1999 and commodity standards;

   b) divide the list into workable packages based on the criteria developed by the Committee for prioritization of the methods of analysis;

   c) conduct a validation exercise on one pilot work package of which the results would be considered by the Committee at its next session.

5. Brazil prepared the compiled list with comments from Argentina, Australia, South Korea, Mauritius, Jamaica, Japan, Republic of Cyprus, Slovak Republic, Switzerland, Uruguay, IDF and NMKL. A list of countries and NGOs that joined the EWG can be found in the Appendix III.

It is important highlight that the criteria for selecting methods of analysis was not discussed in this document.

METHOD OF CONSTRUCTION OF THE LIST

6. The eWG noticed that there are 3 ways to make reference to the methodologies, depending on how the methodologies are currently mentioned in the Codex documents: standardized methods published by international organizations; performance criteria required for provision determination and complete description of the method of analysis.

7. The eWG compiled, as a first step, all the standardized methods. The information of this compiled

list was suggested in the last session of the CCMAS (Annex I). This information was joined in a excel file.

8. The sources of information were the reports and ALINORMS of CCMAS and CODEX STAN 234. This work is very susceptible to mistakes and in several cases was difficult to have the traceability from CODEX STAN 234 to report, because the source of information was the Annex tables. The identified methods were compared with the ones in Codex commodity standards to search for inconsistencies, but the methods that are there only in commodity standards were not compiled yet. It will be the next step.

9. The third step will be the development of a list with the performance criteria and the methods that fit in this criteria and the last step will be the compilation of all methods with a full description in Codex commodity standards.

10. The Reports and ALINORMS were evaluated, comparing this information with that in the commodity standards, CODEX STAN 192, CODEX STAN 193, CODEX STAN 228, CODEX STAN 231, CODEX STAN 239 and CODEX STAN 234. The outcomes of this comparison are in the remarks column of Appendices I and II.

11. The dates of the methods are removed because it was agreed at the 34th Session due the necessity to use the most recent versions of analytical methods and older version of methods are generally not available, however the Committee agreed to include in the list three types of dates i.e. date of publication of the method, year of endorsement of the method by CCMAS; year of the latest version/revision.

12. A column of prioritization permits to divide the methods in workable packages. In the last CCMAS the Committee agreed with the following prioritization criteria: analytical methods directly linked with food safety, Type I and II methods (reference for disputes), methods with inaccurate information and number of years since endorsement (the oldest first).

13. It was highlighted that as Type II methods are chosen from a bulk of methods and only one is chosen as type II while others become type III for a specific provision, these methods (Type II and Type III) should be reviewed at the same time. The package 1 was subdivided, according with the year of the method endorsement. It was also suggested the Type I methods should be updated first because it is the only method to be used.

14. Based on these criteria and the outcomes of the comparison, the EWG makes the following proposal for prioritization:

i. Methods with inaccurate information that requires some action by CCMAS, such as methods not readily available, methods with wrong number, methods from IUPAC, methods that have been abandoned or replaced by others and RM methods. It was also considered inaccurate information when there are two different type II methods or when the CODEX STAN 234 and Commodity standards mention different methods for the same provision.

ii. Type I methods endorsed for over 10 years, related to food safety;

iii. Type II, III and IV methods endorsed for over 10 years, related to food safety;

iv. Type I methods endorsed for over 10 years, not related to food safety;

v. Type II, III and IV methods endorsed for over 10 years, not related to food safety;

vi. Type I methods endorsed for less than 10 years, related to food safety;

vii. Type II, III and IV methods endorsed for less than10 years, related to food safety;

viii. Type I methods endorsed for less 10 years, not related to food safety;

ix. Type II, III and IV methods endorsed for less10 years, not related to food safety.

15. Several eWG participants raised the necessity to define the scope of the provisions “related to food safety”. One member suggested “related to food safety” are any method measuring:

- any physiologically relevant elements (e.g. iron, calcium, manganese), or substances (e.g., vitamins, fibers) , mixtures (soluble fibers,..)
- any characteristic of a food (pH, moisture, salt content, concentration of food preservatives) or microorganism (bacteria, moulds, parasites) that plays a role in its stability
- any element, substances, mixtures or state of a food which have to be avoided or kept within some levels: such as lead, mercury, cadmium, mycotoxins, water activity, pH,..)”

16. However the SPS Agreement establishing the role of Codex Alimentarius on the food safety measures mentions those related to food additives, veterinary drug and pesticide residues, contaminants and guidelines of hygienic practice. Considering CCMAS term of reference, the methods of analysis related

to food additives and contaminants were considered “related to food safety” for this first screening. The CCMAS should consider if other provisions should be included as related to food safety.

17. This definition of “related to food safety” had no impact in the first package and after a Committee decision will be easy make a new classification if necessary.

18. Other issues discussed by the eWG was the number of the years for the endorsement revision. Most of the participants agreed with 10 years. However, a member of the group suggested that the period of 10 years could be reevaluated after the initial workload has been completed due the rate of technological change.

19. According with these prioritization criteria the methods were divided in 9 packages. The number of the methods per package is shown on Table I.

20. In order to allow the formation of workable packages the methods under prioritization 1 were divided according to number of years since endorsement.

21. There are 215 methods from CCNFSU that were not prioritised for the first and second packages, because of time restriction due the difficulty to find a commodity standard that shows the provisions and the related methods. It would be necessary to go to the CCNFSU reports. The CCNFSU methods with be dealt in the next round.

Table I- Number of Methods by number package

PACKAGE	DESCRIPTION	Nº of METHODS
1.	Methods with inaccurate information endorsed for over 10 years	105
	Methods with inaccurate information endorsed for less than10 years	62
2.	Type I methods endorsed for over 10 years, related to food safety	-
3.	Type II, III and IV methods endorsed for over 10 years, related to food safety	68
4.	Type I methods endorsed for over 10 years, not related to food safety	137
5.	Type II, III and IV methods endorsed for over 10 years, not related to food safety	52
6.	Type I methods endorsed for less than 10 years, related to food safety	-
7.	Type II, III and IV methods endorsed for less than10 years, related to food safety	35
8.	Type I methods endorsed for less 10 years, not related to food safety	199
9	Type II, III and IV methods endorsed for less10 years, not related to food safety	198

22. Each package may also be divided by the responsible Committee and commodity categories, depending on CCMAS decision regarding the process of revision.

23. The eWG has realized that there are several limits and parameters established by the Commodity Committees that don’t have the related method of analysis. On the other hand there are methods endorsed that have no provision in any Codex Document.

24. A concern was raised regarding early revision of test methods (e.g. less than 10 years) and whether this would put developing countries at a disadvantage if the endorsed method is one which would not be realistically feasible for the country. However the eWG has not discussed any change in the criteria for selecting methods of analysis.

25. The first and second packages prioritized as number 1 (containing inaccurate information) are in Appendices I and II.

CONCLUSIONS AND RECOMMENDATIONS

26. After compiling the methods in a single list and prioritizing them it is possible to make the following conclusions:

- Almost 20% of the methods from the list were classified as containing inaccurate information that could mean the need to have a harmonized process to update the reference for methods of analysis;
- There are 30 entries in the Annexes I and II corresponding to RM methods or methods described in the Stan, despite the fact that the Codex Alimentarius Commission at its 22nd Session (June 1997) abolished the CAC/RM Numbering System;
- There was not a harmonized way to mention the methods in the report. In several cases was difficult to find which report approved or revoked the method.

After conducting this validation exercise the CCMAS should decide regarding to:

- The approach to be adopted for RM methods, such as compile all of them in an annex of CODEX STAN 234;
- The continuation of the revising work;
- The adoption of a harmonized process to update the reference to methods of analysis, including the role of the commodity committees, IAM and Codex Secretariat, and the format for a single source (document, database) to capture all methods in the scope of CCMAS, such as discussed in CX/MAS 14/35/6;
- The adoption of a harmonized report, including a list of non endorsed or revoked methods and the reason for it, which may facilitate the understanding of all the process.

ANNEX I - METHODS WITH INACCURATE INFORMATION ENDORSED FOR OVER 10 YEARS

Commodities	Source	Provision	Method	Principle	Type	Year Approval	Year Last revision	Year Endorsement by CCMAS	Committee	Remarks
All foods	ALINORM 01/23	Lead, cadmium, copper, iron and zinc	NMKL 161 AOAC 991.10	AAS after microwave digestion	III			2001	CCCF	The method AOAC 991.10 is not for food (Cholinesterase Activity in Whole Blood) It is a typing error, it should be AOAC 999.10.
Bouillons and Consommés	ALINORM 95/23	Tin	AOAC 985.16	Atomic absorption	II			1995	CCSB	a) CODEX STAN 234 doesn't mention this provision . The CODEX STAN 228 doesn´t contain methods for tin neither the CODEX STAN 117
Canned mangoes	ALINORM 87/23	Drained weight	CAC/RM 36	_	I			1987	CCPFV	a) The CODEX STAN 234 doesn't mention this provision for this commodity b) The principle is not mentioned in the ALINORM c) The CODEX STAN 159

										doesn´t contain methods, but has this provision. d)The CAC/RM were revoked
Canned mangoes	ALINORM 87/23	Water capacity of containers	CAC/RM 46	_	I			1987	CCPFV	a) The CODEX STAN 234 doesn't mention this provision for this commodity b) The principle is not mentioned in the ALINORM c) The CODEX STAN 159 doesn´t contain methods, but has this provision. d)The CAC/RM were revoked
Canned mushrooms	Stan 234	Wash drained weight	CAC/RM44	Sieving	I				CCPFV	The report that mention this provision/method was not found. The Codex standard for this commodity was not found.
Cereals, shell fruit and derived	ALINORM 03/23	Sum of aflatoxins B1, B2,	EN 12955 : 1999-07 ISO 16050	HPLC with post column derivatization and	III			2003	CCCF	BS EN 12955:1999 - Superseded, Withdrawn Replaced By : BS EN ISO

Products (including peanuts)		G1 and G2		immunoaffinity column clean up						16050:2011
Cocoa Butter (for all foods)	ALINORM 01/23	Lead	AOAC 999.11 NMKL 139	AAS	II			2001	CCCPC	a) There are methods mentioned in the CODEX STAN 86- According to AOAC 934.07 or IUPAC Method (Pure & Appl. Chem., 63). b) The IUPAC methods are obsolete c) There are methods for lead in Codex Stan 228 934.07 (spectrophotometric method) would not have sufficient limit of determination. NMKL 139 and AOAC 999.11 (AOAC has adopted the NMKL method) have better limit of detection /determination for lead

										and other metals.
Cooked cured chopped meat	ALINORM 95/23	Lead	AOAC 972.25	Atomic absorption	II			1995	CCMPPP	a)There are methods mentioned in the CODEX STAN 98 AOAC 934.07. see above
Cooked cured ham	ALINORM 95/23	Lead	AOAC 972.25	Atomic absorption	II			1995	CCMPPP	a) The CODEX STAN 96 mentions a different method: AOAC 934.07.
Cooked cured ham	ALINORM 95/23	Nitrite	AOAC 973.31	Colorimetry	II			1995	CCMPPP	a)The CODEX STAN 96 doesn't mention this method, only ISO 2918
Cooked cured ham	ALINORM 95/23	Protein	ISO 937	Kjeldahl digestion	II			1995	CCMPPP	a)There are methods mentioned in the CODEX STAN 96 b) The CODEX STAN 96 doesn't mention this method, only ISO Recommendation R 1443 c) The CODEX STAN 234 mentions the provision Protein (conversion factor 6.25)

Cooked cured pork shoulder	ALINORM 95/23	Lead	AOAC 972.25	Atomic absorption	II			1996	CCMPPP	a)The CODEX STAN 97 mentions a different method: AOAC 934.07
Cooked cured pork shoulder	ALINORM 95/23	Nitrite	AOAC 973.31	Colorimetry	II			1995	CCMPPP	a)The CODEX STAN 97 doesn't mention this method, only ISO 2918
Cooked cured pork shoulder	ALINORM 95/23	Protein	ISO 937	Kjeldahl digestion	II			1995	CCMPPP	a) The CODEX STAN 97 doesn't mention this method, only ISO Recommendation R 1443
Degermed maize (corn) meal and maize (corn) grits	CODEX STAN 234	Crude fat	AOAC 945.38F; 920.39C	Gravimetry (ether extraction)	I			1985	CCCPL	a) The Annex of CODEX STAN 155 mentions the method AOAC 945.38F; 920.39C and ISO 5986 (Withdrawn)
Degermed maize (corn) meal and maize (corn) grits	ALINORM 85/23	Protein	ICC 105/1	_	I			1985	CCCPL	CODEX STAN 155 and CODEX STAN 234 mention the method ICC 105/l . The current version of the method is ICC 105/2
Durum wheat semolina and durum wheat flour	ALINORM 85/23	Protein	ICC 105/1	Titrimetry	I			1985	CCCPL	a)The CODEX STAN 178 mentions this method and also ISO 1871 b) CODEX STAN 234

										mentions the principle Titrimetry, Kjeldahl digestion, type I c) The current version of the method is ICC 105/2
Fluid milk	ALINORM 97/23	Aflatoxin M1 0.05 µg/kg	AOAC 986.16	HPLC	Not described	95		1997	CCMMP	CODEX STAN 234 describes only methods for peanuts
Gari	ALINORM 89/23	Acidity	AOAC 14.064 AOAC 14.065	_	I			1989	CCCPL	a) CODEX STAN 234 does not describe this provision b) CODEX STAN 151 mentions AOAC 14.064 – 14.065 (not found) – or – ISO/DP 7305 for total acidity. The standard was revised in 1995 c) The principle is not mentioned in the ALINORM neither in CODEX STAN 151
Honey	ALINORM 01/23	Acidity	MAFF Validated method V19, J A	Titrimetry	I			2001	CCS	This methods is mentioned in the CODEX STAN 12 and in CODEX STAN 234

			Public Analyst 1992, 28(4) 171-175							b) Method MAFF was not readily available.
Honey	ALINORM 97/23[A]	Mineral (ash) <1.0%	J. Assoc. Public Analysts (1992) <1.0% 28 (4) 177-181 MAFF Validated Method V20 for Mineral (ash) in Honey	Gravimetry (ignition at 600°C)	I			1997	CCS	a) This provision is not mentioned in the CODEX STAN 234 b) This method is not readily available
Honey	ALINORM 01/23	Sugars added: detection of corn and cane sugar products.	AOAC 998.12.	Carbon isotope ratio mass spectrometry	I			2001	CCS	a) CODEX STAN 12 does not mention CODEX STAN 234. b) CODEX STAN 234 mention AOAC 978.17 for Sugars added: detection of corn and cane sugar products
Honey	ALINORM 99/23	Sugars added: detection of high	AOAC 979.22	Thin layer chromatography	II			1999	CCS	a) CODEX STAN 12 does not mention CODEX STAN 234. b) CODEX STAN 234

		fructose syrup, corn syrup.								mentions AOAC 978.17 for Sugars added: detection of corn and cane sugar products c) CODEX STAN 12 mentions AOAC 991.41 internal standard for SCIRA (stable carbon isotope ratio analysis). for authenticity
Honey	ALINORM 01/23	Sugars added: for sugar profile	AOAC 998.18	Carbon isotope ratio mass spectrometry	I			2001	CCS	The CODEX STAN 12 mentions the AOAC 977.20 for sugar profile and AOAC 991.41 internal standard for SCIRA. The method AOAC 998.18 was not found
Honey	ALINORM 99/23	Sugars added: for sugar profile	AOAC 977.20	Liquid chromatography	II			1999	CCS	a) The CODEX STAN 12 does not mention CODEX STAN 234. b) This method are mentioned in the CODEX STAN 12. c) CODEX STAN 234 mentions methods

										AOAC 998.18 as type I;
Kimchi	ALINORM 99/23	Drained weight	AOAC 968.30	Gravimetry	I			1999	CCPFV	a) The CODEX STAN 223 / 2001 , mention "See Codex Alimentarius Volume 13". B) CODEX STAN 234 doesn´t mention the commodity
Kimchi	ALINORM 99/23	Mineral impurities	AOAC 971.33	Ashing	I			1999	CCPFV	a) a) The CODEX STAN 223 / 2001 , mention "See Codex Alimentarius Volume 13". B) CODEX STAN 234 doesn´t mention the commodity c) CODEX STAN 234 mentions method AOAC 971.33 for many products.
Kimchi	ALINORM 99/23	Salt (sodium chloride)	AOAC 971.27	Potentiometry (Determination of chloride, expressed	II			1999	CCPFV	a) a) The CODEX STAN 223 / 2001 , mention "See Codex Alimentarius Volume

				as sodium chloride)						13". B) CODEX STAN 234 doesn´t mention the commodity c) CODEX STAN 234 mentions method AOAC 971.27 for many products.
Kimchi	ALINORM 99/23	Total acidity (as lactic acid)	AOAC 942.15	Tritrimetry	I			1999	CCPFV	a) a) The CODEX STAN 223 / 2001 , mention "See Codex Alimentarius Volume 13". B) CODEX STAN 234 doesn´t mention the commodity c) CODEX STAN 234 mentions method AOAC 942.15 for many products.
Luncheon meat	ALINORM 95/23	Lead	AOAC 972.25	Atomic absorption	II			1995	CCMPPP	a) CODEX STAN 89 mentions a different method: AOAC 934.07
Mango Chutney	ALINORM 91/23	Total soluble solids	AOAC 932.14(c)	_	I			1991	CCPFV	a)There aren't methods in the CODEX STAN 160, just the expression "To

										be completed". b) In the CODEX STAN 234 is not mentioned this provision to this commodity c) There is provision CODEX STAN 160
Margarine	CODEX STAN 234	Milkfat	CAC/RM 15	Titrimetry	I				CCFO	The reference report was not found. There is not reference for this method on CODEX STAN 256
Margarine	CODEX STAN 234	Vitamin D	AOAC 936.14	Bioassay	II				CCFO	The method AOAC 981.17 is mentioned on CODEX STAN 256 as Type II
Margarine	CODEX STAN 234	Vitamin E	IUPAC 2.411	TLC followed by spectrophotometry or GLC	II				CCFO	The reference report was not found. The method ISO 9936 is mentioned in CODEX STAN 256
Margarine	CODEX STAN 234	Water	CAC/RM 17-1969 (described in the Standard)	Gravimetry	I				CCFO	The reference report was not found. There is no reference value for water on CODEX STAN 256

Milk	ALINORM 97/23	Aflatoxin M1	IDF STD. 171	Immunoaffinity column & LC	II	95		1997	CCMMP	CODEX STAN 193 mentions the provision. CODEX STAN 234 mentions only methods for peanuts
Milk & dried milk A-5 (milk powder)	ALINORM 97/23	Aflatoxin M1	IDF Std. 111 A	TLC/LC	Not described	95		1997	CCMMP	CODEX STAN 193 mentions the provision. CODEX STAN 234 mentions only methods for peanuts
Minarine	CODEX STAN 234	Fat	IUPAC 2.801	Gravimetry	I				CCFO	The reference report was not found
Minarine	CODEX STAN 234	Milkfat	CAC/RM 15 (described in the Standard)	Titrimetry	I				CCFO	The reference report was not found. The CODEX STAN 256 does not describe this method.
Minarine	CODEX STAN 234	Sodium chloride	AOAC 971.27 (Codex general method)	Potentiometry	II				CCFO	CODEX STAN 256 mentions for determination of salt content the following methods: IDF 12B: 1988, ISO CD 1738 or AOAC 960.29.

Minarine	CODEX STAN 234	Vitamin A	AOAC 960.45	Spectrophotometry	II				CCFO	CODEX STAN 256 mentions for determination of vitamin A content: AOAC 985.30; AOAC 992.04; or JAOAC 1980, 63, 4.
Minarine	CODEX STAN 234	Vitamin D	AOAC 936.14	Bioassay	II				CCFO	CODEX STAN 256 mentions for determination of vitamin D content According to AOAC 981.17
Minarine	CODEX STAN 234	Vitamin E	IUPAC 2.411	TLC followed by spectrophotometry or GLC	II				CCFO	The reference report was not found. The CODEX STAN 256 mentions for vitamin E content ISO 9936:
Minarine	CODEX STAN 234	Water	CAC/RM 17	Gravimetry	I				CCFO	The reference report was not found. There is no reference value for water on CODEX STAN 256
Natural Mineral Waters	CODEX STAN 234	Spores of sulphite-reducing	ISO 6461-2	Membrane filtration	I				CCNMW	Out of CCMAS scope

		anaerobis (Clostridia)								
Olive Oils and Olive Pomace Oils	CODEX STAN 234	Halogenated solvents, traces	COI/T.20/Doc. no. 8	Gas chromatography	II				CCFO	This method was not found
Pearl millet flour	CODEX STAN 234	Colour	Modern Cereal Chemistry, 6th Ed., D.W. Kent Jones & A.J. Amos, pp 605- 612, Food Trade Press Ltd., London, 1969.	Colorimetry using specific colour grader	IV				CCCPL	The article is not readily available
Pearl millet flour	ALINORM 91/23	Crude Fat	AOAC 945.38F AOAC 920.39C	Gravimetry (ether extraction)	I			1991	CCCPL	a) CODEX STAN 170 mention these methods and ISO 5986 (withdrawn) b)In CODEX STAN 234 mention the method Gravimetry (ether extraction)

Pickled Fruits and Vegetables	ALINORM 07/30/23	Benzoic acid	NMKL 103 or AOAC 983.16	Gas Chromatography	III			2007	CCPFV	a) CODEX STAN 234 doesn´t mention this commodity. The Codex Stan 260 mentions these methods. b) The method NMKL-AOAC Method Number 983.16 is for Fish/Fish Homogenate c) NMKL 103 is "Benzoic acid and sorbic acid in foods". The method is tested on apple juice, almond paste, and fish homogenate [at 0.5–2 g/kg levels], NMKL 103 is withdrawn in 2014 due to the use of chloroform.
Powdered sugar (Icing sugar)	CODEX STAN 234	Polarization	ICUMSA GS 2/1/3-15	Polarimetry	I				CCS	a) CODEX STAN 212 mentions to see relevant Codex texts on methods of analysis and sampling b) The ICUMSA GS

										2/1/3-15 method was not found
Powdered sugar (Icing sugar)	ALINORM 95/23	Starch	TBD Proposed AOAC 925.50	Gravimetry	_			1995	CCS	a) The type isn't mentioned in the ALINORM 95.This is not mentioned in CODEX STAN 234 and in the CODEX STAN 212. The CODEX STAN 212 contains provision for starch.
Processed fruits and vegetables	ALINORM 03/23	Fill of containers	CAC/RM 46	Weighing	I			2003	CCPFV	a) The standard was not found. B) The method is described in the CODEX STAN 260 c) CODEX STAN 234 mentions CAC/RM 46-1972 (reference to "metal containers" deleted and refer to ISO 90.1:1999 for determination of water capacity in metal containers)

Quick frozen blocks of fish fillet, minced fish flesh and mixtures of fillets and minced fish flesh	CODEX STAN 234	Sodium Chloride	AOAC 971.21 (Codex general method)	Potentiometry	II				CCFFP	a) There are methods in CODEX STAN 165 b) the method AOAC 971.21 is for Hg.
Quick Frozen Brussels Sprouts	CODEX STAN 234	Cooking Procedure	CAC/RM 33-1970	cooking	I				CCPFV	
Quick frozen fruits and vegetables: Berries, leek and carrot	CODEX STAN 234	Mineral impurities	CAC/RM 54	Flotation and sedimentation	I				CCPFV	
Quick frozen fruits and vegetables	CODEX STAN 234	Net weight	CAC/RM 34-1970	Weighing	I				CCPFV	The reference report was not found
Quick frozen fruits and vegetables	CODEX STAN 234	Thawing procedure	CAC/RM 32-1970	Thawing	I				CCPFV	The reference report was not found
Quick frozen fruits and vegetables: Berries, Whole	CODEX STAN 234	Soluble solids, total	CAC/RM 43	Refractometry	I				CCPFV	The reference report was not found

kernel corn and Corn-on-the-cob										
Quick frozen fruits and vegetables: Peaches and berries	CODEX STAN 234	Drained fruit/drained berries	Described in the Stan	Draining	I				CCPFV	The reference report was not found. The standard for this commodity was not found. The specific Codex commodities don´t describe the method
Quick frozen fruits and vegetables: Vegetables	CODEX STAN 234	Cooking procedure	CAC/RM 33-1970	Cooking	I				CCPFV	The reference report was not found
Quick Frozen Green Beans and Quick Frozen Wax Beans	CODEX STAN 234	Tough Strings	CAC/RM 39	Stretching	I				CCPFV	a) CODEX STAN 113 mentions :See relevant Codex texts on methods of analysis and sampling.
Quick frozen peas	CODEX STAN 234	Solids, alcohol insoluble	CAC/RM 35	Gravimetry	II				CCPFV	The reference report was not found
Quick Frozen Spinach	CODEX STAN 234	Dry matter, Salt-free	Described in the Standard	Weighing	I				CCPFV	CODEX STAN 77 doesn't describe the method

Quick Frozen Spinach	ALINORM 78/25	mineral impurities	ISO R 763	_	_			1978	CCPFV	a) CODEX STAN 234 doesn't mention this commodity. b) The CAC/RM were revoked , but the CAC/RM 46-1972 is described in CODEX STAN 234. c) The principle and type aren't mentioned in the ALINORM
Raisins	CODEX STAN 234	Mineral impurities	CAC/RM 51-1974	Ashing	I				CCPFV	The reference report was not found
Raisins	CODEX STAN 234	Mineral oil	CAC/RM 52-1974	Extraction and separation on alumina	II				CCPFV	The reference report was not found
Sorghum flour	CODEX STAN 234	Colour	Modern Cereal Chemistry, 6th Ed., D.W. Kent-Jones and A.J. Amos (Ed.), pp. 605-612, Food Trade Press	Colorimetry using specific colour grader	IV				CCCPL	a) CODEX STAN 173 mentions the same method The article is not readily available

			Ltd, London, 1969.							
Sorghum flour	ALINORM 87/23	Crude Fat	ISO 5986, Animal Feeding Stuffs	_	I			1987	CCCPL	a) CODEX STAN 173 there are methods: AOAC 945.38F, 920.39C and ISO 5986 b)The Stan 234 does not mention ISO 5986 (withdrawn).
Sorghum flour	CODEX STAN 234	Protein	ICC Method No 105/1	Titrimetry, Kjeldahl digestion	I				CCCPL	a) CODEX STAN 173 mention ICC 105/1 and ISO 1871 b) the correct version is ICC 105/2
Sorghum grains	CODEX STAN 234	Fat Crude	AOAC 945.38F, 920.39C	Gravimetry	I				CCCPL	a) CODEX STAN 172 mentions methods AOAC 945.38F and 920.39C and ISO 5986:1983 – animal feedingstuff
Sorghum grains	CODEX STAN 234	Protein	ICC Method No 105/1	Titrimetry, Kjeldahl digestion	I				CCCPL	a) CODEX STAN 172 there are the methods: ICC Method No 105/1 e ISO 1871

										b) the correct version is ICC 105/2
Sugars (fructose and lactose)	ALINORM 97/23A	pH 4.5-7.0	ICUMSA GS 1/2/3/4/7/8-23	Potentiometry	I			1997	CCS	CODEX STAN 212, item 6. METHODS OF ANALYSIS AND SAMPLING mentions See relevant Codex texts on methods of analysis and sampling. B) The correct method is ICUMSA GS 1/2/3/4/7/8/9-23
Sugars (fructose)	ALINORM 01/23	Conductivity ash	ICUMSA GS 2/3-17	Conductimetry	I			2001	CCS	a) The methods are not mentioned in the CODEX STAN 212. CODEX STAN 212 mentions "see CODEX STAN 234". b) The correct method is ICUMSA GS 2/3/9-17
Sugars (plantation or mill white sugar)	ALINORM 01/23	Invert sugar	ICUMSA GS 2-6	Titrimetry	I			2001	CCS	a) The methods are not mentioned in the CODEX STAN 212. b) The CODEX STAN 212 mentions "see CODEX

										STAN 234". These methods are different from CODEX STAN 234 that mention ICUMSA GS 1/3/7-3 approved in the ALINORM 1997
Sugars (powdered sugar)	ALINORM 97/23A	Conductivity ash	ICUMSA GS 2/3-17	Conductimetry	I			1997	CCS	a) CODEX STAN 212, item 6. METHODS OF ANALYSIS AND SAMPLING mentions See relevant Codex texts on methods of analysis and sampling. b) The correct method is ICUMSA GS 2/3/9-17
Sugars (powdered sugar)	ALINORM 97/23A	Invert sugar	ICUMSA GS 2/3-5 : after filtration if necessary to remove any anticaking agents	Titrimetry	I			1997	CCS	a) CODEX STAN 212, item 6. METHODS OF ANALYSIS AND SAMPLING mentions See relevant Codex texts on methods of analysis and sampling. B) The ICUMSA GS 2/3-5 method was not found

Sugars (soft brown sugar)	ALINORM 97/23A	Sulphated ash	ICUMSA GS 1/3/4/7/8-11	Gravimetry	I			1997	CCS	a) CODEX STAN 212, item 6. METHODS OF ANALYSIS AND SAMPLING mentions: See relevant Codex texts on methods of analysis and sampling. B) The ICUMSA GS 1/3/4/7/8-11 method was not found.
Sugars (soft white sugar, soft brown sugar, white sugar, plantation or mill white sugar and powdered sugar)	ALINORM 97/23A	Loss on drying	ICUMSA GS 2/1/3-15	Gravimetry	I			1997	CCS	A) CODEX STAN 212, item 6. METHODS OF ANALYSIS AND SAMPLING mentions See relevant Codex texts on methods of analysis and sampling. B) The correct method is ICUMSA Method GS 2/1/3/9-15
Sugars (white sugar)	ALINORM 97/23A	Conductivity ash	ICUMSA GS 2/3-17	Conductimetry	I			1997	CCS	a) CODEX STAN 212, item 6. METHODS OF ANALYSIS AND SAMPLING mentions See relevant Codex texts on methods of

										analysis and sampling. b) The correct method is ICUMSA GS 2/3/9-17
Sugars (white sugar)	ALINORM 97/23A	Invert sugar	ICUMSA GS 2/3-5	Titrimetry	I			1997	CCS	a) CODEX STAN 212, item 6. METHODS OF ANALYSIS AND SAMPLING mentions See relevant Codex texts on methods of analysis and sampling. B) The correct method is ICUMSA GS 2/3/9-5
Vegetable protein products	CODEX STAN 234	Fat	CAC/RM 55-1976 - Method 1 Gravimetry (extraction)	Gravimetry (extraction)	I				CCVP	a) CODEX STAN 174 was approved in 1989 and doesn't mention methods
Wheat flour	CODEX STAN 234	Fat acidity	AOAC 939.05	Titrimetry	I				CCCPL	a) CODEX STAN 152 mentions methods: ISO 7305 and AOAC 939.05
Wheat flour	CODEX STAN 234	Moisture	ISO 712 ICC Method No 110/1	Gravimetry	I				CCCPL	a) CODEX STAN 152 is not mentioned these methods
Wheat flour	CODEX STAN 234	Protein	ICC Method No 105/1	Titrimetry, Kjeldahl digestion	I				CCCPL	a) CODEX STAN 152 mentions the same method:ICC Method No

										105/I b) the correct version is ICC 105/2
Whole and Decorticated Pearl Millet Grain	ALINORM 91/23	Crude fat	AOAC 945.38F AOAC 920.39C	Gravimetry (ether extraction)	I			1991	CCCPL	a) The CODEX STAN 169 mentions these methods and the ISO 5986 (withdrawn)
Bouillons and Consommés	CODEX STAN 234	Amino nitrogen	AIIBP Method No 2/7	Volumetry (modified Van Slyke)	II				CCSB	a) CODEX STAN 117 was approved in 2001 b) Methods AIIBP was not found.
Bouillons and Consommés	CODEX STAN 234	Creatinine	AIIBP Method No 2/5	HPLC	II				CCSB	a) CODEX STAN 117 was approved in 2001 b) Methods AIIBP was not found.
Bouillons and Consommés	ALINORM 95/23	Sodium chloride	AIIBP Method No 2/4	Volhard titrimetry	II			1995	CCSB	a)There are methods mentioned in the Codex STAN 117- Method 2/4 of the AIIBP Official Collection of Methods of Analysis, Revision 1998; AOAC Method 971.27 (Codex general method) based on potentiometric determination);

										c) CODEX STAN 234 mentions a different principle: Potentiometric titration (chloride expressed as sodium chloride). d) The method was not found

APPENDIX II – METHODS WITH INACCURATE INFORMATION ENDORSED FOR LESS THAN 10 YEARS

Commodities	Source	Provision	Method	Principle	Type	Year Approval	Year Last revision	Year Endorsement by CCMAS	Committee	Remarks
Blend of sweetened condensed skimmed milk and vegetable fat	REP14/MAS	Milk protein in MSNF	ISO 8968-1/IDF 20-1/AOAC 991.20	Titrimetry (Kjeldahl	IV		2014 (IDF/ISO)	2014	CCMMP	a) There aren´t methods in the CODEX STAN 252 , just the expression see "CODEX STAN 234" b) It was not clear whether AOAC 991.20, listed as equivalent to the method in the Standard, is still equivalent to the newly proposed methods (REPORT 2014 , par. 27) c) The CODEX STAN 234 is not updated regarding to modification of ISO / IDF on 06/09/2014 d) It´s necessary to harmonize in all protein determination to milk products by kjeldahl the mention of total N x 6,38 in the provision file e) Its necessary to verify the

										equivalence of methods
Canned Apple Sauce	REP13/MAS	Fill of containers	CAC/RM 46-1972 (for glass containers)) and ISO 90-1.1 (for metal containers)	Weighing	I			2013	CCPFV	a) There are not methods mentioned in the CODEX STAN 17, just the expression see relevant CODEX Texts on Methods of Analysis b) The CAC/RM were revoked , but the CAC/RM 46 is described in CODEX STAN 234.
Canned Green Peas	ALINORM 09/32/23	Proper fill (in lieu of drained weight)	CAC/RM 45	Pouring and measuring	I			2009	CCPFV	a) CODEX STAN 234 mentions CAC/RM 45 b) CODEX STAN 297 describes CAC/RM 45
Canned Green peas	ALINORM 09/32/23	Types of peas	CAC/RM 48	Visual inspection	I			2009	CCPFV	a) CODEX STAN 234 mentions CAC/RM 48 b) CODEX STAN 297 describes CAC/RM 48.
Canned Green beans	ALINORM 09/32/23	Tough strings	CAC/RM 39	Stretching	I			2009	CCPFV	a) CODEX STAN 234 mentions CAC/RM 39 b) CODEX STAN 297 describes CAC/RM 39. c) The commodity on Stan 234 is canned green beans and wax

										beans
Certain Canned Citrus Fruits	ALINORM 07/30/23	Fill of containers	CAC/RM 46 (Codex General Method for processed fruits and vegetables)	Weighing	I			2007	CCPFV	a) There are methods mentioned in Codex STAN 254: CAC/RM 46-(for glass containers) (Codex general method for processed fruit and vegetables) and ISO 90.1 (for metal containers) (Codex general method for processed fruit and vegetables) b) The ISO 90.1 is not mentioned in ALINORM 2007 c) The provision is not mentioned on CODEX STAN 234 for this commodity
Cheese, unripened including fresh cheese	REP14/MAS	Milk protein	ISO 8968-1/IDF 20-1/AOAC 991.20 and 991.23	Titrimetry (Kjeldahl	I		2014 (IDF/ISO)	2014	CCMMP	a) It was not clear whether AOAC 991.20, listed as equivalent to the method in the Standard, is still equivalent to the newly proposed methods (REPORT 2014 , par. 27) b) The CODEX STAN 234 is not updated regarding to

										modification of ISO / IDF (on 06/09/2014). c) It´s necessary to harmonize in all protein determination to milk products by kjeldahl the mention of total N x 6,38 in the provision file d) CODEX STAN 234 mention ISO 8968-1/2IDF 20-1/2
Cocoa Butter	ALINORM 07/30/23	Free fatty acids	ISO660; or AOCS Cd 3d-63 (03)	Titrimetry	I			2007	CCCPC	a) The CODEX STAN 86 mentions the following methods: IUPAC (1987) 2.201. b) The CODEX STAN 234 mentions these methods
Cocoa Butter	ALINORM 07/30/23	Unsaponifiable matter	ISO 3596 or ISO 18609 or AOCS Ca 6b-53 (01)	Titrimetry after extraction with diethyl ether I	I			2007	CCCPC	a)The CODEX STAN 86 mentions IUPAC (1987) 2.401. b) The CODEX STAN 234 mentions these methods
Cream and Prepared Creams	REP14/MAS	Milk protein	ISO 8968-1/IDF 20-1/AOAC 991.20	Titrimetry (Kjeldahl	I		2014 (IDF/ISO)	2014	CCMMP	a) There isn't provision for Milk Protein on CODEX STAN 275. e) CODEX STAN 234 mentions ISO 8968-1/2 and IDF 20-1/2

										b) It was not clear whether AOAC 991.20, listed as equivalent to the method in the Standard, is still equivalent to the newly proposed methods (REPORT 2014 , par. 27) c) The information is outdated on CODEX STAN 234 regarding to ISO/IDF methods (09/06/2014). d) It´s necessary to harmonize in all protein determination to milk products by kjeldahl the mention of total N x 6,38 in the provision file.
Edible casein products	REP14/MAS	Milk protein (total N x 6.38 in dry matter)	ISO 8968-1|IDF 20-1	Titrimetry (Kjeldahl)	I		2014 (IDF/ISO)	2014	CCMMP	a)There aren't methods in the CODEX STAN 290, just the expression see "CODEX STAN 234" b) The information is outdated on CODEX STAN 234 regarding to ISO/IDF methods (on 09/06/2014). c) It´s necessary to harmonize

										in all protein determination to milk products by kjeldahl the mention of total N x 6,38 in the provision file d) CODEX STAN 234 mention IDF 91 and ISO 5549
Evaporated milks	REP14/MAS	Milk protein in MSNF	ISO 8968-1/ IDF 20-1/ AOAC 991.20 /AOAC 945.48H	Titrimetry (Kjeldahl)	I		2014 (IDF/ISO)	2014	CCMMP	a) There aren't methods in the CODEX STAN 281 b) It was not clear whether AOAC 991.20, listed as equivalent to the method in the Standard, is still equivalent to the newly proposed methods (REPORT 2014 , par. 27) c) The CODEX STAN 234 is not updated regarding to modification of ISO / IDF (on 06/09/2014). d) It´s necessary to harmonize in all protein determination to milk products by kjeldahl
Fats and oils	REP 11/MAS	Soap content	BS 684 Section 2.5/AOCS Cc 17-95	Gravimetry	I			2011	CCFO	a)The method in the CODEX STAN 19 is BS 684 Section 2.5

Fats and oils not covered by individual standards	REP 12/MAS	Peroxide value	AOCS Cd 8b-90 (11)/ISO 3961	Titrimetry using iso-octane	I			2012	CCFO	a) The methods in the CODEX STAN 19 are IUPAC 2.501 (as amended), AOCS Cd 8b - 90 (97) or ISO 3961: 1998. b) C c) CODEX STAN 234 mention the methods AOCS Cd 8b-90 (11) ISO 3960
Fermented milks	REP14/MAS	Milk Protein	ISO 8968-1|IDF 20-1/AOAC 991.20	Titrimetry (Kjeldahl)	I		2014 (IDF/ISO)	2014	CCMMP	a) There aren't methods in the CODEX STAN 243 b) It was not clear whether AOAC 991.20, listed as equivalent to the method in the Standard, is still equivalent to the newly proposed methods (REPORT 2014 , par. 27) c) The CODEX STAN 234 is not updated regarding to modification of ISO / IDF (on 06/09/2014). d) It´s necessary to harmonize in all protein determination to milk products by kjeldahl the mention of total N x 6,38 in

										the provision file
Fish sauce	Codex Stan 234	sodium chloride	AOAC 976.18,	potentiometry	II			2012	CCFFP	a) CODEX STAN 302 mentions the methods FAO 1981, Technical Paper 219 AOAC 937.13 or 976.18 or 976.19.
Jams and jellies	ALINORM 09/32/23	fill of containers	CAC/RM 46	Weighing	I			2009	CCPFV	a) CODEX STAN 234 mentions and describes CAC/RM 46; b) CODEX STAN 296 mentions and describes CAC/RM 46 for glass containers and mentions ISO90.1 to metal containers. .
Jams and jellies	ALINORM 09/32/23	Soluble solids	ISO 2173 AOAC 932.14C	Refractometry	I			2009	CCPFV	a) The methods mentioned on CODEX STAN 296 are AOAC 932.14C ISO 2173 (Codex General Method for processed fruits and vegetables) b) The Codex Stan 234 mentions AOAC 932.12
Milk powders and cream	REP14/MAS	Milk Protein	ISO 8968-1/IDF 20-1/AOAC	Titrimetry (Kjeldahl)	I		2014 (IDF/ISO)	2014	CCMMP	a) There aren't methods in the CODEX STAN 207 , just the expression see "CODEX

powders			991.21							STAN 234" b) It was not clear whether AOAC 991.20, listed as equivalent to the method in the Standard, is still equivalent to the newly proposed methods (REPORT 2014 , par. 27) c) The CODEX STAN 234 is not updated regarding to modification of ISO / IDF (on 06/09/2014). d) It´s necessary to harmonize in all protein determination to milk products by kjeldahl the mention of total N x 6,38 in the provision file e) The name of the provision on 234 and CODEX STAN 207 is Milk Protein (in MSNF)
Named Animal Fats	REP 11/MAS	Acidity	ISO 660/AOCS Cd 3d-63	Titrimetry	I			2011	CCFO	a)The CODEX STAN 211 mentions IUPAC 2.201 and ISO 660

Named Animal Fats	REP 11/MAS	Copper and Iron	AOAC 990.05/ISO 8294/ AOCS Ca 18b-91	Atomic absorption Spectrophotometry (direct graphite furnace)	II			2011	CCFO	a)The CODEX STAN 211 mentions IUPAC 2631, AOAC 990.05/ISO 8294
Named Animal Fats	REP 11/MAS	GLC ranges of fatty acid composition	ISO 5508/ISO 12966-2/ AOCS Ce 2-66/Ce 1e-91/Ce 1f-96	Gas chromatography of methyl esters	II			2011	CCFO	a)The methods in the CODEX STAN 211 are IUPAC 2.301, 2.302 and 2.304 or ISO 5508: 1995/ 5509: 1999. b) The method AOCS Ce1e 91 is not available
Named Animal Fats	REP 11/MAS	Relative density	ISO/AOCS method for apparent density to be inserted	Pycnometry	I			2011	CCFO	a)CODEX STAN 234 mentions type II and doesn't mention the method. b) CODEX STAN 211 mentions the IUPAC 2.101, with the appropriate conversion factor.
Named Animal Fats	ALINORM 07/30/23	Saponification value	ISO 3657 or AOCS Cd 3-25	Titrimetry	I			2007	CCFO	a CODEX STAN 211 mention IUPAC 2.202 or ISO 3657: 1988.
Named Animal Fats	REP 12/MAS	Iodine value (IV)	ISO 3961/AOAC 993.20/AOCS Cd 1d-92	Wijs-Titrimetry	I			2012	CCFO	a) There are methods in the CODEX STAN 211 IUPAC 2.205/1, ISO 3961: 1996, AOAC 993.20, or AOCS Cd 1d-1992 (97).

Named Animal Fats	REP 12/MAS	Peroxide value	AOCS Cd 8b-90/ISO 3960	Titrimetry using iso-octane	I			2012	CCFO	a) There are methods in the CODEX STAN 211 IUPAC 2.501 (as amended), AOCS Cd 8b-90 (97) or ISO 3960: 1998.
Named Animal Fats	REP 12/MAS	Unsaponifiable matter	ISO 3596/ ISO 18609/ AOCS Ca 6b-53	Titrimetry after extraction with diethyl ether	I			2012	CCFO	a) There are methods in the CODEX STAN 211: IUPAC 2.401 (part 1-5) or ISO 3596-1: 1988 and Amendment 1 1997, and ISO 3596-2: 1988 and Amendment 1 1999.
Named Vegetable Oils	REP 12/MAS	GLC ranges of fatty acid composition	ISO 5508, ISO 12966-2, AOCS Ce 2-66, AOCS Ce 1-62 and AOCS Ce 1h-05	Gas chromatography of methyl esters	II			2012	CCFO	a) There are methods in the CODEX STAN 210-ISO 5508: 1990 and 5509: 2000; or AOCS Ce 2-66 (97), Ce 1e-91 (01) or Ce 1f-96 (02).
Named Vegetable Oils	REP 11/MAS	Relative density	IUPAC 2.101	Pycnometry	I			2011	CCFO	a) CODEX STAN 234 and CODEX STAN 210 mention IUPAC method
Natural Mineral Waters	CODEX STAN 234	Coliform organism, thermotolerant organism and presumpetive Escherichia Coli	ISO 9308-1	Membrane filtration	I				CCNMW	Out of CCMAS scope

Natural Mineral Waters	CODEX STAN 234	Faecal Streptococci	ISO 7899-2	Membrane filtration	I				CCNMW	Out of CCMAS scope
Olive Oils and Olive Pomace Oils	REP 11/MAS	Relative density	IUPAC 2.101, with the appropriate conversion factor See comment above	Pycnometry	I			2011	CCFO	a) CODEX STAN 033 and CODEX STAN 234 mentions the IUPAC method. B) CODEX STAN 234 mentions "Error. Bookmarking not defined"
Pickled Fruits and Vegetables	ALINORM 07/30/23	Fill of containers	CAC/RM 46 (Codex General Method for processed fruits and vegetables)	Weighing	I			2007	CCPFV	a) CODEX STAN 234 doesn´t mention this commodity B) There are a full description of methods on CODEX STAN 260 c) The CAC/RM were revoked , but the CAC/RM 46 is described in the CODEX STAN 234.
Preserved Tomatoes	ALINORM 07/30/23	Fill of containers	CAC/RM 46 - Codex General Method for processed fruits and vegetables)	Weighing	I			2007	CCPFV	a) There are methods mentioned in the CODEX STAN 13: CAC/RM 46 (for glass containers) (Codex general method for processed fruit and vegetables) and ISO 90.1 (for

										metal containers) (Codex general method for processed fruit and vegetables) b)The provision "is not mentioned in the Codex Stan 234
Processed Tomato Concentrate	CODEX STAN 234	sodium chloride	AOAC 971.27	Potentiometry	II				CCPFV	a) The CODEX STAN 57 mentions for Sodium Chloride ISO 3634 expressed as sodium chloride (Codex General Method), Potentiometry, type: III.
Processed Tomato Concentrate	ALINORM 07/30/23	Fill of containers	CAC/RM 46 (Codex General Method for processed fruits and vegetables)	Weighing	I			2007	CCPFV	a) CODEX STAN 57 mentions CAC/RM 46-1972 (for glass containers) (Codex general method for processed fruit and vegetables) and ISO 90.1:1999 for metal containers) (Codex general method for processed fruit and vegetables) b)The provision is not mentioned in the Codex Stan 234

Processed Tomato Concentrate	ALINORM 07/30/23	Lactic Acid	EN 2631	Enzymatic determination	II			2007	CCPFV	The CODEX STAN 57 and CODEX STAN 234 mention this method. The method was not found.
Reduced fat blend of Evaporated skimmed milk and vegetable fat	REP14/MAS	Milk protein in MSNF1	ISO 8968-1/IDF 20-1/AOAC 991.20	Titrimetry (Kjeldahl)	IV		2014 (IDF/ISO)	2014	CCMMP	a) There aren't methods in the CODEX STAN 250 b) It was not clear whether AOAC 991.20, listed as equivalent to the method in the Standard, is still equivalent to the newly proposed methods (REPORT 2014 , par. 27) c) The CODEX STAN 234 is not updated regarding to modification of ISO / IDF (06/09/2014).
Reduced fat blend of skimmed milk powder and vegetable fat in powdered form	REP14/MAS	Milk protein in MSNF1	ISO 8968-1/IDF 20-1/AOAC 991.20	Titrimetry (Kjeldahl	IV		2014 (IDF/ISO)	2014	CCMMP	a) There aren't methods in the CODEX STAN 251 b) It was not clear whether AOAC 991.20, listed as equivalent to the method in the Standard, is still equivalent to the newly proposed methods (REPORT 2014 , par. 27)

										c) The CODEX STAN 234 is not updated regarding to modification of ISO/IDF (on 06/09/2014)
Reduced fat blend of sweetened condensed skimmed milk and vegetable fat	REP14/MAS	Milk protein in MSNF[1]	ISO 8968-1/IDF 20-1/AOAC 991.20	Titrimetry (Kjeldahl	IV		2014 (IDF/ISO)	2014	CCMMP	a) There aren't methods in the CODEX STAN 252" b) It was not clear whether AOAC 991.20, listed as equivalent to the method in the Standard, is still equivalent to the newly proposed methods(REPORT 2014 , par. 27) c) The CODEX STAN 234 is not updated regarding to modification of ISO/IDF (on 06/09/2014)
Sweetened condensed milk	REP14/MAS	Milk protein in MSNF[1]	ISO 8968-1 |IDF 20-1/ AOAC 991.20 /AOAC 945.48H	Titrimetry (Kjeldahl)	I		2014 (IDF/ISO)	2014	CCMMP	a) There aren't methods in the CODEX STAN 282 b) It was not clear whether AOAC 991.20, listed as equivalent to the method in the Standard, is still equivalent to the newly proposed methods (REPORT

										2014 , par. 27) c) The CODEX STAN 234 is not updated regarding to modification of ISO / IDF (on 06/09/2014).
Table olives	REP13/MAS	Fill of containers	CAC/RM 46 (for glass containers) and ISO 90-1.1 (for metal containers)	Weighing	I			2013	CCPFV	a) There are methods mentioned in the CODEX STAN 66 b) There are a full description of the method on CODEX/STAN 66 c) The CAC/RM were revoked , but the CAC/RM 46 is described in CODEX STAN 234
Table olives	REP13/MAS	Tin	NMKL 191 | EN 15765	ICP-MS	III			2013	CCPFV	a) There isn't mention of these methods in CODEX STAN 234 .The CODEX STAN 66 mentions AOAC 980.19 as Type II

[1] It´s necessary to harmonize in all protein determination to milk products by kjeldahl the mention of total N x 6,38 in the provision file

LIST OF PARTICIPANTS
CHAIR – BRAZIL

Mrs Lígia Lindner Schreiner
Regulation National Health Surveillance Specialist
National Health Suveillance Agency- Anvisa
SIA Trecho 5 Area Especial 57, Bloco D, 2º andar
Brasilia-DF / Brasil
Phone: (+ 55) 6134625399
Fax: (+ 55) 6134625315
E-mail: ligia.schreiner@anvisa.gov.br

Ms Rosane Maria Franklin Pinto
Regulation National Health Surveillance Specialist
National Health Suveillance Agency- Anvisa
IA Trecho 5 Area Especial 57, Bloco D, 2º andar
Brasilia-DF / Brasil
Phone: (+ 55) 6134625309
Fax: (+ 55) 6134625315
E-mail: rosane.maria@anvisa.gov.br

ARGENTINA

Ms Maria Veronica Torres Leedhan
Codex Alimentarius – Contact Point
Dirección de Relaciones Agroalimentarias Internacionales
Ministerio de Agricultura, Ganaderia y Pesca
Azopardo 1025 Piso 11 Oficina 7 - Buenos Aires (C1063ACW)
Phone: (+54 11) 4363-6290/4363-6329
E-mail: codex@minagri.gov.ar; vtorres@senasa.gov.ar

AUSTRALIA

Ms Karina Budd
Director - Residue Chemistry and Laboratory Performance Evaluation Section
National Residue Survey | Exports Division | Australian Government Department of Agriculture
Phone +61 2 6272 5795 | Fax +61 2 6272 4023 |
iPhone +61 408 695 904 |
18 Marcus Clarke Street, Canberra ACT 2601 Australia
GPO Box 858, Canberra ACT 2601 Australia
E-mail: karina.budd@agriculture.gov.au

BRAZIL

Ms Alice Momoyo Ata Sakuma
Instituto Adolfo Lutz-Public Health Laboratory
Chemist – Director of the Center of Reference Material
Av Dr Arnaldo 355 Cerqueira Cesar
São Paulo/ SP
CEP: 01246-902
Fax: 11-3068-2915
Phone: 11- 3068-2821
E-mail: alice@ial.sp.gov.br

Ms Ivone Delazari
Food Safety Consultant
Brazilian Association of Food Industry (ABIA)
Av. Brigadeiro Faria Lima, 2003- 01451-000
São Paulo –SP
E-mail: detec@abia.org.br

Ms Camila Cardoso de Oliveira
Instituto Adolfo Lutz-Public Health Laboratory
Chemist – Center of Reference Material
Av Dr Arnaldo 355 Cerqueira Cesar
São Paulo/ SP
CEP: 01246-902
Fax: 11-3068-2915
Phone: 11- 3068-2821
E-mail: milaoliv@ial.sp.gov.br

Mr Laercio Goularte
TÜV SÜD do Brasil
SFDK Products Analysis Laboratory
Avenida Aratãs, 754
Moema
04081-004 São Paulo - SP
Phone: +55 (11) 5097 7888; +55 (11) 2898 7888
E-mail: lgoularte@sfdk.com.br

Ms Lina Oliveras
Engineer
Rua João Bastian, 34
91460-010 Porto Alegre - RS, Brazil
Phone: +55 51 21039824
E-mail: lina.yamachita@gmail.com

Mr Fabio Ribeiro Campos da Silva
Regulation National Health Surveillance Specialist
National Health Suveillance Agency- Anvisa
IA Trecho 5 Area Especial 57, Bloco D, 2º andar
Brasilia-DF / Brasil
Phone: (+ 55) 6134625399
Fax: (+ 55) 6134625315
E-mail: fabio.silva@anvisa.gov.br

Ms Maria do Céu Albuquerque
Assessor
Brazilian Health Surveillance Agency (Anvisa)
Laboratories
SIA Trecho 5 Área Especial 57 Bloco D
71 205-050 Brasília/DF, Brazil
Phone: +55+(61) 3462 5472/3462 5476
Fax: +55+(61) 3462 5469
E-mail: mcbealbuquerque@gmail.com

Mr Nilton Couto e Silva
Analyst and researcher in health and technology
Metal Contaminants Laboratory / Ezequiel Dias Foundation - FUNED
Rua Conde Pereira Carneiro, 80, Belo Horizonte/MG, CEP: 30510-010
Phone: (+55)31-3314-4905; Fax: (+55)31-3314-4677
E-mail: niltoncs@gmail.com

Ms Stefani Faro de Novaes Regulation
National Health Surveillance Specialist
National Health Suveillance Agency-Anvisa
IA Trecho 5 Area Especial 57, Bloco D, 2º andar
Brasilia-DF / Brasil
Phone: (+ 55) 6134625313
Fax: (+ 55) 6134625315
E-mail: stefani.novaes@anvisa.gov.br

JAMAICA

Ms Leslie Ann Hoo Fung, MRSC
Assistant Research Scientist
International Centre for Environmental and Nuclear Sciences
2 Anguilla Close
University of the West Indies
Mona, Kingston 7, Jamaica
Phone: (876) 927-1777 Fax: (876) 977-0768
E-mail: leslie.hoofung@uwimona.edu.jm

JAPAN

Mr. Tomonori Shiokawa
Title: Assistant Director
Organization: Department of Food Safety, Ministry of Health, Labour and Welfare
3-2-2 Kasumigaseki, Chiyoda-ku, Tokyo 100-8959, JAPAN;
Phone: + 81 3 5253- 4111;Fax : + 81 3 6734-4010
E-mail: codexj@mhlw.go.jp
Mr Takahiro Watanabe
Title: Section Chief
Organization: Division of Foods, National Institute of Health Sciences
3-2-2 Kasumigaseki, Chiyoda-ku, Tokyo 100-8959, JAPAN
Phone: + 81 3 5253- 4111; Fax : + 81 3 6734-4010 E-mail: tawata@nihs.go.jp

Mr Takanori Ukena
Title: Associate Director
Organization: Food Safety and Consumer Policy Division, Food Safety and Consumer Affairs Bureau, Ministry of Agriculture, Forestry and Fisheries
3-2-2 Kasumigaseki, Chiyoda-ku, Tokyo 100-8959, JAPAN
Phone: + 81 3 5253- 4111; Fax : + 81 3 6734-4010 E-mail:
takanori_ukena@nm.maff.go.jp;
codex_maff@nm.maff.go.jp

KOREA
Mr Moon Guiim
Food Safety Risk Assessment Division National Institute of Food & Drug safety Evaluation E-mail: E-mail: luna@korea.kr; codexkorea@korea.krMr Eun-Jin, Choi Ministry of Food and Drug Safety)
E-mail: cej1@korea.kr; codexkorea@korea.kr

MAURITIUS
Mr Shalini Neeliah
E-mail: sneeliah@mail.gov.mu; sneeliah@gmail.com

MEXICO
Mr Cesar Omar Gálvez González
Gerente de Análisis y Desarrollo de Pruebas Microbiológicas
Comisión de Control Analítico y Ampliación de Cobertura
Comisión Federal para la Protección contra Riesgos Sanitarios (COFEPRIS) Secretaría de Salud.
Correo electrónico: cgalvez@cofepris.gob.mx

Ms Pamela Suárez Brito.
Gerente de Asuntos Internacionales en Inocuidad Alimentaria
Dirección Ejecutiva de Operación Internacional.
Comisión Federal para la Protección contra Riesgos Sanitarios (COFEPRIS) Secretaría de Salud.
Correos electrónico: psuarez@cofepris.gob.mx

NIGERIA
Mrs. Abimbola Uzomah
Department of Food Science and Technology
Organisation: Nigerian Institute for Food Science and Technology
E-mail: abimuzomah@yahoo.com; abimbola.uzoma@futo.edu.ng; codexsecretariat@son.gov.nghttp://www.moh.gov.cy/sgl

REPUBLIC OF CYPRUS
Mr Eleni Ioannou- Kakouri
Chief Chemist, EFSA focal point
Head of Risk Assessment Unit & Quality Assurance Unit
State General Laboratory
44 Kimonos Street, 1451 Nicosia,
Phone: 035722809120; Fax: 0035722316434
E-mail:: ekakouri@sgl.moh.gov.cy or elkakour@spidernet.com.cy or eleni@kakouri.com

RUSSIAN FEDERATION
Mr Konstantin Eller
Head of the Laboratory
Institute of Nutrition RAMS;
Food Analytical Chemistry Division
Ustinsky proezd 2/14
109240 Moscow, Russian Federation
Phone: +7 495 698 5392
Fax: +7 495 698 5407
E-mail: eller@ion.ru

SLOVAK REPUBLIC
Ms Iveta Vojsová
State Veterinary and Food Institute
Veterinary and Food Institute Bratislava
Slovak Republic
Phone: +421 2 60258 321, 322
E-mail: yvojsova@svuba.sk

Mr Martin Polovka
National Agricultural and Food Centre
Food Research Institute
Department of Chemistry and Food Analysis Head of the Department
Slovak Republic
Phone: +421 2 50 237 195, 149, 148
Fax: +421 2 55 571 417
E-mail: polovka@vup.sk

SWITZERLAND
Mr Gérard Gremaud
Scientific advisor
Federal Food Safety and Veterinary Office
Schwarzenburgstrasse 155
3003 Bern, Switzerland
Phone: +41 31 322 95 56
E-mail: gerard.gremaud@blv.admin.ch

Mr Erik Konings Ph.D
Method Management Group - Quality and Safety department
Nestlé Research Center
PO Box 44, Vers-chez-les-Blanc, CH-1000 Lausanne 26
Phone: +41 21 785 8232 Cell: +41 79 279 6884
E-mail: erik.konings@rdls.nestle.com

URUGUAY
Ms Laura Flores
Consultor senior
Laboratorio Tecnológico del Uruguay;
Coordinación de Calidad
Avenida Italia 6201
11500 Montevideo, Uruguay
Phone: +26013724 INT 1252
Fax: +26013724 INT 1280
E-mail: lflores@latu.org.uy; codex@latu.org.uy

INTERNATIONAL ORGANISATIONS

INTERNATIONAL DAIRY FEDERATION (IDF)

Mr Jaap Evers
Senior Regulatory Strategist
FIL-IDF New Zealand c/o Fonterra Co-operative Group Ltd.
Private Bag 11 029
Palmerston North
New Zealand
Phone: +64 6 350 46 13
Fax: +64 6 350 4676
E-mail: jaap.evers@fonterra.com

NMKL
Ms Hilde Skår Norli
Secretary General
Nordic Committee on Food Analysis; NMKL
Norwegian Veterinary Institute
PB 750 Sentrum, N-0106
Oslo, Norway
Phone: +4723216249
E-mail: nmkl@vetinst.no

RESIDUES AND TRACE ELEMENTS

Determination of Arsenic, Cadmium, Mercury, and Lead in Foods by Pressure Digestion and Inductively Coupled Plasma/Mass Spectrometry: First Action 2013.06

KAARE JULSHAMN and AMUND MAAGE
National Institute of Nutrition and Seafood Research (NIFES), PO Box 2029 Nordnes, N-5817 Bergen, Norway
HILDE SKAAR NORLI
National Veterinary Institute, Department of Food and Feed Hygiene, Nordic Committee on Food Analysis, PO Box 8156, Dep., N-0033 Oslo, Norway
KARL H. GROBECKER
European Commission Joint Research Centre, Institute for Reference Materials and Measurements (IRMM), B-2440 Geel, Belgium
LARS JORHEM
National Food Administration, Box 622, SE-751 26 Uppsala, Sweden
PETER FECHER
Bayerisches Landesamt für Gesundheit und Lebensmittelsicherheit, Zentrallabor Chemie, Sachgebiet N6, Eggenreuther Weg 43 D-91058 Erlangen, Germany
DAWN DOWELL
AOAC INTERNATIONAL, 481 North Frederick Ave, Suite 500, Gaithersburg, MD 20877-2417

The method for the determination of As, Cd, Hg, and Pb in foods by pressure digestion and inductively coupled plasma (ICP)/MS, previously published in *J. AOAC Int.* 90, 844–856 (2007), was approved as First Action 2013.06 on April 9, 2013 by the Method-Centric Committee for Elemental Contaminants in Food. Digestion occurs using nitric acid in a closed vessel with elevated temperature and pressure by conventional or microwave-assisted heating. Determination occurs using ICP/MS. The elemental concentration ranges for As were 0.06–21.4, for Cd 0.03–28.3, for Hg 0.04–0.6, and for Pb 0.01–2.4 in mg/kg dry matter. The repeatability RSD (RSD_r) ranged from 3.8 to 24% for As, 2.6 to 6.9% for Cd, 4.8 to 8.3% for Hg, and 2.9 to 27% for Pb. Reproducibility RSD (RSD_R) ranged from 9.0 to 28% for As, 2.8 to 18% for Cd, 9.9 to 24% for Hg, and 8 to 50% for Pb.

Heavy metal poisoning from elements like As, Cd, Hg, and Pb has become a concern for most industrialized countries (1). These toxic metals have a negative effect on physiological processes. Because of the negative health effects, governments have begun to implement regulations on the levels of contaminants allowed in the food supply to protect the public. The implementation of these regulations raises a need to have validated analytical methods that produce reliable and accurate results to ensure compliance. The method has been reviewed and found acceptable for the determination of As, Cd, Hg, and Pb in a variety of foods.

Submitted for publication April 22, 2013.
The method was approved by the Method-Centric Committee for Elemental Contaminants in Food as First Action.
The AOAC Method-Centric Committee for Elemental Contaminants in Food invites method users to provide feedback on the First Action methods. Feedback from method users will help verify that the methods are fit for purpose and are critical to gaining global recognition and acceptance of the methods. Comments can be sent directly to the corresponding author or methodfeedback@aoac.org.
Corresponding author's e-mail: kju@nifes.no
DOI: 10.5740/jaoacint.13-143

AOAC Official Method 2013.06
Arsenic, Cadmium, Mercury, and Lead in Foods
Pressure Digestion and Inductively Coupled Plasma/Mass Spectrometry
First Action 2013

(Applicable to the determination of As, Cd, Hg, and Pb in a variety of foods by pressure digestion and ICP/MS. Method is capable of determining As, Cd, Pb, and Hg at or above 0.06, 0.03, 0.04, and 0.09 mg/kg dry matter, respectively.) For the complete method, *see* the publication in *J. AOAC Int.* (2).

Results

The results of the collaborative study (Table 1; 2) show this method to be suitable for the determination of As, Cd, Hg, and Pb in a variety of foods. The elemental concentration ranges for As were 0.06–21.4, for Cd 0.03–28.3, for Hg 0.04–0.6, and for Pb 0.01–2.4 in mg/kg dry matter. The repeatability RSD (RSD_r) ranged from 3.8 to 24% for As, 2.6 to 6.9% for Cd, 4.8 to 8.3% for Hg, and 2.9 to 27% for Pb. Reproducibility RSD (RSD_R) ranged from 9.0 to 28% for As, 2.8 to 18% for Cd, 9.9 to 24% for Hg, and 8 to 50% for Pb.

References

(1) Sinicropi, M.S., Amantea, D., Caruso, A., & Saturnino, C. (2010) *Arch. Toxicol.* **84**, 501–520. http://dx.doi.org/10.1007/s00204-010-0544-6
(2) Julshamn, K., Maage, A., Norli, H., Grobecker, K., Jorhem, L., & Fecher, P. (2007) *J. AOAC Int.* **90**, 844–856

Table 1. Interlaboratory study results for As, Cd, Hg, and Pb

Matrix	$\bar{x}$, mg/kg[a]	*n*[b]	s_r, mg/kg[c]	s_R, mg/kg[d]	RSD_r, %[e]	RSD_R, %[f]	r, mg/kg[g]	R, mg/kg[h]	HorRat[i]
				As					
Carrot	<LOD	4 [0/8]	—	—	—	—	—	—	—
Fish muscle	1.6	11 [0/1]	0.086	0.14	5.4	9	0.24	0.4	0.6
Mushroom	0.057	9 [1/2]	0.014	0.016	24	28	0.038	0.044	1.2
Wheat flour	<LOD	2 [0/10]	—	—	—	—	—	—	—
Simulated diet	<LOD	5 [1/6]	—	—	—	—	—	—	—
Scampi	19.1	12 [0/0]	0.73	2.3	3.8	12	3.8	6.4	1.2
Mussel	9.3	12 [0/0]	0.45	1.2	4.9	13	1.2	3.4	1.2
				Cd					
Carrot	0.3	13 [0/0]	0.008	0.027	2.7	9	0.023	0.076	0.47
Fish muscle	0.87	13 [0/0]	0.06	0.095	6.9	11	0.17	0.27	0.67
Mushroom	0.46	13 [0/0]	0.017	0.033	3.8	7.2	0.049	0.092	0.4
Wheat flour	0.03	12 [1/0]	0.002	0.006	6.4	18	0.084	0.24	0.8
Simulated diet	0.52	13 [0/0]	0.013	0.044	2.6	8.4	0.037	0.12	0.48
Scampi	0.078	11 [2/0]	0.0022	0.012	2.8	2.8	0.0062	0.032	0.63
Mussel	1.7	12 [1/0]	0.0043	0.17	2.5	9.9	0.12	0.47	0.67
				Hg					
Carrot	<LOD	4 [0/8]	—	—	—	—	—	—	—
Fish muscle	0.096	11 [1/0]	0.0079	0.016	8.2	17	0.022	0,045	0.74
Mushroom	0.23	10 [2/0]	0.011	0.023	5	9.9	0.032	0.063	0.5
Wheat flour	<LOD	3 [0/9]	—	—	—	—	—	—	—
Simulated diet	0.042	8 [2/2]	0.0035	0.01	8.3	24	0.0099	0.029	1.1
Scampi	0.56	12 [0/0]	0.027	0.093	4.8	17	0.075	0.26	0.96
Mussel	0.15	11 [1/0]	0.01	0.023	6.9	15	0.029	0.064	0.72
				Pb					
Carrot	0.086	13 [0/0]	0.0039	0.0091	4.5	11	0.011	0.025	0.45
Fish muscle	2.1	13 [0/0]	0.1	0.17	4.8	8	0.29	0.47	0.56
Mushroom	1.5	12 [1/0]	0.098	0.14	6.7	9.5	0.27	0.39	0.63
Wheat flour	0.013	7 [0/6]	0.0034	0.0063	27	50	0.0095	0.018	2.2
Simulated diet	0.26	13 [0/0]	0.023	0.029	8.7	11	0.063	0.082	0.57
Scampi	1.14	13 [0/0]	0.056	0.11	4.9	9.3	0.16	0.3	0.59
Mussel	2.4	13 [0/0]	0.068	0.19	2.9	8	0.19	0.53	0.57

[a] $\bar{x}$ = Mean.

[b] *n* = Number of laboratories remaining after elimination of outliers/reporting <LOD in brackets.

[c] s_r = Repeatability SD.

[d] s_R = Reproducibility SD.

[e] RSD_r = Repeatability RSD.

[f] RSD_R = Reproducibility RSD.

[g] r = Repeatability value.

[h] R = Reproducibility value.

[i] HorRat = Horwitz ratio.

Estimating Reproducibility from Proficiency Test Data

Are there ways to implement proficiency models into an experiment to estimate reproducibility of a method? In order to experimentally estimate reproducibility, there must be an experiment which is operating under reproducibility conditions. Reproducibility conditions are defined by ISO as "conditions where test results are obtained with the *same method* on *identical test items* in *different laboratories* with *different operators* using *different equipment.*"

The AOAC Committee on Statistics has agreed to the following strategy for accepting proficiency test data as part of method validation.

1. Preferred Approach: A collaborative study (CS) is designed to follow AOAC guidelines with a study protocol developed in conjunction with AOAC Statistics Committee advisors.

2. In the event a collaborative study cannot be organized, Proficiency Test (PT) data may be used in partial substitution if the following important considerations are met.
    a. Acceptance criteria should be agreed on by the Expert Review Panel before the study is performed, or before the data are analyzed and reported.
    b. Laboratories in a PT study or check sample program can be used only if they follow the AOAC Method strictly, without modification.
    c. The minimum number of laboratories should be 8.
    d. Given the estimate for s(r), a 95% CI, and the degrees of freedom from replication, report s(R), a 95% CI, and the degrees of freedom from reproducibility.
    e. Primary decision criterion for Final Action should be based on the upper limit of the 95% CI of s(R) and s(r).

3. The statistical estimation techniques described in ISO 13528 are optimized for proficiency statistics. For validation statistics, AOAC INTERNATIONAL requires the use of the statistical procedures of ISO 5725, with the provision that no outliers be removed without an assigned cause. Recommendations on estimation techniques are as follows.
    a. Collect PT data from check sample programs or other PT data available.
    b. Use only results from labs that admit to running the AOAC Method. Results from other methods shall be removed from the data set.
    c. Do not trim, drop or exclude outliers except for justifiable cause such as an admission from the laboratory that the method was modified.
    d. Use standard AOAC/ISO5725 ANOVA model to estimate reproducibility standard deviation.

Additional Considerations:

The Official Methods Board should be aware that under section 2 above, repeatability may not be estimated, as within-laboratory replication in a PT study may not meet the ISO definition of repeatability conditions. We recommend calculating within-laboratory variance as an intermediate step to estimating reproducibility standard deviation, but the within-laboratory variance term should not be called "repeatability."

The above recommendations do not supersede the requirements set out in OMA Appendix D or ISO5725 regarding number of matrices, number of levels, or levels per matrix.

Statistical estimates derived from PT studies should be used cautiously – any attempt to extrapolate reproducibility estimates to different concentration levels or to different matrices must be discouraged.

Proficiency data is used to certify laboratories to ISO 17025 standards. ISO 13528 is the standard used for analyzing and reporting proficiency data for laboratory accreditation purposes. The advantage of using PT data when possible is that it will allow estimation of reproducibility on existing data sets. In addition, laboratories may be motivated to participate in proficiency studies in order to satisfy the needs of accreditation bodies and to give external feedback on laboratory performance. This is something that CS do not normally provide to participating collaborators. Unfortunately, many laboratories around the world have been forced to look to cut costs and volunteering to help validate a consensus method may be seen as an unnecessary cost to a laboratory. In effect this proposal will allow laboratories to contribute to validation efforts and be rewarded for their contributions by obtaining a z-score for the proficiency study.

The main problem with using proficiency data to estimate reproducibility is the problem of method control in proficiency test regimes. In the past, Proficiency Test (PT) data was all about accrediting the laboratory, and not as much emphasis was put on the method. If PT data is to be used, it can only come from laboratories that confirm they are using the candidate method without modification. Other laboratories in the proficiency study may use other methods, but only data from compliant labs will be used to calculate validation statistics for the candidate method.

Another common issue when using PT data is that matrix and level decisions are generally not made for PT studies the way they would be made for randomized, controlled Collaborative Studies (CS). In a CS situation, the study director will meet with a group of advisors and plan out the number of matrices, concentration levels, and design the experiment to cover a planned design space. Proficiency systems very often use convenience samples commonly obtained at

commercial analyst concentrations, without concern for covering a wide range of analyte concentrations. So in practice, we find that PT data have a more limited range than would a designed CS data set.

In the past, the purpose of proficiency tests was to verify the correct implementation of a method in a laboratory. As a part of laboratory accreditation, the laboratory must demonstrate proficiency vs. other laboratories or against traceable standards or reference materials. Similarly, Method Validation was a process used prior to implementation to assure the method could be used in more than one laboratory and be shown to have a reasonable level of laboratory reproducibility. ISO 5725 is the standard used to design validation experiments and to analyze the results of multi-lab validation studies. Table 1 is a summary of the traditional differences between the Validation process and Verification.

Method Development ➔ Method Validation ➔ Method Verification

Table 1

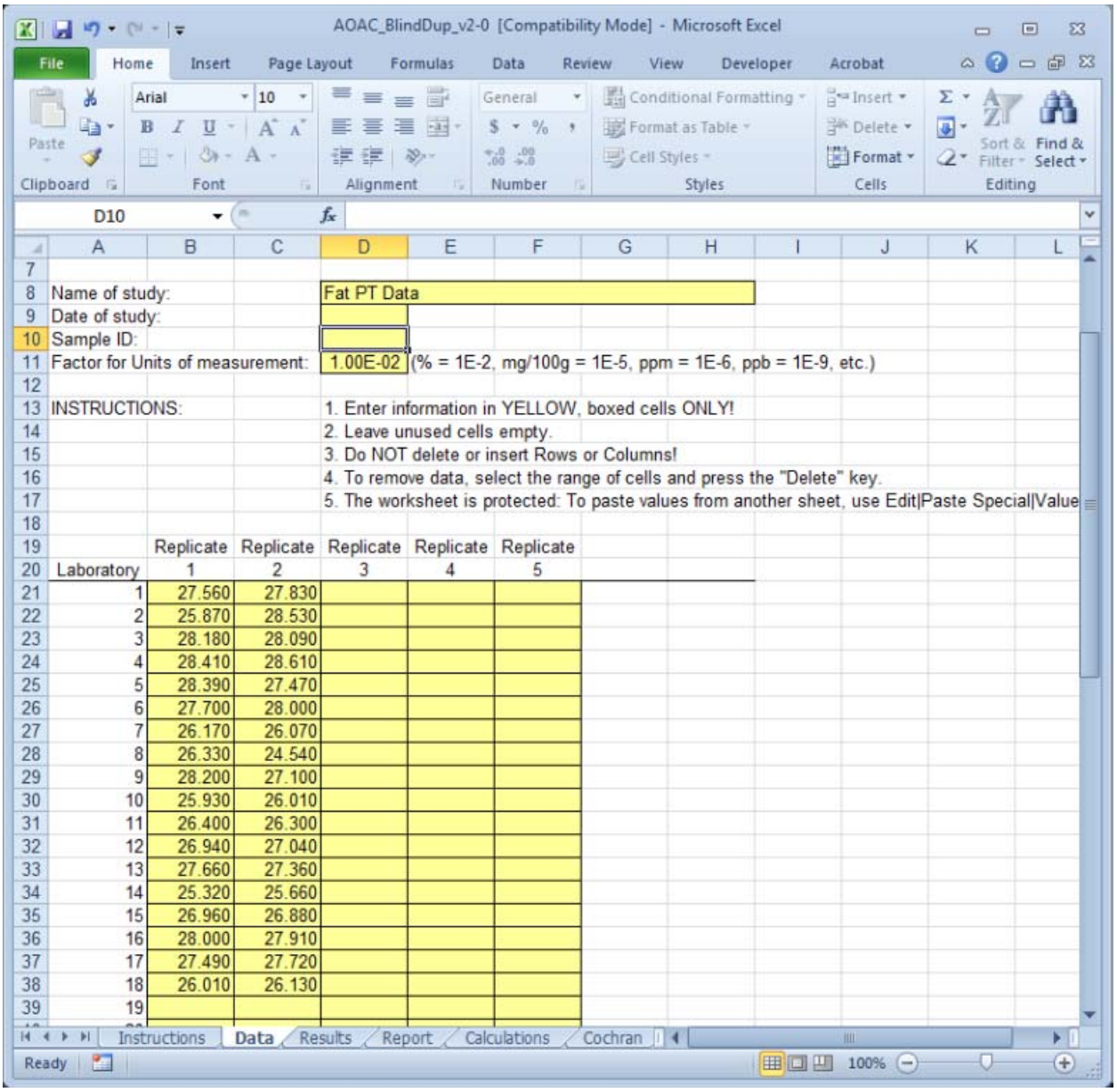
Validation	Verification
After Method Development	After Validation
Pertains to the Method	Pertains to the Laboratory
Validation can be Single Laboratory Multiple Laboratory	Generally requires multiple laboratories, but can be done as a single laboratory with a certified RM
ISO 5725	ISO 13528
Validation Experiments/ Collaborative Studies	Verification Experiments/ Proficiency Tests (PT)
Strict Control of Method	Loose method control
Statistical Output Reproducibility Repeatability Trueness or Bias	Statistical Output: z-score for each lab

Appendix 1: Worked Example

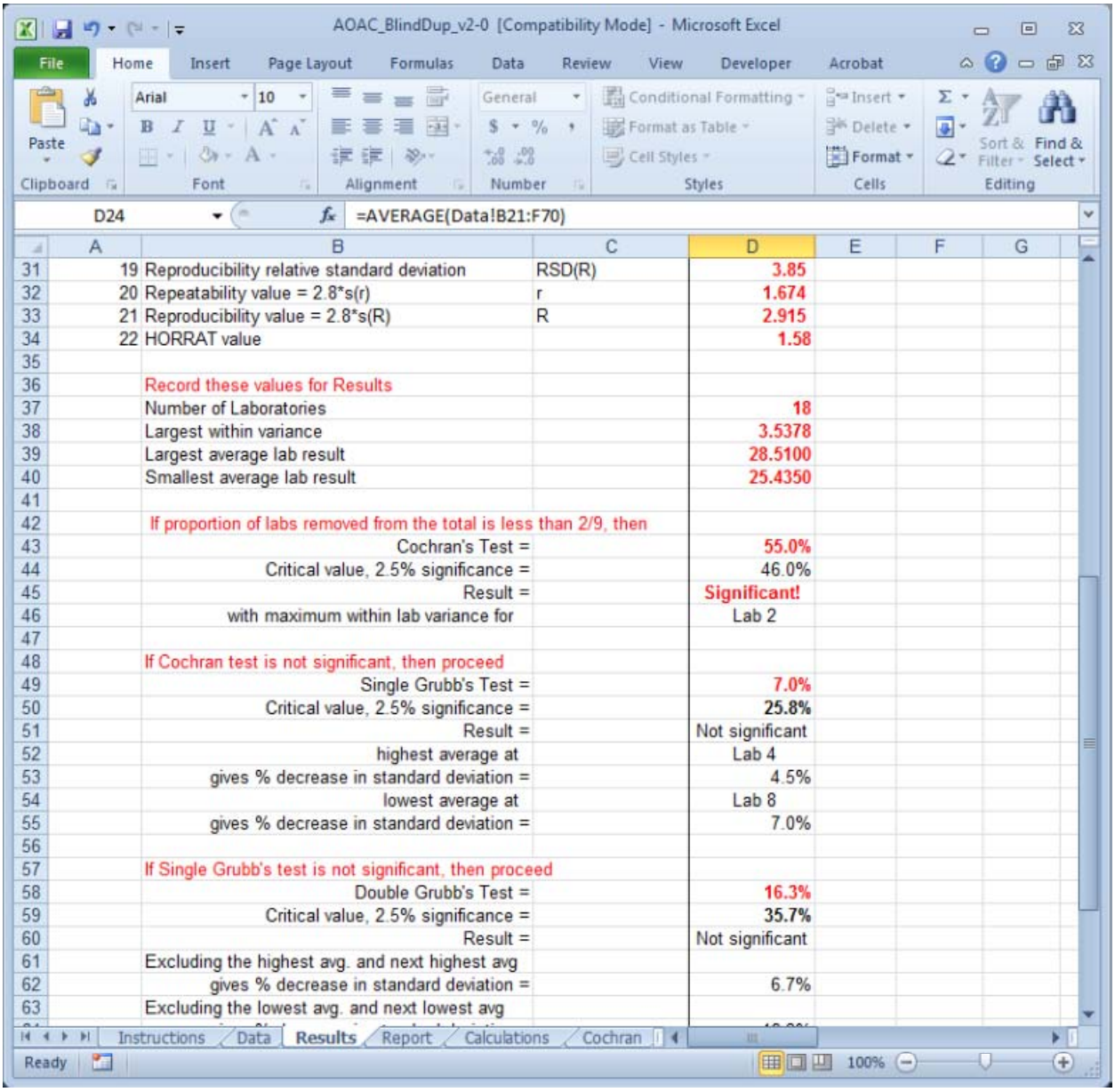
Table A1

Round	Lab	Attribute	Method	Rep1	Rep2
June11	A	Fat	OF	27.56	27.83
June11	B	Fat	OF	25.87	28.53
June11	C	Fat	OF	28.18	28.09
June11	D	Fat	OF	28.41	28.61
June11	E	Fat	OF	28.39	27.47
June11	F	Fat	OF	27.7	28
June11	G	Fat	OF	26.17	26.07
June11	H	Fat	OF	26.33	24.54
June11	I	Fat	OF	28.2	27.1
June11	J	Fat	OF	25.93	26.01
June11	K	Fat	OF	26.4	26.3
June11	L	Fat	OF	26.94	27.04
June11	M	Fat	OF	27.66	27.36
June11	N	Fat	OF	25.32	25.66
June11	O	Fat	OF	26.96	26.88
June11	P	Fat	OF	28	27.91
June11	Q	Fat	OF	27.49	27.72
June11	R	Fat	OF	26.01	26.13

The data in Table A1 were simulated based on past performance of fat analysis. Results are reported in units of g / 100 g. There were 18 laboratories participating in the study, and each laboratory provided duplicate results.

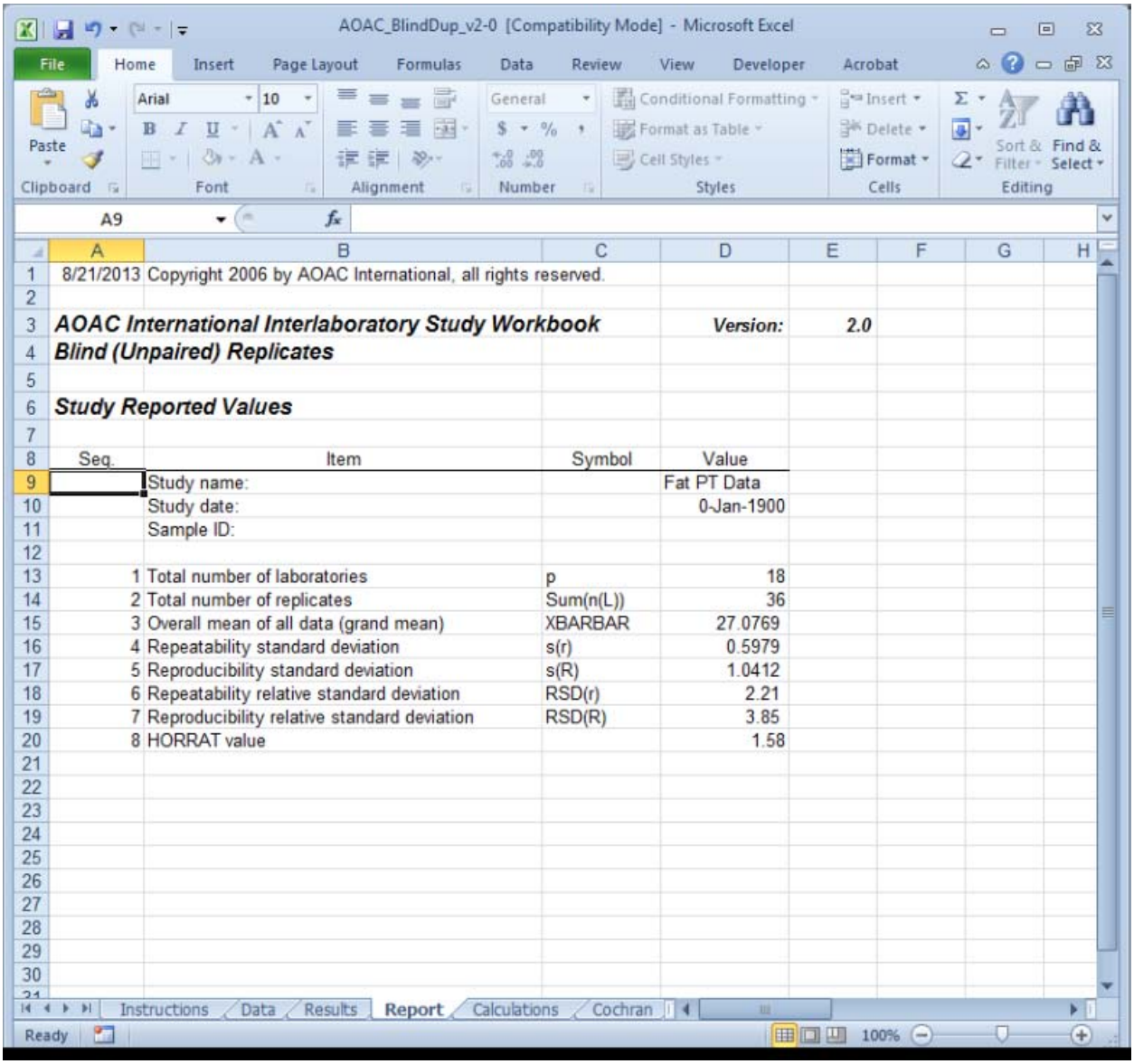


Here the data pairs are entered into the AOAC Blind Duplicate Collaborative Study calculator which has been validated to comply with AOAC and ISO 5725 standards. For calculating HorRat values, the factor of 1.00E-02 is used for g/100g units.



	A	B	C	D	E	F	G
31	19	Reproducibility relative standard deviation	RSD(R)	3.85			
32	20	Repeatability value = 2.8*s(r)	r	1.674			
33	21	Reproducibility value = 2.8*s(R)	R	2.915			
34	22	HORRAT value		1.58			
35							
36		Record these values for Results					
37		Number of Laboratories		18			
38		Largest within variance		3.5378			
39		Largest average lab result		28.5100			
40		Smallest average lab result		25.4350			
41							
42		If proportion of labs removed from the total is less than 2/9, then					
43		Cochran's Test =		55.0%			
44		Critical value, 2.5% significance =		46.0%			
45		Result =		Significant!			
46		with maximum within lab variance for		Lab 2			
47							
48		If Cochran test is not significant, then proceed					
49		Single Grubb's Test =		7.0%			
50		Critical value, 2.5% significance =		25.8%			
51		Result =		Not significant			
52		highest average at		Lab 4			
53		gives % decrease in standard deviation =		4.5%			
54		lowest average at		Lab 8			
55		gives % decrease in standard deviation =		7.0%			
56							
57		If Single Grubb's test is not significant, then proceed					
58		Double Grubb's Test =		16.3%			
59		Critical value, 2.5% significance =		35.7%			
60		Result =		Not significant			
61		Excluding the highest avg. and next highest avg					
62		gives % decrease in standard deviation =		6.7%			
63		Excluding the lowest avg. and next lowest avg					

On the ‘Results’ tab, critical values for Cochran’s and Grubbs’ test are given. In this case, the potential Cochran outlier was not removed from the data set, because the laboratory could not be contacted to assign a cause to the possible outlier.



Summary estimates are given on the ‘Report’ page, including HorRat estimate.

DESCRIPTION OF AOAC STATISTICS COMMITTEE GENERATED DOCUMENTS

ALTERNATIVE APROACHES FOR MULTI-LAB STUDY DOCUMNTS.
Alternative approaches approved by Committee on Statistics and by OMB.

TRADITIONAL PATHWAY MULTI-LAB STUDY DOCUMENTS AND INSTRUMENTS.
Traditional study approach spreadsheet remaining as part of acceptable approaches.

LEAST COST FORMULATIONS, LTD.
824 Timberlake Drive, Virginia Beach, VA 23464-3239
Tel: (757) 467-0954 Fax: (757) 467-2947
E-mail: office@lcftld.com URL: http://lcfltd.com/

TECHNICAL REPORT

NUMBER: TR322 DATE: 2012 July 8

TITLE: Statistical analysis of interlaboratory studies. XXXV. Reproducibility estimates from proficiency test data.

AUTHOR: R. A. LaBudde

ABSTRACT: The issue of estimating reproducibility effects from proficiency test ('PT') data is discussed. It is recommended that such data may be used to estimate reproducibility when: 1) There are sufficient collaborators (8 or more remain in the final set of data); 2) Collaborator results are removed only for known cause based on subject-matter expertise and facts. It is recommended that the method used to estimate reproducibility effects is by the standard deviation of mean (across replicates, if any) results for the entire dataset net of crude errors with known causes, corrected for replication. If useful, a lower bound on reproducibility may be obtained conveniently via the interquartile range of the original dataset.

KEYWORDS: 1) PT 2) REPRODUCIBILITY 3) VARIANCE
4) ROBUST 5) OUTLIER 6) IQR

REL.DOC.:

REVISED:

INTRODUCTION

In the absence of a properly designed randomized and controlled collaborative study, it is tempting to use the less expensive and more commonly available data from proficiency testing ('PT') to estimate variance components, such as intercollaborator, repeatability and reproducibility effects. PT data is compromised of independent and only loosely controlled testing of sample replicates by a number of collaborators purporting to use the method under question for the analyte of interest. The collaborators do not follow a study protocol, so may deviate in minor respects from the orthodox method proposed. PT has a primarily goal of measuring performance of a collaborator vs. a group of others, not that of validating the accuracy or precision of the method in question. 'Check-sample' testing is a common form of proficiency testing.

Repeatability is an intralaboratory component of variance, and is therefore less subject to controversy. Generally there is no obvious objection to using proficiency test data done in replicate to measure repeatability variance.

Interlaboratory and reproducibility variance components are where most objections arise. The source of the objections is principally due to the self-selection of the collaborators involved, the lack of method control, and the means by which the data are cleaned before estimating the effects.

This paper is concerned primarily with the last of these (data cleaning and estimation).

It will be assumed that PT data is available based on m collaborator results, and all collaborators at least purport to use a specific method for a specific analyte in question.

The purpose of estimating reproducibility effects (intercollaborator and reproducibility) is assumed to be in use as criteria by which the quality of the method in question might be assessed. For this purpose, any compromise in methodology should be biased *against* the method.

CHOICE OF ALGORITHM TO ESTIMATE REPRODUCIBILITY VARIANCE

There is a hierarchy of algorithms possible to estimate reproducibility effects from PT data, listed here in order of decreasing skepticism and increasing assumptions:

1. Do not use PT data for this purpose at all, due to lack of control of methodology. This option considers PT data too poor to be relied upon in decision-making about the test method.

The remaining choices assume the PT data are from a properly randomized experiment (allocation of test portions) and therefore are subject to allowable inference. Typically the collaborators, if sufficiently numerous (say, 8 or more in the cleaned data) to allow a claim of some sort of membership in a 'volunteer' hypothetical population which the reproducibility effects might characterize.

2. Do not clean the data. Use the entire set to estimate reproducibility effects. If true outliers or gross errors are present, they will bias variance components high, which will indicate the test method is less precise than it might actually be. This is a conservative approach, but is liberal in that it allows PT data to be used for the purpose.

3. Clean the data, but remove only outliers or gross errors which can be validated by subject matter expertise (rather than purely statistical identification) and external evidence. The reasons for the removal should be documented and non-controversial, and results both with all data and with cleaned data should be reported. This is still a conservative approach, as external and objective evidence of error is required for data removal.

For methods 2) and 3), the presence of unvalidated outliers brings into question assumptions about the type of statistical distribution, *not* the outliers themselves.

The now remaining choices *assert* the PT data come from a normal distribution (or at least a unimodal symmetric distribution), but may be contaminated by a mixture with of other distributions, and this contamination is known a priori as not being related to the test method in question and so should be removed. Generally these assertions will be completely unsupported and therefore highly subject to criticism, unless a substantial quantity of pre-existing data justifies the claims involved. *Although these assertions have been made freely in the past, modern statistical thinking deprecates these assumptions in the absence of clear evidence.*

4. Identify by statistical means any outliers that are improbable given the sample size m. (Generally a conservative 1% significance level is used for this purpose, if $m < 30$.) Remove the identified outliers and make estimates from the reduced set of data. This liberal procedure will *always* bias reproducibility effects *low*.

5. Use so-called ‘robust’ estimators to estimate reproducibility effects via statistics that are unaffected by the outer quantiles of the empirical data distribution. Typically a normal distribution is assumed for the inner quantiles (a unimodal distribution will almost always appear normal near the mode, except for cubic terms). Several such estimators the apparent intercollaborator effect s (equal to reproducibility if a single replicate is done by each collaborator) are:

5.1. The interquantile range (‘IQR’), normalized by a factor of 0.74130. I.e., $s = 0.74130\ IQR$.

5.2. 25% trimmed data, with

$$s = s_W \sqrt{[(m-1)/(k-1)]}$$

where s_W is the Winsorized standard deviation of the data, m is the original number of data and k is the number of data kept after trimming.

5.3. Huber's method, which dynamically adjusts trimming to the empirical data distribution and then follows a procedure similar to 5.2. This method is an M-estimator.

5.4. Use the median absolute deviation ('MAD') from the median and a normalizing factor of 1.4826, i.e., s = 1.4826 MAD.

5.5. Plot a Q-Q normal graph, select the range of data which is linear in the center, and compute s as the slope of the line fit.

Note that all of methods 5.1)-5.5) will result in a lower bound for s, and are therefore maximally liberal (in favor of the test method in question). These methods will generate comparable estimates of s for typical datasets. These methods are heavily dependent upon the normal distribution assumption, and are really only appropriate if it is known a priori that the data do, in fact, follow a normal distribution, and any deviation from this must, in fact, be error.

It is the author's opinion that methods 5.1) are due to an error in thinking. What starts as a valid 'robust' theory for estimates of *location* is improperly twisted into a heavily biased estimate of *scale*. In the author's opinion, method 3) is best compromise for the use of PT data to develop estimates of reproducibility effects.

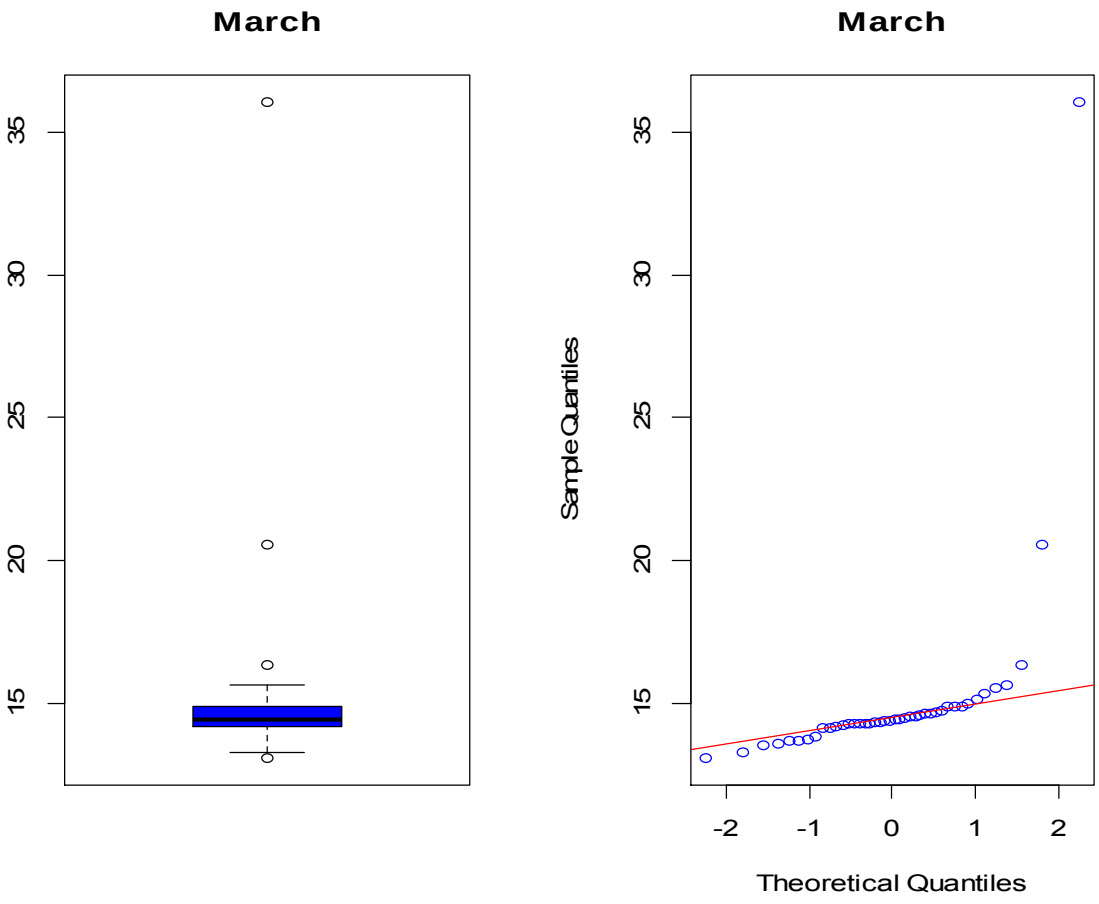
EXAMPLE

Consider the March subset of 'AOAC-C01-Fat-Data.csv'. There are two replicates for each collaborator, and the average of these is the results analyzed for reproducibility effects. Repeatability is measured by the difference in replicate pairs. It will be assumed for purposes of illustration that all collaborators all used the same test method for fat.

There are 42 collaborators, with average results ranging from 13.08 to 36.08 percent fat, with median and mean results 14.42 and 15.10.

Using method 2), the repeatability standard deviation s_r is 0.4739, the apparent intercollaborator standard deviation s is 3.503, and the repeatability adjusted value for reproducibility standard deviation is 3.519.

The boxplot and normal Q-Q plot for these data are:



The boxplot shows outliers on both tails, with a noticeable skewness to the right. The normal Q-Q plot shows non-normality on both tails, but much more pronounced on the right. The block of data from –0.75 to 0.75 normal quantiles is well fit by a straight line. Note that the outliers on the right follow what appears to be a continuous curve of increasing deviation, even the extreme at 36% fat. There is little evidence this distribution is truly normal and contaminated with a few outliers.

Suppose that we have evidence that the extreme outlier at 36.08% fat is due to a crude error in the laboratory (e.g., mix-up in transcription or calculation). Removing this point for cause, and calculating reproducibility effects via method 3) gives s = 1.143 and s_R = 1.192, which are much more believable (based on prior experience in fat measurement) values, given the repeatability s_r = 0.4739. (These are the values recommended to report in the author's opinion.)

Using the IQR = 0.62, the estimates are s = 0.4596 and s_R = 0.5688 using method 5.1). Note that this value is not much different from s_r, and is clearly too small given repeatability. This value of s_R is clearly a *lower bound* on reproducibility, and should be reported as such. One could equally easily just report s_r = 0.4739 as such a lower bound on reproducibility as an effectively equivalent estimate.

Using MAD = 0.2875, the estimates from method 5.4) are s = 0.4262 and s_R = 0.5422. These are very close to those obtained by the IQR in method 5.1).

Using 25% trimming from both tails, 22 data remain, and method 5.2) gives s = 0.3766 and s_R = 0.5041. These are slightly lower, but comparable to the results of methods 5.1) and 5.4).

Finally, Huber's method 5.3) gives s = 0.4918 and s_R = 0.5951, both similar to that of 5.1), 5.2) and 5.4).

The PT provides a conclusion such as:

"Based on the data, the best estimate of repeatability s_r is 0.47% fat and the best estimate of reproducibility s_R is 1.19% fat, with one collaborator removed for cause. The lower bound on reproducibility s_R is no less than 0.57% fat, based on the interquantile range."

LEAST COST FORMULATIONS, LTD.
824 Timberlake Drive, Virginia Beach, VA 23464-3239
Tel: (757) 467-0954 Fax: (757) 467-2947
E-mail: office@lcftld.com URL: http://lcfltd.com/

TECHNICAL REPORT

NUMBER: TR333 DATE: 2013 May 29

TITLE: Statistical analysis of interlaboratory studies. XLII. Guidelines for the use of proficiency test data to replace or supplement collaborative studies.

AUTHOR: R. A. LaBudde

ABSTRACT: Guidelines are given for the acceptable use of proficiency test data to replace or supplement collaborative studies in the estimation of repeatability and reproducibility.

KEYWORDS: 1) PT 2) COLLABORATIVE 3) REPRODUCIBILITY 4) REPEATABILITY

REL.DOC.: TR322, TR323, TR324, TR325

REVISED:

INTRODUCTION

Proficiency testing ('PT') is an economical approach to a collaborative study which has the specific principal goal of measuring a participating collaborator result with respect to the mass of the other collaborator results. This differs in aim from a randomized, controlled collaborative study that is designed specifically to measure repeatability, reproducibility and bias. PT studies are generally performed for a nominal (middle) concentration of analyte in a particular matrix. Designed collaborative studies typically span the gamut of practical concentration levels and use challenging matrices. Participants in PT studies may use nominally the same method, but typically there is no direct control over the exact protocol used. In designed collaborative studies, the precise protocol is specified. In PT studies, replication may or may not be present, and may vary among participants, sometimes without disclosure.

Traditionally, 'robust' statistical methodology has been used to analyze PT data. In TR322 and TR323, the use of such statistics for estimating reproducibility was deprecated.

Here guidelines are given for valid use of data and 'robust' statistical estimates derived from PT studies for repeatability and reproducibility. (See TR323 for more discussion.)

The choice of performing or not performing a designed collaborative study is that of the method developer. The principal premise assumed here is that of 'caveat developer': Statistical estimates are to be designed to be conservative with respect to method approval.

GENERAL GUIDELINES

1. Results must be reported as pertaining only to the specific matrix and concentration involved.
2. The combined set of estimates across all studies will be considered adequate only if the gamut of low to high concentrations for each matrix are studied.
3. All statistical estimates must be reported with 95% confidence intervals. These intervals are important to making the quality of the data visible to reviewers.

GUIDELINES FOR REPEATABILITY ESTIMATION

1. No collaborators should be removed, except for known cause. Such causes may include: 1) does not meet inclusion criteria for protocol, if protocols used are known; or 2) provable contamination. Statistical identification of outliers or influential data is not grounds for removal, only for investigation.
2. Replication may range from 2 to 4 replicates per collaborator. Repeatability should be estimated in the usual way as the pooled standard deviation of the combined set of data.
3. Alternatively, replication may exceed 4 for some collaborators, but each estimate of repeatability standard deviation should be assigned the minimum degrees of freedom across all collaborators, and this number should be used in pooling and reporting.
4. The final number of degrees of freedom assigned to the pooled estimate must be 8 or more.
5. There must be at least 3 collaborators with replication.
6. Robust statistics associated with repeatability may be estimated and reported (such as interquartile range), but not estimates which attempt to convert such statistics to standard deviations by, e. g., constant factors under a normality assumption. Reporting such robust estimates for designed collaborative studies should be encouraged so that comparative results may be accumulated over time.
7. Boxplots and half-normal plots are encouraged.

GUIDELINES FOR REPRODUCIBILITY ESTIMATION

1. No collaborators should be removed, except for known cause. Such causes may include: 1) does not meet inclusion criteria for protocol, if protocols used are known; or 2) provable contamination. Statistical identification of outliers or influential data is not grounds for removal, only for investigation.
2. The number of collaborators providing included data must be 8 or more.
3. If replication is present for most or all collaborators, repeatability, among-collaborator variability and reproducibility should be estimated as standard deviations estimated in the usual way from 1-way analysis of variance (additive model). No more than 4 replicates should be used for any collaborator.
4. If replication is not present, reproducibility only may be estimated (as the standard deviation of collaborator results).
5. Robust statistics associated with reproducibility may be estimated and reported (such as interquartile range), but not estimates which attempt to convert such statistics to standard deviations by, e. g., constant factors under a normality assumption. Reporting such robust estimates for designed collaborative studies should be encouraged so that comparative results may be accumulated over time.
6. Boxplots and half-normal plots are encouraged.

LEAST COST FORMULATIONS, LTD.
824 Timberlake Drive, Virginia Beach, VA 23464-3239
Tel: (757) 467-0954 Fax: (757) 467-2947
E-mail: office@lcftld.com URL: http://lcfltd.com/

TECHNICAL REPORT

NUMBER: TR324 DATE: 2012 September 5

TITLE: Statistical analysis of interlaboratory studies. XXXVII. Incremental collaborative studies.

AUTHOR: R. A. LaBudde

ABSTRACT: Various experimental design are presented which break a traditional collaborative study into incremental modules that can be performed in sequence over time at individually lower cost. Such incremental collaborative studies would solve the enrollment problem often encountered, and would supply more reliable information than proficiency test studies.

KEYWORDS: 1) PT 2) REPRODUCIBILITY 3) COLLABORATIVE 4) INCREMENTAL

REL.DOC.: TR322 TR323

REVISED:

INTRODUCTION

A validation study for an analytical method strives to characterize the performance of the method on the specified analyte across a gamut of concentration levels and for the matrices of interest claimed. Such a validation study must consist of the following elements:

1. Inclusivity study: Validate performance on all commonly encountered variants of the analyte.
2. Exclusivity study: Validate performance (rejection or non-recovery) on near-neighbor analytes.
3. Environmental study: Validate resistance to interferents and situ modifiers expected to be present.
4. Under worst-case conditions.
5. At end-of-life for reagents and equipment.
6. Across the range of analyte concentration from lowest of importance in practice (typically zero) to highest of importance in practice.
7. For each matrix for which the method claims adequate performance.
8. Characterization of variance source due to repeatability (same technician, same equipment, same reagents, same point in time).
9. Characterization of variance source due to between-collaborator (same point in time).
10. Characterization of variance due to reproducibility (collaborator + single replicate).
11. Characterization of bias in recovery.
12. Equivalency or better to a current accepted reference method, if required.
13. Performance within required requirements, if specified.

Achievement of all of these elements in a single planned experiment executed at a single point in time is very difficult in practice, so multiple experiments are typically required.

Traditionally, AOAC International has carried out such a validation study in three steps:

1. Investigation within the method developer's laboratory.
2. Verification in a single independent AOAC-selected laboratory.
3. Investigation in a large-scale collaborative study done in cross-section at a single point in time.

The method developer performs testing adequate to elements 1), 2), 3), 6), 7), 8), 11) and 12). It also investigates 4) and 5) under a 'ruggedness' experiment reported separately.

The independent laboratory repeats a subset of the testing done by the method developer (except for ruggedness) to verify objective performance.

The collaborative study tests elements 6), 7), 8), 9), 10), 11), 12) and 13).

Despite the division of labor into separate parts, the collaborative study remains an expensive and difficult experiment to execute, due to difficulty of enlistment of a sufficient number of collaborators willing to invest the substantial effort involved and the preparation and dispersal of a large number of homogeneous test specimens over a short period of time. These difficulties, plus the availability of a lesser status designation based solely on single laboratory information

(i.e., ‘PTM’ vs. ‘Official’ designation), have led to a great reduction in validation studies which involve collaborative studies.

As of 2012, a new ‘alternative’ methodology to ‘official first action’ has been implemented at AOAC. This new policy allows an ‘official’ status to new methods based on presented single laboratory evidence plus other anecdotal data. The method would be transitioned to ‘final action’ after a period of a year or more in which reproducibility, recovery and repeatability information is collected. The type of evidence which will be considered acceptable for final action has not yet been defined.

Proficiency testing (‘PT’) is an economical approach to a multicollaborator study which has the specific principal goal of measuring a participating collaborator result with respect to the mass of the other collaborator results. PT studies are generally performed for a nominal (middle) concentration of analyte in a particular matrix. Participants may use nominally the same method, but typically there is no direct control over the exact protocol used. Replication may or may not be present, and may vary among participants, sometimes without disclosure.

The use of PT data has been proposed as a possible surrogate for the traditional collaborative study. PT experiments require less intensive involvement for collaborators, so recruitment is easier, and involve typically a single concentration of a single matrix, so deployment is easier. The difficulty is the lack of control and design in PT studies that results in lack of repeatability conditions and lack of interpretability of the reported results. Table 1 shows a comparison of the properties of a collaborative vs. a PT study:

Table 1. Comparison of Collaborative and PT Studies		
Property	*Collaborative*	*PT*
Purpose	Measure method variance components and recovery bias, and to show equivalency to a reference method or meet performance requirements	Measure collaborator result compared to others
Method procedure	Controlled	Variants possible
Test portions	Randomized	Randomize
Levels of concentration of analyte	Full range of interest	Single level, nominal
Matrices	Multiple	Single
Disclosure	Full	Simple result
Collaborator reporting	Controlled	Ad hoc
Experimental design	Controlled	Ad hoc
Reproducibility conditions	Controlled	May vary
Repeatability conditions	Controlled	May vary
Time element	Cross-sectional	Learning curve
Cost	High	Low to moderate
Suspicious data	Infrequent	Common
Interpretability	Usually clear	Quizzical

Here we propose that the optimal solution to this issue is to divide a traditional collaborative into separate incremental experiments (‘modules’) that preserve the randomization and control of the planned collaborative study, but reduce the involvement and deployment load to that of a PT study. Such an incremental collaborative study (as opposed to a cross-sectional collaborative study) would have all of the advantages of the traditional collaborative study and of the PT study, with none of the disadvantages of either.

INCREMENTAL COLLABORATIVE STUDY

The results of a traditional collaborative study are typically reported separately for each concentration level measured for each matrix. Repeatability, reproducibility, recovery and comparative results frequently are different for different matrices; and repeatability, reproducibility and recovery are typically concentration dependent (cf. 'HORRAT' index).

DESIGN ELEMENTS COMMON TO ALL SCHEMES FOLLOWING

All of the proposed versions of incremental collaborative studies will have the following design elements:

1. Fixed number of replicates. (2 are suggested)
2. Repeatability conditions for replicates (same equipment and reagents, same technician, same point of time).
3. Specified and constant method protocol across all measurements and all collaborators (reproducibility conditions).
4. Controls to maintain study integrity.
5. Specified reporting formal for results.
6. Randomization and masking wherever possible and desirable (replications, order of testing concentrations).

INCREMENTAL BY MATRIX

The first major line of demarcation for splitting a collaborative study into modules is at the matrix level. For example, if the plan is to validate a test method for three different matrices, then three different increments of the collaborative study might be performed, one for each matrix involved. Generally, this will involve studies that are still fairly expensive, given the multiple concentration levels and replication involved. The order of the matrices studied may be arranged in declining order of importance so that early termination of the study yields maximum value at minimum cost. If the confounding of time sequence with matrix is unacceptable, the order of the matrices may be randomized. *Different collaborators may be used for each increment*, which will greatly improve ease of enrollment.

Current thinking proposes study of various matrices at the single laboratory level, with a subsequent single worst-case matrix chosen for the collaborative study. Note, however, that this does not allow measurement of reproducibility, and should only be considered when the number of replicates used provides a statistical power to test method equivalency or performance requirements at the necessary level (and no less than that provided from a collaborative study). If reproducibility varies with matrix, as it frequently does, this should be taken into account in selecting the worst-case matrix. Also note that testing only a single worst-case matrix in a collaborative study will characterize the candidate method by its worst-case reproducibility.

An alternative to the single worst-case matrix collaborative study is incremental collaborative studies for each matrix, but with a reduced (e.g., 3) number of collaborators for all but the worst-case matrix (see Fractional by Collaborators below). These (reduced and less expensive) collaborative studies will provide partial, suggestive indications of performance. If performance is poor, the collaborative study may be upgraded to a full collaborative study, or the matrix dropped from claims. These 'pilot' studies would provide information by which the single worst-case matrix full collaborative study could be designed.

INCREMENTAL BY MATRIX AND BY CONCENTRATION LEVEL

The next level of subdivision that is convenient for modularization is by concentration level. A typical collaborative study uses at least 3 levels of concentration (zero, low, high), and frequently 4 or more. Each of these, for a particular matrix, can be considered a separate increment of the collaborative study. The range of concentrations studied should span the range of concentration expected in use for which an adequate performance is claimed. The relevant study questions to be answered are:

1. Does the candidate method have a sufficiently low false positive fraction or response at the zero concentration ('blank') level?

2. Does the candidate method have adequate recovery and reproducibility at low to intermediate concentration levels?

3. Does the candidate method have adequate recover and reproducibility across the gamut of high concentration levels?

4. Is the candidate method better or equal to the specified reference method across all concentrations?

Each concentration level studied will require an adequate set of collaborators to determine reproducibility (*but different collaborators may be used for each matrix and level,* which will greatly improve ease of enrollment).

The concentration levels should be randomized across time, so that a systematic confounding of concentration with time (e.g., learning curve) does not occur. If 'M' denotes 'matrix' and 'C' denotes concentration level, then a possible sequence of study increments for two matrices, each with 4 concentration levels, might be, e.g.:

M1:L3 M1:L2 M1:L4 M1:L1 M2:L2 M2:L3 M2:L1 M2:L4

The time factor (learning curve) would be confounded with matrix here. If this is not acceptable, and a commitment to testing all matrices is made, the order of the M:C combinations may be completely randomized.

Note that the 'Incremental by Matrix and by Concentration Level' study is a randomized controlled versus of the PT study.

FRACTIONAL BY COLLABORATORS

A study with a dozen or more collaborators is still difficult and expensive to execute, due to problems with enrollment. One way around such large studies is to divide the collaborative study module into 'fractions' by groups of collaborators. These groups might be as small as 3 or as large as 6 or more. The collaborators involved in each fraction are different, but the same collaborators may be reused for different matrix-level combinations.

The expectation is that the results of these 'fractional by collaborator' studies would be composited to estimate reproducibility and equivalency or the meeting of performance requirements. In order for this to be feasible (without confounding with sample preparation or concentration level), the concentration level in the matrix must be reasonably accurately controllable, or sufficient time-stable test portions capable of being prepared *ab initio*.

As before, the matrix-level-collaborator combinations M:L:C should be randomized at least over level and collaborator, and also over matrices, if a commitment to the full course of testing can be made. The size of the 'fraction' effect can be estimated in the analysis of the composited data, and examined to see if it is sufficiently negligible, justifying the composition of data.

The time element will be confound with matrix, if matrices are not randomized, otherwise with a higher order interaction term.

MINIMUM SIZE REQUIREMENTS

1. Repeatability standard deviation requires a minimum of 8 degrees of freedom for estimation will any accuracy. Most reasonable designs will provide many more than this.

2. Reproducibility standard deviation requires a minimum of 8 degrees of freedom for estimation with any accuracy. The number of collaborators must be several more than this in order to allow for disqualification for cause or drop-outs.

3. Recovery bias will require a sample size sufficient to provide a 95% confidence interval of acceptable width.

4. Performance requirements may require total sample sizes (across all replicates and collaborators) of 60 or more.

RECOMMENDED SEQUENTIAL VALIDATION PROCEDURE

1. Method developer provides test results for all required sub-studies with the exception of measurement of reproducibility. All matrices and all concentrations are studied, with verification that all performance requirements are met. Repeatability and recovery bias estimates are obtained.

2. A random selection or expertise-based selection of the developer studies are repeated in an independent laboratory chosen by AOAC. The goal is to objectively verify the results obtained by the developer.

3. Based upon favorable results from these studies, a 'first action' status is granted.

4. Subsequent incremental, sequential, fractional collaborative studies are carried out over the course of one or two years.

5. Based upon the composition results, 'final action' status is granted.

SHOWING EQUIVALENCY TO A REFERENCE METHOD

Suppose in lieu of performance requirements that the candidate method must be shown in the validation study to be equal or better in performance than a specified reference method of known quality.

To statistically test such 1-sided equivalency, several steps must occur:

1. A subject-matter expertise based estimate of a 'material difference' Δ must be specified. This is the amount by which the candidate method performance can differ on the average from the reference method performance and still be considered 'equivalent'. The value of Δ depends upon the application, and *cannot* be estimated by statistics.

2. The validation study is carried out, and the mean difference between the candidate and reference method results estimated, along with a 1-sided 95% confidence lower limit.

3. If the 1-sided 95% confidence lower limit found is greater than $-\Delta$, then there is sufficient evidence to claim that the candidate method is *equal or better* in performance to the reference method.

4. If the 1-sided 95% confidence lower limit found is greater than $+\Delta$, then there is sufficient evidence to claim that the candidate method is *better* in performance to the reference method.

LEAST COST FORMULATIONS, LTD.
824 Timberlake Drive, Virginia Beach, VA 23464-3239
Tel: (757) 467-0954 Fax: (757) 467-2947
E-mail: office@lcftld.com URL: http://lcfltd.com/

TECHNICAL REPORT

NUMBER: TR326 DATE: 2012 October 2

TITLE: Statistical analysis of interlaboratory studies. XXXIX. Minimum degrees of freedom for random factor (standard deviation) estimation.

AUTHOR: R. A. LaBudde

ABSTRACT: In collaborative studies question of the minimum number of collaborators required to estimate reproducibility or collaborator effect arises as a contentious issue, as collaborators are expensive. In single laboratory studies, the question of the minimum number of replicates needed to estimate repeatability is a similar, but less contentious, issue, as replicates are cheap to perform. Using as a paradigm the 95% confidence interval on the standard deviation σ, the recommendation is made that minimum number of degrees of freedom needed is no less than five and should be at least seven for reasonable results. Note that the normal distribution paradigm used is a 'best case' scenario. For distributions deviating from normal, even larger number of degrees of freedom should be used. These recommendations correspond to no less than 6 collaborator results in the final dataset, and preferably 8 or more. Guidelines should require 8 or more collaborators, with as low as 6 used in extenuating circumstances. It is also strongly recommended that all reported standard deviations also report a 95% confidence interval (based on a normal distribution, if necessary) so that the degree of imprecision can be assessed by the reader.

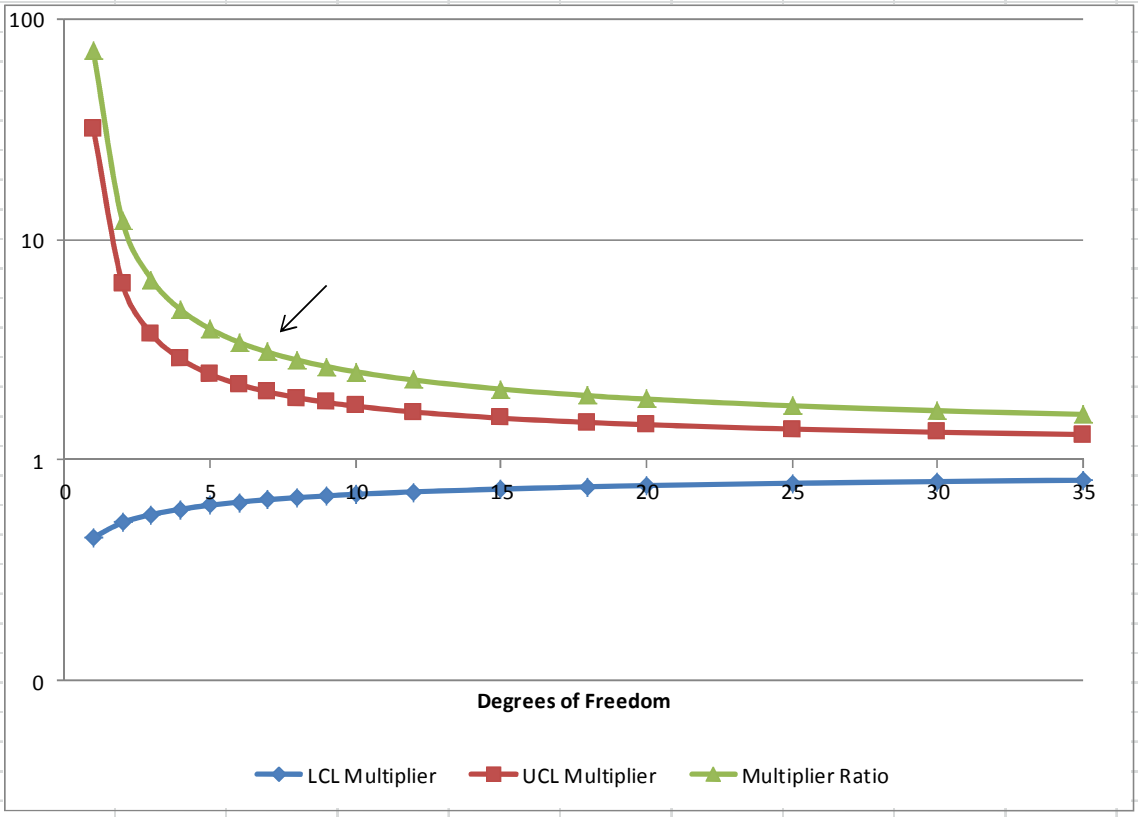
KEYWORDS: 1) REPEATABILITY 2) REPRODUCIBILITY
3) COLLABORATIVE 4) CHI-SQUARE
4) INCREMENTAL

REL.DOC.: TR298

REVISED:

95% confidence interval for Sigma, given normal distribution

Degrees of Freedom	LCL Multiplier	UCL Multiplier	Multiplier Ratio	
1	0.446	31.910	71.52	
2	0.521	6.285	12.07	
3	0.566	3.729	6.58	
4	0.599	2.874	4.80	
5	0.624	2.453	3.93	<-- Long considered the minimum d.f. needed to estimate Sigma
6	0.644	2.202	3.42	
7	0.661	2.035	3.08	<-- Rough 'knee' of the multiplier ratio curve
8	0.675	1.916	2.84	
9	0.688	1.826	2.65	
10	0.699	1.755	2.51	
12	0.717	1.651	2.30	
15	0.739	1.548	2.10	
18	0.756	1.479	1.96	
20	0.765	1.444	1.89	
25	0.784	1.380	1.76	
30	0.799	1.337	1.67	
35	0.811	1.304	1.61	



LEAST COST FORMULATIONS, LTD.
824 Timberlake Drive, Virginia Beach, VA 23464-3239
Tel: (757) 467-0954 Fax: (757) 467-2947
E-mail: office@lcftld.com URL: http://lcfltd.com/

TECHNICAL REPORT

NUMBER: TR323 DATE: 2012 August 13

TITLE: Statistical analysis of interlaboratory studies. XXXVI. When robust statistics make sense in proficiency test studies.

AUTHOR: R. A. LaBudde

ABSTRACT: The use of 'robust' statistical estimators for measures of central location and variation are discussed. Robust estimators for measures of central location are non-controversial and acceptable. Robust estimators for measures of variation, such as reproducibility standard deviation, are heavily biased and therefore deprecated. Examples of performance of robust estimators are given for four example distributions (normal, lognormal, student-t and gamma).

KEYWORDS: 1) PT 2) REPRODUCIBILITY 3) VARIANCE
4) ROBUST 5) OUTLIER 6) IQR

REL.DOC.: TR322

REVISED:

INTRODUCTION

Proficiency testing ('PT') is an economical approach to a multicollaborator study which has the specific principal goal of measuring a participating collaborator result with respect to the mass of the other collaborator results. PT studies are generally performed for a nominal (middle) concentration of analyte in a particular matrix. Participants may use nominally the same method, but typically there is no direct control over the exact protocol used. Replication may or may not be present, and may vary among participants, sometimes without disclosure.

Traditionally, 'robust' statistical methodology has been used to analyze PT data. In TR322, the use of such statistics for estimating reproducibility was deprecated.

Here the issues related to robust statistics is discussed, and indications are made as to when such methodology might actually make sense.

MEASURE OF CENTER (LOCATION)

The original use of robust statistics was with respect to measures of centrality, i.e., the center point of the distribution. The arithmetic mean (first moment) has many good theoretical properties, particularly when a normal distribution is present, but is subject to influence by outliers (with a coefficient of 1/n, where n is the number of data in the sample).

When far or multiple outliers are suspected to be present, there are two general policies in use:

1. Remove the outlier for cause, if investigation and subject-matter expertise renders the data point involved subject to crude error, contamination or other gross failure of methodology. (Statistical identification of outliers may be helpful, but removal solely upon such identification is deprecated.) After removal of any outliers, the usual statistics (e.g., arithmetic mean and standard deviation) are estimated from the remaining data.

2. Do not remove outliers, but remove their influence. This is done by using 'robust' statistics that give less weight to data in the far tails. Examples of such robust statistics as measures of center are:

    2.1. Median.
    2.2. α-trimmed mean (where a fraction α of the data are removed from each tail).

The median may be interpreted as a 50%-trimmed mean, in which case both of the above examples are of the same class. Trimming eliminates the influence of far outliers and concentrates estimation using only the center points of the distribution. The immunity to outliers increases with α, which typically is 10%, 25% or 50%.

Using data exclusively from the center of the empirical distribution to find a good measure of the location of the center of the distribution is non-controversial. Immunizing this measure against

skewness, kurtosis and suspect outliers makes good sense. Use of robust statistics for measures of central location is well-established and in common use in a variety of subject areas.

MEASURE OF VARIATION (SPREAD)

As reviewed in TR322, robust statistics have been extended to provide measures of variation that are less influenced by outliers than the standard deviation, which is based on the second central moment and amplifies the effect of far outliers. The standard deviation is much more sensitive to far outliers than is the arithmetic mean.

However, as mentioned in TR322, variation is intrinsically a property of the entire width of the data distribution, not just the center cluster. So use of robust statistics for this purpose results in heavily biased (downward) estimates, and is deprecated. Such robust statistics also commonly scale results to an assumed underlying normal distribution, which is a strong and frequently unwarranted assumption.

In studies that provide quantitative measurement of analytes (both microbiological counts and chemical components), the most common distribution encountered is the lognormal, which is heavily skewed. Data from the lognormal distribution appears to contain sporadic outliers due to this skewness, and consequently use robust estimates of variation are unacceptably low.

RESULTS FOR EXAMPLE DISTRIBUTIONS

It is instructive to see how robust measures of variation perform for several example distributions. In each case, the results are given for a sample set of data of size 24.

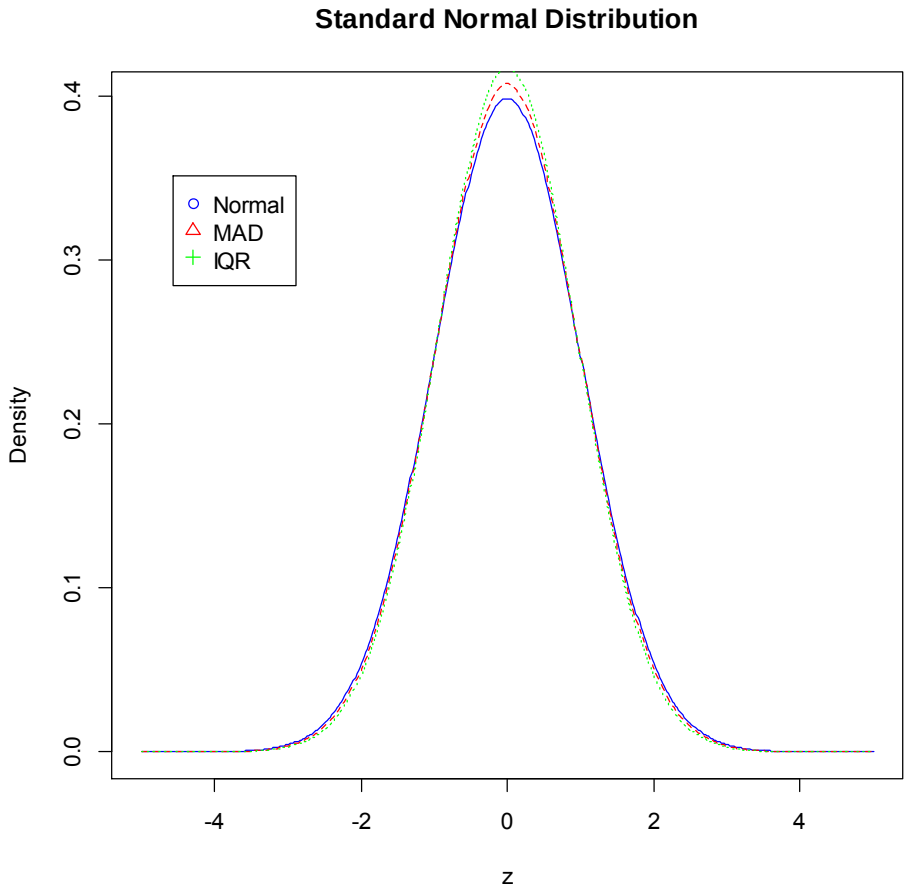
NORMAL DISTRIBUTION

Consider first the unit (standard) normal distribution, with mean 0 and standard deviation 1.

Based on 100,000 realizations of samples of size 24, the estimated mean standard deviation (‘s’) is 0.9999, the equivalent estimate based on the mean absolute deviation from the median (‘MAD’) is 0.9766, and the equivalent estimate based on the interquartile range (‘IQR’) is 0.9538. Note that there are residual biases in the MAD and IQR based estimates, due to use of asymptotic scale factors that are slightly in error for a finite sample of size 24.

The standard errors of the statistics (i.e., standard deviations of the sampling distributions) are 0.1466 for s, 0.2311 for the MAD-based estimate and 0.2219 for the IQR-based estimate. These correspond to efficiencies relative to s of 0.4024 for MAD and 0.4363 for IQR. This means is would take 2.5 times the sample size to get equivalent precision for the MAD-based estimate and 2.3 times the sample size for the IQR-based estimate.

Even for the normal distribution, the robust estimates of variation are biased by several percent for reasonable sample sizes and are of very low efficiency compared to the sample standard deviation. This is a step price to pay for protection from outliers. The mean results do reasonably reproduce the originating distribution (with the small bias obvious at the mode):



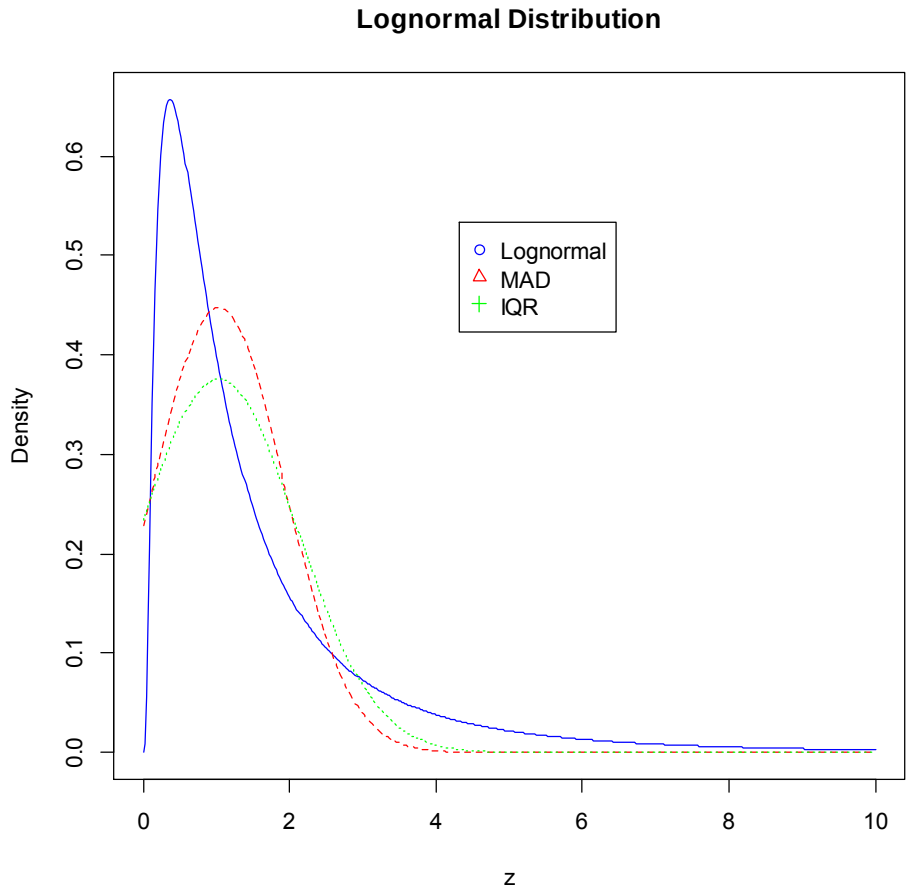
LOGNORMAL DISTRIBUTION

Now consider the standard lognormal distribution with log mean 0 and log standard deviation 1. The unlogged mean is 1.6487 and the unlogged median is 1.0, with an unlogged standard deviation of 2.1612.

Based on 100,000 realizations of samples of size 24, the estimated mean standard deviation ('s') is 1.899, the equivalent estimate based on MAD is 0.8904, and the equivalent estimate based on the IQR is 1.062. The biases in the MAD- and IQR-based estimates are substantial.

The standard errors of the statistics (i.e., standard deviations of the sampling distributions) are 1.054 for s, 0.8904 for the MAD-based estimate and 0.3756 for the IQR-based estimate. The sample standard deviation s is imprecise, but unbiased. The MAD- and IQR-based estimates are precise, but heavily biased.

Use of 'robust' estimators for the standard deviation when the underlying distribution is lognormal (i.e., heavily skewed) results in estimates which are only ½ of the correct value.



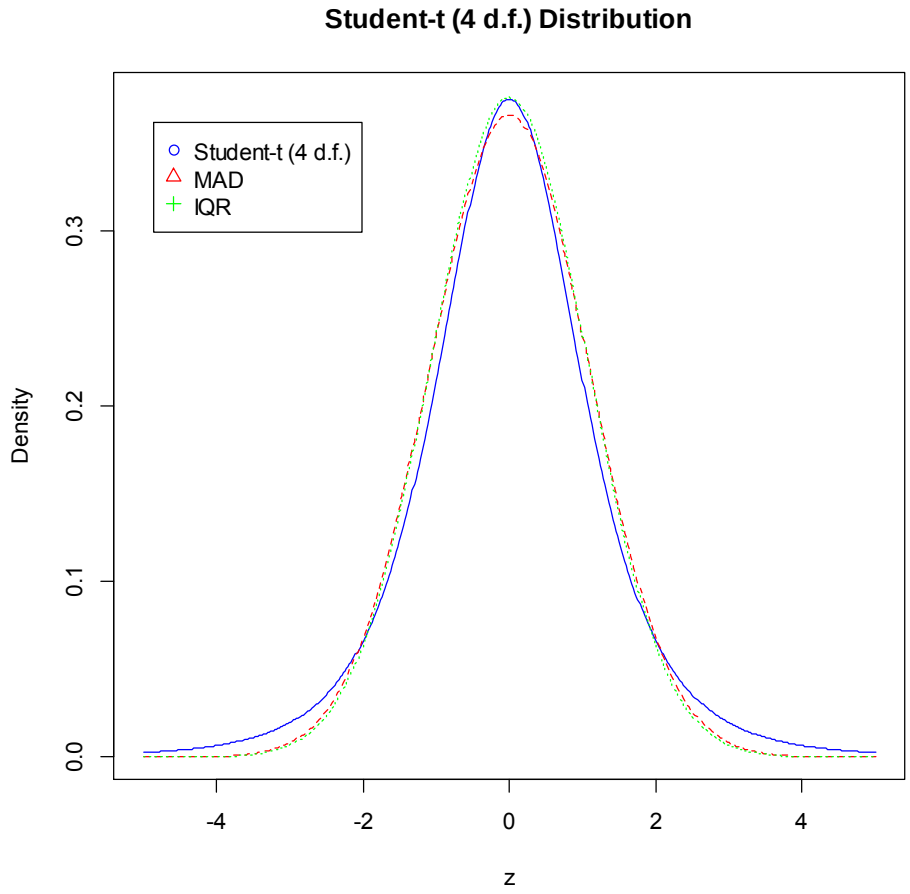
STUDENT-t WITH 4 DEGREES OF FREEDOM

The standard student-t distribution with 4 degrees of freedom has mean 0 and standard deviation of 1.4142. It is an example of a symmetric distribution with long tails.

Based on 100,000 realizations of samples of size 24, the estimated mean standard deviation ('s') is 1.376, the equivalent estimate based on MAD is 1.090, and the equivalent estimate based on the IQR is 1.061. The biases in the MAD- and IQR-based estimates are substantial.

The standard errors of the statistics (i.e., standard deviations of the sampling distributions) are 0.3895 for s, 0.2752 for the MAD-based estimate and 0.2638 for the IQR-based estimate. The sample standard deviation s is less precise, but unbiased. The MAD- and IQR-based estimates are precise, but biased.

Use of 'robust' estimators for the standard deviation when the underlying distribution is platykurtic results in estimates which are too small by 30+%.



GAMMA DISTRIBUTION

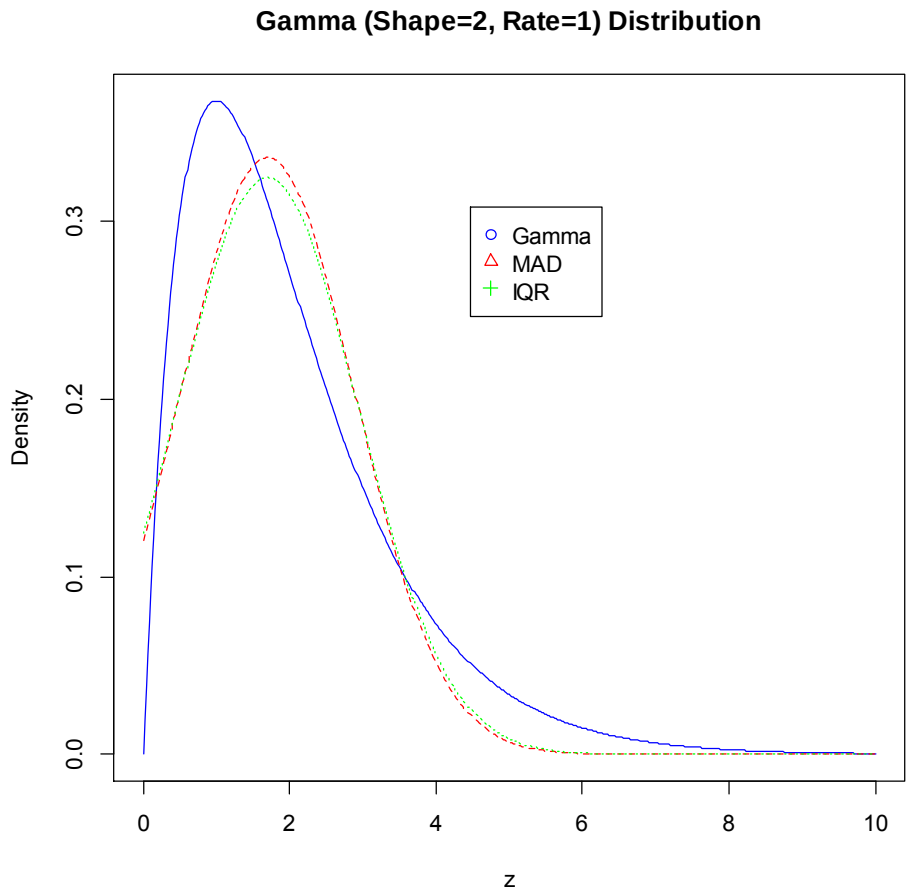
The gamma distribution with shape = 2 and scale = 1 (rate = 1) has mean 2 and standard deviation of 1.4142. It is an example of a asymmetric distribution skewed to the right, but less so than the lognormal distribution.

Based on 100,000 realizations of samples of size 24, the estimated mean standard deviation (‘s’) is 1.396, the equivalent estimate based on MAD is 1.187, and the equivalent estimate based on the IQR is 1.229. The biases in the MAD- and IQR-based estimates again are substantial.

0.3075745 0.3059277 0.3226098

The standard errors of the statistics (i.e., standard deviations of the sampling distributions) are 0.3076 for s, 0.3059 for the MAD-based estimate and 0.3226 for the IQR-based estimate. All estimates are comparable in precision, but the MAD- and IQR-based estimates are biased.

Use of ‘robust’ estimators for the standard deviation when the underlying distribution is skewed results in estimates which are too small by 20%.



RECOMMENDATIONS

1. Use of ‘robust’ estimators for measures of center location is non-controversial, as the measure of centrality is based on central data.

2. Use of ‘robust’ estimators for measures of variation or spread is deprecated, as they will be substantially biased low.

3. A circumstance in which ‘robust’ estimators of variation might be recommended is when:

a. The underlying distribution is *known a priori* to be normally distributed or substantial additional evidence (other than the actual data in question) supports this assertion.

b. The observed data are *known a priori* to be contaminated with data a foreign distribution, and this contamination is exclusively found in the tails of the empirical distribution.

c. The outliers present are *known a priori* to not be identifiable for assigned cause.

This circumstance might arise, for example, in PT data where it can be supposed that substantially different variants of the method in question may be in use, and these variants cannot be identified from the information collected in the study. Inclusion of all data in such a study may result in an estimate of reproducibility standard deviation that is *known a priori* to be much too large.

4. In all other circumstance, reproducibility standard deviation should be estimated in the usual way after removal of outliers for assignable cause.

STATISTICAL ANALYSIS

Determining a One-Tailed Upper Limit for Future Sample Relative Reproducibility Standard Deviations

Foster D. McClure and Jung K. Lee
U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition, Office of Scientific Analysis and Support, Division of Mathematics, Department of Health and Human Services, 5100 Paint Branch Pkwy, College Park, MD 20740-3835

A formula was developed to determine a one-tailed 100*p*% upper limit for future sample percent relative reproducibility standard deviations $\left(RSD_R,\% = \frac{100 s_R}{\bar{y}}\right)$, where s_R is the sample reproducibility standard deviation, which is the square root of a linear combination of the sample repeatability variance $\left(s_r^2\right)$ plus the sample laboratory-to-laboratory variance $\left(s_L^2\right)$, i.e., $s_R = \sqrt{s_r^2 + s_L^2}$, and $\bar{y}$ is the sample mean. The future RSD_R,% is expected to arise from a population of potential RSD_R,% values whose true mean is $\xi_R,\% = \frac{100\sigma_R}{\mu}$, where σ_R and μ are the population reproducibility standard deviation and mean, respectively.

The sample relative reproducibility standard deviation (RSD_R), usually expressed as a percent (RSD_R,%) is obtained using a completely randomized model (CRM; 1) and is defined as $RSD_R,\% = \frac{100 s_R}{\bar{y}}$, where s_R is the sample reproducibility standard deviation, which is the square root of a linear combination of the sample repeatability variance $\left(s_r^2\right)$ plus the sample laboratory-to-laboratory variance $\left(s_L^2\right)$, i.e., $s_R = \sqrt{s_r^2 + s_L^2}$, and $\bar{y}$ is the sample mean. The sample RSD_R,% is an important method performance indicator for validation organizations such as AOAC INTERNATIONAL. Therefore, we reasoned that it might be of great value to have a statistical procedure to determine a one-tailed 100*p*% upper limit $\left(\gamma_P\right)$ for future sample RSD_R,% values. A thorough literature search suggested that until now no such procedure, based on a CRM, has existed. However, we did note that Hald (2) had investigated the distribution of the coefficient of variation for the single sample model, i.e., $y_i = \mu + e_i$, where μ is an unknown constant and e_i is the random error associated with y_i.

Received May 17, 2005. Accepted by GL January 31, 2006.
Corresponding author's e-mail: foster.mcclure@cfsan.fda.gov

After considerable study of the problem, we came to the conclusion that an exact limit for an RSD_R was unachievable, primarily because the exact distributions of the sample s_R^2 and s_R are very complicated, and possibly impossible to obtain. Therefore, we sought to develop a formula to determine an approximate one-tailed 100*p*% upper limit $\left(\gamma_p\right)$ for future sample RSD_R values, obtained under a CRM model, by extending Hald's single sample approximation for γ_p. In doing so, we used a normal approximation and the delta-method (δ-method; 1, 3, 4).

Collaborative Study Model

Here, we will review the CRM used by AOAC to establish background notations. The model represents 2 sources of variation: the first is often referred to as "among-laboratories" and the other as "within-laboratory" variation. For the CRM, an analytical result $\left(y_{ij}\right)$ obtained by laboratory i on test sample j is expressed as $y_{ij} = \mu + \tau_i + \varepsilon_{ij}$, $i = 1, 2, \ldots, L$ and $j = 1, 2, \ldots, n$, where μ is the grand mean of all potential analyses for the material, τ_i a constant associated with laboratory i, and ε_{ij} the random error associated with analysis y_{ij}. It is also assumed that τ_i and ε_{ij} are independent random variables, such that τ_i is normally distributed (~) with a mean of 0 and variance of σ_L^2, i.e., $\left[\tau_i \sim N\left(0, \sigma_L^2\right)\right]$. Similarly, ε_{ij} is normally distributed with a mean of 0 and variance of σ_r^2, i.e., $\left[\varepsilon_{ij} \sim N\left(0, \sigma_r^2\right)\right]$.

Given the above model, we note that the expected value of y_{ij} equals the grand mean (μ) $\left[E\left(y_{ij}\right) = \mu\right]$, the variance of y_{ij} equals the reproducibility variance $\left[\text{var}\left(y_{ij}\right) = \sigma_L^2 + \sigma_r^2\right]$, the covariance of y_{ij} and y_{ik} equals the "among-laboratories" component of variation $\left[\text{cov}\left(y_{ij}, y_{ik}\right) = \sigma_L^2\right]$ for $j \neq k$, and the correlation between y_{ij} and y_{ik} is $\frac{\sigma_L^2}{\sigma_r^2 + \sigma_L^2}$ for $j \neq k$, i.e., within a given laboratory the y_{ij} are correlated under the CRM (5, 6).

Data Analysis

To obtain the sample estimate of the repeatability and reproducibility variances (s_r^2 and s_R^2), respectively, the data from the CRM are analyzed to obtain the mean squares reflecting the "among-laboratories" and "within-laboratory" variations. Using an analysis of variance (ANOVA) technique for analyzing the data, the sample mean for the *i*th laboratory $\left(\bar{y}_i = \frac{\sum_1^n y_{ij}}{n}\right)$ and the sample grand mean $\left(\bar{y} = \frac{\sum_1^L \sum_1^n y_{ij}}{nL}\right)$ are used in computing the "among-laboratories" mean square

$$MS_L = \frac{n}{L-1}\sum_1^L (\bar{y}_i - \bar{y})^2 = s_r^2 + ns_L^2$$

and the "within-laboratory" mean square

$$MS_r = \frac{1}{L(n-1)}\left(\sum_1^L \sum_1^n (y_{ij} - \bar{y}_i)^2\right) = s_r^2$$

The sample reproducibility variance

$$\left(s_R^2 = \frac{1}{n}(MS_L - MS_r) + MS_r = s_r^2 + s_L^2\right)$$

is an estimate of the population reproducibility variance $\left(\sigma_R^2 = \sigma_r^2 + \sigma_L^2\right)$. The sample reproducibility standard deviation (s_R) is the square root of s_R^2 $\left(s_R = \sqrt{s_R^2}\right)$ and is an estimate of the population reproducibility standard deviation (σ_R). The sample $RSD_R = \frac{s_R}{\bar{y}}$ is an estimate of the population relative reproducibility standard deviation $\left(\xi_R = \frac{\sigma_R}{\mu}\right)$, where μ is the population mean.

Statistical Distribution and Independence of s_R and $\bar{y}$

In developing a formula for γ_p, it is important to establish that the distribution and independence of s_R and $\bar{y}$ exist. In an earlier paper, McClure and Lee (1) detailed the derivation of the asymptotic distribution of s_R, assuming that the reproducibility variance $\left(s_R^2\right)$ was approximately normally distributed (~) with mean $\left(\sigma_R^2\right)$ and variance $\left[V\left(s_R^2\right)\right]$, i.e., $s_R^2 \sim N\left(\sigma_R^2, V\left(s_R^2\right)\right)$, by finding $V\left(s_R^2\right)$ and applying the δ-method (3, 4). Thus, the distribution of s_R is asymptotically normal with mean (σ_R) and variance $\left[V(s_R)\right]$, i.e., $s_R \sim N\left(\sigma_R, V(s_R)\right)$, where $V(s_R) = \left(\frac{1}{2\sigma_R^2}\right)\left[\left(\frac{n-1}{n^2L}\right)\sigma_r^4 + \frac{\left(\sigma_r^2 + n\sigma_L^2\right)^2}{n^2(L-1)}\right]$. Also, based on the CRM, the sample mean $\left(\bar{y}\right)$ is normally distributed with a mean (μ) and variance $\left[V(\bar{y}) = \frac{\sigma_r^2 + n\sigma_L^2}{nL}\right]$, i.e., $\bar{y} \sim N\left(\mu, V(\bar{y})\right)$.

In establishing the independence of s_R and $\bar{y}$, we direct attention to the work of Stuart et al. (5), who have shown the mean, "among-groups" and "within-groups" sums of squares, which are analogous to our mean $\left(\bar{y}\right)$, "among-laboratories" sum of squares (SS_L) and "within-laboratory" sum of squares (SS_r), are statistically independent under the CRM, and, hence, the mean $\left(\bar{y}\right)$ and reproducibility standard deviation $\left(s_R = \sqrt{s_R^2} = \sqrt{\frac{SS_r}{Ln} + \frac{SS_L}{n(L-1)}}\right)$ are independent.

100p% One-Tailed Upper Limits for Future Sample RSD_R Values

In approximating the distribution of the sample RSD_R, we want the probability that the sample RSD_R is less than the *p*th percentile value $\left(\gamma_p\right)$ to equal *p*, i.e., $\Pr\left(RSD_R < \gamma_p\right) = p$ or $\Pr\left(s_R - \bar{y}\gamma_p < 0\right) = p$. Here we note that the variable $z = s_R - \gamma_p \bar{y}$ in the probability statement $\Pr\left[s_R - \gamma_p \bar{y} < 0\right] = p$ is approximately normally distributed with mean $\left(E(z) = \sigma_R - \gamma_p \mu\right)$ and variance $\left(V(z) = V(s_R) + \gamma_p^2 V(\bar{y})\right)$.

We chose the variable $z = s_R - \gamma_p \bar{y}$ because it is known that a linear function of a normal and an approximately normal variable will usually deviate less from the normal distribution than the distribution of the ratio of the 2 variables (2). Substituting the variances $\left[V(s_R)\right]$ and $\left[V(\bar{y})\right]$ into $V(z)$, we obtained the following:

$$V(z) \cong \frac{1}{2\sigma_R^2}\left[\frac{(n-1)\sigma_r^4}{n^2L} + \frac{\left(\sigma_r^2 + n\sigma_L^2\right)^2}{n^2(L-1)}\right] + \frac{\gamma_p^2}{nL}\left(\sigma_r^2 + n\sigma_L^2\right)$$

Hence, we obtained

$$\Pr\left(s_R - \gamma_p \bar{y} < 0\right) = \Pr\left[\frac{\left(s_R - \gamma_p \bar{y}\right) - \left(\sigma_R - \gamma_p \mu\right)}{[V(z)]^{1/2}} < \frac{-\left(\sigma_R - \gamma_p \mu\right)}{[V(z)]^{1/2}}\right]$$

$$\cong \Phi\left[\frac{\gamma_p \mu - \sigma_R}{[Var(z)]^{1/2}}\right] = p$$

where Φ represents the cumulative standard normal distribution. Therefore, $\frac{\gamma_p \mu - \sigma_R}{\left[V(z)\right]^{1/2}} \cong z_p$, where z_p is the abscissa on the standard normal curve that cuts off an area *p* in the upper tail. Substituting the expression for *V(z)* in the above formula, we have

$$z_p \cong \frac{\gamma_p \mu - \sigma_R}{[V(z)]^{1/2}} = \frac{\gamma_p \mu - \sigma_R}{\left\{\frac{1}{2\sigma_R^2}\left[\frac{(n-1)\sigma_r^4}{n^2L} + \frac{\left(\sigma_r^2 + n\sigma_L^2\right)^2}{n^2(L-1)}\right] + \frac{\gamma_p^2}{nL}\left(\sigma_r^2 + n\sigma_L^2\right)\right\}^{1/2}}$$

Performing some algebra on the right-most expression above, we obtained the following:

$$z_p \cong \frac{\gamma_p\mu - \sigma_R}{\left\{\left[\frac{(n-1)\sigma_R^2}{2n^2L}\left(\frac{\sigma_r^2}{\sigma_R^2}\right)^2 + \frac{\sigma_R^2}{2n^2(L-1)}\left(n-(n-1)\frac{\sigma_r^2}{\sigma_R^2}\right)^2\right] + \frac{\gamma_p^2\sigma_R^2}{nL}\left(n-(n-1)\frac{\sigma_r^2}{\sigma_R^2}\right)\right\}^{1/2}}$$

Letting $\Theta = \frac{\sigma_r}{\sigma_R}$ (the ratio of the population repeatability and reproducibility standard deviations), we obtained the following:

$$z_p \cong \frac{\gamma_p\mu - \sigma_R}{\sigma_R\left[\frac{(n-1)\Theta^4}{2n^2L} + \frac{\left(n-(n-1)\Theta^2\right)^2}{2n^2(L-1)} + \frac{\gamma_p^2\left(n-(n-1)\Theta^2\right)}{nL}\right]^{1/2}}$$

Letting $\xi_R = \frac{\sigma_R}{\mu}$ be the population relative reproducibility standard deviation, the following expression was obtained:

$$z_p \cong \frac{\frac{\gamma_p}{\xi_R} - 1}{\left[\frac{(n-1)\Theta^4}{2n^2L} + \frac{\left(n-(n-1)\Theta^2\right)^2}{2n^2(L-1)} + \frac{\gamma_p^2\left(n-(n-1)\Theta^2\right)}{nL}\right]^{1/2}}$$

Solving this equation for γ_p we obtained:

$$\gamma_p = \frac{1 + z_p\left[\left(\frac{(n-1)\Theta^4}{2n^2L} + \frac{\left(n-(n-1)\Theta^2\right)^2}{2n^2(L-1)}\right)\left(1 - \frac{z_p^2\xi_R^2\left(n-(n-1)\Theta^2\right)}{nL}\right) + \frac{\xi_R^2\left(n-(n-1)\Theta^2\right)}{nL}\right]^{1/2}}{\frac{1}{\xi_R}\left(1 - \frac{\xi_R^2 z_p^2\left(n-(n-1)\Theta^2\right)}{nL}\right)}$$

To reiterate, γ_p = a one-tailed 100p% upper limit for future sample RSD_R values, $\Theta = \frac{\sigma_r}{\sigma_R}$ (the ratio of the population repeatability and reproducibility standard deviations), $\xi_R = \frac{\sigma_R}{\mu}$ (the population relative reproducibility standard deviation), z_p (the abscissa on the standard normal curve that cuts off an area p in the upper tail), and L and n are the number of laboratories and replicates/laboratory, respectively.

Accuracy of γ_p

To assess the accuracy of γ_p with respect to the intended probability level, a Monte Carlo (*MC*) simulation study was conducted (*see Appendix* for details). The *MC* simulation was developed for use with Statistical Analysis System (SAS) software to model a CRM ANOVA assuming L laboratories and n replicates/laboratory to draw a set of simulated data, assuming known laboratory-to-laboratory and within-laboratory standard deviations (σ_L and σ_r), respectively, and population mean (μ) or concentration of analyte. The simulated data were then used to obtain an estimate of the sample relative reproducibility standard deviation (RSD_R). For each set of σ_L, σ_r, and μ, the cumulative distribution of a total of 10 000 simulated sample relative reproducibility standard deviations was examined to obtain the 95th and 99th percentile values to represent simulated one-tailed 95 and 99% upper limits for future sample relative reproducibility standard deviations.

The results of the simulation are presented in Table 1 for values of ξ_R,% = 2, 16, and 64; Φ =1/2 and 2/3; number of laboratories = 8 and 20; number of replicates = 2, 5, and 20; and probability levels of 95 and 99%. In general, Table 1 presents one-tailed 95 and 99% upper limits in percent ($\gamma_{0.95}$,%) and ($\gamma_{0.99}$,%) for future sample RSD_R,% obtained in a collaborative study employing L = 8 and L = 20 laboratories, each performing 2, 5, or 20 replicates. Also presented in Table 1 are the *MC* simulated one-tailed 95 and 99% upper limit values ($MC_{\gamma_{95},\%}$ and $MC_{\gamma_{99},\%}$). The probability levels (p^*) are simulated probability levels that are equivalent to percentiles for the simulated *MC* values that equal the ($\gamma_{0.95}$,%) and ($\gamma_{0.99}$,%) values.

Based on the results in Table 1, it can be seen that there is excellent agreement between the $MC_{\gamma_p,\%}$-values and γ_p,%-values and corresponding p^*-values. Hence, the computational formula (γ_p) provides a satisfactory approximation for obtaining a 100p% one-tailed upper limit for future sample RSD_R,% values.

Determining γ_p

Consensus Values Assumed for Population Values for ξ_R,% and Θ

Usually, the population values for ξ_R,% and Θ will not be known. However, in some cases, consensus values, i.e., values obtained on the basis of long-time experience, may be satisfactory approximations. For some analytical methods and materials, consensus values for ξ_R,% and Θ may be obtained from the results of research by Horwitz and Albert (7, 8).

For example, one might use the "Horwitz equation" to predict a consensus value ($\xi_{R,C}$,%) for the population percent relative reproducibility standard deviation (ξ_R,%). The predicted relative reproducibility standard deviation expressed as a percent ($PRSD_R$,%) is computed as $\xi_{R,C}$,% $\cong PRSD_R$,% $= 2C^{-0.1505}$ using for C a known spike or a consensus level of analyte to provide a consensus value for (ξ_R,%).

To obtain a consensus value for $\Theta = \frac{\sigma_r}{\sigma_R}$, one might appeal to Horwitz's conclusion based on his observation of several thousand historic collaborative studies (7, 8). That is, Horwitz

Table 1. Comparison of simulated one-tailed 95 and 99% upper limits ($MC_{\gamma_{95},\%}$ and $MC_{\gamma_{99},\%}$) and calculated one-tailed 95 and 99% upper limits ($\gamma_{95},\%$ and $\gamma_{99},\%$) for future sample percent relative reproducibility standard deviations

				Probability level, %					
				95			99		
$\xi_R,\%$[a]	Θ[b]	No. labs[c]	No. reps[d]	$MC_{\gamma_{95},\%}$[e]	$\gamma_{95},\%$[f]	(p^*)[g]	$MC_{\gamma_{99},\%}$[e]	$\gamma_{99},\%$[f]	(p^*)[g]
2	1/2	8	2	2.76	2.78	0.955	3.11	3.10	0.990
			5	2.69	2.71	0.955	3.05	3.00	0.988
			20	2.67	2.67	0.950	3.04	2.95	0.985
		20	2	2.47	2.47	0.950	2.68	2.67	0.991
			5	2.43	2.43	0.950	2.63	2.61	0.990
			20	2.41	2.41	0.950	2.60	2.58	0.988
	2/3	8	2	2.68	2.71	0.951	3.01	3.00	0.990
			5	2.59	2.59	0.950	2.92	2.83	0.984
			20	2.52	2.51	0.949	2.80	2.73	0.986
		20	2	2.44	2.43	0.949	2.62	2.61	0.989
			5	2.36	2.36	0.950	2.54	2.50	0.986
			20	2.31	2.31	0.950	2.47	2.44	0.987
16	1/2	8	2	22.32	22.51	0.955	25.44	25.31	0.989
			5	21.83	21.95	0.952	24.99	24.51	0.987
			20	21.44	21.65	0.955	24.36	24.09	0.988
		20	2	19.82	19.92	0.954	21.83	21.59	0.987
			5	19.60	19.59	0.950	21.25	21.11	0.988
			20	19.39	19.41	0.951	21.08	20.85	0.988
	2/3	8	2	21.81	21.94	0.953	24.77	24.49	0.988
			5	21.01	20.93	0.948	23.25	23.05	0.988
			20	20.47	20.35	0.946	22.79	22.22	0.987
		20	2	19.59	19.59	0.950	21.35	21.11	0.987
			5	18.97	18.89	0.950	20.42	20.25	0.988
			20	18.66	18.63	0.949	19.90	19.75	0.987
64	1/2	8	2	108.31	109.45	0.954	142.35	142.35	0.990
			5	103.31	105.86	0.957	131.18	135.24	0.991
			20	100.96	104.03	0.955	126.23	131.70	0.993
		20	2	88.26	88.64	0.951	102.69	102.31	0.989
			5	86.08	86.86	0.956	99.45	99.39	0.990
			20	85.10	85.93	0.954	96.75	97.89	0.991
	2/3	8	2	102.82	105.28	0.955	135.37	133.87	0.989
			5	97.41	98.97	0.956	119.42	121.87	0.992
			20	93.48	95.63	0.958	116.67	115.81	0.989
		20	2	86.27	86.63	0.952	99.26	98.96	0.990
			5	83.73	83.42	0.948	94.12	93.76	0.989
			20	81.41	81.68	0.952	90.96	90.99	0.990

[a] $\xi_R,\%$ = Population percent relative reproducibility standard deviation.

[b] $\Theta = \sigma_r / \sigma_R$ = Ratio of the population repeatability standard deviation to the population reproducibility standard deviation.

[c] Number of laboratories.

[d] Number of replicates/laboratory.

[e] $MC_{\gamma_{95},\%}$ and $MC_{\gamma_{99},\%}$ = Monte Carlo simulated one-tailed 95 and 99% upper limits for future sample percent relative reproducibility standard deviations.

[f] $\gamma_{95},\%$ and $\gamma_{99},\%$ = Calculated one-tailed 95 and 99% upper limits for future sample percent relative reproducibility standard deviations.

[g] (p^*) = Simulated percentile corresponding to a simulated *MC* value that equals $\gamma_p,\%$.

observed from his research that the estimate of $\Theta = \frac{\sigma_r}{\sigma_R}$, i.e., the ratio of the sample repeatability standard deviation to the sample reproducibility standard deviation $\left(s_r / s_R\right)$, for most accepted methods ranged from 1/2 to 2/3 (i.e., 0.500 to 0.667). Because for any ξ_R,% γ_p is at a maximum when Θ = 0.5, relative to the γ_p obtained when Θ = 0.667, we recommend using Horwitz's lowest observation limit of s_r / s_R = 0.5 as a consensus value for Θ.

Example 1

In this example, we assume that a Study Director has no knowledge of ξ_R,% and Θ but would like to know the largest RSD_R,% that might be confidently obtained in a collaborative study on a given material having a specified concentration (C). Given the above, we will start by using the "Horwitz equation," if analytically applicable, to predict a consensus value for the population percent relative reproducibility standard deviation as follows: $\xi_{R,C}$,% = $PRSD_R$,% = $2C^{-0.1505}$ (using for C a known spike or a consensus level of analyte) to provide a consensus value for $(\xi_R$,%). Assume that the spike level or consensus value for the concentration is $C = 5.1147 \times 10^{-5}$. Substituting the value for C in $\xi_{R,C}$,% = $PRSD_R$,% = $2(C)^{-0.1505} = 2\left(5.147 \times 10^{-5}\right)^{-0.1505}$, we obtained $\xi_{R,C}$,% = 8.8398. For use in calculations later, $\xi_{R,C}$,% will be converted to a decimal, i.e., $\xi_{R,C} = \frac{\xi_{R,C},\%}{100} = \frac{8.8398}{100} = 0.088398$.

Next, we assume that we want a 95% upper limit for future sample RSD_R,% values ($\gamma_{0.95}$) obtained from a collaborative study employing L = 8 laboratories each analyzing duplicates (n = 2). We assume further a consensus value of Θ = 0.5. Upon substituting the special case values L = 8, n = 2, Θ = 0.5, and $z_{0.95}$ = 1.645 (the standard normal deviate for p = 0.95) into

$$\gamma_p = \frac{1 + z_p \left[\left(\frac{(n-1)\Theta^4}{2n^2 L} + \frac{\left(n-(n-1)\Theta^2\right)^2}{2n^2(L-1)} \right) \left(1 - \frac{z_p^2 \xi_R^2 \left(n-(n-1)\Theta^2\right)}{nL} \right) + \frac{\xi_R^2 \left(n-(n-1)\Theta^2\right)}{nL} \right]^{1/2}}{\frac{1}{\xi_R}\left(1 - \frac{\xi_R^2 z_p^2 \left(n-(n-1)\Theta^2\right)}{nL} \right)}$$

we obtained an easier-to-use formula for computing $\gamma_{0.95}$, given the above special case values as follows:

$$\gamma_{0.95} \cong \frac{\xi_R \left(1 + 1.645\sqrt{0.05566 + 0.09293\xi_R^2}\right)}{1 - 0.29597\xi_R^2}$$

Substituting $\xi_{R,C}$ = 0.88398 for ξ_R in the previous general formula and performing the indicated mathematical operations, we obtained $\gamma_{0.95}$ = 0.12321 or $\gamma_{0.95}$,% = 12.321. This is the 95% upper limit for sample RSD_R,% arising from a population whose true mean percent relative reproducibility standard deviation is ξ_{RC},% = 8.84.

Provided in the following is an easier-to-use formula for computing a 99% upper limit ($\gamma_{0.99}$) for future sample RSD_R,% values obtained from collaborative studies employing L = 8 laboratories each analyzing duplicates (n = 2). Here, we substituted the special case values L = 8, n = 2, Θ = 0.5, and $z_{0.99}$ = 2.326 (the standard normal deviate for p = 0.99) into γ_p above, and obtained the following:

$$\gamma_{0.99} \cong \frac{\xi_R \left(1 + 2.326\sqrt{0.05566 + 0.07644\xi_R^2}\right)}{1 - 0.59175\xi_R^2}$$

Example 2

Those familiar with the results from the "Horwitz equation" or predicted relative reproducibility standard deviation, $PRSD_R$, may recognize that the ξ_R,% = 2, 16, and 64 in Table 1 coincide with $PRSD_R$,% = 2, 16, and 64 when the concentrations $C = 10^0$, 10^{-6}, and 10^{-10}, respectively, are used in $PRSD_R$,% = $2C^{-0.1505}$. This implies that γ_p may also be used to obtain one-tailed 100p% upper limits for future sample RSD_R obtained from a population with known $RSD_R = PRSD_R$ using the "Horwitz equation."

Figure 1 presents plots of $PRSD_R$,% and one-tailed 95 and 99% upper limits, assuming L = 8, n = 2, and Θ = 0.5, for future sample RSD_R,% on predefined concentrations transformed to Log_{10}(C). In Figure 1, the lower curve represents a plot of the $PRSD_R$,% values on Log_{10}(C) of analyte. This curve is called the "Horwitz curve." The 2 upper curves reflect, respectively, one-tailed 95 and 99% upper limits for future sample RSD_R,% values.

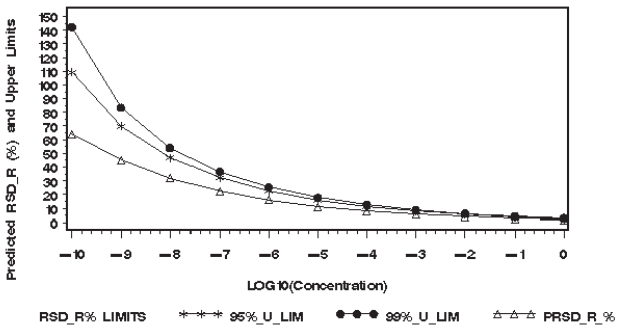


Figure 1. Predicted relative reproducibility standard deviation (PRSD_R%), 95% upper limits (95% U_Lim) and 99% upper limits (99% U_Lim) for future sample relative reproducibility standard deviations (RSD_R%) on log_{10} (concentration).

Figure 1 appears to suggest that if one were to use the 95%_U_Lim or 99%_U_Lim values to define method acceptability, when the variability is higher, usually for low concentrations, the limits are wider, as they should be, allowing a greater degree of leniency for a method to be classified as acceptable than when the variability is lower for the higher concentrations.

Summary

A formula was developed for use in computing an upper limit for future sample relative reproducibility standard deviations obtained using a given method to analyze a given material in a collaborative study. This formula, and to a degree the results in Table 1, will prove useful to Study Directors in the design of collaborative studies because they can use the formula calculations or the results in Table 1 as a barometer for the worst that can be expected, given a specified level of confidence, with respect to reproducibility precision prior to conducting a study. The one drawback in using the formula is that it assumes that the relative reproducibility standard deviation and the ratio of the repeatability standard deviation to the reproducibility standard deviation are known population parameters. However, in practice this assumption may be relaxed by accepting and using the research results by Horwitz and Albert (7, 8) with respect to reproducibility precision. The results of that research, particularly that relating to the "Horwitz equation," appear useful for obtaining reproducibility precision consensus values for the above mentioned parameters that are generally accepted as standards.

Acknowledgements

The authors are grateful to Robert Blodgett (FDA/CFSAN, College Park, MD) for assistance in developing the SAS simulation procedure. In addition, we thank the referee for comments, which have assisted in improving the paper.

References

(1) McClure, F.D., & Lee, J.K. (2005) *J. AOAC Int.* **88**, 1503–1510

(2) Hald, A. (1952) *Statistical Theory with Engineering Applications*, John Wiley & Sons Inc., New York, NY

(3) Bishop, Y., Fienberg, S., & Holland, P. (1975) *Discrete Multivariate Analysis: Theory and Practice*, MIT Press, Cambridge, MA

(4) ISO 5725 (2000) *Statistical Methods for Quality Control, Vol. 2 Measurement Methods and Results Interpretation of Statistical Data Process Control*, 5th Ed., International Organization for Standardization, Geneva, Switzerland

(5) Stuart, A., Ord, K., & Arnold, S. (1999) *Kendall's Advanced Theory of Statistics,* 6th Ed., Vol. 2A, Oxford University Press Inc., New York, NY

(6) Scheffe, H. (1959) *The Analysis of Variance,* John Wiley & Sons, Inc., New York, NY

(7) Horwitz, W.H., & Albert, R.A. (1996) *J. AOAC Int.* **79**, 589–621

(8) Horwitz, W. (1999) Personal Communication on the Magnitude of Historic Ratios of the Repeatability Standard Deviation to the Reproducibility Standard Deviation $\left(S_r/S_R\right)$

(9) *Official Methods of Analysis* (2005) Appendix D: Guidelines for Collaborative Study Procedures to Validate Characteristics of a Method of Analysis; Part 6: Guidelines for Collaborative Study, AOAC Official Methods Program Manual (OMA Program Manual): A Policies and Procedures Guide for the Official Methods Program (OMA), AOAC INTERNATIONAL (2003)

(10) Mood, A., Graybill, F., & Boes, D. (1974) *Introduction to the Theory of Statistics*, McGraw-Hill, Inc., New York, NY

Appendix

The following Statistical Analysis System (SAS) program was written and executed to obtain a simulated distribution of sample RSD_R values. It is an unabridged version of the program used to generate the simulation results presented earlier.

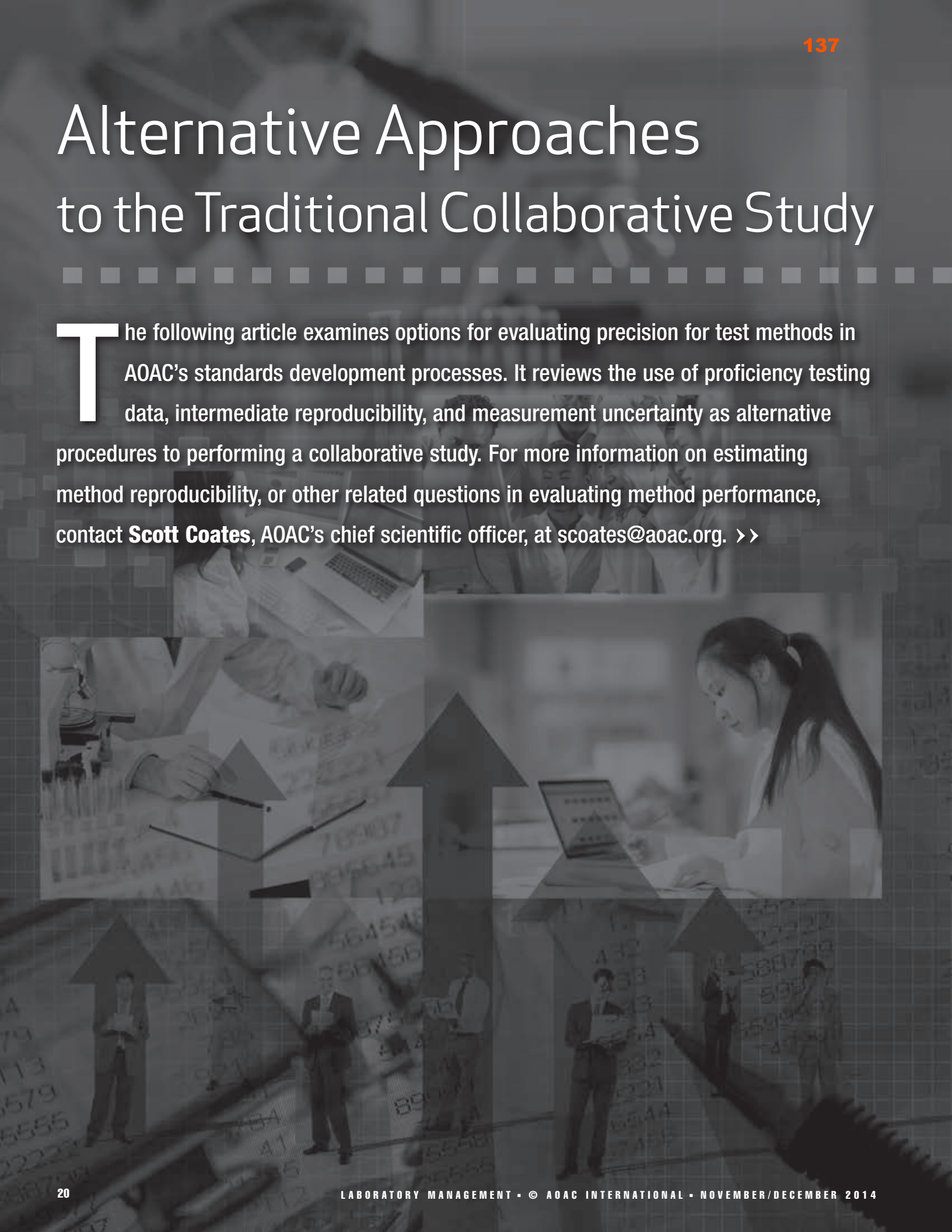
SAS Program to Determine a One-Tailed 100p% Upper Limit for Future Sample Relative Reproducibility Standard Deviations

```
OPTIONS NODATE NONUMBER;
%LET TEST = 10000;     /*INPUT NUMBER OF SAMPLE RSD_R SIMULATIONS*/
%LET N_LABS = 8;       /*INPUT NUMBER OF LABORATORIES*/
%LET REPS= 2;          /*INPUT NUMBER OF REPLICATES*/
%LET C = 1;            /*INPUT VALUE FOR CONCENTRATION LEVEL*/
%LET XI_R = .02;       /*INPUT CONSENSUS VALUE FOR POP. */
%LET THETA = 0.5;      /*INPUT Θ = σr/σR */
DATA FSIM (KEEP=X LAB I RHO N_LABS REPS ); /* NEEDED FOR GLM**/
ARRAY XG{&N_LABS.} XG1 - XG&N_LABS.;
ARRAY SLGP{&N_LABS.} SLGP1 - SLGP&N_LABS.;
SIG_L = SQRT((&C.*&XI_R.)**2 - (&THETA.*&XI_R.*&C.)**2); /*LAB STD*/
RHO = 1 - &THETA**2; /**ICC CALC.***/
SIG_R = &THETA*&XI_R.*&C; /*REPEATABILITY STANDARD DEVIATION*/
N_LABS = &N_LABS.;
REPS = &REPS.;
DO I = 1 TO &TEST.;
DO J = 1 TO &N_LABS.;
SLGP{J} = SIG_L*RANNOR(0); /*LABORATORY SELECTION*/
END;
DO J = 1 TO &REPS.;
DO LAB = 1 TO &N_LABS.;
X = &C + SLGP{LAB} + SIG_R*RANNOR(0); /*REPLICATE SELECTION*/
OUTPUT FSIM;
END;
END;END;
RUN;
PROC GLM DATA=FSIM NOPRINT OUTSTAT=STATS;
BY I;
CLASSES LAB;
MODEL X= LAB;
RUN; QUIT;
```

```
DATA ALL; SET STATS;
RETAIN MS_ERR DF_ERR MS_LAB DF_LAB S_R S_RR ;
IF _TYPE_ = 'SS1' THEN DELETE;
IF _SOURCE_ = 'ERROR' THEN DO;
    MS_ERR = SS/DF;
    DF_ERR = DF;
    END;
IF _SOURCE_ = 'LAB' THEN DO;
    MS_LAB = SS/DF;
    DF_LAB = DF;
    IF MS_LAB < = MS_ERR THEN SIGMA2_L = 0;
    ELSE;
    SIGMA2_L = (MS_LAB - MS_ERR)/&REPS;
    S_R = SQRT(MS_ERR);
    S_RR = SQRT(MS_ERR + SIGMA2_L);
    OUTPUT;
END;
RUN;
PROC MEANS NOPRINT DATA=FSIM;
BY I;
VAR X ;
OUTPUT OUT=A N=N MEAN= XBAR;
RUN;
DATA AB; SET A;
N_LABS = &N_LABS;
REPS = &REPS;
DROP _TYPE_ _FREQ_;
RUN;
DATA VV; MERGE AB ALL;
RSD_R = ROUND(100*(S_R/XBAR),.01);
RSD_RR = ROUND(100*(S_RR/XBAR),.01);
THETA1 = S_R/S_RR;
RUN;
PROC SORT DATA=VV;
BY RSD_RR;
RUN;
PROC FREQ DATA = VV;
TABLES RSD_RR;
RUN;
DATA D; SET VV;
LOG10_MU = LOG10(&C);
POP_THETA = &THETA;
POP_RSD = &XI_R.;
KEEP N_LABS REPS PCTILE POP_RSD LOG10_MU RSD_RR POP_THETA;
DO PCTILE = .99, .95, .90, .80, .70, .60, .50, .40, .30, .20, .10, .05, .01;
J=CEIL(PCTILE*&TEST);
SET VV POINT=J;
RSD_RR=RSD_RR;
OUTPUT D;
END;STOP;
RUN;
PROC PRINT DATA=D NOOBS;
VAR POP_RSD LOG10_MU POP_THETA N_LABS REPS RSD_RR PCTILE;
RUN;
```

Alternative Approaches to the Traditional Collaborative Study

The following article examines options for evaluating precision for test methods in AOAC's standards development processes. It reviews the use of proficiency testing data, intermediate reproducibility, and measurement uncertainty as alternative procedures to performing a collaborative study. For more information on estimating method reproducibility, or other related questions in evaluating method performance, contact **Scott Coates**, AOAC's chief scientific officer, at scoates@aoac.org. ››



Introduction

Many different systems have been designed to evaluate methods. AOAC INTERNATIONAL is well-known for its *Official Methods of Analysis*℠ based on the traditional collaborative study. The AOAC collaborative study format has been adopted by many organizations, most notably the United Nations-sponsored *Codex Alimentarius* and the International Organization for Standardization (ISO). Over the years, AOAC *Official Methods* became the "gold standard" for methods of analysis for food, commodities, and water. In the United States, the U.S. Code of Federal Regulations directs the U.S. Department of Agriculture and U.S. Food and Drug Administration to use AOAC *Official Methods*. Many AOAC *Official Methods* have been incorporated by reference into *Codex Alimentarius* food standards.

The requirements for a collaborative study validation of quantitative chemistry methods were codified by AOAC, ISO, and the International Union of Pure and Applied Chemistry (IUPAC) in 1987. The guidelines were subsequently published by AOAC as the *Guidelines for Collaborative Study Procedure to Validate Characteristics of a Method of Analysis* (1, 2). These guidelines are commonly referred to as the "harmonized protocol." The harmonized protocol was revised once in 1993, and again in 1994. The harmonized protocol was adopted by AOAC as the guideline for the AOAC *Official Methods* program in 1995 (3).

The hallmark of the harmonized protocol is the requirement of valid data from a minimum of eight laboratories after the removal of outliers (1). As a result of this requirement, most method developers try to recruit a minimum of 10 collaborators, in case one or two collaborators fail to complete their analyses, or if the results from some of the laboratories are determined to be statistically inconsistent with the other results ("outlier").

Alternative Pathway

Between 1991 and 2000, an average of 28 collaborative studies per year were completed, written, reviewed, and approved as *Official Methods*. The number of *Official Methods* approvals began declining in 2001, and by 2010 the number of approved *Official Methods* diminished to three or four per year. In early 2011, the AOAC Board of Directors organized a presidential task force, consisting of board members who previously served as chairs of the Official Methods Board (OMB), to determine the causes for the decline in *Official Methods* output and to consider ways to improve the *Official Methods* process.

After much consideration, the task force made several recommendations:

1. AOAC should establish voluntary consensus standards, *Standard Method Performance Requirements*℠ (SMPRs), for First Action *Official Methods of Analysis*.
2. SMPRs are voluntary consensus standards that contain minimum performance requirements for methods.
3. Expert review panels (ERPs) should assess candidate methods using the performance requirements in SMPRs to ensure that adopted First Action *Official Methods* are fit for the purpose.
4. First Action *Official Methods* can be adopted by an ERP with or without collaborative study data.
5. The reproducibility of First Action *Official Methods* should be demonstrated prior to adoption as Final Action *Official Methods*. (Reproducibility refers to data from multiple laboratories using common samples. Repeatability refers to repeated analysis of a sample within a single laboratory.)
6. Alternate types of reproducibility data, such as proficiency testing data, may be used in lieu of the traditional collaborative study, provided that the alternative data demonstrates adequate method reproducibility of "similar magnitude" to the traditional collaborative study (4).

Collectively, these recommendations are known as the "Alternative Pathway." The Alternative Pathway model was adopted by the AOAC Board of Directors in March 2011 (5). Under the Alternative Pathway, a method may be designated as a First Action *Official Method* based on the judgment of an ERP. First Action *Official Methods* remain as First Action for a period of no more than 2 years. During the First Action period, the method will be used in laboratories, and method users will be asked to provide feedback on the performance of the method. The presiding ERP will monitor the performance of the method, and at the completion of the 2-year First Action period, at which time reproducibility data is expected, determine whether the method should be recommended to the OMB for adoption as an AOAC Final Action *Official Method*.

This paper examines other approaches that could potentially be considered to generate suitable data that could be deemed equivalent to those generated in the past through a well-organized collaborative study.

This paper examines other approaches that could potentially be considered to generate suitable data that could be deemed equivalent to those generated in the past through a well-organized collaborative study.

Fitness-for-Purpose Model

A collaborative study serves several functions: 1. determines the inter-

(Continued on page 22)

Alternative Approaches to the Traditional Collaborative Study

laboratory reproducibility of a method as measured by the relative standard deviation for reproducibility [$RSD_{(R)}$]; 2. provides or confirms the accuracy (trueness; when a certified reference material is used) and repeatability (precision) characteristics of a method; 3. determines if the instructions for a method are clear and can be followed by analysts who are not affiliated with the method developer; and 4. determines that the method has been designed so that the operating parameters that might affect the performance of the method are truly known and under control (robustness).

Most of a method evaluation can be completed in a single laboratory. For example, accuracy, repeatability, and ruggedness can be determined in just one laboratory, AOAC has a well-described procedure, the Youden ruggedness procedure (6), to determine ruggedness of a candidate method. (Ruggedness can be determined in a single laboratory. Robustness is demonstrated in a collaborative study.) Method instruction clarity could be determined using an established review procedure. Interlaboratory reproducibility is the only parameter that requires collaborators.

The obvious question to ask when assessing the traditional collaborative study design is: Are 8 valid data sets really required? Clearly, 10 valid data sets are better than eight, and 12 better than 10, but how many valid data sets are really needed to satisfy the purposes of a collaborative study to quantify "reproducibility." It is mainly a question of the confidence associated with the calculated $RSD_{(R)}$. It may not be immediately obvious, but organizations such as AOAC indirectly establish a confidence interval around the calculated $RSD_{(R)}$ by the simple act of requiring a minimum number of data sets. This has been the paradigm of method validation for more than 50 years. (AOAC has been operating for over 125 years, but for much of its history, there was not an agreed upon minimum number of valid data sets. That didn't happen until the 1980s.)

There is another paradigm that is generally called "fitness-for-purpose." Instead of forcing method developers and users to accept a confidence level derived as a consequence of the minimum number of collaborators, it is also possible to allow method developers to determine the appropriate confidence level and then find the necessary number of collaborators. The key to a fitness-for-purpose validation model is that a method developer would be required to report the target confidence interval. A target interval is not normally calculated or reported because there is an implied target interval with the current eight laboratory minimum collaborative study model.

A fitness-for-purpose model has two advantages: 1. potential method users can decide if the reported reproducibility and confidence level are good enough for their purposes, much as a potential user can now assess the recovery, accuracy, LOQ, and range of applicability; and 2. in some cases, notably government-sponsored validation projects, the number of data sets far exceeds the eight laboratory minimum. In these admittedly rare and rarer cases, the estimate of the reproducibility is known with much greater confidence, and this could be reported to potential users.

There is a new benefit to the fitness-for-purpose model in that the acceptance criteria for the method validation can be clearly and quantitatively stated using target measurement uncertainty. A paper by Weitzel and Johnson (7) describes a process using decision rules and probability to determine a target measurement uncertainty that is then used to set the acceptance criteria for a method validation. Target measurement uncertainty is defined as "measurement uncertainty specified as an upper limit and decided on the basis of the intended use of measurement results (8)." The target measurement uncertainty can be used to decide appropriate values for validation criteria, such as bias, precision, LOD, and LOQ; thus, directly linking the SMPR to fitness-for-purpose.

Proficiency testing (PT) is a widely recognized practice for monitoring analytical performance, and in some ways the PT process is very similar to the process of a collaborative study.

Proficiency Testing

Proficiency testing (PT) is a widely recognized practice for monitoring analytical performance, and in some ways the PT process is very similar to the process of a collaborative study. Test materials are prepared and distributed by a program/project coordinator. Each participating laboratory analyzes a common set of blind test samples, and reports their results back to the coordinator. The coordinator then analyzes the data. Of course, there are several differences between PT programs and collaborative studies: 1. the aim of PT is to assess the performance of the laboratory not the method; 2. laboratories may use any appropriate method they choose for PT; and 3. the data is analyzed to determine how the individual laboratory performs in relation to the whole group of laboratories.

For many years, it has been strictly forbidden to even suggest that PT data might be used for the purposes of evaluating a method. However, in 2010, Ellison et al. published a paper proposing that there might be a role for proficiency testing data in method validation under certain conditions. They concluded that a properly implemented PT program provides very similar information to a traditional collaborative study, and should be given equal weight in appraising methods for suitability (9).

Thompson also showed that the *robust standard deviation* for PT data can usually be directly compared to the $RSD_{(R)}$ determined in a collaborative study (10).

Ellison et al. identified some conditions that must be met in order for PT data to be used to assess reproducibility: 1. collection of reproducibility data is designed into the PT scheme before the PT scheme is initiated; 2. the candidate method should be characterized for precision and bias in a single-laboratory type of evaluation prior to being included in a PT validation project; 3. there must be a formal set of method instructions; 4. some minimum number of the laboratories participating in the PT program must use the candidate method under review; and 5. the PT scheme must include a range of materials covering the scope of the method.

The main purpose for method validation is to ensure that an analytical method designed and developed for a specific purpose can actually achieve an acceptable accuracy and precision.

Using Intermediate Reproducibility to Determine Measurement Uncertainty

Estimation of measurement uncertainty is an integral part of the modern accreditation process. ISO 17025 states that measurement uncertainty must be estimated and made available if requested by the customer. The *Codex Alimentarius* Commission has guidelines that require laboratories involved in the import/export of foods to be accredited and report measurement uncertainty (11). Historically, AOAC has relied on the $RSD_{(R)}$ as an adequate estimate of the measurement uncertainty, and therefore AOAC does not require method developers to calculate or report measurement uncertainty as a part of the method evaluation process.

However, measurement uncertainty can be estimated using many procedures which are described in the literature (12–14). In principle, two approaches may be used when calculating the measurement uncertainty of a test result: the 'Top-down' or Type A approach which is based upon a statistical evaluation of the test results from samples that have undergone the entire analytical process; and the 'Bottom-up' or Type B approach in which all possible sources of variation of the result are listed separately and the contribution of each source to the measurement uncertainty is estimated. The Bottom-up approach to estimate the uncertainty of analytical results seems to be rather impractical for methods of analysis (15). In practice most laboratories have used the Top-down or Type A approach, estimating the measurement uncertainty using the data available from quality control, sample duplicates, and method validation, especially intermediate reproducibility.

There are three kinds of data that may be used to calculate the expanded uncertainty (U) using the Top-down approach:

1. Data from the original validation of the method
2. Data obtained from collaborative studies
3. Data obtained within a laboratory using the method (16)

ISO Technical Standard 21748 "Guide to the Use of Repeatability, Reproducibility and Trueness Estimates in Measurements Uncertainty Estimation" provides several procedures for the estimation of the measurement uncertainty using repeatability and trueness data. This would make it possible to determine measurement uncertainty using only in-house or single-laboratory data. This may be an attractive option in lieu of the difficulties in organizing collaborative studies.

In a recent article entitled *The Estimation and Use of Measurement Uncertainty for a Drug Test Procedure Validated According to USP <1225>,* Weitzel illustrated with examples the procedures to determine measurement uncertainty from single-laboratory validation (SLV) data (17). Weitzel used accuracy, bias, precision, ruggedness, and intermediate reproducibility data to calculate the measurement uncertainty.

In a separate communication, Weitzel also pointed out that that some AOAC method manuscripts already include a measurement uncertainty calculation (18). For example, in AOAC *Official Method* **2011.07,** a method for the determination of vitamins A and E by UPLC-UV or FLD, the authors use a simplified approach described by Barwick and Ellison (19) to calculate measurement uncertainty using precision and trueness study data. AOAC *Official Method* **2011.12,** a method for the determination of vitamins D_2 and D_3 in food by UPLC/MS/MS, also includes an estimate of the measurement uncertainty calculated using a combination of precision and analytical competence data.

These method evaluations demonstrate that calculating measurement uncertainty from a variety of in-house or SLV data is a relatively trivial task if the evaluation studies are properly planned to consider the necessary data required to calculate measurement uncertainty.

On-Site Verification

The main purpose for method validation is to ensure that an analytical method designed and developed for a specific purpose can actually achieve an acceptable accuracy and precision. The main purpose for investigating the reproducibility of a method is to assess

(Continued on page 24)

Alternative Approaches to the Traditional Collaborative Study

the likeliness that a validated method will provide equivalent results in the hands of multiple independently operating users at different laboratories. It is sometimes assumed that validated methods can be implemented "straight off the shelf" and achieve the published performance data straight away by whomever uses the method. In truth, the analytical performance of any given method, validated or not, is not known until the method has been verified on-site where the method will be used with the existing equipment and analysts. It is reasonable to expect that a validated method with lower $RSD_{(R)}$ should perform better than a method with an unknown $RSD_{(R)}$. A collaborative study, although it involves multiple laboratories and many factors, does not include all potential sources of variation. So a laboratory must verify a new method to ensure that there are no factors in its laboratory or with its samples that negatively impact the behavior of the new method.

On-site verification became a requirement for laboratory accreditation after the adoption of ISO 25, a precursor to ISO 17025, in 1999. Today, all accredited laboratories have adopted the practice of on-site verification. AOAC maintains a method verification guideline on its website that describes how to meet the method verification requirements of ISO 17025 (20).

With the prevalence of on-site verification of analytical methods, one must wonder if the role of the collaborative study is still as relevant as it once was 30 years ago. Perhaps it is time for another paradigm shift that embraces measurement uncertainty and the on-site verification process.

Conclusions and Recommendations

Collaborative studies are not always practical. There are several alternative procedures that might be used to estimate reproducibility that include use of proficiency testing data, intermediate reproducibility, and measurement uncertainty.

PT data has been found to be equivalent to collaborative study data, and a properly designed PT program could be used to determine reproducibility without interfering with the principles of PT.

Measurement uncertainty is a widely used convention to describe the possible range of results represented by an analytical result. All accredited laboratories are required to determine and, where applicable, report measurement uncertainty. Measurement uncertainty can be considered equivalent in concept to $RSD_{(R)}$. ISO has provided guidance for using single-laboratory data to determine the measurement uncertainty of a method. Weitzel and others have demonstrated that single-laboratory data can be used to determine measurement uncertainty with proper planning.

On-site verification is a common practice for accredited laboratories. It is widely understood that a method cannot be used "out of the box" based on its $RSD_{(R)}$, but must be verified. The practice of on-site verification reduces the reliance on reproducibility results [$RSD_{(R)}$].

—Scott Coates and Deborah McKenzie
Contributing Writers
scoates@aoac.org
dmckenzie@aoac.org

—M.L.J. Weitzel
Contributing Writer
Independent Consultant
mljweitzel@msn.com

References

(1) AOAC INTERNATIONAL, *Guidelines for Collaborative Study Procedure to Validate Characteristics of a Method of Analysis, J. Assoc. Off. Anal. Chem.* **72**, 694–704(1989)

(2) *Pure and Applied Chemistry* **67**(2), 331-333(1995)

(3) *J. AOAC Int.* **78**(5), 143A–160A(1995)

(4) AOAC INTERNATIONAL (July 2011) "Alternative Pathway to Official First Action Method Status Requirements"

(5) AOAC INTERNATIONAL (May/June 2011) "AOAC Implements Alternative Pathway to First Action Status," *Inside Laboratory Management,* Vol. 15, No. 3, pp 22-24

(6) Youden, W., & Steiner, E. (1975) *Statistical Manual of the AOAC,* AOAC INTERNATIONAL (reprinted 1987)

(7) Weitzel, M.L.J., & Johnson, W.M. (2012) "Using Target Measurement Uncertainty to Determine Fitness-for-Purpose," *Accred. Qual. Assur.* doi: 10.1007/s00769-012-0899-x

(8) *International Vocabulary of Metrology–Basic and General Concepts and Associated Terms (VIM)* (2008) *JCGM* 200:2008, Joint Committee for Guides in Metrology, www.bipm.org

(9) Ellison, S.L.R., Thompson, M., Westwood, D., & Wood, R. (2010) "The Role of Proficiency Testing in Method Validation," *Accred. Qual. Assur.* **15**, 73-79

(10) Thompson, M., & Lowthian, P.J. (1995) *Analysts* **120**, 271-272

(11) *Guidelines for the Assessment of the Competence of Testing Laboratories Involved in the Import and Export Control of Food* (CAC/GL 27-1997)

(12) Ellison, S.L.R., Rösslein, M., & Williams, A. (Eds) (2000) *Eurachem/CITAC Guide: Quantifying Uncertainty in Analytical Measurement,* 2nd Ed., ISBN 0 948926 15 5, www.eurachem.org

(13) *Measurement Uncertainty Revisited: Alternative Approaches to Uncertainty Evaluation* (2007) Eurolab 2007/1, www.eurolab.org

(14) *Guidance for the Use of Repeatability, Reproducibility and Trueness Estimates in Measurement Uncertainty Estimation* (2010) ISO 21748:2010, International Organization for Standardization (ISO), Geneva, Switzerland

(15) Horwitz, W. (1998) "Uncertainty—A Chemist's View," *J. AOAC Int.* **81**, 785-794

(16) Federal Agency for the Safety of the Food Chain (Belgium) (November 2008) *Estimating Measurement Uncertainty in Quantitative Chemistry Analysis,* http://www.favv.be/laboratories/approvedlaboratories/officecircular/_documents/03-11-2008-procedureENLAB-P-508-Measurement-uncertainty-v.01_en.pdf

(17) Weitzel, M.L.J. (2012) "The Estimation and Use of Measurement Uncertainty for a Drug Substance Test Procedure Validated According to USP," *Accred. Qual. Assur.* **17**, 139-146

(18) Weitzel, M.L.J. (January 10, 2012) personal communication

(19) Barwick, V., & Ellison, S. (2000) "The Evaluation of Measurement Uncertainty from Method Validation Studies," *Accred. Qual. Assur.* **5**, 47-53

(20) *How to Meet ISO 17025 Requirements for Method Verification* (2007) AOAC INTERNATIONAL, http://www.aoac.org/iMIS15_Prod/AOAC/PUBS/GAR/AOAC_Member/PUBSCF/GARCF/GUIDE_A.aspx?hkey=965b2306-1083-404c-b41a-bf159216a610 ■

AOAC INTERNATIONAL

The Scientific Association Dedicated to Analytical Excellence®

MEMORANDUM

Date: **February 5-6, 2015**

To: **AOAC INTERNATIONAL Official Methods Board**

From: **Deborah McKenzie – Staff Liaison, AOAC Official Methods Board**

Subject: **OMB Liaisons**

As the AOAC Mid-Year Meeting approaches, OMB liaisons need to be identified.

Meeting	OMB Liaison(s)
ISPAM	
SPADA	Doug Abbott
SPDS	
SPIFAN	
SPSFAM	
ERP – microbiology	
ERP – Gluten	

A SPADA meeting with working groups was held on February 3-4, 2015. An update on the meeting activities will be provided.

AOAC INTERNATIONAL MID-YEAR MEETING

MONDAY, MARCH 16, 2015

AOAC Stakeholder Panel on Strategic Analytical Methods (SPSFAM) **1:00pm -5:00pm**

The AOAC Stakeholder Panel on Strategic Food Analytical Methods (SPSFAM) builds consensus on methodology impacting the community and develops standards related to food for the strategic growth of the food industry. Working Chair will present draft SMPR for Heavy Metals Speciation for stakeholder consensus. Agenda in development, additional details are forthcoming.

TUESDAY, MARCH 17, 2015

AOAC Stakeholder Panel on Infant Formula and Adult Nutritionals (SPIFAN) **8:30am – 5:00pm**

The AOAC Stakeholder Panel on Infant Formula and Adult Nutritionals (SPIFAN) Working Group chairs will be present draft SMPRS for B-vitamins for stakeholder consensus. SPIFAN will also begin initiating preliminary discussion on a "new" program for "ingredients" that go into infant formula. While there are as many as 100 ingredients in Infant Formula, there are three major categories: dairy, carbohydrates, and oils. The initial focus of this program will be on dairy ingredients, both nutrients and contaminants. We highly encourage technical experts from your laboratory working in the area of safety/contaminants and experts from the dairy industry to attend the meeting. SPIFAN leaders will present the framework and outline for this new program. Agenda in development, additional details are forthcoming.

AOAC International Stakeholder Panel on Alternative Methodology (ISPAM) **8:30am – 2:30pm**

The AOAC International Stakeholder Panel on Alternative Methodology will launch the new Harmonized Salmonella Method Working Group, receive updates on the ISPAM Fresh Produce Initiative, and hear a special presentation on Virus methodology. Agenda in development, additional details are forthcoming.

WEDNESDAY, MARCH 18, 2015

AOAC Expert Review Panel for SPIFAN Nutrient Methods (ERP – SPIFAN) **8:30am – 5:00pm**

The AOAC SPIFAN Expert Review Panel will be meeting the following day to review methods for First and Final Action and screening potential methods to advance through the AOAC methods approval process. Agenda in development, additional details are forthcoming.

AOAC Expert Review Panels – AOAC Research Institute Submissions **8:30am – 5:00pm**

The AOAC Expert Review Panels will meet consecutively to review specific proprietary/commercial methods submitted through the AOAC Research Institute. Additional details to be determined. Agenda in development, additional details are forthcoming.

THURSDAY, MARCH 19, 2015

AOAC Stakeholder Panel on Dietary Supplements (SPDS) **8:30am – 5:00pm**

The AOAC Stakeholder Panel on Dietary Supplements (SPDS) will meet to review, deliberate, and achieve stakeholder consensus on standard method performance requirements for ashwagandha, folin C, kratom, and cinnamon. New ingredients and working groups to be launched are tea, vitamin D, and aloin in aloe. Agenda in development, additional details are forthcoming.

AOAC Expert Review Panels – AOAC Research Institute Submissions

The AOAC Expert Review Panels will meet consecutively to review specific proprietary/commercial methods submitted through the AOAC Research Institute. Additional details to be determined. Agenda in development, additional details are forthcoming.

FRIDAY, MARCH 20, 2015

AOAC Stakeholder Panel on Dietary Supplements (SPDS) Working Groups **8:30am – 5:00pm**

The AOAC SPDS Working Groups on Tea, Vitamin D, and Aloin in Aloe will have consecutive meetings to begin drafting standard method performance requirements. Agenda in development, additional details are forthcoming.

AOAC INTERNATIONAL

The Scientific Association Dedicated to Analytical Excellence®

MEMORANDUM

Date: **February 5-6, 2015**

To: **AOAC INTERNATIONAL Official Methods Board**

From: **Deborah McKenzie – Staff Liaison, AOAC Official Methods Board**

Subject: **OMB Guidance to Expert Review Panels for First to Final Action**

Verbal Update.

Appendix G: Procedures and Guidelines for the Use of AOAC Voluntary Consensus Standards to Evaluate Characteristics of a Method of Analysis

Expert Review Panels, Official Methods Board, First and Final Action *Official Methods*℠

In early 2011, an AOAC Presidential Task Force recommended that AOAC use Expert review panels (ERPs) to assess candidate methods against standard method performance requirements (SMPRs) to ensure that adopted First Action Official Methods℠ are fit for purpose.

Formation of an ERP

AOAC ERPs are authorized to adopt candidate methods as First Action *Official Methods* and to recommend adoption of these methods to Final Action *Official Methods* status. Scientists are recruited to serve on ERPs by a variety of ways. Normally, a call for experts is published at the same time as a call for methods is posted. Interested scientists are invited to submit their *curriculum vitae* (CV) for consideration. Advisory panel, stakeholder panel, and working group members may make recommendations to AOAC for ERP members. All CVs are reviewed and evaluated for expertise by the AOAC Chief Scientific Officer (CSO). The CVs and CSO evaluations are forwarded to the OMB for formal review. Both the CSO and OMB strive to ensure that the composition of a proposed ERP is both qualified and represent the various stakeholder groups. The recommended ERP members are submitted to the AOAC president who then appoints the ERP members.

Review of Methods

Methods submitted to AOAC in response to a call for methods are collected and compiled by AOAC staff. The AOAC CSO and working group chair perform a preliminary review of the methods and classify them into three categories: (*1*) fully developed and written methods that appear to meet SMPRs; (*2*) fully developed and written methods that may or may not meet SMPRs; and (*3*) incomplete methods with no performance data. Method submitters are apprised of the evaluation of their methods. Method developers with submissions that are classified as Category 2 or 3 are encouraged to provide additional information if available. A list of all the submitted methods and their classifications are posted for public review.

Usually, two ERP members (sometimes more) are assigned to lead the review of each Category 1 method. An ERP meeting is convened to review the methods. ERP meetings are open to all interested parties, and are usually well-attended events with about 50–60 attendees common. Each Category 1 method is reviewed and discussed by the ERP. If stakeholders have designated the method to be a dispute resolution method (as stated in the SMPR), then the ERP is asked to identify the single best candidate method to be adopted as a First Action *Official Method*. If the SMPR does not specify the need for a dispute resolution method, then the ERP may choose to adopt all methods that meet the SMPRs, or may choose to adopt the single best method in their collective, expert opinion.

In addition, an ERP may choose to require changes to a candidate method as part of its First Action adoption and/or identify issues that are required to be resolved prior to adoption as a Final Action *Official Method.*

Methods adopted by an ERP as First Action *Official Methods* may not be in AOAC *Official Methods* format. Method developers/authors are asked to assist AOAC to rewrite the method and accompanying manuscript into an AOAC-acceptable format.

Two-Year First Action Evaluation Period

Under the new pathway, a method may be designated as a First Action *Official Method* based on the collective judgment of an ERP. *Official Methods* remain as First Action for a period of about 2 years. During the First Action period, the method will be used in laboratories, and method users will be asked to provide feedback on the performance of the method.

As previously described, two (or more) ERP members are assigned to lead the review of candidate methods for adoption as First Action *Official Methods*. After a method has been adopted as First Action, these lead reviewers are expected to keep track of the use of and experience with the First Action *Official Method*. At the conclusion of the 2-year evaluation period, one or both of the lead reviewers will report back to the ERP on the experience of the First Action *Official Method.*

The presiding ERP will monitor the performance of the method, and, at the completion of the 2-year First Action evaluation period, determine whether the method should be recommended to the OMB for adoption as an AOAC Final Action *Official Method*.

It is also possible that First Action *Official Methods* are not recommended for Final Action. There are two possibilities for an ERP to decide not to proceed with a First Action method: (*1*) feedback from method users indicates that a First Action method is not performing as well in the field as was expected; or (*2*) another method with better performance characteristics has been developed and reviewed. In either case, the ERP may choose to repeal the First Action status of a method.

OMB Review

The OMB will review all methods recommended for Final Action or repeal by the ERP, and will consider a number of factors in their decision. A guidance document for factors to consider is provided on the AOAC website at http://www.aoac.org/vmeth/OMB_ERP_Guidance.pdf. Some of the factors identified by the guidance document for OMB consideration are (*1*) feedback from method users, (*2*) comparison to the appropriate SMPR, (*3*) results from single-laboratory validation, (*4*) reproducibility/uncertainty and probability of detection, (*5*) availability of reference materials, and (*6*) safety concerns.

Conclusion

The new pathway to *Official Methods*℠ is deliberately designed to avoid creation of elaborate review systems. The intent of the model is for method experts to use their scientific knowledge, experience, and good judgment to identify and adopt the best methods possible for the analytical need.

These methods are then published as First Action *Official Methods*, and used by analysts while additional information about the method is collected.

Method reviewers may consider other forms of information in lieu of the traditional collaborative study to demonstrate method reproducibility.

Additional Information

Coates, S. (2012) "Alternative Pathway," *Inside Laboratory Management* **16**(3), pp 10–12

Expert Review Panels, Policies and Procedures, AOAC INTERNATIONAL, http://www.aoac.org/News/EXPERT%20REVIEW%20PANELS%20final%20revision.pdf

Standard Format and Guidance for AOAC Standard Method Performance Requirement (SMPR) Documents, AOAC INTERNATIONAL, http://www.aoac.org/ISPAM/pdf/3.5%20SMPR%20Guideline%20v12.1.pdf

Guidance Documents

Requirements for First Action Official Methods℠ Status

See Figure 1 for process flowchart.

Expert Review Panels

(*1*) Supported by relevant stakeholders.

(*2*) Constituted solely for the ERP purpose, not for SMPR purposes or as an extension of an SMPR.

(*3*) Consist of a minimum of seven members representing a balance of key stakeholders. A quorum is the presence of seven members or 2/3 of total vetted ERP membership, whichever is greater.

(*4*) ERP constituency must be approved by the OMB.

(*5*) Hold transparent public meetings only.

(*6*) Remain in force as long as method in First Action status.

First Action Official Method℠ Status Decision

(*1*) Must be made by an ERP constituted or reinstated post March 28, 2011 for First Action *Official Method℠* status approval.

(*2*) Must be made by an ERP vetted for First Action *Official Method℠* status purposes by OMB post March 28, 2011.

(*3*) Method adopted by ERP must perform adequately against the SMPR set forth by the stakeholders.

(*4*) Method must be adopted by unanimous decision of ERP on first ballot. If not unanimous, negative votes must delineate scientific reasons.

(*5*) Negative voter(s) can be overridden by 2/3 of voting ERP members after due consideration.

(*6*) Method becomes Official First Action on date when ERP decision is made.

(*7*) Methods to be drafted into AOAC format by a knowledgeable AOAC staff member or designee in collaboration with the ERP and method author.

(*8*) Report of First Action *Official Method℠* status decision complete with ERP report regarding decision, including scientific background (references, etc.), to be published concurrently with method in traditional AOAC publication venues.

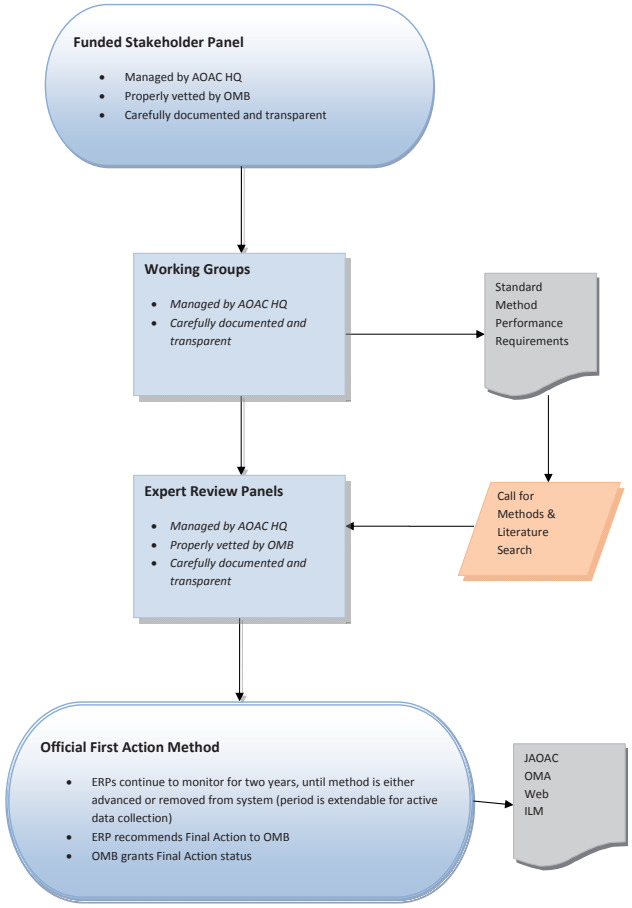


Figure 1. Summary of standards development through *Official Methods of Analysis*.

Method in First Action Status and Transitioning to Final Action Status

(*1*) Further data indicative of adequate method reproducibility (between laboratory) performance to be collected. Data may be collected via a collaborative study or by proficiency or other testing data of similar magnitude.

(*2*) Two years maximum transition time [additional year(s) if ERP determines a relevant collaborative study or proficiency or other data collection is in progress].

(*3*) Method removed from Official First Action and OMA if no evidence of method use available at the end of the transition time.

(*4*) Method removed from Official First Action and OMA if no data indicative of adequate method reproducibility is forthcoming as outlined above at the end of the transition time.

(*5*) ERP to recommend method to Final Action Official status to the OMB.

(*6*) OMB decision on First to Final Action status.

These guidance documents were approved by the AOAC Board of Directors on May 25, 2011. Revised in February 2014 to include the definition of a quorum under the section *Expert Review Panels*, item (*3*).

First Action to Final Action Methods: Guidance for AOAC Expert Review Panels

In December 2011, the Official Methods Board (OMB) approved a guidance document for ERPs to support their work as they deliberate on methods, adopt methods as Official First Action, and, subsequently, track method usage and performance between First Action status and Final Action consideration. The guideline is based on parameters of a method that the OMB will consider when deliberating on methods recommended for Final Action status. ERPs are to use this guideline in their deliberations.

ERPs working within the AOAC process may recommend a First Action status method be elevated to Final Action status. Such a recommendation leverages the ERP's high level of expertise supported by data from the initial evaluation, and results from the subsequent 2-year method performance evaluation period.

The OMB receives the recommendation with supporting documentation, and determines if Final Action status is warranted. OMB's review verifies the method process was conducted in compliance with the guidelines and protocols of the Association.

For transparency and to expedite the review process, the main areas OMB will review when evaluating ERP recommendations to promote methods to Final Action are listed below. Documentation of the areas listed below will also increase confidence in method performance and assist users to properly and safely perform the methods at their locations.

A. Method Applicability

(**a**) A method's applicability to the identified stakeholder needs is best assessed by the stakeholder panel and should be a part of the process from the onset. OMB liaisons will remind stakeholder panels to maintain this focus point.

(**b**) OMB may ask ERPs and stakeholder panels for feedback to improve the applicability of the method, such as potential method scope expansions and potential points of concern.

B. Safety Concerns

(**a**) A safety review must be performed for a method to be recognized as First Action.

(**b**) All safety concerns identified during the 2-year evaluation period must be addressed.

(**c**) Guidance and support can be obtained from the AOAC Safety Committee.

C. Reference Materials

(**a**) Document efforts undertaken to locate reference materials. Methods may still progress to Final Action even if reference materials are not available.

(**b**) Guidance and support can be obtained from the AOAC Technical Division on Reference Materials.

D. Single-Laboratory Validation

(**a**) Data demonstrating response linearity, accuracy, repeatability, LOD/LOQ, and matrix scope must be present. Experimental designs to collect this data may vary with the method protocol and the intended use of the method.

(**b**) Resources can be identified by the AOAC Statistics Committee.

E. Reproducibility/Uncertainty and Probability of Detection

(**a**) For quantitative methods, data demonstrating reproducibility and uncertainty must be present. Experimental designs to collect this data may vary with the method protocol, available laboratories, and the intended use of the method (i.e., collaborative studies, proficiency testing, etc.).

(**b**) For qualitative methods, data must be present demonstrating the probability of detection at specified concentration levels as defined by the SMPR. Experimental designs to collect this data may vary with the method protocol, available laboratories, and the intended use of the method.

(**c**) Guidance and support can be obtained from the AOAC Statistics Committee.

F. Comparison to SMPR

(**a**) Document method performance versus SMPR criteria. Note which SMPR criteria are met. For SMPR criteria not met, the ERP documents the reasoning why the method is still acceptable.

(**b**) Data is present to assure the matrix and analyte scopes are covered. This is critical for methods used for dispute resolutions.

G. Feedback from Users of Method

(**a**) Document positive and negative feedback from users of the method during the trial period.

(**b**) Feedback from users demonstrating method ruggedness should be documented.

(**c**) Assess the future availability of vital equipment, reference materials, and supplies.

H. ERP Recommendations to Repeal First Action Methods

Recommendations to repeal First Action methods shall be accompanied with detailed reasons for the decision.

The First to Final Action guidance for ERPs was approved by the OMB in December 2011 and effective as of February 1, 2012.

AOAC INTERNATIONAL

The Scientific Association Dedicated to Analytical Excellence®

MEMORANDUM

Date: **February 5-6, 2015**

To: **AOAC INTERNATIONAL Official Methods Board**

From: **Shauna Roman – Chair, AOAC Official Methods Board**

Subject: **Update on OMB Awards Document**

This agenda item will be a verbal report.

OFFICIAL METHODS[SM] PROGRAM AWARDS

Contents

AWARD IN RECOGNITION OF TECHNICAL AND SCIENTIFIC EXCELLENCE

Selection Criteria

The purpose of this award is for the Official Methods Board (OMB) to recognize a team, stakeholder panel or working group that has published a major document or other body of work that demonstrates a unique or particularly noteworthy level of technical and scientific expertise.

The minimum criteria for selection are:

a. The body of work includes major initiatives or technical guidelines accepted, completed or published within the last three years.
b. The team has been instrumental in developing or modifying technical guidelines or method validation processes.
c. The team product demonstrates significant merit as to the scope of the project, the involvement of a diverse and/or international group of stakeholders or an innovative approach to difficult analytical challenges.
d. The award recognizes teamwork that enhances the reputation of the Association and fosters the mission of AOAC INTERNATIONAL.

Selection Process:

a. The chair of the OMB solicits the OMB members for nominees.
b. Written recommendations and supporting information will be submitted to the OMB chair. The information will be distributed to the members of the OMB.
c. The OMB selects the recipient of this award. The winner is selected by a 2/3 vote. . If necessary, the OMB chair may cast the tie-breaking vote.

Award

An appropriate letter of appreciation and thanks will be sent to the recipient(s) of this award. The winner will be announced at the appropriate session of the AOAC INTERNATIONAL annual meeting, with presentation of an award. All members participating in the winning team will be acknowledged at the annual meeting, receive an award and a letter of appreciation. The name of the winner, with supporting story, will be carried in the announcement in the *ILM*.

EXPERT REVIEW PANEL OF THE YEAR

Selection Criteria

The minimum criteria for selection are:

a. The expert review panel must have completed a significant milestone (e.g. First Action Method, Final Action Method, method modification) within the last three years.
b. Generally, some unique or particularly noteworthy aspect of the ERP's work is highlighted as making the ERP worthy of the award, such as innovative technology or application, breadth of applicability, critical need, difficult analysis, or timeliness.
c. The panel report demonstrates significant merit as to the scope of the project, the involvement of a diverse and/or international group of recognized experts or an innovative approach to difficult analytical challenge.

Selection Process:

a. AOAC staff lists all eligible panels for consideration and forwards that list along with the ERP report to the Chair of the Official Methods Board (OMB).
b. The OMB Chair forwards the list along with any supporting information to the OMB.
c. The OMB selects the Expert Review Panel of the Year. Winner is selected by a 2/3 vote. If necessary, the OMB chair may cast tie-breaking vote.

Award

An appropriate letter of appreciation and thanks will be sent to the members of the winning Expert Review Panel. The winning panel will be announced at the appropriate session of the AOAC INTERNATIONAL annual meeting, with presentation of an award. All panelists participating in the winning panel will be acknowledged at the annual meeting, receive an award and a letter of appreciation. The name of the winning ERP, with supporting story, will be carried in the announcement in the *ILM*.

AOAC TECHNICAL VOLUNTEER OF THE YEAR (NEW)

More than one volunteer may be selected in this category each year. In each case the area of expertise should be noted at the time of presentation of the award.

Selection Criteria includes:

a. Has demonstrated timely, competent, and continuous service in an exemplary manner to a Stakeholder Panel (SP), Expert Review Panel (ERP), Working Group (WG), Section, Community, and Committee and/or to the Official Methods Board (OMB).
b. Has donated this service within the three years prior to nomination.
c. Gives outstanding expert guidance and support in all technical aspects as needed and requested.

Additional support for selection is exemplary performance in one or more of the areas below:

a. Has provided guidance on safety, statistical, technical matters, or process expertise.
b. Has been instrumental in developing, modifying or validating a high quality method for publication in the Official Methods of Analysis.
c. Communicates related activities through the appropriate channels, either through the panel/group/community chairs, the Committee on Statistics or Safety or through the Chief Scientific Officer or other staff designees.
d. Contributes significantly to AOAC INTERNATIONAL over a period of years with other accomplishments related to his/her area of expertise (e.g symposium presentations, poster presentations, publications, workshops, meetings).
e. Contributes to the development and improvement of AOAC INTERNATIONAL guidelines , OMA methods, statistics or safety programs.
f. Helps guide AOAC in the decision-making process to make the organization a leader in the field of analytical science.

Selection Process

a. The Official Method Board (OMB) will solicit the Chairs of the Stakeholder Panels, Expert Review Panels, Working Groups, Committees, Community, and the Association membership for nominees. Recommendations based on input from anyone qualified to discuss the contribution of the nominee can be submitted.
b. Written recommendations and supporting information must be submitted to the OMB Chair. The OMB chair will distribute the information to the members of the OMB.
c. The OMB selects the AOAC Technical Volunteer of the year. Winner is selected by a 2/3 vote. If necessary, the OMB chair may cast tie-breaking vote.

OMA METHOD OF THE YEAR

OMB may select more than one method in this category each year.

Selection Criteria

The minimum criteria for selection are:

a. The OMA manuscript must have been submitted for publication within the last three years.
b. Generally, some unique or particularly noteworthy aspect of the method is highlighted as making it worthy of the award, such as innovative technology or application, breadth of applicability, critical need, difficult analysis, and/or range of collaborators.
c. The study demonstrates significant merit as to the scope of the method or an innovative approach to a difficult analytical problem.

Selection Process:

a. AOAC staff lists all eligible methods for consideration and forwards that list to the Chair of the Official Methods Board (OMB).
b. The Chair forwards the list along with any supporting information to the members of the OMB.
c. The OMB selects the OMA Method of the Year. The winner is selected by 2/3 vote. If necessary, the OMB chair may cast tie-breaking vote.

Award

An appropriate letter of appreciation and thanks will be sent to the author(s) of the winning method. The corresponding author will be announced at the appropriate session of the AOAC INTERNATIONAL annual meeting, with presentation of an award. All authors will be acknowledged at the annual meeting, will receive an award and a letter of appreciation. The name of the winner(s), with supporting story, will be carried in the announcement in the *ILM*.

SECTION OF THE YEAR

Selection Criteria
The minimum criteria for selection are:

a. The Section(s) must have completed a significant milestone (e.g. meeting, symposium, webinar, etc.) within the last three years.
b. Generally, some unique or particularly noteworthy aspect of the Section's work is highlighted as making the Section worthy of the award, such as critical need or timeliness.
c. The award recognizes teamwork that enhances the reputation of the Association and fosters the mission of AOAC INTERNATIONAL.

Selection Process:

a. The Official Method Board (OMB) will solicit the Committee on Sections and the Association membership for nominees. Recommendations based on input from anyone qualified to discuss the contribution of the section can be submitted.
b. Written recommendations and supporting information must be submitted to the OMB Chair. The OMB chair will distribute the information to the members of the OMB.
c. The OMB selects the Section of the Year. Winner is selected by a 2/3 vote. If necessary, the OMB chair may cast tie-breaking vote.

Award

An appropriate letter of appreciation and thanks will be sent to the President of the winning Section acknowledging the Section's work. The winning Section will be announced at the appropriate session of the AOAC INTERNATIONAL annual meeting, with presentation of an award. The name of the winning Section, with supporting story, will be carried in the announcement in the *ILM*.

AOAC INTERNATIONAL

The Scientific Association Dedicated to Analytical Excellence®

MEMORANDUM

Date: **5 February 2015**

To: **AOAC INTERNATIONAL Official Methods Board**

From: **Brad Stawick, Chair TDLM**

Subject: **Revision to ALACC document**

Background:
The current revision of the *AOAC International Guidelines for Laboratories Performing Microbiological and Chemical Analyses of Food and Pharmaceuticals* is dated March 2010. Over the last several years, numerous requests for clarifications from laboratories, as well as accrediting bodies and assessors have been received and considered. Over the past year, members of ALACC have developed a new version of the document taking into account these comments as well as adding two new sections (Dietary Supplements and Pharmaceuticals) to it.

Discussion:
The creation of this new revision represents a complete overhaul of the document. Many confusing sections have been reorganized, including the work of two working groups assigned to focus on section 5.9 and Appendix A.

Recommendation:
ALACC has voted and recommends approval of this revision by the Official Methods Board.

Draft 6. Note: This document is a draft suggestion only and is not an approved document. Please do not distribute to laboratory staff for use.

ISBN: 0-935584-81-1

481 North Frederick Ave, Suite 500
Gaithersburg, Maryland 20877-2417, USA
Tel: +1-301-924-7077
Fax: +1-301-924-7089
E-mail: aoac@aoac.org
Web site: http://www.aoac.org

Printed in The United States of America

DRAFT 6

AOAC INTERNATIONAL Guidelines for Laboratories Performing Microbiological and Chemical Analyses of Food, Dietary Supplements, and Pharmaceuticals

An Aid to Interpretation of ISO/IEC 17025:2005

A Revision of the ALACC Criteria

Prepared by the
Analytical Laboratory Accreditation
Criteria Committee
of AOAC INTERNATIONAL

Revised Insert Date

Draft 6. Note: This document is a draft suggestion only and is not an approved document. Please do not distribute to laboratory staff for use.

Table of Contents

Pages numbers listed in the table of contents need fixed

Acknowledgments

AOAC INTERNATIONAL Analytical Laboratory Accreditation Criteria Committee (ALACC)

The criteria were revised under the leadership of:

David J. Fall, Covance Laboratories Inc., USA, Chair of the ALACC
Heidi Phillips, Chair of the ALACC Chemistry Subcommittee
Michael Brodsky, Brodsky Consulting, USA, Chair of the ALACC Microbiology Subcommittee
Sumit Sen, U.S. Food and Drug Administration, USA, Chair of the ALACC Pharmaceutical Subcommittee
Dr. Yan-Bo Yang, BioPharm Development, USA, Chair of the Dietary Supplement Subcommittee

The names of ALACC Subcommittee members who participated in the revision process are available on the AOAC Web site at **www.aoac.org**.

AOAC Introduction

AOAC INTERNATIONAL Guidelines for Laboratories Performing Microbiological and Chemical Analyses of Food, Dietary Supplements, and Pharmaceuticals, An Aid to Interpretation of ISO/IEC 17025:2005 provides detailed criteria to aid in assessing the essential requirements for performing these types of analyses. This document closely follows ISO/IEC 17025 and provides a section-by-section interpretation of the general ISO/IEC 17025 requirements. For those sections of ISO/IEC 17025 that are self-explanatory and sufficiently focused on testing laboratories, no further comment was deemed necessary.

AOAC welcomes recommendations for revisions from its practitioners. These recommendations will be reviewed by ALACC to determine if a clarification is required. However, in order to expedite the review, submit these in the form of Yes/No type questions. Such clarifications will be posted on the AOAC Web site (**www.aoac.org**) in the Accreditation Section under Frequently Asked Questions (FAQ).

Some quotes are taken from ***CITAC/Eurachem Guide to Quality in Analytical Chemistry: An Aid to Accreditation*** (2002). This material is reproduced with permission of the authors.

AOAC Background

The International Organization for Standardization (ISO) issued in May 2005 the second edition of ISO/IEC 17025, “General requirements for the competence of testing and calibration laboratories.” This ISO/IEC Standard provides requirements for testing and calibration laboratories to establish management systems to help ensure the acquisition of consistent and reliable laboratory data. Because ISO/IEC 17025 is intended to apply to both calibration and testing laboratories, it is, by necessity, broad. However, ISO/IEC 17025 competently and succinctly presents management requirements for these laboratories. Regulatory Bodies, in the background to the Current Good Manufacturing Practices regulations, present a regulatory philosophy that provides for appropriate application of this Standard to regulated laboratories. Consistent with that philosophy and the needs of testing laboratories, this document provides more precise direction on how to meet the Standard requirements to help avoid interpretation differences. This approach is consistent with that of regulatory bodies and the need for establishing more definitive applications for specific fields.

Many regulatory bodies have demonstrated their acceptance of and the applicability of ISO/IEC 17025 by achieving accreditation of their own testing laboratories, as well as by being actively involved in maintenance of ISO/IEC 17025 standard.

General Requirements for the Competence of Testing and Calibration Laboratories

1. Scope

"Where a laboratory claims compliance against, or certification or accreditation to, a particular standard, it is important to be clear to what this compliance, certification, or accreditation applies. The formal statement of the activities that have been certified against ISO 9001, or accredited against ISO/IEC 17025 is known as the "scope." ISO 9000 and GLP require only a brief description of the activities covered, but with ISO/IEC 17025, a detailed description of the specific work covered by the accreditation is usually required." [*CITAC/Eurachem Guide to Quality in Analytical Chemistry: An Aid to Accreditation* (2002)]

Refer to the ILAC document: G18 04/2010, *Guidelines for the Formulation of Scopes of Accreditation for Laboratories*.

1.1

For most testing laboratories, all requirements found in this document are essential in obtaining accreditation. This document covers testing by standard methods that are internationally and nationally recognized such as AOAC INTERNATIONAL, U.S. Food and Drug Administration (FDA), U.S. Pharmacopeia (USP), European Pharmacopeia (EP), U.S. Department of Agriculture (USDA), International Union of Pure and Applied Chemistry (IUPAC), International Commission for Microbiological Specifications for Foods (ICMSF), Health Canada ,Compendium of Methods for the Microbiological Examination of Foods (CMMEF), International Organization for Standardization (ISO), new methods, and laboratory developed methods.

This document is intended to provide guidance consistent with regulatory bodies having jurisdiction over dietary supplements such as FDA, Health Canada, and the Therapeutic Goods Administration (TGA).

“The validation of a standard or collaboratively studied methods should not be taken for granted, no matter how impeccable the method’s pedigree, the laboratory should satisfy itself that the degree of validation of a particular method is adequate for the required purpose, and that the laboratory is itself able to verify any stated performance criteria.” [*CITAC/Eurachem Guide to Quality in Analytical Chemistry: An Aid to Accreditation* (2002)] A laboratory may use an in-house method that has demonstrated superior performance or utilizes more modern technology, and has been adequately validated as defined in this document. However, methods of analysis that are specified in law or regulation shall be followed in accordance with those requirements.

Performance in proficiency testing programs for the analytes in question, where reasonably available, will be a required element in determining whether or not such analyses can be accredited

1.2

Because both sampling and methods are critical components of an analytical assessment, the testing laboratory shall note whether other parties conducting portions of this procedure are operating under this document. In addition, this document specifically addresses proficiency in the execution of test methods and is not generally intended for research and/or product development laboratories, unless specified by a customer and/or proficiency scheme for application to a test method critical to these functions.

1.4

This document is for the implementation of laboratory management systems. It covers all analytical laboratories, including those associated with companies, government agencies, trade organizations, academic and independent laboratories. It is not intended for calibration laboratories.

1.5

Although compliance with regulatory and safety requirements is not generally part of accreditation, compliance with all applicable regulatory, safety, and chemical hygiene requirements is expected as a part of the laboratory’s quality system. The safety of all personnel is a responsibility of management.

The proper handling and disposal of reagents, solvents, microbials, tissue, etc., is a societal safety issue as well as a

matter of good practice in the laboratory, and shall conform to all applicable environmental or health and safety regulations. In the absence of specific guidance or regulation, proper disposal of materials shall be implemented to protect the environment and society. Optimally, all experiments and test procedures should include not only the in-use procedures but also the safe disposal of all waste materials.

2. Normative References

A list of useful references is provided on the AOAC Web site (**www.aoac.org**) in the Publications and Resources section. This approach was chosen to ensure that the most current references are specified.

3. Terms and Definitions

The following bibliography for definitions may be used to find the recent definition from authoritative sources. Some definitions are not directly applicable to laboratories and some terms have multiple definitions. The laboratory should review the definitions and select the one that is most applicable to its use.

In addition, a list of terms and definitions not found in the authoritative sources is provided on the AOAC Web site (**www.aoac.org**) in the Accreditation Section. This approach was chosen to ensure that the most current internationally harmonized definitions and terms are specified.

Terms and Definitions Bibliography

Please note that the current version applies for the references in this document.

(*1*) JCGM 200, International vocabulary of metrology—Basic and general concepts and associated terms (VIM), Vocabulaire international de métrologie—Concepts fondamentaux et généraux et termes associés (VIM), ©JCGM 2008, http:/www.bipm.org/en/publications/guides/vim.html [This 3rd edition cancels and replaces the 2nd edition, 1993. This 3rd edition is also published as ISO Guide 99 by ISO (ISO/IEC Guide 99 International Vocabulary of Metrology—Basic and General Concepts and Associated Terms, VIM).].

(*2*) Conformity assessment—Vocabulary and general principles. ISO/IEC 17000.

(*3*) Quality management systems—Fundamentals and vocabulary. ISO 9000.

(*4*) Terms and definitions used in connection with reference materials. ISO Guide 30.

(*5*) Revision of definitions for reference material and certified reference material. ISO Guide 30.

(*6*) Standardization and related activities—General vocabulary. ISO Guide 2.

(*7*) United States Pharmacopoeia and National Formulary (USP/NF) http://www.uspnf.com/uspnf/login

(*8*) European Pharmacopoeia, http://online6.edqm.eu/ep603/

(*9*) International Committee of Harmonization (ICH) Q2 (R1): Validation of Analytical Procedures: Text and Methodology, http://www.ich.org

(*10*) *Official Methods of Analysis of AOAC INTERNATIONAL*, http://eoma.aoac.org/

(11) United States Code of Federal Regulations 21 CFR 210, 211, and 111

4. Management Requirements

4.1 Organization

4.1.5 Conflict-of-interest agreements shall be established along with appropriate training programs for personnel. On a pre-determined schedule, all affected staff members shall attest that they understand the conflict-of-interest agreement and shall adhere to the requirements.

There shall be readily available to staff members an organizational description that could include an organizational chart or charts indicating all reporting relationships and responsibilities. The organizational description shall include the most responsible position at each level of that hierarchy.

4.1.6

Note: Examples of communication processes are regularly scheduled meetings, distributing the annual management review to laboratory staff, effective leadership and supervision, etc.

4.2 Management System

4.2.1 The management systems can be incorporated into a quality manual for a multifunctional laboratory, but specific sections pertaining to special needs for various analytes and/or techniques shall be easily identifiable. There may be specific subsections for various analytes included in the document.

4.6 Purchasing Services and Supplies

4.6.2 In some industries, such as dietary supplement or pharmaceutical, the use of specific reference materials is mandated by the authoritative body, for example, the USP Reference Standards or the EP Certified Reference Standards. Reference Materials/Standards obtained from such authoritative sources are presumed to be suitable for their defined uses.

The laboratory shall ensure that the quality of the reagents used is appropriate for the tests concerned.

4.6.4 Once a supplier has been evaluated and approved there shall be a program to ensure continued suitability of the supplier.

4.8 Complaints

For dietary supplements and pharmaceuticals, a qualified person must review complaints for possible failures and investigate where needed.

4.9 Control of Nonconforming Testing and/or Calibration Work

Note: Specifications may be an important aspect of the laboratory's samples, therefore procedures for responding to out of specification (OOS) results should be considered. The degree to which OOS results are investigated can vary, so the laboratory is encouraged to design procedures that suit the industries they serve. Guidelines are available from organizations such as FDA and TGA.

4.13 Control of Records

4.13.1 General

4.13.1.1 The laboratory shall specify a minimum acceptable level of record maintenance and security. The maintenance and security of all records shall be consistent with customer requirements.

4.13.1.2 Record retention policies shall be consistent with customer requirements and the requirements of the laboratory.

4.13.2 Technical Records

4.13.2.1 Quality-critical reagents prepared in the laboratory shall be labeled and the preparation recorded to identify substance, strength, solvent (where not water), any special precautions or hazards, restrictions of use, and date of preparation and/or expiration. The person responsible for the preparation of the reagent shall be traceable through the information on both the label and in the records.

The requirement for an audit trail in laboratory records applies to:

(a) sample receipt (check-in)
(b) sample preparation
(c) sample handling and storage
(d) sample analysis
(e) equipment qualification and maintenance
(f) equipment performance → (e.g., using Certified Reference Materials [CRMs], proficiency checks, and daily checks)
(g) calibration records → with traceability to CRMs
(h) traceability to each analyst performing steps in the testing process
(i) analyst training → with traceability to RMs and proficiency checks
(j) results
(k) reviews
(l) reports (mailed reports, faxes)
(m) review of electronic transmissions (e.g., Laboratory Information Management Systems [LIMS] acquisitions)
(n) proficiency test results

If a method allows multiple testing options then the laboratory record shall document which option was followed. The option selected could be recorded many ways, such as including the information in a laboratory work instruction or on a space on a form or LIMS entry.

Note: The independent system to collect the data can vary from manually recording the times to using electronic recording of the time such as High Performance Liquid Chromatography (HPLC) electronic files, printouts or chart recordings. Also, for systems that are automatically controlled, it may be adequate to periodically verify the automatic control. However, if the verification fails, all runs since the most recent successful verification are suspect. An example of such an automatic control is an autoclave.

4.13.2.3 All alterations to records shall also include the date(s) of the change.

4.14 Internal Audits

4.14.1 Internal audit programs should include both horizontal and vertical investigations. Horizontal audits examine a particular management system requirement, activity, or process in detail, e.g. across multiple samples, persons, equipment, departments, etc. Vertical audits trace a single sample through all aspects of handling, e.g. from sample receipt to data reporting.

4.15 Management Reviews

4.15.1 The records for management review shall identify the top management responsible for and conducting the management review process.

5. Technical Requirements

5.2 Personnel

5.2.1 The laboratory shall have procedures for defining the initial and ongoing competency of all personnel. Personnel shall have demonstrated their competency prior to working on customer samples.

The phrase "working on" means the analyst performs the analysis of customer samples independently with the intention of reporting the results. Whenever a trainee is performing tasks on customer samples, the trainee must do so under the supervision of a trained analyst and it is the trained analyst who takes responsibility for these tasks. The laboratory must ensure that the trainee performing the tasks does not impact the analysis. An example where a trainee may perform a task on customer samples is the simple task of pureeing plant material such as lettuce; the task has a distinct endpoint that the trained analyst can observe and ensure the trainee has performed correctly. Another example is entering sample sets into a computer. The trained analyst can verify the information is correct and entered correctly before the analysis takes place.

Data demonstrating the initial and ongoing competency of all personnel shall be retained along with, or be referenced in the training records. Records shall include verification that the effectiveness of the training action has been evaluated.

A review of the completeness of training records, ongoing analytical performance (e.g. results of internal and external quality controls such as proficiency testing, control charts, etc.) and training requirements shall be performed periodically.

The need for competency re-verification shall be assessed and, if needed, implemented for those individuals who have not performed a particular analysis for a prolonged period of time.

Personnel working in teams or work groups shall be qualified as a team or work group. Alternatively, a staff member can be qualified on only a portion of a procedure. In these cases, the training records shall reflect the appropriate training authorizations.

Each person engaged in the process shall have training and experience that is appropriate to their assigned functions. Sufficient supervisory resources shall be provided to ensure appropriate supervision and oversight of all personnel. The number of personnel reporting to supervisors and managers shall be based on the complexity and diversity of the testing work within the organization.

5.2.2 Laboratory management shall retain records that demonstrate that each individual has the required knowledge, skills, and abilities to adequately perform their assigned tasks. All personnel operating under this document shall have training, at pre-determined intervals, on their roles and responsibilities in the management system and in its proper maintenance.

5.3 Accommodation and Environmental Conditions

5.3.2 Environmental monitoring requirements shall be planned and results shall be recorded. Monitoring shall be consistent with the industry standard for the field of testing on the scope of accreditation. The environmental monitoring shall meet the requirements of the test methods listed on the scope of the accreditation. Additionally, monitoring shall include the requirements necessary to operate instrumentation properly. Examples of microbiological monitoring are laboratory swabbing, hand swabbing, air plates, water testing, and PCR amplicon swabbing. Examples of chemistry monitoring are instrument room temperatures and water testing.

The grade of any reagent or reference material used (including water) that affects the quality of tests should be stated in the method together with guidance on any particular precautions that should be observed in its preparation or use. Samples, reagents, measurement standards and reference materials must be stored so as to ensure their integrity. In particular, consideration should be given to avoiding the potential for cross-contamination when storing samples. The laboratory should guard against their deterioration, contamination, and loss of identity. Reagents, reagent solutions, media, and sample solutions shall not be used past their expiry date without verification that they are still suitable for use.

The laboratory must define the use of the water and ensure the water is fit for that use. There are various documents that state specifications for water, such as USP, EP, the Standard Methods for the Examination of Water and Waste Water (SMEWW), and ASTM Standard D1193-06 Standard Specifications for Water.

5.3.3 Frequently, it will be necessary to segregate certain types of work that are prone to interference from other work, or which present particular problems or hazards. Examples include but are not limited to areas for reagent preparation or trace analysis instrumentation where physical separation to avoid systems contamination is necessary. When selecting designated areas for special work, account shall be taken of the previous use of the area. Before use, confirm the area is ready for use. Once in use, access to such areas shall be restricted, as needed, and the type of work undertaken there carefully controlled.

5.3.4 "It may be necessary to restrict access to particular areas of a laboratory because of the nature of the work carried out there. Restrictions might be made because of security, safety, or sensitivity to contamination or interferences. Typical examples might be work involving explosives, radioactive materials, sterility testing, carcinogens, forensic examination, polymerase chain reaction (PCR) techniques, and trace analysis. Where such restrictions are in force, staff shall be appropriately trained on the:

- intended use of a particular area
- restrictions imposed on working within such areas
- reasons for imposing such restrictions
- procedures to follow when such restrictions are breached"

[*CITAC/Eurachem Guide to Quality in Analytical Chemistry: An Aid to Accreditation* (2002)]

5.3.5 For pharmaceutical laboratories, cleaning and sanitization schedules shall be established by the laboratory for laboratory areas (benches, floors, etc.) and for laboratory equipment (incubators, water baths, centrifuges, refrigerators, freezers, etc.). Sanitization of key areas and equipment shall be recorded.

For microbiological testing, in cases where sterile supplies are necessary, the supplies shall be purchased as sterile or sterilized in the laboratory (e.g., gloves, pipettes, pipette tips, petri dishes, tongs, etc.). If the laboratory sterilizes the item, it shall maintain the item in a sterile condition/environment.

5.4 Test and Calibration Methods and Method Validation

5.4.2 Selection of Methods

Matrix and analyte matched Certified Reference Materials, when available, shall be used to determine any systematic method bias. Where this is not possible, method bias shall be determined by using a variety of techniques, preferably based on different principles of analysis. All laboratory-developed and non-standard methods shall be fully documented, including validation data, limitations of applicability, procedures for quality control, and calibration. Determination of measurement uncertainty shall form part of the method validation process.

The laboratory must confirm it can properly perform standard methods **before** these are used in routine testing (e.g. it is not appropriate for the laboratory to run concurrent controls and/or reference materials in order to qualify their competence to perform the method at same time they are running the sample, rather the laboratory must be able to properly prove the method is fit for purpose beforehand).

Note: Where no method is specified, the laboratory shall choose an appropriate method. Examples of food, dietary supplement, and pharmaceutical methods are found in AOAC, USDA, FDA, EPA, AOCS, AACC, ISO, IUPAC, USP, and FCC method manuals. Many trade associations publish their own methods and provide useful resources. A few examples include the Corn Refiners Association, National Food Processors Association, Association for Dressings and Sauces, and the American Spice Trade Association.

The laboratory shall record the laboratory representative who authorized adoption of the method and the date this authorization was granted.

Adjustments to maintain system suitability specifications that do not alter the fundamental nature of the method may be made without validation. Modifications of methods that alter the fundamental nature of the method shall be validated to demonstrate that equivalent results are obtained and that the method is suitable for its intended use.

5.4.5 Verification and Validation of Methods

Note: There are many documents that provide guidance for method verifications and validations such as, "AOAC Reference Guidelines for Validation of Qualitative Binary Chemical Methods", "AOAC Reference Guidelines for Validation of Microbiology Methods for Food and Environmental Surfaces", IUPAC "Guidelines for Single-Laboratory Validation of Methods of Analysis", and "Definitions and Calculations of HorRat Values from Intralaboratory Data".

Note: The AOAC Food Triangle, along with the applicable NIST SRMs is a useful tool for food when determining how many different food matrices should be part of the validation or how to select representative matrices when expanding the scope of an existing method. There are limitations in the assumptions inherent in the triangle (e.g., a method for shellfish toxins in oysters does not necessarily work well for scallops and the Food Triangle would not show this).

5.4.5.3

Note: Accuracy can be established by analyzing a suitable Reference Material. It is preferable to work with well characterized, homogenized, and stable materials such as NIST standard reference materials or proficiency test samples; however, an estimation of accuracy can be obtained by spiking test portions. The value of spiking is limited, as it can only be used to determine the accuracy of those stages of the method following the spiking. Accuracy can also be established by comparison with results obtained by a definitive method or other alternative procedures and via interlaboratory comparison studies.

5.4.6 Estimation of Uncertainty of Measurement

5.4.6.3 The laboratory will be required to identify the components of uncertainty in their test methods and calculate estimates of measurement uncertainty when required by the accrediting body. The ISO *Guide to the Expression of Uncertainty in Measurement* (GUM), ISO Guide 98, and the corresponding American National Standard ANSI/NCSL Z540-2-1997 (R2012) provide the current international consensus method for estimating measurement uncertainty. There are three main categories of uncertainty in life science testing laboratories: qualitative test methods, semi-quantitative test methods, and quantitative test methods.

Uncertainty of measurement can be estimated using quality control data, such as the analysis of reference materials. The standard deviation of data points is multiplied by the uncertainty coverage factor, *k*, obtained from the Student *t*-tables. At least 20 data points should be used, though it can be calculated using fewer points, as long as the appropriate coverage factor is used. If using this approach, the laboratory shall demonstrate that all uncertainty components which are of importance in the given situation have been taken into account, such as sampling which may not be a component in the uncertainty estimated from the analysis of reference materials. In some cases matrix or analyte specific estimates of measurement uncertainty may need to be calculated. Method validation data, if available and appropriate, may be used to estimate uncertainty of measurement. Depending on the test method and the accrediting body, in the case of collaboratively studied methods, the reproducibility standard deviation may be used to estimate the uncertainty.

It is important for the laboratory to understand what the major factors of uncertainty are and provide appropriate control for all such factors. Refer to S L R Ellison and A Williams (Eds). Eurachem/CITAC guide: Quantifying Uncertainty in Analytical Measurement, Third edition, (2012) the GLP Handbook from the Organization of Economic Cooperation and Development (OECD), Handbook: Good Laboratory Practice (GLP), Quality Practices for Regulated Non-Clinical Research and Development for additional information.

5.5 Equipment

Records of the calibration, verification, service, and maintenance of equipment shall be maintained.

In addition to the routine maintenance that is performed on a measuring instrument, each instrument type may require

additional performance checks. Examples include the consistency of retention times and resolution of analytes in a chromatographic system, the stability and linearity of a detector, and the resolution, alignment and wavelength accuracy of spectrometers. Results of these performance checks shall be documented. The frequency of such performance checks shall be specified in manuals or operating procedures based on manufacturer requirements, lab experience, equipment type, and/or previous performance of the equipment. Intervals for performance checks should be shorter than the time the equipment has been found, in practice, to take to drift outside acceptable limits. The performance checks shall be satisfactorily completed before the equipment is used. The manufacturer of the instrument may be consulted and should offer a program to ensure proper instrument performance.
Many types of equipment can affect a test result and thus will require calibration or verification as well as maintenance. The laboratory shall have a plan and/or procedure for the calibration or verification and maintenance of the equipment listed in Appendix A, Table 1. Appendix A, Table 1 provides minimum requirements for the calibration and verification of critical equipment; regulations and accrediting bodies may specify additional requirements.

5.6 Measurement Traceability

According to 5.6.1 and 5.6.2 of ISO/IEC 17025 and the ILAC Policy on the Traceability of Measurement Results (ILAC-P10:01/2013), if the calibration of instruments used in testing contributes significantly to the overall uncertainty of the measurement result the requirements of traceability to the International System of units should be met. Further information about meeting the requirements for traceability are available in ILAC P10 and policy documents provided by the individual accrediting bodies. If the equipment or instrument does not contribute significantly to the overall uncertainty, demonstrated by calculation of a full uncertainty budget, the traceability to the SI may not be required.

Note: Depending on regulations, the frequency of verifications or calibrations may need to be increased; in these cases, laboratories shall always follow the most stringent requirements to remain in compliance with their specific programs.

The following guides and policy are useful when developing and maintaining the program and procedure for establishing trace ability:

EURACHEM/CITAC Guide: Traceability in Chemical Measurement—A guide to achieving comparable results in chemical measurement (2003) http://www.eurachem.org/

Meeting the traceability requirements of ISO/IEC 17025: An Analyst's Guide, 3rd Edition

ILAC-P10 International Laboratory Accreditation Cooperation (2013 ILAC) Policy on Traceability of Measurement Results,

5.6.3 Reference Standards and Reference Materials

5.6.3.1 Reference Standards

Reference Standards shall be stored according to the documentation supplied, unless valid reasons exist for not doing so. Deviations from documentation should be recorded and justified appropriately. Documentation accompanying the reference standard shall be stored in the laboratory's record management system and available at all times.

Reference standards shall not be used past their expiry date without requalification demonstrating that they are still suitable for use.

5.6.3.2 Reference Materials

All Reference Materials shall be labeled using an identification scheme that allows the laboratory to trace the lot of Reference Material used in any analysis. In addition, each Reference Material shall be labeled with the date received and expiration date. Upon receipt of the Reference Material, records shall also be kept to include name or description, manufacturer's lot number, assigned laboratory number, date received, manufacturer's expiration date if

available, or laboratory determined expiration date, and traceability to the person assuming responsibility for the chemical Reference Material. For further guidance, refer to APLAC TC012-09/10, "Guidelines for acceptability of chemical reference materials and commercial chemicals for calibration of equipment used in chemical testing."

Reference Materials shall not be used past their expiry date without requalification demonstrating that they are still suitable for use.

If possible, Reference Materials shall be obtained from Reference Material producers accredited to ISO Guide 34, "General requirements for the competence of reference material producers."

5.7 Sampling and Sub-Sampling

Most laboratories do not sample materials outside the laboratory. When the laboratory has not been responsible for the sampling stage, it may be appropriate to state in the report that the samples were analyzed as received. The customer selects samples in the vast majority of cases. In cases where the laboratory is required to conduct field sampling of products, they shall comply with established procedures for those programs (for example, the Meat Importers Council of America sampling plan for fat testing) and these requirements.

Most laboratories do not test the entire sample as received, but instead perform testing on a sub-sample (portion, aliquot, etc). The laboratory shall have documented procedures for sub-sampling, compositing, and/or homogenization to ensure that a representative test portion is used for analysis.

Note: Whatever strategy is used for the sampling, it is of vital importance that the sampler keep a clear record of the procedures followed in order that the sampling process may be repeated exactly and that the analytical result is traceable to the lot it represents. Routinely used sampling procedures should be fully documented. "In some circumstances, for example where samples have been taken for legal purposes, the sample may be sealed so that access to the sample is only possible by breaking the seal. Confirmation of the satisfactory condition of the seals will normally form part of the analytical report." [*CITAC/Eurachem Guide to Quality in Analytical Chemistry: An Aid to Accreditation* (2002)]

Note: Appropriate considerations should be made for multi-phase and labile samples, aseptic handling, cross-contamination, and other issues to reduce the known errors associated with sample heterogeneity. "If the laboratory has conducted or directed the sampling stage, it should report on the procedures used and comment on any consequent limitations imposed on the results." "Where more than one sample is taken from the original material it may be useful to include a diagram as part of the documentation to indicate the pattern of sampling. This will make it easier to repeat the sampling at a later date and also may assist in drawing conclusions from the test results." [*CITAC/Eurachem Guide to Quality in Analytical Chemistry: An Aid to Accreditation* (2002)]

5.8 Handling of Test and Calibration Items

5.8.1 Storage areas shall be kept clean and organized so there is minimized risk of contamination or cross-contamination. The samples shall be stored in such a way that the packaging, and/or any related seals are not damaged. Adverse extremes of environmental conditions shall be avoided.

A checklist detailing the sample storage procedure can be used to ensure all necessary steps are taken to store the sample correctly. Adverse storage conditions might change the composition of the sample, for example, causing loss of analyte through degradation or adsorption. If necessary, environmental monitoring shall be used. An appropriate level of security shall be exercised to restrict unauthorized access to the samples.

5.8.2 Labeling shall be firmly attached to all of the sample portions packaging and, where appropriate, be resistant to fading, autoclaving, sample or reagent spillage, and reasonable extremes of temperature and humidity.

Note: Sample labeling is particularly important as a sample progresses further into the analytical process where the sample may be divided, subsampled, or modified in some way. In such instances, additional information may be appropriate, such as references to the main sample, and to any processes used to extract or subsample the sample.

Note: Bar-coded labels offer advantages from an efficiency viewpoint, but shall conform to the requirements listed above.

5.8.4 Staff associated with administration of the sample handling system shall be properly trained, competent, and authorized. Minimum sample retention periods and storage conditions shall be documented in the management system and communicated to customers so that all parties are aware of how long the sample will be available for retesting or retrieval.

5.9 Ensuring the Quality of Test Results

5.9.1 Quality Control Testing

Quality Control Samples

Quality control procedures shall be defined for both quantitative and qualitative methods. These procedures shall include the use of quality control samples (QCS), with each batch of samples in order to demonstrate that the test worked properly. The laboratory shall define and justify what constitutes a batch of samples. A QCS includes, but is not limited to, CRMs/RMs, replicate analyses, positive/negative control samples, laboratory control samples, blanks, and matrix spikes. When testing for pathogens or select agents, a quality control sample that contains a surrogate analyte may be used.

Note: Some laboratories use the term "batches"; other laboratories use the term "lots." Any term is acceptable; but, the laboratory must define the term unambiguously.

Analysis of a Certified Reference Material (CRM) is the best measure of method accuracy. However, for some analytical sectors there may not be a CRM. In this case the laboratory must determine an appropriate reference material (RM) or secondary RM that can provide a measure of accuracy. A CRM may be available, but may be so scarce or expensive that it limits the ability of the laboratory to use the CRM routinely. In this case it might only be used to qualify secondary RMs. In the absence of any CRM/RM the laboratory shall do its best to obtain a material with some limited consensus of accuracy (e.g., by subjecting material to multiple methods or analyses in-house, sharing material with another laboratory to determine an average result, etc.). The suitability of the QCS used shall be justified by the laboratory.

There are a number of techniques to measure method precision. Duplicate or replicate analyses of a CRM/RM, positive samples, matrix spikes, laboratory control samples, or reference materials can be used. Precision can also be demonstrated by evaluating data over time using appropriate statistical process control (SPC) techniques.

Proficiency Test Samples

Proficiency testing (PT) is the determination of the testing performance of a laboratory against pre-established criteria by means of inter-laboratory comparison. Inter-Laboratory Comparison (ILC) is the evaluation of test results for the same or similar item by two or more laboratories in accordance with predetermined conditions. The laboratory shall have a documented proficiency testing plan for all test methods on the scope of accreditation. Proficiency testing shall be performed following the normal working practices operated in the laboratory. They are not intended to represent individuals in the laboratory, unless this represents the normal mode of operation where only one person is involved in the analysis. They shall be rotated among qualified analysts.

Note: When selecting an external scheme, consideration should be given to using a scheme that is based on the requirements of ISO/IEC 17043:2010, and, when available, one that is accredited to this standard.

Pre-Accreditation: The laboratory shall have successfully analyzed proficiency testing samples for each test, type of test/method, and/or technique for which the laboratory wants to become accredited. When a relevant external PT program is not available, alternative means of evaluation may be used as described below.

Laboratory On-going Competency: Laboratories shall participate in at least one PT event annually for each test, type of test/method, and/or technique on the scope of accreditation.

Competency by Alternative Means of Evaluation: For those tests/methods and/or techniques which are not covered by relevant and available external PT schemes, the laboratory shall demonstrate competency by an alternative means of evaluation, justifying its actions. Alternative actions, listed in suggested order of preference, are:

- Participate in a round robin: interlaboratory test performed independently several times
- Testing of a blinded well characterized LCS
- Performance of an ILC with other accredited testing labs
- Performance of a comparison with another test method/technology
- Address the elements identified in ISO/IEC 17025 Section 5.9 including the evaluation criteria of the data

5.9.2

Quality Control Sample Acceptability

The laboratory shall have procedures that define the acceptability of quality control samples. A laboratory's SPC data shall be reviewed on a regular basis that ensures it is reporting reliable data. The laboratory shall define what constitutes a trend in the SPC data and investigate trends where necessary. Corrective action shall be initiated when controls do not meet the established acceptability criteria.

When using multi-analyte test methods the probability exists that at least one analyte in each run will be out of limits; however, that does not necessarily mean there is an error and assignable cause for the result. The laboratory's criteria should be balanced: avoiding unproductive corrective actions for statistically random events, yet not so broad as to ignore correctable, non-random errors. The laboratory's criteria may take into consideration the fact that for some multi-analyte methods, some analytes behave better than others (i.e. exhibiting less variance and/or higher mean recovery) and that an analyte's variance may increase as the concentration of the analyte decreases. There are several approaches that could be taken to set limits that take into account the probability of an out of control result in multi-analyte methods.

- Assign the analytes to groups that have similar analytical characteristics or chemical structure. An example of this is low-molecular-weight ketones that tend to be lost in the sample preparation process or organic acids that may be poor performers in certain extraction processes. Then the quality control and control charting procedure can be designed to track a representative analyte of each of these groups.
- Set limits that take into the account the probability that an out of control result will be encountered, such as the approach set forth for environmental testing laboratories in the 2003 National Environmental Laboratory Accreditation Conference (NELAC) Standard (Appendix D, section D.1.1.2.1.e).

Proficiency Test Sample Acceptability

The laboratory shall evaluate PT results when they are received. Most external PT providers issue acceptability limits and criteria; if issued, the laboratory shall use the PT provider's criteria to evaluate the results. If the PT provider does not issue acceptability criteria or the laboratory is performing proficiency testing by the alternative means described above, then they shall have procedures that define the acceptability of the results.

The following information provides guidance to assist the laboratory in evaluating the results. The assigned value can be established by one of the following four options:

- Consensus of the majority of the laboratories, providing that a sufficient number of laboratories participate in a particular round (set). When using a consensus value, outliers may be removed for statistical analysis after an error analysis has been shown to be inconclusive
- The SPC ranges for blinded LCSs
- Fortification value of prepared samples
- Assigned result from a previous round (set)

- Results obtained from a group of two or more accredited laboratories for that analyte which have demonstrated proficiency in the past

Note: Proficiency testing is only a part of the overall quality assurance of test results and should not be used as the only assessment of laboratory competency.

5.10 Reporting the Results

Procedures, including the use of handwritten and electronic signatures, shall be established to prevent the production of unauthorized reports or other documents. For dietary supplement and pharmaceutical laboratories, electronic records and signatures must meet the requirements of USA Title 21, *Code of Federal Regulations*, Part 11.

Appendix A: Equipment

Table 1. Calibration, verification, and service of equipment or systems		
Equipment /System	Parameter	Frequency
Autoclaves	Accuracy of temperature sensing system	Calibrate at installation (or initial use) Verify annually
	Temperature and Pressure	Verify each load
	Performance	Verify weekly with *Bacillus stearothermophilus* biological sterility indicator
	Uniformity and stability of temperature[D]	Conduct an initial mapping of the chamber and annually thereafter.
	Service	As recommended by manufacturer or per laboratory procedure
Automated colony counters	Accuracy	Verify annually with manual count
Balances	Mass measurement	Verify daily when in use with internal calibration or with a working weight Calibrate annually[A]
Chromatographic Systems (GC, IC, LC)	Detector Response	Verify at a frequency established by the test method or laboratory using multi-level standards that establish a correlation between analytical standard concentrations and instrument response[E]
		Verify with an analytical standard at mid-range concentration with each batch
DI Systems	Conductivity	Weekly
Dispensing equipment and vial fillers used in Microbiology	Mass measurement/volume	Verify at installation and daily when in use at each volume dispensed
Freeze-dryers, vacuum ovens	Ability to achieve and sustain vacuum; gauges calibrated or verified	Verify annually
Fume Hoods	Service	Annually
Hydrometer, reference	Specific gravity	Calibrate Every 2 years

Table 1. Calibration, verification, and service of equipment or systems		
Equipment /System	Parameter	Frequency
Hydrometer, working	One point comparison to reference hydrometer	Verify Annually
Microscope	Length	Calibrate stage micrometer at installation
pH meters, ion selective, and related conductivity equipment	Reading with standard reference buffers[C]	Verify (bracketing range-of use)
Safety cabinets and laminar airflow cabinets (if used for culture or sterility work)	Magnehelic gauge	Verify at installation and each day of use
	Open media control (sterility check)	During each use
	Service	As recommended by manufacturer
Temperature controlled chambers (refrigerators, freezers, ovens, furnaces, waterbaths)	Temperature	Monitor continuously with a validated system or check daily when in use.
	Uniformity and stability of temperature [D]	Conduct an initial mapping of the chamber. Verify annually and/or if the instrument has had maintenance repairs that would affect the inner chamber.
Temperature controlled chambers used for incubation (incubators, water baths)	Temperature	Check daily am and pm when in use
	Uniformity and stability of temperature[D]	Conduct an initial mapping of the chamber. Verify annually and/or if the instrument has had maintenance repairs that would affect the inner chamber[G].
Temperature sensing devices/systems (e.g., thermometers, thermocouples, data loggers, data tracers, thermistors, digital displays, continuous monitors, etc.)	Temperature	Reference Device: Calibrate annually
		Working Device: Verify annually against reference device[B]
Timers and Internal Timing Devices[F]	Time	Calibrate reference device annually if used
		Verify annually working device against reference or against NIST time clock[B]
UV/Vis Spectrophotometer	Blank reading	Verify Daily when in use
	Wavelength	Verify at installation by manufacturer

Table 1. Calibration, verification, and service of equipment or systems		
Equipment /System	Parameter	Frequency
Volumetric delivery devices: mechanical pipets, micropipettors, mechanical burets, and bottle-top dispensers	Accuracy and precision using mass of water or by spectrophotometric method	Verify every 6 months or at an increased frequency if required by regulation or test method
Volumetric delivery devices: positive displacement syringes used for volumetric delivery	Accuracy	Verify upon receipt; (manufacturer's Certificate of Accuracy may be accepted)
Volumetric glassware, non-class A—pipets, burets, and volumetric flasks	Accuracy and precision using mass of water or by spectrophotometric method	Verify upon receipt; (manufacturer's Certificate Accuracy may be accepted)
Water activity meter	Water activity of known solutions	Verify daily when in use[C]
Weights, reference	Mass	Calibrate every 5 years[A]
Weights, working	Mass	Verify against reference weights annually

Notes:

A: All weights and balances shall be calibrated traceable to recognized national or international calibration units (i.e., National Institute for Standards and Technology (NIST), Bureau International des Poids et Mesures (BIPM), Organisation Internationale de Metrologie Legale (OIML), or equivalent traceable weights). Accrediting bodies may require calibration by an ISO17025 accredited calibration laboratory.
B: Accrediting bodies may require initial calibration by an ISO17025 accredited calibration laboratory.
C: When pH and water activity are used to generate results reported to the customer the traceability requirement is critical; hence, the reference material (e.g. buffer or water activity analytical standard) needs to be one that has the estimate of uncertainly available in the Calibration Certificate. In addition, the calibration must be done in a defined manner to take into account the measurement uncertainty. Accreditation bodies may require buffers obtained from a Guide 34 accredited manufacturer.
D: Uniformity and stability may not be needed for the following equipment: small chambered autoclaves, incubators, ovens, and refrigerators; circulating water baths; muffle furnaces; and freezers based on use or design. In these cases, the laboratory should have reasonable justification and document the justification for not determining uniformity and stability.
E: Frequently, an instrument such as a gas chromatograph does not lend itself to calibration using a national or international standard. In these cases, adequate performance of the whole method involving the instrument is ensured by using a Certified Reference Material (CRM) or Reference Material (RM).

F: Timers and internal timing devices only need to be verified when time is a critical factor in the test method. Time may not be a critical factor when time is not the reported result or a specific time requirement is not required for the test method.
G: When determining mapping schedules, attention should be paid to extremes in laboratory ambient conditions (such as those brought on by seasonal changes) that can influence the performance of equipment.

Appendix B: Microbiology

1. Organisms

The organisms required for the tests shall be verified, stored appropriately, checked for purity and demonstration of biochemical or other biological characteristics, as appropriate for their application

The organisms are traceable and documented from date of possession.

2. Media

2.1 Dehydrated Media Requirements and Records

2.1.1 There shall be a lot acceptance procedure where each lot will be evaluated for suitability before use.

2.1.2 Records of commercially purchased dehydrated media shall be kept to include media name or description, manufacturer's lot number, assigned laboratory identification, date received, date opened, date prepared for quality control (QC), manufacturer's expiration date, and initials of responsible person providing this information. All dehydrated media shall be labeled with laboratory identifier, date received, and date opened.

2.1.3 Every batch of media prepared internally or purchased externally shall be examined to ensure it is suitable for use. Media preparation records are technical records (*see* 4.13.2.1) and shall include preparation, traceability to dehydrated media, pH (as specified in the instructions/recipe), appearance, sterilization batch (with related records), fill volumes (if appropriate), batch size, and quantity. The evaluation of prepared media shall include productivity (+ culture), selectivity (if appropriate), and sterility. The records shall be traceable to the person approving or rejecting the media.

3. Reagents/Kits/Identification Systems

As with media, every lot of materials shall be approved following a specified procedure. Records include the date approved and traceability to the person approving or rejecting the material.

4. Sterilization

Autoclave records shall show date, run number, autoclave identifier, nature of material/load, time at desired temperature, and traceability to persons performing the activities.

For other sterilization means, records shall show date, nature of material, and confirmation of sterilization procedure (including heating condition, filtration, and chemical denaturation) and traceability to persons performing the activities.

Appendix C: Chemistry

The laboratory shall define the acceptance criteria for each test method for the following items (when included in the test method): calibration curves, calibration checks, second source standards, quality control samples, blanks, spikes, matrix spikes, and duplicates.

The laboratory shall have a procedure or policy that provides guidance and/or criteria for the reprocessing and/or reintegrating of analytical data.

Appendix D: Pharmaceutical Analysis and Legal Standards

(A pharmaceutical laboratory approach to measurement uncertainty is stated in ISO/IEC 17025 Sections. 5.4.1, 5.4.6.2, 5.4.6.3, 5.6.3.1, and 5.6.3.2)

A pharmaceutical product shall conform to its Legal Standard Requirements throughout its expiry period. The Legal Standard Requirements include an allowable statement of uncertainty. Uncertainty or variance components resulting from sampling, Legal Reference Methods (testing requirements), Compendial Reference Standards, etc., are included in the Legal Standard Requirements. It is very important that the Compendial Reference Standards values and the assessments of Legal Standard Requirements remain unchanged because these values are linked to the product safety and efficacy data. Any uncompensated change in a method or a Reference Material is a change in the Legal Standard that should not occur without careful consideration with regard to manufacturing requirements, product safety and efficacy implications, and market competition.

Appendix E: Legal Samples

Legal samples are samples to be used in a court of justice or samples taken under the authority of a government agency for legal testing. All legal procedures prescribed by the agency or the body requiring the samples must be followed.

A chain of custody procedure must be applied for all samples and fully documented. Retain samples, if available or sufficient, for additional testing or to fulfill the right to access a second opinion or expertise must be kept according to the body requiring the sample.

Process for Selecting Members of the Official Methods Board (OMB)

The process begins with the OMB Search Committee.

Composition

The Search Committee shall consist of three (3) members: two members of the current OMB and the Immediate Past Chair of the OMB who shall serve as chair of the Search Committee.

Purpose

The objective of the Search Committee is to identify and recommend a slate of nominees as potential candidates for membership on the OMB. They shall seek candidates from such sources as the Association Membership, the Communities, and Stakeholders Groups. The OMB will select a nominee from this slate.

Process

Criteria for Member of the OMB

- Must provide a current Curriculum Vitae
- Should be a member of AOAC INTERATIONAL in good standing
  - Must have a letter of support from the sponsoring organization [employer/supervisor]
  - Must have an executed AOAC Volunteer Acceptance Form
  - Must provide two letters of recommendation from someone other than an employee, employer or supervisor.
- Should be willing and capable of acting as a Liaison with the Communities, Technical Divisions, Research Institute, and other major Stakeholders.
- Should possess the minimum of a Bachelor's degree in chemistry, biology, mathematics or a related scientific field
- Should demonstrate technically competent written and oral communication and networking skills
- Should demonstrate leadership capabilities through documentation of project management, supervisory experience, or leadership positions within AOAC
- Should have experience in the AOAC collaborative study process
- Should be familiar with the AOAC Program Manual and the Official Methods of Analysis appendices
- Should have successfully completed OMB training in the method validation process, demonstrate ability to perform adequate review of AOAC collaborative studies, and agree to appropriate retraining at least every three years.

Appointment of the Candidate

The nominee shall be contacted by the Chair of the OMB to confirm his/her willingness and ability to serve. Once confirmation has been received, the nominee shall be presented to the Board of Directors for their approval and subsequent appointment by the President of the Association.

Composition of The Official Methods Board

The OMB shall be composed of the Chair, Vice Chair, the Chair of the Safety Committee, the Chair of the Statistics Committee, and up to 9 more members not to exceed a total of 13 members at any given time. The 9 appointed members are to represent a balance of government, industry, and academia as appropriate to the needs of the Association. No more than one-half of the members of the OMB may be from a single agency and no more than one-half of the members may be from industry.

AOAC INTERNATIONAL
OFFICIAL METHODS BOARD
2014 –2015

Chair	**Shauna Roman** Reckitt Benckiser, Inc. Shauna.Roman@reckittbenckiser.com Term: August 29, 2013 – September 21, 2016	*Member*	**Joe Boison** Canadian Food Inspection Agency Joe.Boison@inspection.gc.ca Term: August 29, 2013 – September 21, 2016
Member	**Doug Abbott** Independent Consultant dabbott2@bresnan.net Term: September 11, 2014 - September 27, 2017	*Member*	**Perry Anthony Martos** University of Guelph pmartos@uoguelph.ca Term: October 4, 2012 - September 30, 2015
Member	**Sneh Bhandari** Silliker, Inc. Sneh.Bhandari@Silliker.com Term: August 29, 2013 – September 21, 2016	*Member*	**Shang-Jing Pan** Abbott Nutrition shang-jing.pan@abbott.com Term: October 4, 2012 - September 30, 2015
Member	**Jo Marie Cook** Florida Department of Agriculture and Consumer Services JoMarie.Cook@freshfromflorida.com Term: August 29, 2013 – September 21, 2016	*Member*	**Tom Phillips** Maryland Department of Agriculture phillitd@mda.state.md.us Term: August 29, 2013 – September 21, 2016
Member	**Erin Sutphin Crowley** Q Laboratories, Inc. ecrowley@qlaboratories.com Term: October 4, 2012 - September 30, 2015	*Member*	**Victoria Siegel** Office of the Indiana State Chemist - Purdue University vsiegel@purdue.edu Term: September 11, 2014 - September 27, 2017
Member	**Qian Graves,** US FDA *AOAC Committee on Statistics, Chair* Qian.graves@fda.hhs.gov Term: August 29, 2013 – September 21, 2016	*Member*	**Bradley Stawick** Microbac Laboratories, Inc. brad.stawick@microbac.com Term: October 4, 2012 - September 30, 2015
Member	**Yvonne Salfinger,** Independent Consultant *AOAC Committee on Safety, co-Chair* Yhale@aol.com Term: August 29, 2013 – September 21, 2016	*Past Chair (Ex-officio Member)*	**John Szpylka** Silliker, Inc. John.Szpylka@Silliker.com Term: August 29, 2013 – September 21, 2016

AOAC Staff Liaisons

Deborah McKenzie Sr. Director- Standards Development Sr. Director- AOAC Research Institute dmckenzie@aoac.org	Delia Boyd Program Manager – Standards Development dboyd@aoac.org

AOAC INTENATIONAL Terms begin following the AOAC Business Meeting. Terms expire at the AOAC Business Meeting.

The Scientific Association Dedicated to Analytical Excellence®

AOAC INTERNATIONAL

TERMS OF REFERENCE

I. NAME:

OFFICIAL METHODS BOARD (OMB)

II. MISSION:

To serve the Association in a scientific and advisory capacity on standards and methods with ethical, timely, open and independent scientific oversight for the implementation of standards development and conformity assessment policies and procedures of AOAC INTERNATIONAL.

III. RESPONSIBILITIES:

To provide ethical, timely, open and independent scientific oversight for the policies and procedures of AOAC INTERNATIONAL.

To approve "Final Action" status for First Action Methods (new and revised) following a proactive review;

To repeal methods, if necessary, in accordance with established policies and procedures;

To participate in addressing appeals and requests for action or guidance, and in resolving disputes;

To endorse and monitor all voluntary consensus panels for appropriate representation and balance of stakeholders' perspectives;

To endorse and monitor all volunteer subject matter experts for volunteer conformity assessment activities;

To adopt and monitor scientific and technical guidance and references;

To acknowledge outstanding scientific and technical volunteer activity and achievement within AOAC;

To actively participate in AOAC standards development activities and maintain and communicate explicit knowledge of AOAC standards development and conformity assessment;

IV. COMPOSITION AND ORGANIZATION:

The Official Methods Board shall consist of up to 13 voting members including a Chair, a Vice-chair, the Chair of the Committee on Safety and the Chair of the Committee on Statistics. The Committee on Safety and the Committee on Statistics may contain co-chairs. The co-chairs for these committees represent one vote on the OMB. Members of the OMB may serve in multiple volunteer roles for the benefit of the Association. The Chair of the Official Methods Board shall have previously served as a member of the Official Methods Board. The Chair, Vice-chair, and members of the Official Methods Board including the chairs of standing committees shall be appointed for a term of three years. A member of the OMB may be reappointed upon the recommendation of the Chair of the Official Methods Board with a maximum term of service of six (6) years. Exceptions may be made at the discretion of the President. The Chair of the Official Methods Board is eligible to serve an additional post chair term of up to three (3) years as an *ex-officio* member. Members of the Official Methods Board must be members of AOAC.

All members of the Official Methods Board are recommended by the Chair and appointed by the President. All Official Methods Board members serve at the pleasure of the President.

The Official Methods Board represents the membership of AOAC INTERNATIONAL. It shall be composed of members representing a balance of scientific expertise, government, industry, and academia as appropriate to the scope of the Board. Every effort should be made to include international representation on the Board.

Additional working groups, task forces, and other appropriate subgroups shall be appointed as needs arise by the Chair of the Official Methods Board.

V. STAFF LIAISON:

The Executive Director shall assign a member of the staff to serve as staff liaison.

VI. REVIEW SCHEDULE:

Every three years.

VII. DATE ESTABLISHED:

Renamed in 1981

VIII. DATES REVIEWED

01/08,

IX. DATES REVISED:

9/89; 5/90; 1/91; 8/06;
02/07; 07/07; 2/08; 4/13; 8/13

AOAC Research Institute
EXPERT REVIEW PANEL FOR FOOD ALLERGENS - GLUTEN

TABLE OF CONTENTS

MEMORANDUM

DATE: January 30, 2015

TO: Members of the Official Methods Board

FROM: La'Kia Phillips, Conformity Assessment Coordinator

SUBJECT: **AOAC Research Institute**
Expert Review Panel for Food Allergens - Gluten

BACKGROUND

AOAC will convene the Expert Review Panel (ERP) for Food Allergens – Gluten on **Thursday, March 19, 2015, from 8:30 a.m. to 5:00 p.m.** at the Hilton Washington DC North hotel in Gaithersburg, Maryland. This meeting will be held in conjunction with the 5th Annual AOAC Mid-Year Meeting.

The purpose of the meeting will be to:

1. Review the Collaborative Study Manuscript for R-Biopharm, Competitive Enzyme Immunoassay Based On The R5 Monoclonal Antibody To Determine Partially Hydrolysed Gluten In Foods Containing Wheat, Rye, And Barley
2. Discuss First to Final Action requirements and Feedback mechanisms.

RECOMMENDATION

The following four (4) candidates are being submitted for consideration by the Official Methods Board to evaluate candidate methods for Food Allergens - Gluten methods as an addition to the current panel as per the Expert Review Panel (ERP) Policies and Procedures.

Also, we are currently proposing Terry Koerner as the Co-Chair for this Expert Review Panel to serve with Shang-Jing (Jean) Pan.

The following candidates are highly recommended by the Food Allergens Community and other Food Allergen experts. Many of the following candidates have participated in various AOAC activities, including but limited to, members of Committee H, and expert reviewers for the AOAC Research Institute's PTM Program.

Current Panel

1. Shang Jing Pan (Chair)
2. Sneh Bhandari
3. Joe Boison
4. Eric Garber
5. Terry Koerner
6. Todd Marrow
7. Bert Popping
8. Girdhari Sharma (Alternate)
9. Paul Wehling

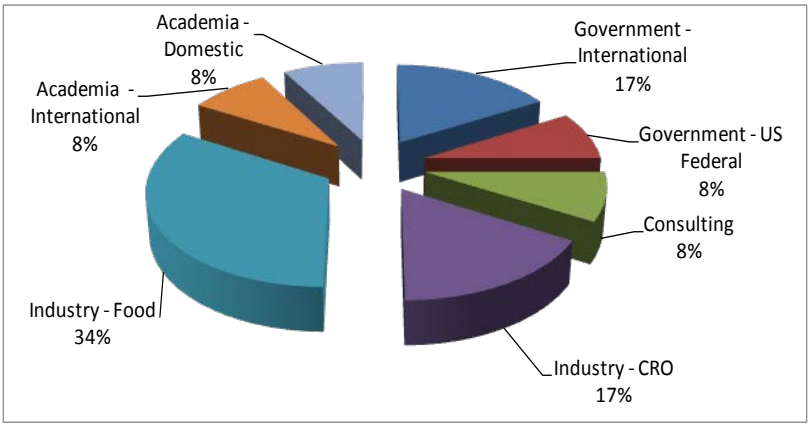
Proposed Candidates

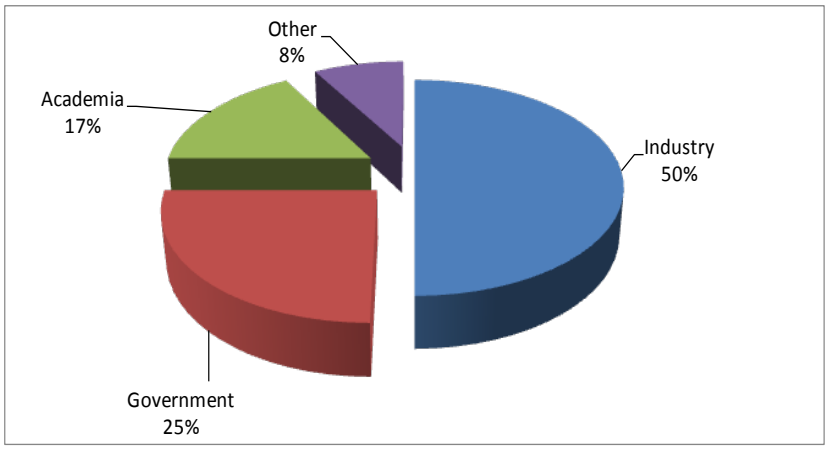
10. June Calero
11. Yie-Hwa Chang
12. Clyde Don
13. Jupiter Yeung

CURRENT EXPERT REVIEW PANEL ROSTER & PERSPECTIVES

Name	Organization	Perspectives	Status
Shang Jing Pan (Chair)	Abbott Nutrition	Industry - Food	Current
Sneh Bhandari	Silliker, Inc.	Industry - CRO	Current
Joe Boison	Canadian Food Inspection Agency	International government	Current
June Calero	**Hain Celestial Canada**	**Industry - Food**	**New**
Yie-Hwa Chang	**St. Louis University**	**Domestic Academia**	**New**
Clyde Don	**Food Physica**	**Consulting**	**New**
Eric Garber	U.S. Food and Drug Administration	Domestic government	Current
Terry Koerner	Health Canada	International government	Current
Todd Marrow	University of Guelph	International Academia	Current
Bert Popping	Eurofins	Industry - CRO	Current
Girdhari Sharma	U.S. Food and Drug Administration	Domestic government	Current
Paul Wehling	General Mills	Industry - Food	Current
Jupiter Yeung	**Nestle Nutrition**	**Industry - Food**	**New**

SPECIFIC & MAJOR PERSPECTIVES





JUNE L. CALERO
103-7227 Balmoral Street
|Burnaby, BC, Canada, V5E 1J6
Phone:(604) 785-1025
E-mail: junecalero@yahoo.ca

OBJECTIVE: To contribute my skills and abilities to the organization thru volunteer work

HIGHLIGHTS OF QUALIFICATION

- B.Sc. in Chemistry; worked as a Chemist for 11 years at Universal Robina Corp. and Colgate Palmolive in the Philippines.
- Proven problem-solving and analytical skills; well organized, with excellent planning and follow-through
- Proven ability to quickly master new job skills; performed complicated tasks quickly and accurately
- Record of rapid advancement based on demonstrated competence and leadership
- Excellent interpersonal, communication and leadership skills
- Good computer skills using Word and Excel

RELEVANT SKILLS AND ABILITIES

QA Microbiologist - Hain Celestial Canada, Delta, BC 2008-Present

- Performed Micro testing on all finished products, Raw Ingredients, R&D plant trial test.
- Improved Food safety awareness in the facility by daily monthly Food Safety Crew trainings(GMP, CCP, CQP, Sanitation). Conducts Environmental Swabbing on all Food contacts and Non Food Contact surfaces to ensure efficiency of the sanitation Program. Submits Micro trending report on Environmental Swabbing every month to monitor which areas need more cleaning. Performs allergen testing(Egg, Dairy, Soy) after every allergen production run before releasing the line for non allergen. Test are also done for Non GMO and Gluten Free.
- Conducts Shelf life and Code Determination in projects for QA, R&D and production. Ensures R&D and Process keep track of heir samples and timeline so tests are completed
- Support continuous improvement Projects for potential savings for grounds and Wieners
- Participates on all External Audits(Fraser Health, SQF, SAI Global, Non GMO and Whole Foods). Excellent rating was achieved for SQF level 3
- Performs Daily Sensory Evaluation on all finished Product.
- Prepared standard solutions and reagents used in laboratory testing

Lab Technician – Wyeth Organics, Brandon, Mannitoba 2007-2008

- Conducted Micro testing on city water for SPC, Coliform and Yeast and Mold using Millipore plates
- Performed testing on Purified water and water for injection in a timely manner, meeting all corporate and compendia criteria
- Operated and maintained Laboratory equipment such as Turbidimeter, Turbidimeter Analytical Balance, pH meter, Microscope. Ensured that calibration and a maintenance is performed at scheduled times
- Performed validation protocols for methods and equipment qualification
- Prepared standard solutions and reagents used in Laboratory analyses
- Acted as a second checker for calculations and reported information

QA Lab Technician - Leading Brands of Canada, Richmond, BC 2001-2007

- Conducted routine analyses on the Batches and Finished products to ensure that they within clients specifications on both the carbonated and non carbonated line
- Performed Micro testing on Finished products for SPC, Coliform and Yeast and Mold
- Operated and calibrated laboratory equipment such as pH Meter, Turbidimeter, UV Spectrophotometer and Refractometer.
- Documented and interpreted test results and reports analytical problems immediately to the Lab Manager and segregate all the affected products with proper hold tags Completed necessary documentation to support finding
- Trained new Technicians with ongoing mentoring to work as team
- Performed other duties as requested by the Laboratory Management

TRAINING

3M Food Safety Training - Surrey, BC - May 9, 2013

Sampling and Analysis - British Columbia Food Protection Association, Burnaby, BC - April 30, 2009

HACCP – Hain Celestial Canada – September 29, 2008

GMP and WHMIS – Hain Celestial Canada – September 29, 2008

GMP Basics for Finished Pharmaceutical Products - Wyeth Organics Brandon, Mannitoba, August 8, 2007

WHMIS – Wyeth Organics – Brandon, Mannitoba, August 07, 2007

RECOGNITION

5 Years of Service, Hain Celstial Canada

Extra Effort - for going above and beyond, Hain Celstial Canada

Instant Recognition – for exceptional organizational skills, Wyeth Organics

EDUCATION

High Performance Liquid Chromatography *2003*
BCIT
Burnaby, B.C

Food Safe Level 1 *2001*
Vancouver School Board
Vancouver, B.C.

Bachelor of Science in Chemistry *1979*
University of San Agustin
Manila, Philippines

Curriculum Vitae

Yie-Hwa Chang, Ph.D.

Education:

B.S. - Chemistry (Organic Chemistry major), National Taiwan University (1972-1977);
Ph.D. - Chemistry (Chemical Biology major), California Institute of Technology (1980-1986);
Research Fellow - Department of Molecular Biology, Massachusetts General Hospital and Department of Genetics, Harvard Medical School (1986-1991).

Current Position and Address:

Associate Professor (Tenured)
Dept. of Biochemistry & Molecular Biology
Saint Louis University School of Medicine
Doisy Research Center Room 515
1100 S. Grand Boulevard
St. Louis, MO 63104
Phone: 1-314-977-9263
E-mail: changyh@slu.edu

President
Mediomics, LLC
5445 Highland Park Drive,
St. Louis, MO 63110

Professional Society Memberships:

- American Chemical Society (1989-present);
- Society of Chinese Bioscientists in America (1985-present)

Awards and Hornors:

- Mallinckrodt Young Faculty Award (1991)
- 2011 MCASTA Outstanding Scholar Award (2011)
- 2011 SLU Faculty Innovation Award (2011)

Professional Services: (University or Departmental)

- Chinese Student Association, Chairman, California Institute of Technology (1982);
- Chinese Student Association of Southern California, Vice President (1983);
- Faculty Recruiting Committee, St. Louis University School of Medicine (1991-1992);
- Graduate Student Recruiting Committee, St. Louis University School of Medicine (1992-present);
- Graduate Curriculum Committee, St. Louis University School of Medicine (1992-1997);

- Graduate Curriculum Committee, Chairman, St. Louis University School of Medicine
  (1996);
- Curriculum Committee for Faculty Development, St. Louis University School of Medicine (1996);
- Faculty Search Committee (1999-2002).
- Chairman, Graduate Curriculum Committee (2008-2009)

Public Service:

- Chair, Biotechnology Session, Science and Technology Conference for Midwest Chinese American (1994, 1998);
- Chair of Scientific Program Committee, Science and Technology Conference for Midwest Chinese American (1995);
- Conference Chairman, Science and Technology Conference for Midwest Chinese American (1996, 1997);
- The Association of Science and Technology for Midwest Chinese American (Founder, 1999);
- St. Louis Academy of Sciences, Volunteer, (1995-present);
- Ad hoc reviewer for Proc. Natl. Acad. Sci., FASEB. J., J. Biol. Chem., etc.

Patents and Pending Patent Applications:

1.) U.S. Patent No. 5,888,796 (Date: 03/30/1999), titled “Clone of a Nucleotide Sequence Encoding a Protein Having Two Functions,” Inventor: Yie-Hwa Chang.
2.) U.S. Patent Application, Serial No: 09/943,123 (Filed 08/30/2001), titled “Dominant Negative Variants of Methionine Aminopeptidase 2 (MetAP2) and Clinical Uses Therefor,” Co-Inventors: Yie-Hwa Chang, William S. Micka, and Joseph A. Vetro.
3.) U.S. Patent Application, Serial No. 09/864,732 (Filed 05/24/2001; Divisional of US Patent No. 6,621,794 B1), titled ““Methods for Identifying Inhibitors of Methionine Aminopeptidases,” Inventor: Yie-Hwa Chang
4.) U.S. Patent Application, Serial No. 09/928,385 (Filed 08/13/2001), titled “A Rapid and Sensitive Proximity-Based Assay for the Detection and Quantification of DNA Binding Factors,” Inventor: Tomasz Heyduk.
5.) European Patent Application, Nationalized PCT, Serial No. 00984526.4 (Filed: 04/18/2002), titled “Methods for Identifying Inhibitors of Methionine Aminopeptidases,” Inventor: Yie-Hwa Chang.
6.) European Patent Application, Nationalized PCT, Serial No. 02761229.0 (Filed 03/18/2004), titled “Dominant Negative Variants of Methionine Aminopeptidase 2 (MetAP2) and Clinical Uses Therefor,” Inventor: Yie-Hwa Chang.
7.) U.S. Patent Application, Serial No: 10/888,962 (Filed 07/09/2004), titled “Compositions and Methods for Inhibiting,” Inventor Yie-Hwa Chang.
8.) Canada Patent Application, Nationalized PCT, Serial No: 2,387,126 (Filed 10/12/2000), titled “Methods for Identifying Inhibitors of Methionine Aminopeptidases,” Inventor: Yie-Hwa Chang.
9.) Japan Patent Application, Nationalized PCT, Serial No: 2001-530447 (Filed 10/12/2000), titled “Methods for Identifying Inhibitors of Methionine Aminopeptidases,” Inventor: Yie-Hwa Chang.
10) PCT Patent Application, Serial No: PCT/US02/24661 (Filed 08/02/2002), titled “Dominant Negative Variants of Methionine Aminopeptidase 2 (MetAP2) and Clinical Uses Thereof,” Inventor: Yie-Hwa Chang.

11) U.S. Patent No. 5,888,796 (Date: 3/30/99), title "Clone of a Nucleotide Sequence Encoding a Protein Having Two Functions", Inventor: Yie-Hwa Chang.
12) U.S. Patent No. 5,885,820 (Date: 3/23/99), title "Clone of a Nucleotide Sequence Encoding a Protein Having Two Functions", Inventor: Yie-Hwa Chang.
13) US Patent No. 6, 261,794 B1 (Date: July 17, 2001), title "Methods for Identifying Inhibitors of Methionine Aminopeptidases", Inventor: Yie-Hwa Chang.
14) PCB'· Patent Application, PC '/USOO/41146 (Filed: 10/12/01), title "Methods for Identifying Inhibitors of Methionine Aminopeptidases", Inventor: Yie-Hwa Chang.
15) US Patent Application, Serial No. 09/943,123 (Filed: 08/30/01), "Dominant Negative Variants of Methionine Aminopeptidase 2 (MetAP2) and Uses Therefor", Inventors: Yie-Hwa Chang, William S. Micka (student) and Joseph A. Vetro (student).
16) US Patent Application, ER 351201282 US “Compositions and Methods for Inhibiting Liver Stellate Cell Growth”, Inventor: Yie-Hwa Chang, Ranjit Ray
17) US Patent Application “Kits and Methods for determining risk for primary liver cancer. Inventor: Yie-Hwa Chang and Claus Fimmel.
18) PCT patent application. 2010. Molecular PINCER® with amplifiable signals. Inventors: Yie-Hwa Chang, Ling Tian and Tomasz Heyduk.
19) PCT patent application 2012. Novel screening method for aptamers and multivalent binders. Inventors: Yie-Hwa Chang, Ling Tian and R Wang.

Publications:

1. Chang YH, Teichert U, Smith JA. Purification and characterization of methionine-specific aminopeptidase from *Saccharomyces cerevisiae*. J. Biol Chem. 1990, 265:19892-19897.
2. Chang YH, Labgold MR, Richards JH. Altering enzymatic activity. Recruitment of carboxypeptidase activity into an RTEM- 1 13-lactamase/penicillin-binding-protein 5 chimera. Proc. Natl. Acad. Sci. U.S.A. 1990; 87:2823-2827.
3. Liu Z, Williams KP, Chang YH, Smith JA. Single amino acid substitution alters T cell determinant selection during antigen processing. J. Immunol. 1991; 146:438-443.
4. Chang YH, Teichert U, Smith JA. Molecular cloning, sequencing, deletion and overexpression of a eukaryotic methionine aminopeptidase gene from Saccharomyces cerevisiae. J. Biol. Chem. 1992; 267:8007-8011.
5. Liu Z, Williams KP, Chang YH, Smith JA. Immunodominance : A single amino acid substitution within an antigenic site alters intramolecular selection of T cell determinants J. Immunol.1993; 151:1-7.
6. Zuo SL, Guo Q, Chang YH. A protease assay via pre-column derivatization and high pressure liquid chromatography. Analytical Biochemistry 1994, 222:514-516.
7. Zuo SL, Guo Q, Chang YH. Evidence that zinc fingers in a methionine aminopeptidase from S. cerevisiae are important for normal growth. Mol. Gen. Genetics 1995, 246:247-253.
8. Li X, Chang YH. Cloning of a human cDNA encodes a protein associated with initiation factor-2. Biochim, Biophys. Acta. 1995, 1260:333-336.
9. Li X, Chang YH. Amino-terminal protein processing in *Saccharomyces cerevisiae* is an essential function that requires two distinct methionine aminopeptidases. Proc. Natl. Sci. Acad. USA 1995, 92:12357-12361.
10. Li X, Chang YH. Evidence that the human homologue of a rat initiation factor-2 associated protein (p67) is a methionine aminopeptidase. Biochem Biophys.

Res. Commun. 1996, 227:152-159.

11. Griffith EC, Su Z, Turk B, Chen S, Chang YH, Wu Z, Biemann K, Liu JO. Methionine aminopeptidase (Type 2) is the common target for angiogenesis inhibitors AGM-1470 and ovalicin. Chemistry and Biology, 1997, 4:461-471.
12. Klinkenberg M, Ling C, Chang YH. A dominant negative mutation in *S. cerevisiae* methionine aminopeptidase-1 affects catalysis and interferes with the function of methionine aminopeptidase-2. Arch. Biochem. Biophys. 1997, 347:193-200.
13. Griffith EC, Su, Z, Niwayama S, Ramsay CA, Chang YH. Molecular recognition of angiogenesis inhibitors fumagillin and ovalicin by methionine aminopeptidase 2. Proc. Natl. Acad. Sci. USA 1998, 95:15183-15188.
14. Turk BE, Griffith EC, Wolf S, Bieman K, Chang YH, Liu JO. Selective inhibition of N-terminal processing by TNP-470 and Ovalicin in endothelial cells. Chemistry and Biology,1999, 6:823-833.
15. Udagawa T, Yuan J, Panigrahy D, Chang YH, Shah J, D'Amato RJ. Cytochalasin E, an epoxide containing Aspergillus-derived fungal metabolite, inhibits angiogenesis and tumor growth. J. Pharmacol. Exp. Ther. 2000, 294:421-427.
16. Kwon JY, Jeong HW, Kim HK, Kang KH, Chang YH, Bae KS, Choi JD, Lee UC, Son KH, Kwon BM cis-Fumagillin, a new methionine aminopeptidase (type 2) inhibitor produced by Penicillium sp. F2757. J. Antibiotics, 2000, 53:799-80.
17. Metheny N., Chang YH etc. Pepsin immunoassay as a marker for pulmonary aspiration. American J. Critical care, 2002, 11:150-154.
18. Son KH, Kwon JY, Joeng HW, Kim HK, Kim CJ, Chang YH, Choi JD, Kwon BM 5-Demethylovalicin, as a methionine aminopeptidase-2 inhibitor produced by Chrysoporium. Bioorganic & Medicinal Chemistry 2002, 10:185-188.
19. Chen S, Vetro J, Chang YH. The specificity *in vivo* of two distinct methionine aminopeptidase from *S. cerevisiae*. Arch Biochem. Biophys. 2002, 398:87-93.
20. Vetro J. and Chang YH. Yeast MetAP1 is ribosome-associated and requires its N-terminal zinc finger domain for normal function *in vivo*. J. Cell. Biochem. 2002, 85:678-688.
21. Dummitt B, Fei Y, Chang YH. Functional expression of human methionine aminopeptidase-1. Protein and Peptide Letters. 2002, 9:295-303.
22. Dummitt B., Micka W., Chang YH. N-terminal methionine removal and methionine metabolism in S. cerevisiae. J Cell Biochem. 2003 ,89:964-974.
23. Metheny NA, Dahms TE, Chang YH, Steward BJ, Frank PA, Clouse RE. Detection of pepsin in tracheal secretions after forced small aspirations of gastric juice. JPEN. 2004, 28:79-84.
24. Vetro J., Micka WS, Dummitt B, Chang YH. Identification and characterization of a dominant negative mutant of yeast methionine aminopeptidase 2. J Cell Biochem 2005, 94:656-658.
25. Babbitt SE, Kiss A, Deffenbaugh AE, Chang YH, Bailly E, Erdjument-Bromage H, Tempst P, Buranda T, Sklar LA, Baumler J, Gogol E, Skowyra D. ATP hydrolysis-dependent disassembly of the 26S proteasome is part of the catalytic cycle. Cell, 2005, 121:553-565.
26. Dummitt B, Micka WS, Chang YH Yeast Glutamine-fructose-6-phosphate Amidotransferase (Gfa1) requires methionine aminopeptidase activity for proper function J. Biol. Chem., 2005, 280:14356-14360.

27. Basu A, Saito K, Meyer K, Ray RB, Friedman SL, Chang YH, Ray R. Stellate cell apoptosis by a soluble mediator from immortalized human hepatocytes. Apoptosis. 2006 11:1391-1400.
28. Metheny NA, Clouse RE, Chang YH, Stewart BJ, Oliver DA, Kollef MH. Tracheobronchial aspiration of gastric contents in critically ill tube-fed patients: frequency, outcomes, and risk factors. Crit Care Med. 2006, 34:1007-1015.
29. Timmer JC, Enoksson M, Wildfang E, Zhu W, Igaroshi Y, Denault J-B, Ma Y, Chang YH, Dummitt B, Mast AE, Eroshmin A, Osterman A, Smith J, Tao A and Salvesen GS, Profiling constitutive proteolytic events in vivo. 2007, 407:41-48.
30. Heyduk E, Dummitt B, Chang YH, Heyduk T. Molecular pincers: antibody-based homogeneous protein sensors. Anal Chem., 2008, 80:5152-5159.
31. Tian L, Wang RE, Fei Y, Chang YH. A homogeneous fluorescent assay for cAMP-phosphodiesterase enzyme activity. J Biomol Screen. 2011, 17:409-14.
32. Wang RE, Tian L, Chang YH. A homogeneous fluorescent sensor for human serum albumin. J Pharm Biomed Anal. 2012, 63:165-9.
33. Tian L, Wang RE, Chang YH. Molecular PINCER for biomarker analysis and their potential application in hepatitis C diagnosis. Antiviral Therapy. 2012, 17:1437-1442.
34. Hassan MI, Waheed A, Chang YH, Sly WS, Faizan Ahmad F and Fleming Re. Characterization and Quantization of Hepcidin from Human and Mouse Serum and Secretion Medium from Human Cell Line Hu.7 by MALDI Mass Spectrometry. J. Proteins and Proteomics. 2012, 3:177:185.
35. Schallom M, Tricomi S, Chang YH, Metheny NA. A Pilot Study of Pepsin in Tracheal and Oral Secretions. American J. of Critical Care. 2013, 22:5

Book Chapters:

1. Labgold MR, Chang YH, Richards JH. Catalysis by chimeric proteins: conversion of a β-lactamase to a D,D-carboxypeptidase.. Current Research in Protein Chemistry pp489-497. Edited by: Academic Press, Inc. 1990.
2. Liu Z, Chang YH, Williams KP, Kassel DB, Poellinger B, Smith JA. Single amino acid substitution alters T cell determinant selection during antigen processing of staphylococcal nuclease. Peptides pp. 895-897. Edited by Girat E and Andrew D: Leiden NV: Escom Science Publishers. 1990.
3. Chang YH. Biochemical and genetic analysis of yeast aminopeptidases. In Aminopeptidases. Edited by Allen Taylor: R.G. Landes Bioscience Publishers. 1996.
4. Chang YH. Methionine aminopeptidase, Encyclopedia of Molecular Medicine. Edited by Thomas E. Creighton. John Wiley & Sons, Inc. New York, N. Y. 2001.
5. Vetro J, Dummitt B & Chang YH, Angiogenesis: Emerging role of methionine in aminopeptidases, Aminopeptidases in Biology and Disease Series: Proteases in Biology and Disease , Vol. 2 Edited by Nigel Hooper, Lendeckel Uwe, Kluwer Academic Publishers, 2004. (Vetro and Dummitt were Chang's graduate students).
6. Dummitt B & Chang YH Molecular beacons for DNA binding proteins: an emerging technology for detection of DNA binding proteins and their ligands. Assay Drug Dev Technol. 2006 4:343-349.
7. Tian L, Simmons G, Chang YH Protein O-GlcNacylation. JSM Biochem Mol Biol, 2013 1:1005.

CDC-FP
Vogelwikke 12, 6665 HP
Driel
Tel. ++31-6 22 543 047
clyde.don@foodphysica.com

Clyde Don Consultancy
FoodPhysica

Short Professional Profile: Dr. Clyde Don

Title & Name: Dr. Clyde Don
Experience: **>** 20 years in applied R&D & analyses
Education: MS in Chemistry (Amsterdam), PhD in Food Chemistry (Wageningen)

Fields
Food & Agri, cereal science, meat science, analyses, technical support, analytical method evaluation, quality assurance, immunological methods, species identification, supervision of labscale- and pilot scale experiments, ingredient functionality, set-up and supervision of R&D projects, by-product valorisation and rendering, explorative analyses, technical reporting, speaker at conferences.

Examples of relevant projects of the last 5 years:

- Study Director for immunological method evaluation according to AACC/AOAC guidelines with special focus on immunological methods (ELISA). Successfully led collaborative studies resulting in AACC approval and AOAC 1st action
- Developing a new method of analysis
- Lab-training and training of technicians/R&D officers
- Assessing protein functionality in applications
- Pilot testing of mechanical deboning and wet separation/centrifugation
- (interim)project-management for lab and technical development
- Trouble-shooting & developing a new moisture barrier formulation
- Interactions during wheat flour dough processing

CDC FoodPhysica
2009-today: Consultant Food & Agri / Director of CDC-FoodPhysica.
Various projects in:

- Meat / meat processing industry
- Cereals / Gluten / Bakery / Dairy
- Food Ingredients Industry
- Analytical Method Development & Validation according to international guidelines

2006-2009: Consultant, Commercial Lab, with focus on protein, meat, rendering industry and ELISA for species identification, The Netherlands
1997-2006: Project Manager at TNO Quality of Life with focus on Protein Technology, The Netherlands
1995-1997: Researcher ATO-DLO, Wageningen, The Netherlands
1990-1992: R&D traineeships in Chemistry & Technology at: DSM, ICI and AKZO NOBEL

CDC-FP
Vogelwikke 12, 6665 HP
Driel
Tel. ++31-6 22 543 047
clyde.don@foodphysica.com

Other activities (non-profit organisations)

- Leadership of various divisions & committees AACCI (2006 – now)
- Symposium organizer / presenter AACCI (2000 –now); active member of AOAC
- Scientific Advisor at Meattech Ltd
- Course / seminar organization for methods of analysis
- Reviewer for several food chemistry/biochemistry/technology Journals

Most recent publications/validation reports on allergen ELISA

Koehler, P., Schwalb, T., Immer, U., Lacorn, M., Wehling, P., and Don, C. 2013. AACCI approved methods technical committee report: collaborative study on the immunochemical determination of intact gluten using an R5 sandwich ELISA. Cereal Foods World 58:36-40

Koehler, P., Schwalb, T., Immer, U., Lacorn, M., Wehling, P., and Don, C. 2013. AACCI approved methods technical committee report: collaborative study on the immunochemical determination of partially hydrolyzed gluten by an R5 competitive ELISA. Cereal Foods World 58:154-158.

Don, C., Halbmayr-Jech E., Rogers, A., Wehling, P. and Koehler P. 2014. AACCI approved method technical committee report: Collaborative Study on the Immunochemical Determination of Intact Gluten in Rice Flour and Rice Based products by G12 Sandwich ELISA. Cereal Foods World (in press)

Don, C., Koehler P. 2014. Feature article: On Enzyme-Linked Immuno Sorbent Assays for the Detection and Quantitation of Gluten in Cereal-Based Foods. Cereal Foods World (article in press)

CURRICULUM VITAE

JUPITER M. YEUNG

I. PERSONAL DATA

Address:
Nestle Nutrition
445 State Street
Fremont, MI 49413
U.S.A.

E-mail: Jupiter.yeung@rd.nestle.com
JupiterYeung@gmail.com

Telephone: (231) 928-2420 (Business)
(301) 602-3352 (Cell)

Fax: (231) 928-2167

II. EDUCATION

1975-79 B.Sc. (Pharmacy), Faculty of Pharmacy and Pharmaceutical Sciences, University of Alberta, Canada

1979-83 Ph.D. (Medicinal Chemistry), Faculty of Pharmacy and Pharmacy and Pharmaceutical Sciences, University of Alberta, Canada

III. POST-GRADUATE TRAINING

1983-85 Postdoctoral Fellow, Neurochemical Research Unit, Department of Psychiatry, Faculty of Medicine, University of Alberta, Canada

IV. EMPLOYMENT

1983-85	Postdoctoral Fellow, Department of Psychiatry, Faculty of Medicine, University of Alberta, Canada
1985-87	Research Scientist (Toxicology), Research Station, Agriculture Canada, Lethbridge, Alberta, Canada
1987-91	Assistant Professor (Neurochemistry) and Supervisor of the Clinical Laboratory, Dept. Psychiatry; and concurrently a Retained Consultant (Analytical Chemistry), Dept. Pharmacology, Medical College of Pennsylvania, Philadelphia, PA, U.S.A.
1991-97	Research Scientist (Analytical Chemistry), Food Directorate, Health Protection Branch, Health Canada, Ottawa, Ontario, Canada
1997-1999	Senior Scientist (Food Chemistry & Packaging Department), National Food Processors Association, Washington, DC, U.S.A.
2000-2008	Principal Scientist/Director, Chemistry, Center for Technical and Laboratory Services, Scientific and Regulatory Affairs, Food Products Association/Grocery Manufacturers Association, Washington, DC, U.S.A.
2008-Present	Principal Scientist, Global Product Safety, Nestlé Nutrition R&D Center, Fremont, MI, USA

VI. PROFESSIONAL AFFILIATION

Member of Nestlé Allergen Expert Community
AOAC International (Chair of Presidential Task Force on Food Allergen; Chair of Allergen Community; and Technical Program Council)
IFT Subject Matter Expert for high risk foods model project for FSMA
Served in IFT Food Allergen Expert Panel
Served in Scientific Advisory panel for the Allergen Methods committee of Joint Health Canada and CFIA
Served as a Secretary of Food Allergens Committee, Grocery Manufacturers Association
Served as External Consultant for the EU funded allergen program for the University of Natural Resources and Applied Life Sciences, Vienna Department IFA-Tulln, Tulln, Austria
Served in Research Committee of Anaphylaxis Foundation of Canada
American Chemical Society
Alberta Pharmaceutical Association
Canadian Network of Toxicology Centres

VII. REFERENCES

Dr. Kristina M. Williams, Chief - Immunobiology Branch, FDA/CFSAN/OARSA/DVA Laurel, MD 20708, (301) 210-7504, kristina.williams@fda.hhs.gov

Dr. Samuel Godegroy, Director General, Food Directorate, Bureau of Chemical Safety, Sir F. Banting Research Centre, Health Canada, Ottawa, Ontario, K1A 0L2, Canada. Telephone (613) 957-1821. Fax: (613) 941- 1784, Samuel_Godefroy@hc-sc.gc.ca

Dr. Mike Pisano, President and Co-Founder, Proteomic Research Services, Inc., 4401 Varsity Drive, Suite E, Ann Arbor, MI 48108. Phone: (734) 973-7914, Fax: (734) 973-7932. mike.pisano@prsproteomics.com

XIII. PUBLICATIONS AND ABSTRACTS

Publications:

1. Koerner TB, Abbott M, Godefroy SB, Popping B, Yeung JM, Diaz-Amigo C, Roberts J, Taylor SL, Baumert JL, Ulberth F, Wehling P,Koehler P. (2013) Validation procedures for quantitative gluten ELISA methods: AOAC allergen community guidance and best practices. J AOAC Int. 96(5):1033-40.

2. Abbott M., Hayward, S., Ross S.W., Godefroy S.B., J, , Franz Ulberth, van Hengel, A.J., Roberts J., Akiyama H., Popping, B., Yeung J.M., Wehling P., Taylor S.L. and Poms R.E. (2010) Validation Procedures for Quantitative Food Allergen ELISA Methods, Community Guidance and Best Practices, J. AOAC Intl. 93:442-450.

3. Jupiter M. Yeung (2010) Criteria to determine major/priority tree nut allergens: Tree Nut Allergy Review In Allergen Management in the Food Industry, John Wiley & Sons, Editors: Joyce I. Boye and Samuel Godefroy, pp53-74.

4. Warren E. Stone and Jupiter M. Yeung (2010) Principle and Practice for Allergen Management and Control In Allergen Management in the Food Industry, John Wiley & Sons, Editors: Joyce I. Boye and Samuel Godefroy, pp145-166.

5. Carmen Diaz-Amego and Jupiter M Yeung (2009) Critical Evaluation on Uncertainties of Gluten Testing – Issues and Solutions for Food Allergen Detection, In: Pathogens and

Toxins in Foods: Challenges and Interventions, Eds: JK Juneja and JN Sofos, ASM Press, Washington, DC, pp 286-300.

6. Jupiter Yeung (2009) Food Allergies and Allergens, In Managing Allergens in Food Processing Establishment, 4th Ed., Eds. W.E. Stone and K.E. Stevenson, A Grocery Manufacturers Association (GMA) Publication, pp 1-10.

7. Jupiter Yeung (2009) Allergen Testing and Research, In Managing Allergens in Food Processing Establishment, 4th Ed., Eds. W.E. Stone and K.E. Stevenson, A Grocery Manufacturers Association (GMA) Publication, pp 57-64.

8. Peter Vadas, Milton Gold, Boris Perelman, Gary Liss, Gideon Lack, Thomas Blyth, F. Estelle R. Simons, Keith J. Simons, Dan Cass, Jupiter Yeung (2008) Platelet activating factor, PAF-acetylhydrolase and severe anaphylaxis. New Eng J Med 358(1):28-35.

9. Tao Geng, Carmen D Westphal, and Jupiter M Yeung (2008) Detection of Gluten by Commercial Test Kits: Effects of Food Matrices and Extraction Methods, In Food Contaminants – Mycotoxins and Food Allergens, eds. D. Siatar and E. Herman, ACS Symposium Series 1001, pp 462-475.

10. Steve L. Taylor, Susan L. Hefle, Kevin Farnum, Steven W. Rizk, Jupiter M. Yeung, Michael E. Barnett, Francis Busta, Fred R. Shank, Rosetta Newsome, Sarah Davis and Cory M. Bryant (2007) Survey and Evaluation of Pre-FALCPA Labeling Practices Used by Food Manufacturers to Address Allergen Concerns, Comp Rev Food Sci Food Safety, 6:36-46.

11. Jupiter M. Yeung (2006) Enzyme-linked Immunosorbent Assays for Allergens in Foods. In Detecting Allergens in Foods, eds. Stef Koppleman and Susan Hefle, Woodland Publishing Limited, Cambridge, England, pp 109-124.

12. Susan L. Hefle, Jupiter M. Yeung, and Ricki M. Helm (2006) Antibodies. In Detecting Allergens in Foods, eds. Stef Koppleman and Susan Hefle, Woodland Publishing Limited, Cambridge, England, pp 65-78.

13. Steve L. Taylor, Susan L. Hefle, Kevin Farnum, Steven W. Rizk, Jupiter M. Yeung, Michael E. Barnett, Francis Busta, Fred R. Shank, Rosetta Newsome, Sarah Davis and Cory M. Bryant (2006) Analysis and Evaluation of Manufacturing Practices Used by Food Manufacturers to Address Allergen Concerns, Comp Rev Food Sci Food Safety, 5:138-157.

14. Tsai, B., Yeung, J., gold, M., Sussman, G., Parelman, B. and Vadas, P. (2005) Study of the allergenicity of plant protein hydrolysates. Food Allergy and Intolerance, 4:117.

15. Nogueira M.C.L., McDonald Regina, Westphal C.D., Maleki S.J. and Yeung, J.M. (2004) Can Commercial Peanut Assay Kits detect Peanut Allergen? J. AOAC Intl. 87(6) 1480-1484.

16. Samuel Benrejeb, Michael Abbott, David Davies, Jessica Querry, Chantal Cléroux, Christine Streng, Philippe Delahaut and Jupiter M. Yeung. (2003) Immunochemical-Based Method for Detection of Hazelnut Proteins in Processed Foods J.AOAC Intl, 86 (3): 557-563.

17. Baumgartner, S., Steiner, I., Hirmann, D.; Kloiber, S.; Krska, R.; Yeung, J. (2002) Towards the development of a dipstick immunoassay for the detection of trace amounts of egg proteins in food. European Food Research and Technology, 214 :168-170.

18. Huang, H. C., and Yeung, J. M. (2002). Biochemical pathway for the formation of abnormal sclerotia of Sclerotinia sclerotiorum. Bulletin. Plant Pathol. Bull. 11:1-6.

19. Diaz C., Fernandez, C., McDonald, R., and Yeung, J.M. (2002) Determination of Cry9C protein in processed foods made with StarLink™ corn, J. AOAC International, 85: 1070-1076.

20. Mohammed, I, Mullett, W.M., Lai, E.P.C., and Yeung, J.M. (2001) Is biosensor a Viable method for food allergens detection? Anal. Chim. Acta .444: 97 – 102.

21. Huang, H. C., and Yeung, J. M. (2001). Biochemical changes in abnormal sclerotia of Sclerotinia sclerotiorum. Pages 91-92. In: Young CS, Hughes KJD, eds. Proceedings of Sclerotinia 2001 - The XI International Sclerotinia Workshop, York, 8th -12th July 2001, York, England: Central Science Laboratory, York, England.

22. Wolf, L., Yeung, J., Doucette, R.and Nazarali, A. (2001) Coordinated expression of Hoxa2, Hoxd1 and Pax6 in the developing diencephalon, NeuroReport, 12, 329-333.

23. Yeung, J.M. (2001) Food Allergen Awareness. Inside Laboratory Management. July/August Issue, 9-10.

24. Carmen Diaz Westphal, Cecilia Fernandez, and Jupiter Yeung. (2001) Allergen Management in the Food Industry, La Alimentacion Latinoamericana 240, 18-21.

25. Jupiter Yeung, and Carmen Diaz Westphal (2001)Current Issues in Food Allegens, NFPA Journal December 2001, 16-20.

26. Xing-Zheng Wu, Tiemin Huang, Wayne M. Mullet, Jupiter M. Yeung, and Janusz Pawliszyn (2001) Investigation of the immunoreaction selectivity of peanut allergens to

antibody rabbit IgG by whole column imaged capillary isoelectric focusing. Journal of Microcolumn Separations, 13 (8): 322-326.

27. Yeung, J.M., Newsome, W.H. and Abbott, M.A. (2000) Development of an enzyme immunoassay for the determination of egg proteins in food products. J. AOAC Intl.83: 139-143.

28. Yeung, J.M. Applebaum, R.S., and Hildwine, R. (2000) Criteria to determine food allergen priority. J. Food Prot. 63: 982-986.

29. James F. Lawrence, Cathie Menard, Jupiter, M. Yeung, Samy Ben Rejeb (2000) Evaluation of silica and sepharose-based immunoaffinity sorbents for sample cleanup for the determination of fumonisin B1 and B2 in corn products. J. AOAC Intl. 83: 597-603.

30. A. Nazarali, R. Puthucode, V.leung, L. Wolf, Z. Hao and Yeung. J. M. (2000) Temporal and spatial expression of Hoxa-2 during murine palatogenesis. Cellular and Molecular Neurobiology 20(3): 269-290.

31. Mullett W., Lai, E.P.C., and Yeung, J.M. (2000) Surface Plasmon Resonance-Based Immunoassays, Methods, 22, 77-91.

32. Cecilia Fernandez, and Jupiter Yeung. (2000) Food Allergies: a current problem Industry, La Alimentacion Latinoamericana 232, 24-27.

33. Z.Hao, J.M. Yeung, L. Wolf, R.Doucette & Nazarali, A (1999) Differential expression of Hoxa-2 protein along the dorsal-ventral axis of the developing and adult mouse spinal cord. Developmental Dynamics 216: 201-217.

34. Rejeb, S.B., Fischer-Durand, N., Martel, A., Le Goffie, F., Lawrence, J.F., Yeung, J.M. and Abbott, M.A. (1998) Development and validation of an indirect enzyme immunoassay for the detection of the herbicide isoproturon in water matrices. Int. J. Env. Anal. Chem. 69, 13-30.

35. Rejeb, S.B., Fischer-Durand, N., Lawrence, J.F., Yeung, J.M. and Martel, A., Le Goffie, F. (1998) Ligand choice strategy for the purification of polyclonal antibodies used for improved immunochemical-based analytical mehtods for the herbicide isoproturon. Int. J. Env. Anal. Chem. 69, 157-174.

36. Yeung, J.M. (1998) All antibodies are not created equal: Strategies to make quality antibodies that will meet your needs. Proceedings of the Second Biennial International Conference on Chemical Measurement and Monitoring of the Environment, Ottawa, Canada, May 11-14, 1998. Eds. Ray Clement and Bob Burk. pp 233-238.

37. Rejeb, S.B., Fischer-Durand, N., Martel, A., Daniel, R., Jolivali, C., Le Goffie, F., Lawrence, J.F., Yeung, J.M. and Hennion, M.C. (1998) Purified polyclonal antiphenylurea antibodies for an improved immunoaffinity chromatography , food and agricultural immunology, 10, 203-213.

38. Scott, P.M., Yeung, J.M., Lawrence, G.A. and Prelusky, D.B. (1997) Evaluation of enzyme-linked immunosorbent assay for analysis of beer for fumonisins. Food Additives and Contaminants 14, 445-450.

39. Yeung, J.M. and Collins, P.G. (1997) Determination of Soy Proteins in food Products by Enzyme Immunoassay. Food Tech. Biotech., Special Issuue: Immunochemical Techniques and Methods 36, 209-214.

40. Yeung, J.M., Prelusky, D.B., Savard, M.E., and Robinson, L.A. (1996) Sensitive immunoassay for fumonisin B_1 in corn. J. Agric. Food Chem. 44, 3582-3586.

41. Yeung, J.M., Prelusky, D.B. and Wang, H-Y. (1996) Fumonoisin B1 induces protein kinase C translocation via direct interaction with diacylglycerol binding site. Toxicol. Appl. Pharmacol. 141, 178-184.

42. Yeung, J.M. and Collins, P.G. (1996) Enzyme immunoassay for determination of peanut proteins in food products. J. AOAC Intl. 79, 1411-1416.

43. Yeung, J.M., Mortimer, R.D. and Collins, P.G. (1996) Development and application of a rapid immunoassay for difenzoquat in wheat and barley product. J. Agric. Food Chem. 44, 376-380.

44. Prelusky, D.B., Tremholm, H.L., Rotter, B.A., Miller, J.D., Sevard, M.E, Yeung, J.M. and Scott, P.M. (1996) Biological fate of fumonisin B_1 in food-producing animals. In: Advances in Experimental Medicine and Biology, Vol. 392, Fumonisins in Food (L.S. Jackson, J.W. DeVries & L.B. Bullerman, eds.), Plenum Press, New York, Chapter 23, pp 265-278.

45. Yeung, J.M. and Newsome, W.H. (1995) Determination of chlorothalonil in produce by immunoassay. Bull. Environ. Contam. Toxicol. 54, 444-450.

46. Wang, H-Y, Yeung, J.M. and Friedman, E. (1995) Prenatal cocaine exposure selectively reduces mesocortical dopamine release. J. Pharmacol. Exp. Ther. 273, 1211-1215.

47. Yeung, J.M. and Newsome, W.H. (1995) Biotin-streptavidin complex as sensitivity enhancer for ELISA in foods. In: New Frontiers in Agrochemical Immunoassay (D.Kurtz, J.H. Skerrit and L. Stanker eds.) AOAC International p 163-170.

48. Yeung, J.M. and Newsome, W.H. (1993) Survey of captan and its degradation product tetrahydrophthalimide in baby foods by ELISA and GC-MS: a comparative study. J. AOAC International 76, 1225-1229.

49. Newsome, W.H., Yeung, J.M. and Collins P.G. (1993) Development of an enzyme immunoassay for captan and its degradation product tetrahydrophthalimide in foods. J. AOAC International 76, 381-386.

50. Prelusky, D.B., Yeung J.M., Thompson, B.K. and Trenholm, H.L. (1992) Effect of deoxynivalenol on neurotransmitters in dicrete regions of swine brain. Arch. Environ. Contam. Toxicol. 22, 36-40.

51. Stoff D.M., Pasatiempo, A.P., Yeung, J.M., Cooper, T.B., Bridger, W.H. and Rabinovich, H. (1992) Neuroendocrine responses to challenge with fenfluramine and aggression in disruptive behavior disorders of children and adolescents. Psychiatry Research 42, 263-276.

52. Stoff, D.M., Pasatiempo, A.P., Yeung, J.M., Wagner W.H. and Rabinovich, H. (1992) Prolactin and cortisol response to repeated fenfluramine in disruptive behavior disorder. Psychiatry Research 42, 65-72.

53. Yeung, J.M. and Friedman, E. (1991) Effects of aging and diet restriction on monoamines and amino acids in cerebral cortex of Fischer-344 rats. Growth Develop. Aging 55, 275-283.

54. Baker, G.B., Wong, J.T.F., Yeung, J.M. and Coutts, R.T. (1991) Effects of the antidepressant phenelzine on brain levels of ?-aminobutyric acid (GABA). J. Affect. Dis. 21, 207-211.

55. Vitiello, B., Yeung, J. M. and Friedman, E. (1990) Plasma and saliva nortriptyline levels in a case of black tongue. Clin. Pharm. 9, 421-422.

56. Yeung J. M., Colwell, D. D. and Shemanchuk, J. A. (1989) Fenvalerate residues on cattle hair coat from impregnated ear tags. Pestic. Sci. 26, 21-28.

57. Yeung, J. M. and Taylor, W. G. (1988) Metabolism of N,N-diethyl-m-toluamide (DEET) by liver microsome from male and female rats: simultaneous quantitation of DEET and its metabolites by high performance liquid chromatography. Drug Metab. Dispos. 16, 600-604.

58. Yeung J. M., Shemanchuck, J.A. and Spooner, R. W. (1988) A small-scale method for the determination of permethrin residue in cattle hair by gas-liquid chromatography with electron capture detection. J. Agric. Food Chem. 36, 1287-1290.

59. Yeung, J. M. and Knaus, E. E. (1987) Synthesis of N-(3,6-dihydro-1(2H)-pyridinyl)-benzamides with hyperglycemic-hypoglycemic activity. J. Med.Chem. 30, 104-108.

60. Nazarali, A. J., Baker, G. B., Coutts, R. T., Yeung, J. M. and Rao.T. S. (1987) Rapid analysis of ß-phenylethylamine in tissues and body fluids utilizing pentaflourobenzoylation followed by electron-capture gas chromatography. Prog. Neuropsychopharmacol. & Biol. Psychiat. 11, 251-258.

61. Rao, T. S., Baker, G. B., Coutts, R. T., Yeung, J. M., McIntosh, G. J. A., and Torok-Both, G. A. (1987) Analysis of the antidepressant phenelzine in brain tissue and urine using electron-capture gas chromatography. J. Pharmacol. Methods 17, 297-304.

62. Yeung, J. M. , Baker, G. B. and Coutts, R. T. (1986) A simple automated gas chromatographic analysis of amino acids in brain tissue and body fluids. J. Chromatogr. Biomed. Appl. 378, 293-304.

63. Yeung, J. M. and Knaus, E. E. (1986) Synthesis of 3,6-dihydro-1(2H)- pyridinyl derivatives with hyperglycemic activity. Eur. J. Med. Chem. 21, 181-185.

64. Coutts, R. T. and Yeung, J. M. Gas chromatographic methods for analysis of amino acids, In: Neuromethods, vol. 3 (Boulton, A. A., Baker, G. B., and Wood, J. D., eds.), Humana Press, Clifton, N. J., p. 29-50, 1985.

65. Baker, G. B., Coutts, R. T., Yeung, J. M., Hampson, D. R., McIntosh, G. J. A., and McIntosh, M. G. Chronic administration of monoamine oxidase inhibitors: basic and clinical investigations, In: Neuro-psychopharm-acology of the Trace Amines (Boulton, A. A., Riederer, P., Maitre, L.,and Bieck, P. R., eds.), Humana Press, Clifton, N. J. p. 317-328, 1985.

66. Yeung, J. M., Corleto, L. A. and Knaus, E. E. (1982) Synthesis of N-[(substituted phenylcarbonyl)amino]-1,2,3,6-tetrahydropyridines with analgesic activities. J. Med. Chem. 25, 720-723.

67. Yeung, J. M., Corleto, L. A., and Knaus, E. E. (1982) Synthesis of N-(carbonylamino)-1,2,3,6-tetrahydropyridines with analgesic, anti-inflammatory and hyperglycemic activities. J. Med. Chem. 25, 191-195.

Abstracts:

1. Jupiter M. Yeung, Hua Wang, and Sarah Gee (2008) Can fryer oil serves as a allergen cross contact medium? 122nd AOAC Annual Meeting & Exposition, September 21-24,

2008, Dallas TX, Abstr. S-1300, p 72.

2. Yeung, J.M (2008) Tree Nuts – What Are They? Fifth Workshop on Food Allergen Methodologies, May 11 – 14, 2008 Halifax, Nova Scotia, Canada, Abstr.

3. Hua Wang, Sarah Gee, and Jupiter M. Yeung (2008) A food industry survey on possibility of residual allergens in fryer oils during commercial frying operations, Food Safety & Security Summit, Washington, DC, March 17-18, Abstr p 12.

4. Yeung, J.M (2007) Public health implication of FDA's tree nut list in 121st AOAC Intl. annual Meeting in Anaheim, CA Sep 16-21, 2007, Abstract S-500, p. 52

5. Wang, H., Gee, S. and Yeung, J.M., (2007) Can commercial gliadin ELISA test kits detect "gliadin" in pure oats? IFT Annual Meeting, Chicago, IL, July 28-Aug 1, 2007, Abstract #?

6. Yeung, J.M., Carmen D. Westphal, Dorcas Weber, Frances M. DuPont, William J. Hurkman (2006) Gluten detection – Behind the wells Heath Canada Fourth Workshop on Food Allergens, October 15-18, 2006 Quebec City, Quebec, Canada, Abstract in Session 6-2.

7. Yeung, J.M. and Geng, T (2006) Commercial gluten test kits: Issues and solutions, 232nd American Chemical Society Annual Meeting and Exposition, Sept 10-14, 2006, San Francisco, CA, Abstract AGFD 197 in 232nd ACS Annual Meeting CD.

8. Geng, T and Yeung, J.M. (2006) Effects of extraction methods in quantitative determination of glutens in food using commercial test kits in 2006 FDA Science Forum, A century of FDA Science: Pioneering the future of public health, April 18-20, 2006, Washington Convention Center, Washington, DC, Abstract L-18, p 140.

9. Eric A.E. Garber, Michael Abbott, Sue Hefle, Jupiter Yeung, and Arjon van Hengel, (2006) Validation of Egg Test Kits in 120th AOAC Intl. annual Meeting in Mineapolis, Abstract S-1501, p76-77.

10. Yeung, J.M. (2006) New Challenges in Managing Food Allergens in the US Food Industry in The 14th Eurofins International Seminar in molecular biology for seed, feed and food safety in Paris France, February 16 & 17, 2006, Abstract p29.

11. Yeung, J.M. (2004) Analytical Sensitivity of Allergen methods, Food allergens symposium: Thresholds vs. detection limits of analytical methods in the 118th AOAC International annual meeting and exposition, Sept 19-23, 2004, Adam's mark Hotel, St. Louis, MI, USA. Abstract, S-301, p68.

12. Yeung, J.M. (2004) Seafood Allergy and allergens, Pacific Fisheries Technologists Annual Meeting, Seattle, WA, Mar 2, 2004, No pagination for the abstract.

13. Vadas P, Gold M, Liss G, Smith C, Yeung J, Perelman B. PAF acetylhydrolase predisposes to fatal anaphylaxis. J Allergy Clin Immunol 2003;111(2):S206.

14. Yeung, J.M. (2003) Commercial Peanut Kits Can Detect Specific Peanut Allergens, In the Second Workshop on Food Allergen Methodologies, October 27-29, 2003 Ottawa, Ontario, Canada, organized by Health Canada and Canadian food Inspection Agency. No pagination for the abstract.

15. Yeung, J.M. (2003) Allergenicity studies on biotech-derived foods/crops, IFT Annual Meeting, Chicago, IL, July 12, 2003, Abstract 80-5.

16. Yeung, J.M. (2002) "Allergen Testing – What does the future hold?" in the Food Allergen Workshop in FDA Northeast Regional Laboratory, Jamaica, NY, September 4-6, 2002.

17. Yeung, J.M. (2002) Future for detection of food allergens. Food Allergen Symposium, Midwest Regional AOAC International Meeting, De Moines, IA, June 11-13, 2002, Program: abstract 31.

18. Yeung, J.M., Diaz, C., and Fernandez, C. (2002) An Update on Food Allergen Test Kits and Methodologies in the Symposium of Managing Food Allergens organized by The Association of Food And Drug Officials, April 25, 200, Hilton, Costa Mesa, CA. No pagination.

19. Yeung, J.M., Diaz, C., and Fernandez, C. (2001) An Update on Food Allergen Test Kits and Methodologies in the Symposium of Managing Food Allergens organized by The Association of Food And Drug Officials, November 8, 2001, Arlington, VA. No pagination.

20. Yeung, J.M., Diaz, C., and Fernandez, C. (2001) Food Allergen Testing: Present and Future. The 115th AOAC International Annual Meeting, September 9-13, 2001, Westin Crown Center, Kansas City, MI. Final Program p 75.

21. Ben Rejeb, S., Abbott, M., Davis, D., Querry, J., Cleroux, C, Yeung, J.M., and Le Goffic, F. (2001) Development and optimization of immunochemical-based methods for the detection of hazelnut proteins in chocolate. The 115th AOAC International Annual Meeting, September 9-13, 2001, Westin Crown Center, Kansas City, MI. Final Program p 76.

22. Yeung, J.M., Diaz, C., Fernandez, C. and MacDonald, R. (2001) Testing of

Cry9Cproteinsin Processed Foods. The Analytical Environmental Immunochemical Consortium Annual Meeting, May 2 2001.

23. Yeung, J.M., Diaz, C., and Fernandez, C. (2001) Managing food Allergens. International Food Technologies Washington Meeting, April 26, 2001

24. Yeung, J.M., Lai, E.P.C. and Mullett, W. (2000) Is Biosensor a viable method for food allergen detection? 219th Annual ACS National Meeting in San Francisco. Abstracts of Papers American Chemical Society, . 219 (1-2), AGRO 116.

25. Yeung, J.M. (1999) Developments in Immunochemical Methods for food allergens. Presented in the 113th AOAC International Annual Meeting and Exposition, Harvey W. Wiley Award Address and Symposium, September 26-30, 1999, Houston, TX, #104, p 48-49.

26. Yeung, J.M., Fernandez, C., McDonald, R. (1999) Evaluation of three commercial ELISA kits for peanut proteins. Presented in 218th Annual ACS Natonal Meeting in New Orleans, August 22-26, 1998. Abstracts of papers, Part 1, AGFD #.54

27. Tsai, E., Yeung, J., Gold, M., Sussman, G., Vadas, P. (1999) Study of the allergenicity of plant protein hydrolysates. J. Allergy Clin. Immunol. 103 NO.1 PART 2, 1999,PP. S68.

28. Yeung, J.M., Newsome, W.H. and Abbott, M.A. (1998) Determination of undeclared egg allergen in food. Presented in 216th Annual ACS Natonal Meeting in Boston, August 223-27, 1998. Abstracts of papers, Part 1, AGFD #080.

29. Yeung, J.M. (1998) Frontiers of immunoassay for the analysis of food. The 15th annual Hewlett Packard Analytic Forum, January 19-21, 1998, Vienna, Austria, Abstract p 17.

30. Yeung, J.M. (1998) Strategies to detect food allergens. Center for Analytical Chemistry, Institute for Agrobiotechnology, Tulln, Austria, January 22, 1998.

31. Yeung, J.M. and Collins, P.G. (1997) Determination of undeclared soy allergen in foods. Eleventh symposium of the Protein Society, July 12-16, 1997, Boston, MA, Abstract # 0574.

32. Yeung, J.M., Collins, P.G. and Abbott, M.A. (1997) Detection allergens to avoid tragedies. First Interagency Meeting on Food Safety and Nutrition Research, May 12-13, 1997, Ottawa, Ontario, Abstract #8.

33. Yeung, J.M. and Abbott, M.A. (1997) Determination of undeclared egg proteins in foods. Interagency Meeting on Food Safety and Nutrition Research, May 12-13, 1997, Ottawa, Ontario, Abstract #40.

34. Scott, P.M., Yeung, J.M., Lawrence, G.A., Prelusky, D.B. (1997) Evaluation of enzyme-linked immunosorbent assay for analysis of beer for fumonisins. First Annual Interagency Meeting on food Safety and Nurition research, May 12-13, 1997, Ottawa, Ontario. Abstract #37.

35. Doucette, R., Yeung, J. M. and Nazarali, A. (1996) Olfactory ensheathing cells continue to express the Hox-a2, -b3 & -b4 transcription factors in cultures fed with triiodothyronine, TGF-beta, NGF or retinoic acid. Fourth Altschul Symposium on "Cell Biology and Pathology of Myelin: evolving biological concept and therapeutic approaches", University of Saskatchewan, June 27-29, 1996.

36. Hao, Z., Yeung, J. M., Doucette, R. and Nazarali, A. (1996) Hox-a2 Homeobox protein expression in the developing embryo. The 8th Pharmacy Research Day, Special Symposium on Drug Metabolism in Honour of Professor Ron Coutts, The University of Alberta, Sept 27, 1996.

37. Yeung, J.M. and Sen N.P. (1996) Determination of undeclared peanut proteins in wafers. International food Technologists Annual Meeting, June 22-26, 1996, New Orleans. Book of Abstracts 14C-10, p28.

38. Yeung, J.M., Prelusky, D.B. and Savard, M. (1995) A sensitive immunoassay for fumonisins B1 in corn. Ottawa Life Sciences Conference October 17 & 18, 1995. D2-04.

39. Mortimer, R.D. and Yeung, J.M. (1995) A simple immunoassay for difenzoquat in foods. Ottawa Life Sciences Conference October 17 & 18, 1995. D2-01.

40. Prelusky, D.B., Yeung, J.M. and Savard, M. (1995) A simple immunoassay for fumonisins B1 in corn. 5th Annual Joint Agriculture and Agri-Food Canada Meeting on Agri-Food Safety Research, September 11 & 12, 1995. Poster 1.

41. Yeung, J.M. and Collins, P. (1995) Immunochemical determination of peanuts in food products. Pediatr. Res. 37, 12A.

42. Yeung, J.M. and Newsome, W.H. (1994) An immunoassay for chlorothalonil in produce. Book of Abstracts, vol. 1, 75, Eighteenth IUPAC Congress of Pesticide Chemistry, July 4-9, 1994, Washington, DC.

43. Yeung, J.M. and Collins, P.G. (1993) Development of antibodies and an ELISA for alachlor. Book of Abstract, 311, American Chemical Society, 25th Central Regional Meeting, Pittsburgh, Pennsylvania.

44. Newsome, W.H. and Yeung, J.M. (1992) Development of ELISA method for the

determination of captan and its degradation product tetrahydrophthalimide. Book of Abstracts, Part 1, Agro 168. 203rd ACS National Meeting at San Fransico.

45. Stoff, D.M., Pasatiempo, A., Yeung J., Bridger, W.H. and Rabinovich, H. (1991) Prolactin response to repeated fenfluramine challenges in children. Biol. Psychiat. 29, 523S.

46. Stoff, D.M., Pasatiempo, A., Moja, E.J., Yeung J., Friedman, E. and Bridger, W.H. (1991) Rapid reduction in plasma tryptophan ratio by tryptophen free drink in healthy male volunteers. Biol. Psychiat. 29, 598S.

47. Stoff, D.M., Cook, E., Perry, B., Pasatiempo, A., Bridger, W.H., Friedman, E. and Yeung J. (1991) Blood serotonin indices in children. Biol. Psychiat. 29, 523S.

48. Stoff, D. M., Bridger, W. H., Friedman, E., Mahoney, A., Pasatiempo, A., Pollock,, L., Vitiello, B. and Yeung, J. (1989) Fenfluramine stimulates plasma prolactin and cortisol release in boys with disruptive behavior disorders. Biol. Psychiatry, 25. 120A.

49. Baker, G. B., Coutts, R. T., Yeung, J. M., Bornstein, R. A., Douglass, A. B. and Therrien, S. E. (1986) Utilization of electron-capture gas chromatography to study biogenic amines and their precursors and metabolites in body fluids. Provincial Mental Health Advisory Council (1986) Annual Conference Abstr. no pagination.

50. Nazarali, A. J., Baker, G. B., Boivert, D. P. and Yeung, J. M. (1985) A rapid and sensitive procedure for the analysis of polyamines in brain and plasma using electron-capture gas chromatography. Fifth Ann. Heritage Med. Res. Days Abstr. 5, 40.

51. Yeung, J. M., Baker, G. B. and Coutts, R. T. (1985) A rapid sensitive procedure for simultaneous analysis of seven bioactive amines in urine. J. Neurochem. 44, Suppl. (tenth Meet. Int. Soc. Neurochem., Abstr.), S102C.

52. Martin, R. T., Dowener, R. G. H., Baker, G. B., Boivert, D. P., Dewhurst, T. A., Yeung, J. M. and Locock, R. A. (1985) Combining electron-capture gas chromatography (GC-ECD) and high-pressure liquid chromatography with coulometric detection (HPLC-CD) for analysis of amino acids and amines in regions of monkey brain. J. Neurochem. 44, Suppl. (Tenth Meet. Int. Soc. Neurochem., Abstr.), S102A.

53. Yeung, J. M., Baker, G. B. and Coutts, R.T. (1984) Quantitative analysis of amino acids in biological samples by gas chromatography of their N(O,S)-pentafluorobenzoyl isobutyl esters. Soc. Neurosci. Abstr. 10, 232.

54. Yeung, J. M. and Baker, G. B. (1984) A novel gas chromatographic method of analyzing trace amines as their pentafluorobenzoyl derivatives in biological samples. Fourth Ann.

Heritage Med. Res. Days Abstr. 4, 56.

55. Dewhurst, T. A., Downer, R. G. H., Baker, G. B., Boivert, D. P. J., Martin, R.J., Locock, R. A., and Yeung J. M. (1984) Use of gas chromatography and high-pressure liquid chromatography to study brain levels of amino acids, amines and their metabolites in regions of monkey brain. Fourth Ann. Heritage Med. Res. Days Abstr. 4, 52.

56. Yeung, J. M. and Knaus, E. E. (1982) Substituted N-phenylcarbonyl-amino-1,2,3,6-tetrahydropyridines with analgesic hyperglycemic/hypoglycemic activities. Second Ann. Heritage Med. Res. Days Abstr. 2, A077.

57. Yeung, J. M. and Knaus, E. E. (1981) N-carbonylamino- 1,2,3,6-tetrahydropyridines with potent analgesic and hyperglycemic activity. First Ann. Heritage Med. Res. Days.

58. Yeung, J. M. and Knaus, E. E. (1980) The design and synthesis of N-(carbonylamino)-1,2,3,6-tetrahydropyridines with hyperglycemic and hpoglycemic activities. The 27th Canadian Conference on Pharmaceutical Res.

AOAC INTERNATIONAL

The Scientific Association Dedicated to Analytical Excellence®

MEMORANDUM

Date: **February 5-6, 2015**

To: **AOAC INTERNATIONAL Official Methods Board**

From: **Deborah McKenzie – Staff Liaison, AOAC Official Methods Board**

Subject: **Methods Approved Update**

Verbal Update.

AOAC INTERNATIONAL

The Scientific Association Dedicated to Analytical Excellence®

MEMORANDUM

Date: **February 5-6, 2015**

To: **AOAC INTERNATIONAL Official Methods Board**

From: **Deborah McKenzie – Staff Liaison, AOAC Official Methods Board**

Subject: **Achieving Quorum and ERP Member Conduct**

Verbal Update.

AOAC INTERNATIONAL

The Scientific Association Dedicated to Analytical Excellence®

MEMORANDUM

Date: **February 5-6, 2015**

To: **AOAC INTERNATIONAL Official Methods Board**

From: **Shauna Roman – Chair, AOAC Official Methods Board**

Subject: **OMB Spring/Summer Meeting**

Verbal Update.