Laboratory Capacity Building for the Determination of Toxic Contaminants in Seafood

APEC Subcommittee on Standards and Conformance

July 2012

APEC Project CTI 21/2011T

Prepared by

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Asia-Pacific
Economic Cooperation

Contents

Project CTI 21/2011T: "Laboratory Capacity Building for the Determination of Toxic Contaminants in Seafood"

Background

This Project aim was to develop and strengthen the laboratory capacity of food inspection laboratories within APEC economies to measure toxic and essential elements like arsenic (As), cadmium (Cd), iron (Fe), and zinc (Zn) in seafood for domestic consumption and for export purposes. The Project follows up on issues identified through the APEC Project (CTI 20/2009T) Strengthening Chemical Metrology Infrastructure for Member Economies and directly supports APEC Food Safety Cooperation Forum (FSCF) objectives of building laboratory capacity.

2. The Project Overseer was Mr. Jose Dajes Castro, Head of INDECOPI, Peru NMI and the Project Coordinators were from the Asia-Pacific Metrology Programme (APMP): Dr. Della Sin of the Government Laboratory of Hong Kong, China (GLHK), Chair of the APMP Technical Committee for Metrology in Chemistry (TCQM), and Drs. Lindsey Mackay (Member, TCQM) and Angela Samuel (Member, APMP Developing Economies' Committee) from the National Measurement Institute, Australia (NMIA). The Project Consultant was Dr. Chainarong Cherdchu, former Deputy Director of the National Institute of Metrology (Thailand) (NIMT).

The Preparatory Workshop

3. The Preparatory Workshop was co-hosted by NIMT and the Department of Medical Sciences (DMSc) and was held from 12-16 September 2011 at DMSc, Nontaburi, Thailand. There were 18 registered Workshop participants representing 10 APEC member economies (**Annex A**). The training courses included method validation and estimation of measurement uncertainty of testing results as well as hand-on operation and laboratory demonstration. The workshop was delivered by 2 Thai experts, namely Dr. Charun Yafa from NIMT and Ms. Laddawan Rojanapantip from DMSc. Overall results of the workshop were evaluated by the participants and experts to be of high quality.

4. The participants' recommendations for improvement are as follows:

a) Administrative details such as invitation letters, confirmation forms, etc. should be provided at least one month prior to the actual date of travel in

order to facilitate travel and financial arrangements. Some participants also suggested that the workshop be hosted at a hotel to avoid/reduce accommodation and meal costs;

b) Participants should be informed 2-3 weeks in advance of the agenda, timetable, and venue so they can prepare well for active participation in the workshop;

c) It would be better if participants had the opportunity to perform the practical work themselves in addition to demonstrations by the experts.

d) The workshop duration should be longer than one week; and

e) Participants should be provided with more information about PT programs, specific testing, selection of scientific equipment as well as methods and procedures.

5. Participants also suggested more discussion on the following topics:

a) Seafood safety- Collection of data re: toxic heavy metal contamination in seafood according to species, size and origin, which should provide information on the status of pollution in each economy;

b) More practical information on statistics in the use of laboratory generated data to estimate combined uncertainty and expanded uncertainty;

c) More in-depth training on ICP-MS, CTA, VCA, microwave digestion, determination of arsenic speciation;

d) Method validation and quality assurance systems; and

e) More background on PT schemes and procedures for conducting them.

6. Participants proposed the following follow-up activities:

a) Gathering of information from each economy and relevant institution on the position, activity, method, technique, and mechanism for the determination of the maximum permissible limits of toxic elements in seafood, to be shared among APEC member economies;

b) Each participant should provide the Project Coordinators with information on their approaches to method validation and estimation of measurement uncertainty prior to distribution of PT samples for analysis and reporting; and

c) Notifications and invitations for the Workshops and PT scheme should be sent to one contact person per economy well ahead of activities. More laboratories should be invited to participate in the PT scheme.

The APEC Proficiency Testing (PT) Program "Essential and Toxic Elements in Seafood"

7. The PT program was organized by GLHK as the PT provider. The APEC PT was run in parallel with a supplementary APMP comparison (APMP.QM-S5) using the same test samples of dried shrimp. It was stipulated that the supplementary comparison reference values (SCRV) of APMP.QM-S5 would be used as the assigned values for the APEC PT.

8. A total of 18 laboratories from 10 APEC member economies registered for the program. The test samples were distributed after the Preparatory Workshop by the end of September 2011. Results of determinations were reported to the organizer by all 18 laboratories before the scheduled deadline of 20 February 2012. PT participants are listed in **Annex B** and participants in the Concluding Workshop in **Annex D**. Almost all participants who attended the APEC Preparatory Workshop also participated in the APEC PT except Chile and Singapore, who attended neither the Preparatory Workshop nor the Concluding Workshop. The representatives from Indonesia who attended the Preparatory Workshop did not participate in either the APEC PT or the Concluding Workshop.

9. Pending confirmation of the SCRV by the Consultative Committee for Metrology in Chemistry (CCQM) (http://www.bipm.org/en/committees/cc/ccqm/), the median values of the results reported by national metrology institutes (NMIs) or designated institutes (DIs) obtained from APMP.QM-S5 were used as the provisional assigned values for evaluating the performance of participants in the APEC PT, as shown in the Report in **Annex C**. The Final Report of the APEC PT will be issued pending final approval of the SCRV by the CCQM.

The Concluding Workshop

10. The Concluding Workshop was held from 18-20 June 2012 in Bangkok, Thailand. The objectives were to present the PT results, review methodologies and discuss action plans to address identified issues and further develop measurement capabilities and related issues for APEC member economy laboratories. The agenda is shown in **Annex D**.

11. A total of 15 participants from 9 economies attended the workshop. Participants who attended the Concluding Workshop were mainly from government laboratories/institutes responsible for food testing and were very interested to learn and share technical experiences. Amongst the economies that participated in the APEC PT, only Chile and Singapore did not send any representatives responsible for food testing to attend the Concluding Workshop. Two representatives, one from Brunei Darussalam and the other from Chinese Taipei, were self-funded; and the rest were APEC-funded participants. Ms. Supanoi Subsinserm from Thailand, only attended the first day of the Workshop to discuss her results on the amount of cadmium in seafood. Three APEC experts, namely Ms. Maria del Rocio Arvizu from CENAM, Dr. Yip Yiu-chung from GLHK (self-funded) and Dr. Charun Yafa from NIMT provided lectures and presentations on the PT results.

12. All participants in the Concluding Workshop were informed of the use of median values for the valid results from APMP.QM-S5 as the provisionally assigned values for the evaluation of the performance of PT participants by means of z-scores, as detailed in the Final Report (**Annex C**).

13. A round table discussion was held on the final day of the Concluding Workshop on laboratory capacity building in food testing. Participants' views are summarized in **Annex E**.

14. All participants and the 3 experts were asked to evaluate the Concluding Workshop by filling in an Evaluation Form, returned to Dr. Chainarong for collection and analysis. Their evaluation is summarized in **Annex F**. Most participants suggested that another round of similar APEC PT program be organized and that the protocol for administration should be prepared well in advance, i.e. providing at least one month for preparation before the actual activity takes place.

Conclusions

15. This APEC Project has paved the way for increased and closer future

collaboration among APEC member economies. The Project has demonstrated an efficient integrative model of analytical chemistry with metrology in chemistry and the related priority issues such as the use of reference materials and certified reference materials, method validation, estimation of measurement uncertainty, proficiency testing schemes, and the quality infrastructure system which includes metrology, standardization, testing and quality assurance. This Project has reinforced the need for technical/procedural capability building of analysts/chemists involved in food safety testing. Testing procedures (eg. ISO or AOAC) and quality assurance requirements for method validation and estimation of measurement uncertainty need to be understood in order to achieve comparable and meaningful results. The organizers hope to see international harmonization of quality assurance requirements for food testing for use by chemists.

Acknowledgements

16. The Project Overseer and all project coordinators would like to thank the APEC SCSC for supporting the project, and all experts and scientists for their efforts in organizing and running the workshops and proficiency testing program.

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Annex A. Agenda and List of Participants for APEC Preparatory Workshop

Economy	Name of applicant	Position in organization	E-mail address	Telephone & Fax	Name of Organization	APEC FUNDING
Papua New Guinea	Peter Corbett	Laboratory Manager	peter.corbett@nari.org.pg	(+675) 321 2690 *& (+675) 320 2411*	National Agricultural Research Institute (NARI) Chemistry Laboratory.	Yes
Papua New Guinea	Hilda.Sim	Quality Manager	hilda.sim@nari.org.pg	(+675) 321 2690 & (+675) 320 21411	National Agricultural Research Institute (NARI) Chemistry Laboratory	Yes
Philippines	Belinda S. Raymundo	Chief, Fisheries Product Testing Laboratory	bfarphtd@yahoo.com	411-60-15	Bureau of Fisheries and Aquatic Resources	Yes
Philippines	Flordeliza D. Cambia	Quality Assurance Manager (QA), Fisheries Product Testing Laboratory	bfarphtd@yahoo.com	411-60-15	Bureau of Fisheries and Aquatic Resources	Yes
Chinese Taipei	Shih, Ju-Ying	Technical Specialist	jy.shih@bsmi.gov.tw	Tel: 886-7-2511151 Fax: 886-7-2415825	Kaohsiung Branch, Bureau of Standards, Metrology and Inspection	No
Chinese Taipei	Hsu Che-Lun	AssociateTechnical Specialist	jerlun@fda.gov.tw	Tel: 886-2-27877711	Food and Drug Administration	No
Thailand	Laddawan Rojanapantip	Medical Scientist	laddawan.r@dmsc.mail.go.th	Tel.: 6629511021	Bureau of Quality and Safety of Food	Yes
Thailand	Mrs Supanoi Subsinserm	Senior Food Technologist	supanois@fisheries.go.th; supanois@ymail.com	Tel.: 6625580150-5 ext 13300	Fish Inspection & Quality Control Division	Yes
Indonesia	Dra Hurip Budi Riyanti	Head of Nutrition Section	hbrbbu06@yahoo.co.id	Tel.: 62 21 424 5075	National Quality Control Laboratory of Drug and Food, National Agency of Drug and Food Control	Yes
Indonesia	Ms. Christine Elishian	Research Staff	kristinshian@yahoo.com	Tel.: +62-22-2503051	Research Center for Chemistry-Indonesian Institute of Sciences (RCChem-LIPI)	Yes
Indonesia	Mr Willy Cahya Nugraha, S.Si	Technical Staff	willy_cahyanugraha@yahoo.com	Tel.: +62-22-2503051	Research Center for Chemistry-Indonesian Institute of Sciences (RCChem-LIPI)	No
Malaysia	Mr. Abdul Mokty Nor Muaiza Binti	Food Technologist	normuaiza@moh.gov.my	Tel: 603-61261200-1250	National Public Health Laboratory, Ministry of Health	Yes
Mexico	Mr. Daniel Gonzalez Avila	Centro Nacional de Residuos T é xicos	daniel.gonzalez@senasica.gob.mx	Tel. +52 55 590510 00	SENASICA	Yes
Mexico	Mr. Guillermo Vega	Commission for Analytic Control and Coverage Extension, Federal Commission for Protection from sanitary risk	gvega@cofepris.gob.mx	Tel. +52 55 50805200	COFEPRIS	Yes
Peru	Mr. Christian Uribe	Chemical Metrology Laboratory Responsible	curibe@indecopi.gob.pe	Tel. +5112247800-1331	INDECOPI	Yes
Peru	Mrs. Diana Milagros Aranda Pariasca	Chemistry Laboratry Analyst	daranda@itp.gob.pe	Tel. 055-01- 5773130 Annex 131	Instituto Tecnologico Pesquero del Per ú - ITP	Yes
Vietnam	Mr. Vo khanh ha	Quality manager and specialist of food analysis	haquatest2@yahoo.com	Telephone: +84.511.3848338 & Fax: +84.511.3910064	Quality Assurance and Testing center 2 (Quatest2)	Yes
Vietnam	Mrs Le Thi Viet Hong	Head of Food Testing Laboratory	leviethong72@yahoo.com	Tel: 84-4 37564618; Fax: 84-4 38361199	Quality Assurance and Testing Center 1	Yes
China	LIU Hanxia	Head of Food Testing Department	liuhanxia@caiqtest.com	86-10-85773355-2255 / 86-13552141479	Chinese Academy of Inspection and Quarantine (CAIQ)	Yes

Annex B

Participant list for APEC PT "Essential and Toxic Elements in Seafood"

No.	ECONOMIES	INSTITUTES
1	Chile	1. Gestion de Calidad y Laboratorio S.A
2	Malaysia	1. National Public Health Laboratory, Ministry of Health Malaysia 2. SGS Laboratory Services (M) Sdn Bhd
3	Mexico	1. Centro Nacional de Servicios de Constatacion en Salud Animal 2. Laboratorio de Residuos Toxicos del Centro de Investigacion en Alimentacion y Desarrollo, A.C. 3. Commission for Analytic Control and Coverage Extension, Federal Commission for Protection from Sanitary Risk 4. Commission for Analytic Control and Coverage Extension, Federal Commission for Protection from Sanitary Risk
4	Papua New Guinea	1. National Agricultural Research Institute (NARI) Chemistry Laboratory
5	Peru	1. INSTITUTO TECNOLOGICO PESQUERO DEL PERU 2. INDECOPI
6	Philippines	1. Fisheries Product Testing Laboratory (FPTL) - Bureau of Fisheries & Aquatic Resources
7	Singapore	1. Veterinary Public Health Laboratory 2. Health Sciences Authority – Food Safety Lab
8	Chinese Taipei	1. Food and Drug Administration
9	Thailand	1. Fish Inspection and Quality Control Division, Department of Fisheries, Thailand 2. Heavy Metal Laboratory, Bureau of Quality and Safety of Food, Department of Medical Sciences
10	Vietnam	1. Quality Assurance and Testing Center 1 - Laboratory No. 4 2. QUALITY ASSURANCE & TESTING CENTRE 2 CHEMISTRY AND MICROBIOLOGY TESTING LABORATORY
	Total No.:	**18**

Asia-Pacific Economic Cooperation Proficiency Testing Programme (APEC PT)

Essential and Toxic Elements in Seafood

Final Report - Using the Median Values obtained from APMP.QM-S5 as the Provisional Assigned Values for Performance Evaluation

Coordinated by
Government Laboratory, Hong Kong (GLHK)

7/F., Homantin Government Offices
88 Chung Hau Street, Homantin, Kowloon
Hong Kong, China

June 2012

APEC Proficiency Testing Programme: Essential and Toxic Elements in Seafood

1. Overview of the programme

1.1. The purposes of the study were (i) to assist participating laboratories in demonstrating competence on the measurement of the contents of the incurred analytes (iron, zinc, total arsenic and cadmium) at μg/g levels in the proficiency test sample containing dried shrimp powder by various analytical techniques; and (ii) to identify problems and opportunities for self-improvement.

1.2. A total of 18 laboratories registered for the APEC PT programme. All 18 laboratories returned the analytical results to the proficiency testing provider within the scheduled timeline.

2. Assigned values and standard deviations for proficiency assessment

2.1. The APEC PT was concurrently conducted in parallel with the supplementary comparison of the Asia Pacific Metrology Programme APMP.QM-S5 using the same test material of dried shrimp. It was stipulated that the supplementary comparison reference values (SCRV) obtained from APMP.QM-S5 would be used as the assigned values for evaluating the performance of participants in the APEC PT.

2.2. The results for APMP.QM-S5 submitted by the participating national metrology institutes/designated institutes were presented by the Government Laboratory, Hong Kong (The Coordinating Laboratory of this APEC PT and APMP.QM-S5) at the Consultative Committee for Amount of Substance (CCQM) Inorganic Analysis Working Group (IAWG) meeting held in April 2012. After discussions with some members of the IAWG and the APMP coordinators, the median values were proposed by the Government Laboratory to be the best estimate of SCRV. Subject to the final approval by the CCQM IAWG, the median values of the four analytes obtained from APMP.QM-S5 were used as the provisional assigned values for the evaluation of the performance of participants in this report. The Final Report of the APEC PT would be issued pending final approval of the SCRV.

2.3. The standard deviations for proficiency assessment (σ) were derived from the Horwitz Equation[7.1]. The assigned values and σ are summarized as follows:

Analyte	Assigned value (µg/g)	Standard deviation for proficiency assessment, σ (µg/g)
Iron	183.5	13.4
Zinc	60.0	5.2
Arsenic (total)	44.7	4.0
Cadmium	0.224	0.045

3. Performance assessment

3.1. Participants' performance was assessed using the z-score, which is calculated as follows:

$$z = \frac{x_i - x}{\sigma}$$

where x_i = the reported result of the i^{th} participant
x = the assigned value*
σ = the standard deviation for proficiency assessment estimated from the Horwitz Equation
[$\sigma = 0.02c^{0.8495}$, where c is the assigned value of the analyte expressed as a dimensionless mass ratio (e.g. 1 µg/g = 1 ppm = 10^{-6})]

Note: * The median values of the four analytes obtained from APMP.QM-S5 were used as the assigned values.

3.2. The z-Score is commonly interpreted as:

(i) $|z| \leq 2$ Satisfactory

(ii) $2 < |z| < 3$ Questionable

(iii) $|z| \geq 3$ Unsatisfactory

Participants having $|z| \geq 3$ should thoroughly investigate their results. Participants having z-scores in the range $2 < |z| < 3$ are also encouraged to review their results.

4. Number of valid results submitted by participants

Analytes	Fe	Zn	As (total)	Cd
Number of valid results submitted by participants	14	15	16	18

5. Participants' results and z-scores

5.1. Participants' results (mean value, combined standard uncertainty, coverage factor and expanded uncertainty) of Fe, Zn, As (total) and Cd and z-scores are given in Tables I to IV respectively.

5.2. z-scores marked bold were considered as unsatisfactory (ie. $|z| \geq 3$).

5.3. Participants' z-scores for Fe, Zn, As (total) and Cd are presented graphically in Appendixes I to IV respectively.

5.4. It is possible for the z-scores published in this report to differ slightly from the z-score that can be calculated using the equation given in Clause 3.1. These differences arise from the necessary rounding of the actual assigned values and standard deviations for proficiency assessment prior to their publication in Tables I to IV.

6. The outcome of the APEC PT, and reflecting the application of knowledge gained in the workshops

6.1. This APEC PT was conducted after the Preparatory Workshop held on 12-16 September 2011 in Bangkok, Thailand, which involved hands-on laboratory training as well as lectures on estimation of measurement uncertainty and method validation.

6.2. To sum up the outcome of the APEC PT, the participants' z-scores for the four analytes are summarized as follows:

z-Score	Number of Participants (Percentage)			
	Iron	**Zinc**	**Arsenic (total)**	**Cadmium**
$\|z\| \leq 2$	7 (50.0%)	13 (86.7%)	11 (68.8%)	14 (77.8%)
$2 < \|z\| < 3$	3 (21.4%)	1 (6.7%)	2 (12.5%)	1 (5.6%)
$\|z\| \geq 3$	4 (28.6%)	1 (6.7%)	3 (18.8%)	3 (16.7%)
Total:	14 (100%)	15 (100%)	16 (100%)	18 (100%)

6.3. Most of the participants obtained satisfactory results related to the determination of Zinc, Arsenic (total) and Cadmium. However, only 50% of participants obtained satisfactory results related to the determination of Iron. Further improvement on the technical competence on the measurement of Iron was necessary.

6.4. The PT performance was reviewed and discussed at the Concluding Workshop held on 18-20 June 2012 in Bangkok, Thailand. Amongst other things, most of the participants suggested that another round of similar PT programme be organized.

Table I. Participants' results and z-scores for Iron

Lab. code	Mean value (µg/g)	Combined standard uncertainty (µg/g)	Coverage factor *k* (95% level of confidence)	Expanded uncertainty (µg/g)	z-Score
1	122.278	0.016	2	0.031	**-4.57**
2	167	4.3	2	8.6	-1.23
3	179	---	---	---	-0.34
4	143	5.00	2	10.0	**-3.02**
5	153.923	14.882	2	29.764	-2.21
6	207	---	2	11.1	1.75
7	---	---	---	---	N/A
8	178	8.03	2	16.1	-0.41
9	194.855	---	---	---	0.85
10	204.110	---	---	---	1.54
11	---	---	---	---	N/A
12	145	6.10	2.26	± 13.8	-2.87
13	185	11.6	2	23.2	0.11
14	127	4.13	2	8.26	**-4.22**
15	131.175	14.1370	2	28.274	**-3.91**
16	---	---	---	---	N/A
17	---	---	---	---	N/A
18	145	1.44	2	2.88	-2.87

"---" Data or information was not provided.
N/A: Not applicable

Table II. Participants' results and z-scores for Zinc

Lab. code	Mean value (µg/g)	Combined standard uncertainty (µg/g)	Coverage factor *k* (95% level of confidence)	Expanded uncertainty (µg/g)	z-Score
1	54.995	0.021	2	0.042	-0.96
2	56.4	1.11	2	2.22	-0.69
3	61.3	---	---	---	0.26
4	52.5	1.84	2	3.68	-1.44
5	54.257	1.728	2	3.456	-1.10
6	61.7	---	2	2.27	0.34
7	---	---	---	---	N/A
8	60.8	2.63	2	5.26	0.16
9	60.124	---	---	---	0.03
10	60.095	---	---	---	0.03
11	---	---	---	---	N/A
12	55.5	2.35	2.26	± 5.31	-0.86
13	58.6	4.04	2	8.08	-0.26
14	57.1	1.86	2	3.72	-0.55
15	37.083	2.488	2	4.977	**-4.42**
16	---	---	---	---	N/A
17	47.8	1.5	2	3	-2.35
18	52.1	0.855	2	1.71	-1.52

"---" Data or information was not provided.
N/A: Not applicable

Table III. Participants' results and z-scores for Arsenic (total)

Lab. code	Mean value (µg/g)	Combined standard uncertainty (µg/g)	Coverage factor *k* (95% level of confidence)	Expanded uncertainty (µg/g)	z-Score
1	34.842	0.121	2	0.241	-2.44
2	43.5	0.5	2	1.0	-0.30
3	46.8	0.067	2	0.134	0.52
4	38.9	1.36	2	2.72	-1.44
5	50.073	2.794	2	5.588	1.33
6	22.0	---	2	1.69	**-5.62**
7	38.479	± 0.07	2	± 0.14	-1.54
8	44.2	1.86	2	3.73	-0.12
9	37.404	---	---	---	-1.81
10	40.642	---	---	---	-1.01
11	46.1	1.9	2	3.8	0.35
12	51.1	0.913	2.26	± 2.06	1.59
13	53.5	2.90	2	5.80	2.18
14	---	---	---	---	N/A
15	25.841	2.253	2	4.506	**-4.67**
16	---	---	---	---	N/A
17	26.8	1.3	2	2.7	**-4.43**
18	39.2	1.57	2	3.14	-1.36

"---" Data or information was not provided.
N/A: Not applicable

Table IV. Participants' results and z-scores for Cadmium

Lab. code	Mean value (µg/g)	Combined standard uncertainty (µg/g)	Coverage factor *k* (95% level of confidence)	Expanded uncertainty (µg/g)	z-Score
1	0.276	0.019	2	0.038	1.16
2	0.139	0.0025	2	0.005	-1.90
3	0.056	0.000108	2	0.000217	**-3.74**
4	0.121	0.00424	2	0.00848	-2.30
5	0.368	0.063	2	0.126	**3.21**
6	0.242	---	2	0.013	0.40
7	0.751	± 0.08	2	± 0.16	**11.74**
8	0.231	0.010	2	0.021	0.15
9	0.185	---	---	---	-0.87
10	0.176	---	---	---	-1.07
11	0.243	0.010	2	0.020	0.42
12	0.233	0.00489	2.26	± 0.0111	0.20
13	0.218	0.009	2	0.018	-0.14
14	0.304	1.99×10^{-3}	2	3.97×10^{-3}	1.78
15	0.250	0.0577	2	0.1155	0.58
16	0.232	0.001	2	0.002	0.18
17	0.29	0.02	2	0.033	1.47
18	0.202	0.003	2	0.006	-0.49

"---" Data or information was not provided.
N/A: Not applicable

6. Contact Person

6.1. For enquiries, participants may wish to make contacts as follows:

The co-ordinator of the proficiency testing programme
E-mail: apecs5@govtlab.gov.hk

Dr. Della Wai-mei SIN, GLHK
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Dr. Chuen-shing MOK, GLHK
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E-mail: ycyip@govtlab.gov.hk
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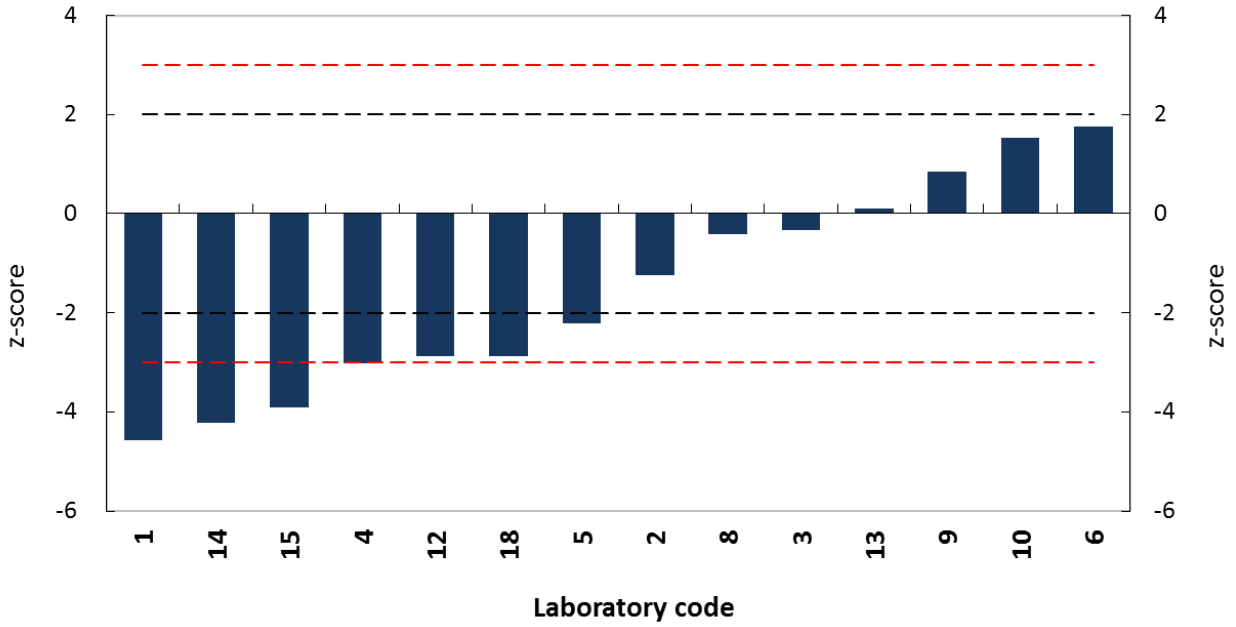
Dr. Lindsey MACKAY
E-mail: Lindsey.Mackay@measurement.gov.au

Dr. Angela SAMUEL, NMIA
E-mail: Angela.Samuel@nmi.gov.au
Tel.: +61 2 8467 3580

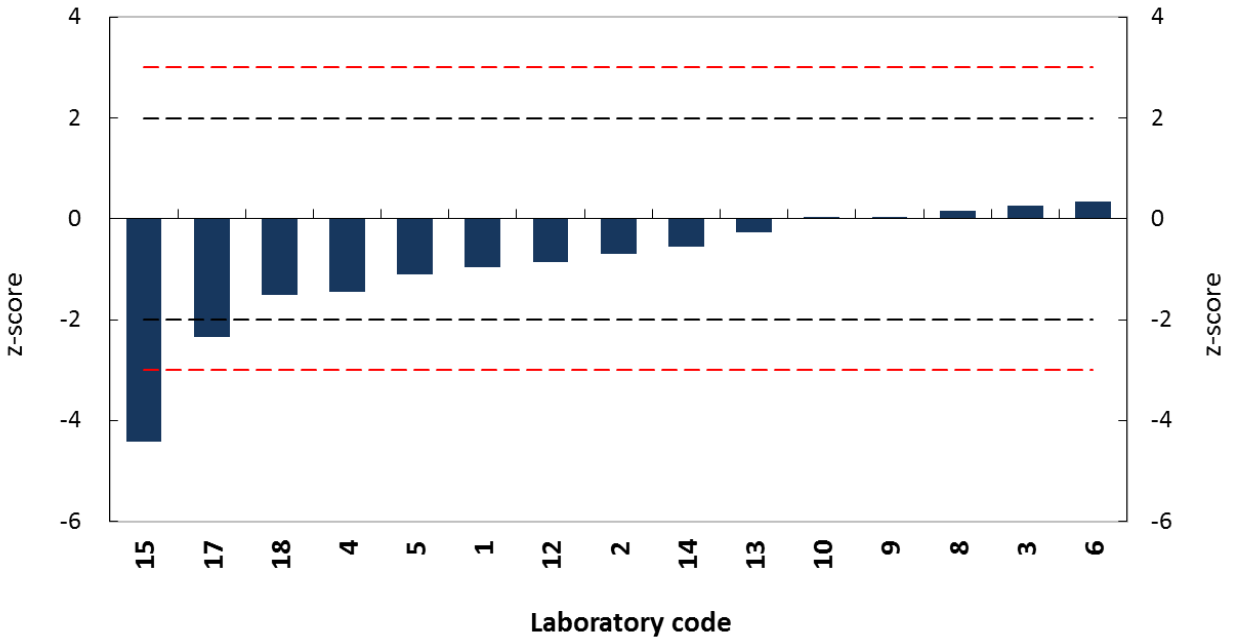
7. References

7.1. International Standards Organization. ISO 13528:2005, Statistical methods for use in proficiency testing by interlaboratory comparisons, ISO, Geneva, Switzerland.

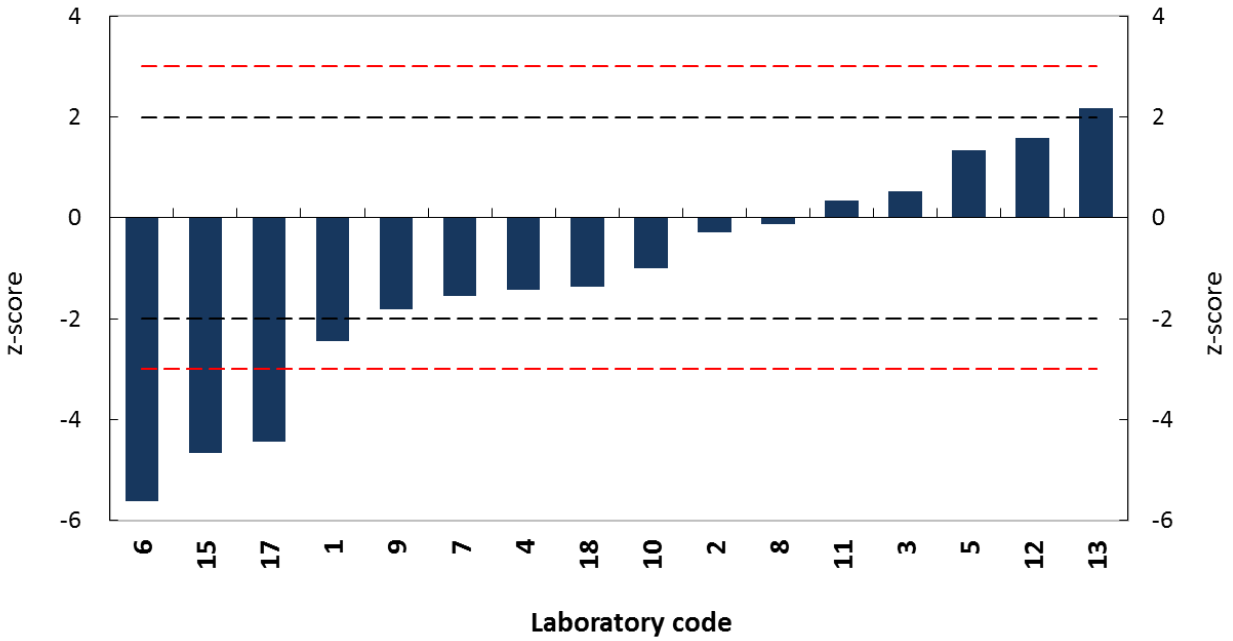
Appendix I: Participants' z-scores for Iron



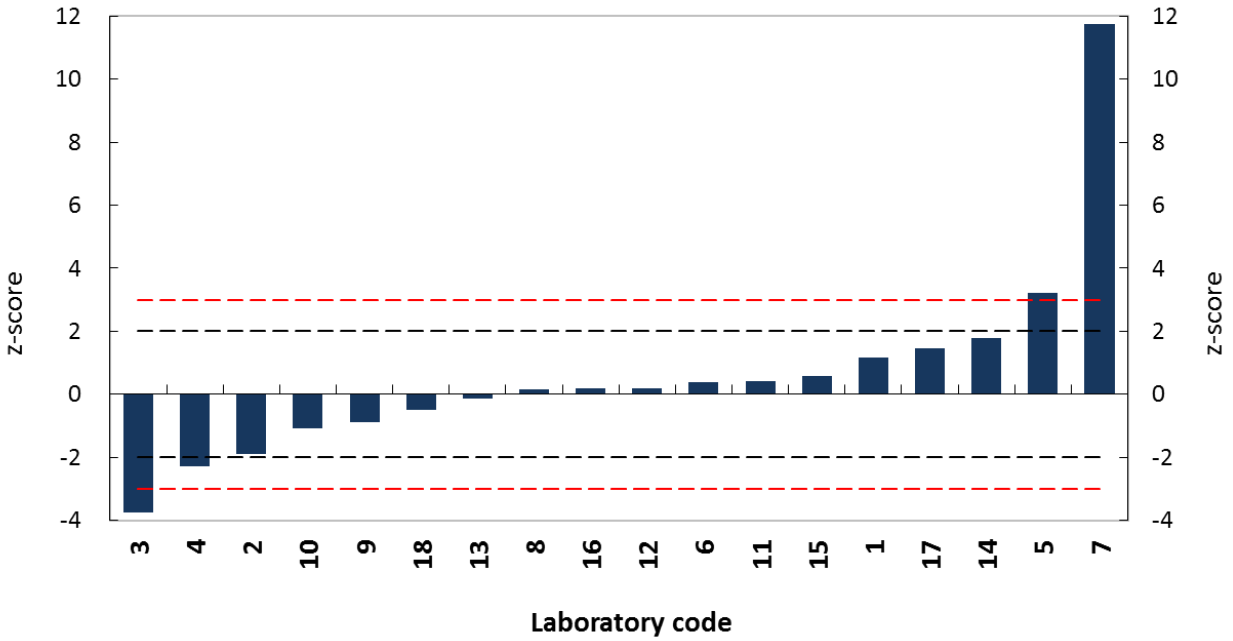
Appendix II: Participants' z-scores for Zinc



Appendix III: Participants' z-scores for Arsenic (total)



Appendix IV: Participants' z-scores for Cadmium



Agenda
APEC Concluding Workshop for Proficiency Testing Results: Essential and Toxic Elements in Seafood
18th – 20th June 2012
Krungthep III Room, Centara Grand Hotel at Central Plaza, Ladprao, Bangkok, Thailand

Day 1 (18th June, 2012)

09h00 - 09h15	Welcome address (NIMT Director)
09h15 - 09h30	Introduction to the workshop (Dr. Chainarong)
09h30 - 10h00	Overview of the APEC preparatory workshop held in Thailand (Dr. Chainarong/Charun)
10h00 - 10h45	Presentation and discussion of the proficiency test results (Drs. YC Yip, Charun Yafa, Maria del Rocio Arvizu)
11h15 - 12h30	Q&A from PT participants
14h00 - 15h30	Presentation by economies on lessons learnt (Economies concerned)
16h00 - 17h00	Presentation by economies on lessons learnt (Economies concerned)
17h00 - 18h00	Review of Day 1 activities

Day 2 (19th June, 2012)

09h00 - 09h15	Orientation
09h15 - 12h30	***Group work: discussions on approaches to method validation and measurement uncertainty in food testing** The session will allow participants to work through examples brought by economies and discuss different approaches, issues etc, including eg., traceability of results, calibrants, RMs.
14h00 - 15h30	Continuation of Group work
16h00 - 17h00	Presentation back on issues discussed and major problems
17h00 - 18h00	Review of Day 2 activities

Day 3 (20th June, 2012)

09h00 - 09h15	Orientation
09h15 -12h30	***Round Table Discussions** • How APEC could contribute to enhance laboratory capacity building in food testing? • The need of future laboratory capacity building programmes • The need of the economy for food testing, e.g. is that related to trade or food safety, identify the common needs among economies in the APEC • Identify problem facing the food testing laboratories in the APEC, i.e. is that related to a) lack of instrumentation, or b) lack of expertise, or c) lack of information exchange, or d) lack of resources. • Identify the current status of testing capability of the APEC economies, and what is the most appropriate support from APEC for capacity building etc. • The need for Traceable Measurements in Food Testing
14h00 - 15h30	Continuation of Round Table Discussions
16h00 - 17h00	Reporting back by discussion groups

17h00 - 18h00	Evaluation and Concluding remarks - Recommendations on future APEC activities

*Morning coffee break (10h45 - 11h15), Lunch (12h30 - 14h00) Afternoon coffee break (15h30 - 16h00)

Feedbacks and comments from participants on laboratory capacity building in food testing

No.	Question	Feedback and comment made by participants
1	How APEC could contribute to enhance laboratory capacity building in food testing?	Participants suggested the followings for consideration by APEC: • Provide training on the manipulation of advanced analytical instruments (e.g. HPLC-MS) for the analysis of complex analytes (e.g. marine toxins) • Provide training on the development of new analytical methodologies • Provide more appropriate PT programmes on a regular basis • Provide workshops on food testing • Provide work attachments • Provide free certified reference materials /reference materials (CRMs/RMs) or subsidize the cost of CRMs/RMs • Establish websites and database for sharing information about food testing • Provide updates on the latest food safety requirements/standards as legislated by countries such as USA, Australia, Japan, EU, etc. • Support in attaining ISO/IEC 17025 accreditation on food testing • Provide support to the service maintenance of analytical instruments • Similar projects like APEC Project CTI 21 2011T should be continued for the participation of more food inspection laboratories in the Asia-Pacific region.
2	The need of future laboratory capacity building programmes?	Participants gave their views on the need of future laboratory capacity building programmes as follows: • Future laboratory capacity building programmes could assist APEC member economies in defining and achieving goals towards sustainable food safety activities, commitments, and development of action plans about food safety.

No.	Question	Feedback and comment made by participants
		• Future laboratory capacity building programmes may be focused on the following areas: ➢ Harmonization of food safety requirements/standards ➢ Organization of new proficiency testing programmes related to the determination of contaminants/residues/environmental pollutants/toxic chemicals (e.g. marine toxins, carcinogens, radionuclides, toxic elements) ➢ Calibration services/activities ➢ Quality system audits ➢ Training courses on food safety ➢ Training courses on various analytical techniques ➢ Exchange of technical expertise through meetings, site visits, seminars, workshops and consultative work ➢ Risk assessment on food safety ➢ Development of metrology in Chemistry and its importance to food safety • Future programmes should have collaboration with the NMIs of the economies.
3	The need of the economy for food testing (e.g. is that related to trade or food safety, identify the common needs among economies in the APEC)	Participants gave their views on the need of the economy for food testing as follows: • Related to trade ➢ Food testing is important for (i) import/export quality compliance certification; (ii) showing compliance with nutritional labelling requirements; and (iii) promotion of food trade and investment. • Related to food safety ➢ Credible food testing ensures the production of high quality of food and food products in

No.	Question	Feedback and comment made by participants
		compliance with national and international standards and promotes the public awareness on food safety ➢ Prepare and tackle food outbreaks and incidents ➢ Protect the public health
4	Identify problem facing the food testing laboratories in the APEC, (i.e. is that related to (a) lack of instrumentation; (b) lack of expertise; (c) lack of information exchange; or (d) lack of resources)	The following problems were identified and currently faced by the participants: • Lack of instrumentation ➢ Funding for the acquisition of new facilities for sample dissolution/preparation (e.g. microwave digestion system) is not sufficient. • Lack of expertise ➢ Local service maintenance personnel do not possess the skills for the repair and maintenance of advanced analytical instruments (e.g. ICP instruments) ➢ Training on local service maintenance personnel should be necessary. • Lack of information exchange ➢ Local testing laboratories are not networked for sharing of resources and information. • Lack of resources ➢ Some CRMs/RMs supplied by foreign reference material producers are not affordable for some participants. ➢ Local reference material producers could not completely meet the demand for the production of sufficient CRMs/RMs for use by testing laboratories. Some countries do have any reference material producers.
5	Identify the current status of testing capability of the APEC	The current status of testing capability of the APEC economies are summarized as follows:

No.	Question	Feedback and comment made by participants
	economies and what is the most appropriate support from APEC for capacity building etc.	• Some participants reported that the quality systems adopted in their laboratories were in accordance with ISO/IEC 17025. • Some participants have demonstrated the strong testing capabilities on the determination of trace elements in seafood. However, a few participants are still developing testing capabilities on trace elemental analysis. Participants gave their views on the most appropriate support from APEC for capacity building as follows: • Establish a network for information exchange • Promote the use of ISO/IEC 17025 for laboratory accreditation • Conduct surveys on the organization of new proficiency testing programmes (e.g. speciation analysis of arsenic and tin) for consideration by APEC • Support government laboratories to provide testing services that are not readily available from private testing laboratories • Assist testing laboratories in developing testing capabilities so as to meet new food safety requirements/standards • Support the purchase of CRMs • Provide support to service maintenance of advanced analytical instruments
6	The need for traceable measurements in food testing	Participants gave their comments on the need for traceable measurements in food testing as follows: • Ensure that analytical results are traceable to SI and comparable to each other • Ensure the accuracy and reliability of analytical results reported to clients Participants also suggested the ways for the establishment of traceability in food testing: • Development of primary methods for inorganic

No.	Question	Feedback and comment made by participants
		analysis • Proper use of CRMs for calibration and method validation • Organization of new proficiency testing programmes like the current APEC PT on the determination of elements in seafood/other food matrices

APEC CTI 21/2011T: Laboratory Capacity Building for the Determination of Toxic Contaminants in Seafood- Concluding Workshop
June 18-20, 2012
Centara Grand Hotel at Central Plaza Ladprao, Bangkok, Thailand

ANNEX E. SUMMARY OF EVALUATION

Dear Participants(14)/Experts(3)

Your opinion is important for us and we would be grateful if you could fill in this questionnaire in order to help us to improve our workshops. We thank you in advance for your help!

Please provide us with:
Your profession: __Eng-Metalurgy Chemist, Analytical Chemist(Inorganic), Chemical Engineer,_Chemical Metrologist, Analytical Chemist, Food & Chemistry Analyst, Analysis of heavy metal element in water and food, Industrial Chemical Engineer, Science Officer,_Fisheries Officer

_____

Your position:_Scientific Coordinator,_Laboratory Manager,_Head of Chemical Metrology Laboratory,__Head of Inorganic Chemical Metrology Laboratory,_Analyst of Laboratory, Assistant Technical Specialist, Quality Manager, Staff in Food Testing Laboratory, Deputy Head of Laboratory, Coordinator and analyst of the Department Aquaculture and Fisheries,_Assistant Director of Accreditation, Head of Seafood Analytical Laboratory, Acting Senior Chemist, Chief, Fisheries Product Testing Laboratory, Quality Control Manager

_____

Are you working with a (please tick a box):

Accreditation Body	Inspection Body	Certification Body	State Laboratory	Private Laboratory	Other
2	4		11		

How long have you worked in toxic contaminant in seafood analysis (please tick a box)?

not yet	1 year	2-5 years	more than 5 years
1	2	6	6

Category	1 	2	3	4	5	6 
1. Organisation and logistics of the Workshop						
• Preparation, advance information			**11.8%**	**23.5%**	**35.3%**	**29.4%**
Comments: 1. It will be better to have the agenda at least 3 weeks before. 2. Although the workshop has been planned for long time the registration for the workshop came almost at the final day of the preparation. 3. Excellent. 4. The PT interim report was sent a bit late for participants to really sit down and go through.						

5. The information provided so fast despite the distance between countries. 6. Any presentation need to be done by participants, should be informed earlier as we need to get the data from relevant departments/agencies.						
• Logistics				**11.8%**	**29.4%**	**58.8%**
***Comments*:** 1. Excellent. 2. PowerPoint Presentation request for participants were also received late and participants have a limited time to present/prepare PowerPoint slides for this presentation.						
• Time schedule and overall duration					**41.2%**	**58.8%**
***Comments*:** 1. Everything was fine. 2. Excellent. 3. The agenda covers 9 hours each day it was a little tired but it's understandable because need to cover a lot of information a subject. 4. Okay since all participants were told to stay in the same hotel where the event was hosted.						
2. Workshop Program and Contents						
• Quality of information material: hand-outs			**5.9%**	**17.6%**	**23.5%**	**52.9%**
***Comments*:** 1. Very good. 2. Fit for intended purpose. 3. Information is well provided.						
• Quality of information material: slides			**5.9%**	**5.9%**	**35.3%**	**52.9%**
***Comments*:** 1. Excellent. 2. Good, but a few slide presentation is pretty hard to swallow in too short a time (e.g. MU-bottom up approach). 3. Hardcopy needs to be provided.						
• Relevance of topics for your work			**5.9%**		**23.5%**	**70.6%**
***Comments*:** 1. It must improve my work. 2. Very important. 3. All were good. 4. Clear, as it relates to work activities.						
• Did the workshop meet your expectations				**5.9%**	**29.4%**	**64.7%**
***Comments*:** 1. Meet that and more, we get to learn new techniques employed by other economies, generating good quality output. 2. Yes, it fulfilled my expectations.						
• Overall satisfaction with the workshop				**11.8%**	**47.1%**	**41.2%**

***Comments*:** 1. The participants must be reading some related information before the workshop. 2. Sorrowly, the agenda arrived me when I was leaving my country. It would be better if this is made with more anticipation. 3. Central Bangkok is not nice, may be the Workshop can be held in another part of Bangkok in the future (Just a thought). 4. It is well workshop.						
3. Experts(For participants only)						
• Professional competence of experts					**28.6%**	**71.4%**
***Comments*:** 1. Very experience and knowledgeable and helpful. 2. They are good and active. 3. Experts have extensive knowledge of the subject.						
• Professional and presentation skills of experts				**7.1%**	**21.4%**	**71.4%**
***Comments*:** 1. Good as expected. 2. They are very intelligent.						

Recommendations for improvement:

1. To encourage to the participants to read previous documents related with the topic of the workshop.
2. I am very grateful for the invitation but it would be good that the agenda of the Concluding Workshop had been sent with more days in advance.
3. Agenda may offer us earlier.
4. If confidentiality is not a problem to the participants, I would like to suggest if economies can be group together(satisfactory and non-satisfactory PT performance grouped together), so issues can be discussed and problems, advantages identified for improvement and enhancement.
5. One time PT program per one year.
6. Hold more workshop in the future.
7. Problems which every laboratory met when analyse PT sample.
8. Include other elements.
9. I think participants would be exhausted if it's too much discussion. May be organizer can vary the discussion like case study, etc.
10. To prepare handouts of presentation slides prior to workshop. Nonetheless participants able to discuss interesting matters in relevant to the PT program.
11. Participants should be able to present their PowerPoint presentation in English.
12. Group discussion and actual situationaire from the participating economies must always be a part of the workshop for sharing experience and identifying the gaps in the operational activities of the respective laboratories among APEC economies.
13. Acceptance for the attendance of workshop/meeting/seminars is

recommended to be at least 3-4 weeks in advance for the preparation of travel documents.

Which topics would you like to discuss more?

1. Details of the methods used for each participant.
2. Measurement uncertainty of the results.
3. Traceability of measurement results.
4. Method validation.
5. Uncertainty calculation for seafood (determination of metals in seafood).
6. It was okay.
7. Measurement uncertainty estimation and standard method verification.
8. I would like to have more discussion on measurement uncertainties since it is a big topic which is actually cannot be covered in one day session.
9. As you perform the analysis of the elements.
10. PT programmes including measurement uncertainty, method validation, etc.
11. The elements of method validation and measurement uncertainty for reporting test results.
12. The proper use of CRMs for method validation and calibration.
13. The establishment of SI-traceable of analytical results.
14. Topics on uncertainty measurement of practical exercise, how to evaluate them and perform corrective actions.

Which topics would you like to discuss less?

1. None, as all topics are interesting.
2. It was okay.
3. I don't think there is. This is because all the topics that what we have been discussed is very useful for our knowledge and good to be practiced to our lab works.
4. All issues are important to us.
5. Robustness, because it's involved analytical method.
6. Every topics discussed and evaluated in the workshop are very relevant and important to food testing laboratories.
7. None, all topics are relevant and informative/useful in our agency's goal of achieving ISO/IEC 17025 accreditation.

Proposals for follow-up activities:

1. To continue improving the different of procedures for method validation.
2. More PT schemes.
3. There should be for the workshop of this type on food quality testing.
4. Comparison of metals or pesticides in meat products.
5. Determination of biotoxins by HPLC-MS(training about this).
6. Development of rapid methods for detecting marine toxins(for example; ELISA technique).
7. Measurement uncertainty and method validation related directly to method development for toxic and essential elements in foods(e.g. seafood).
8. Both method validation and also measurement uncertainties.
9. Support CRMs, standard solutions, may be equipment option.
10. Carry out the project again to see the progress of the laboratories that

went wrong.

11. Organizer needs to keep in touch with all participants. They should update the achievement of participants.
12. Perhaps the PT sample distributed can be delivered to participants not participating in the first place.
13. Laboratory capacity building for the determination of trace organics in food should be organized to enhance the measurement capabilities of participating laboratory in future.
14. Host a laboratory training for laboratory personnel in the field of chemical and microbiological analyses relevant to food safety and SPS measures.
15. In-house training for method validation and estimation of measurement uncertainty.

Other comments:

1. To be in contact with the experts at least one month before the workshop in order to prepare better information material(slides).
2. It is convenient to continue with this kind of activities.
3. Nothing more in general, all were very good.
4. Thank you very much for involving us in this very important APEC workshop, we have learned a lot, met some new interesting people and hope we can still use that to broaden our knowledge and improve our capacity.
5. Can APEC support CRM sample for some labs ? Or can APEC introduce which company to buy CRM sample ?
6. It would be best if there is a compilation of data analysis/testing on Fisheries product/seafood on toxic element among the APEC's Laboratories. So from there we can see the trend on sample preparations to instrument analysis process where it can be as a guideline to improve the testing if possible.
7. To inform APEC economies for future PT program in canned food and feed for toxic contaminants, pesticide residues and microbiology analyses.
8. Food safety issues and testing activities in APEC economies to be shared so that economies can know the risk analysis/assessment that has been done/implemented.
9. Sharing of food regulating act in APEC economies so that members can develop/establish food standards comprising to current and future food safety.
10. Administrative arrangement must be transmitted in advance to facilitate travel authorization and financial logistics on the part of the participants.