CHILE, A FOOD POWER: THE IMPORTANCE OF THE QUALITY AND SAFETY OF EXPORTED PRODUCTS

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CENTRO METROLOGÍA
QUÍMICA DE AGUAS Y ALIMENTOS

GENERAL CONTEXT

- **The Chilean international trade strategy has led to trade agreements with more than 50 countries. This strategy has opened markets including more than 2,000 millions inhabitants.**
- **As tariffs decrease, technical barriers to international trade tend to increase. Lack of compatibility in standards, technical regulations or measurements are risk factors for the export products.**
- **Stringent regulations on the quality and safety of foods are continuously increasing, especially in the most sophisticated markets such as the European Union, North America and Japan.**
- **Consumers are more informed and more demanding on the safety, quality and nutritional issues of the food they consume.**

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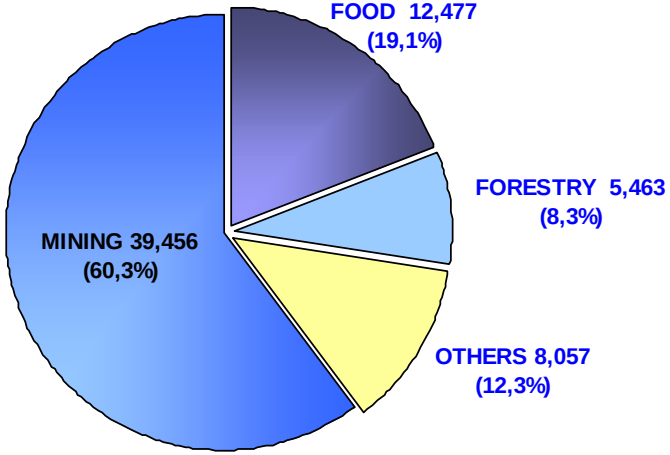
CHILE: A FOOD POWER

The Chilean food sector is the second most important export area after the mining industry.

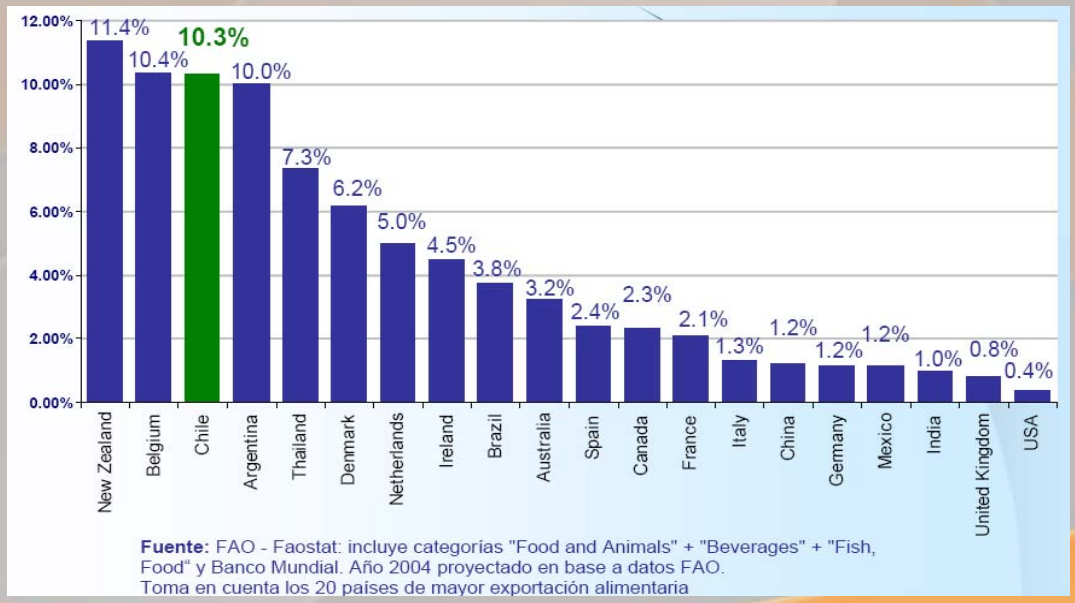
Our country aims to become one of the 10 main food exporters in the world.

Current exports of food products is quite diversified in type of products and destination markets.

Total Exports per Year 2008 (Millions USD)



Proportion of the export market as % del GIP



Fuente: FAO - Faostat: incluye categorías "Food and Animals" + "Beverages" + "Fish, Food" y Banco Mundial. Año 2004 proyectado en base a datos FAO.
Toma en cuenta los 20 países de mayor exportación alimentaria

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CHILE: A FOOD POWER

- **Presently, there exists an important private-public agreement in order to reach the target of becoming a "Food Power" in 2014, i.e., becoming one of the 10 most important world food exporters.**

Nº	País	2005*
1°	Estados Unidos	39.667
2°	Francia	28.147
3°	Bélgica	23.519
4°	Alemania	20.512
5°	Holanda	20.269
6°	Canadá	18.190
7°	China	17.219
8°	España	15.379
9°	Italia	14.582
10°	Australia	12.998
11°	Inglaterra	12.861
12°	Brasil	11.307
13°	Dinamarca	9.972
14°	Tailandia	9.480
15°	México	8.960
16°	Argentina	8.428
17°	**Chile**	**7.907**
18°	Nueva Zelanda	6.328
19°	Irlanda	5.860
20°	India	5.466

Fuente: FAO

Nº	País	2014
1°	Bélgica	52.532
2°	Estados Unidos	36.898
3°	Francia	23.765
4°	Canadá	22.294
5°	Alemania	20.771
6°	China	19.948
7°	Holanda	19.509
8°	España	18.152
9°	**Chile**	**17.170**
10°	Italia	16.145
11°	Brasil	15.495
12°	Australia	13.437
13°	México	11.202
14°	Inglaterra	10.112
15°	Dinamarca	9.981
16°	Tailandia	8.995
17°	Argentina	8.208
18°	Nueva Zelanda	7.315
19°	India	5.934
20°	Irlanda	4.653

Fuente: Proyecciones ChileAlimentos en base tasa de crecimiento anual promedio 2000-2004

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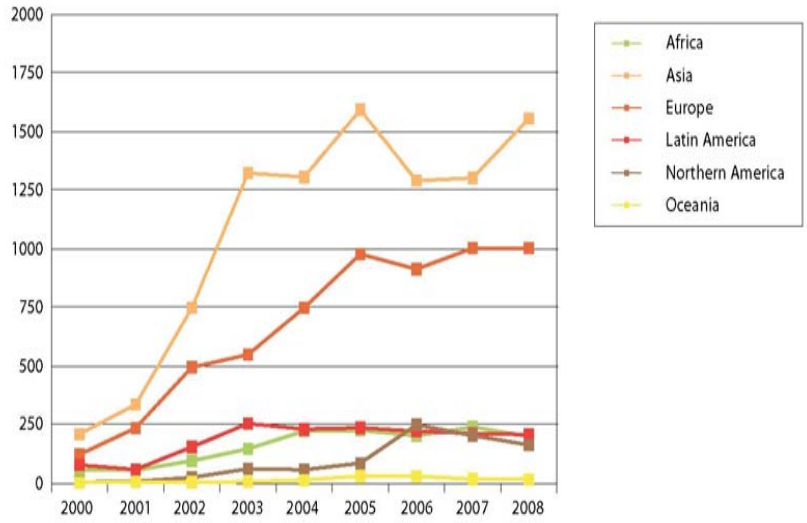
STRICT CONTROL SYSTEMS IN DESTINATION MARKETS: THE EU EXAMPLE

NOTIFICATIONS BY ORIGIN OF THE PRODUCT, CLASSIFIED BY WORLD REGION

World region	2000	2001	2002	2003	2004	2005	2006	2007	2008	total
Eastern Africa	8	4	8	15	6	21	22	25	16	125
Middle Africa	2		4	1	1	10	3	10	1	32
Northern Africa	18	28	32	73	67	61	71	77	96	523
Southern Africa	6	7	32	25	33	25	10	15	12	165
Western Africa	23	17	20	33	116	109	97	113	75	603
Eastern Asia	49	82	163	180	203	316	317	420	555	2285
South-central Asia	73	100	150	649	655	676	412	320	410	3445
South-eastern Asia	53	100	280	270	224	325	261	211	218	1942
Western Asia	35	54	155	225	225	277	301	352	373	1997
Eastern Europe	11	11	42	57	91	155	173	208	176	924
Northern Europe	25	38	85	109	157	156	157	135	146	1008
Southern Europe	28	108	145	162	221	330	265	316	305	1880
Western Europe	59	79	223	221	280	337	319	344	376	2238
Caribbean	2			4	2	2	7	8	14	39
Central America	8	3	10	10	19	17	10	31	23	131
South America	68	56	145	241	210	218	205	174	171	1488
Northern America	6	8	25	62	58	86	250	204	164	863
Australia and New Zealand	3	6	4	7	13	31	25	16	16	121
Melanesia			1		1		4	2	1	9
Polynesia							1			1

NOTIFICATIONS BY WORLD REGIONS 2000 - 2008



2008 – ALERT NOTIFICATIONS BY PRODUCT CATEGORY

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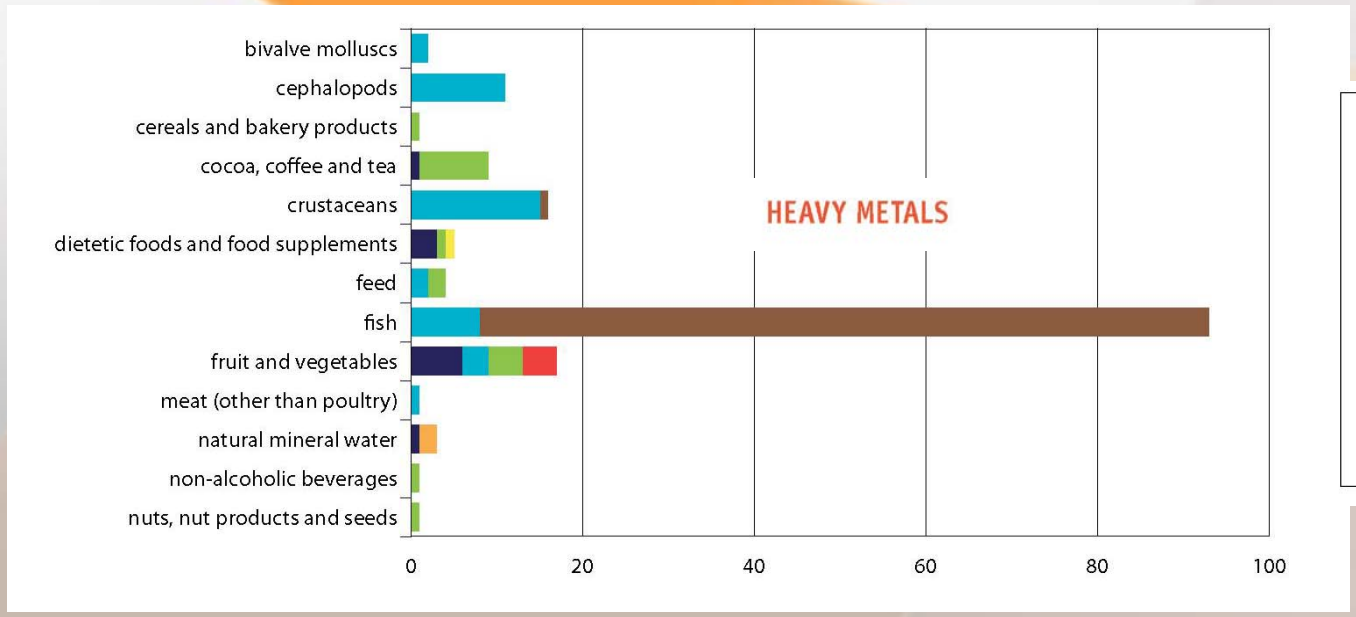
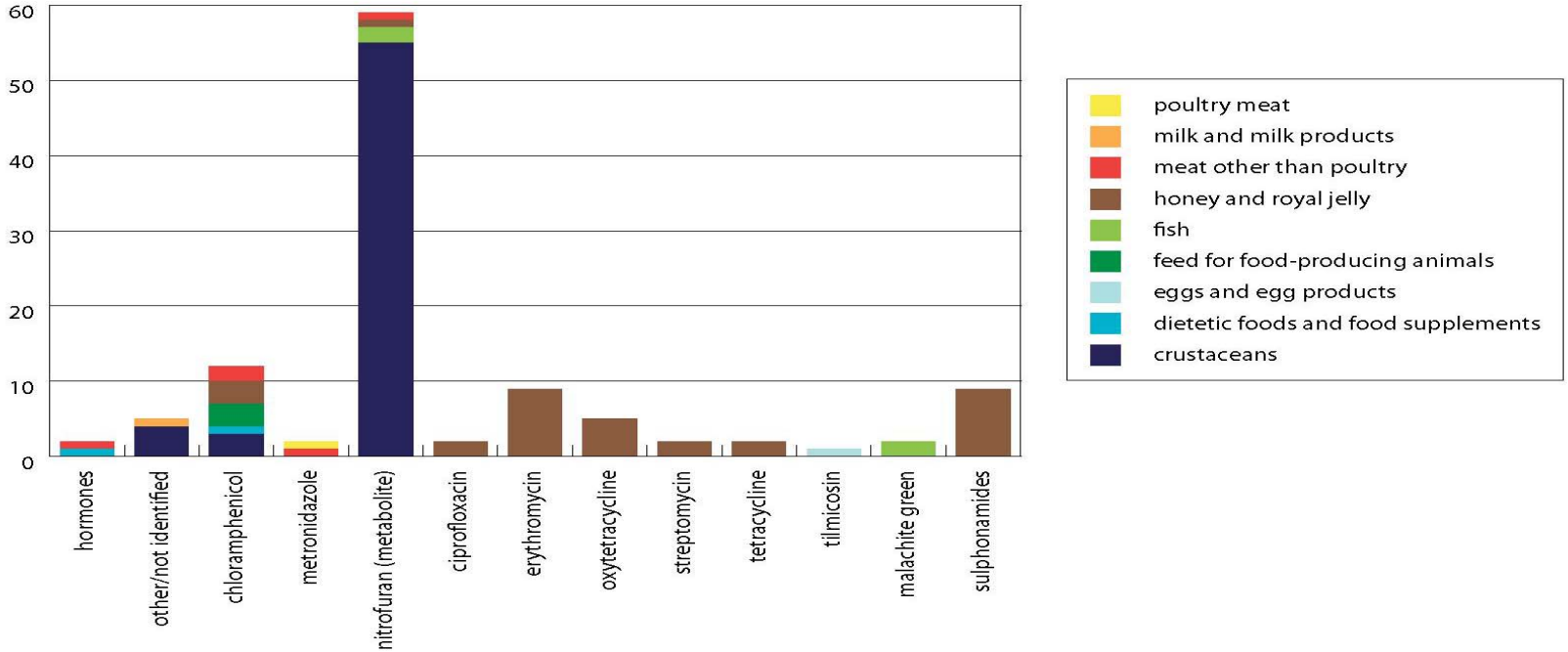


RESIDUES OF VETERINARY MEDICINAL PRODUCTS



RECENT EVENTS IN CHILEAN PRODUCTS

Alert Notifications of Chilean Products at EU, Years 2007-2009

PESTICIDES
- Carbaryl in wine

HEAVY METALS IN SEAFOOD
- Cd in frozen mussels
- Hg in frozen swordfish

MYCOTOXINS IN FRUIT
- Patulin in mashed apples

FUNGICIDES IN FRUITS
- Tiabendazole in apples
- Azinphos-methyl in grapes
- Azinphos-methyl in peaches
- Omethoate and dimethoate in grapes

Fuente: Rapid Alert System for Food and Feed (RASFF)

Temporary Closure of markets due to the presence of residues

- Crystal violet in salmón, UE (Oct 2006)
- Leucomalaquite green in salmón, Taiwan (Oct 2007)
- Emamectin/Ivermectin in salmon,Canada (Oct.2007)
- Abamectin in salmon, Germany (Oct 2008)
- Amphenicol in Salmon, Canada (April 2008)
- Dioxin in pig meat, Corea (July 2008)

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IMPACTS FROM UNRELIABLE MEASUREMENTS

ECONOMICAL LOSSES DUE TO TEMPORAL CLOSURE OF INTERNATIONAL MARKETS TO CHILEAN EXPORTS

Due to unreliable measurements, it is likely that certain residues in foods such as antibiotics, pesticides, or heavy metals might result in higher concentration values than those established by international regulations. This might cause a temporal closure of certain destination markets. If it is assumed that, on average, such closure can last 2 months, and that re-establishment of normal trade can be achieved in 4 months, then the economic losses would be approximately:

- Temporal closure of grapes market in USA : MMUS $ 161
- Temporal closure of salmon market in USA : MMUS $ 198
  Japan : MMUS $ 176
  UE : MMUS $ 77
- Temporal closure of pig meat market in Japan : MMUS $ 161

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CMQ CENTRO METROLOGÍA QUÍMICA DE AGUAS Y ALIMENTOS

CENTRE OF CHEMICAL METROLOGY FOR WATERS AND FOODS

MISSION

To ensure the international comparability of chemical measurements carried out in waters and foods, so as to avoid risks in the consumers and to support the Chilean export activities.

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MAIN ACTIVITIES OF THE CENTRE OF CHEMICAL METROLOGY

a) Public function

- **Technological antenna and continuous improvement of measurement capabilities (staff and equipments)**
- **Chilean representativeness at the International Forums** (BIPM-CCQM), participating in the technical working groups
- **International demonstration of measurement capabilities,** in order to support mutual recognition agreements (MRAs)
- **Metrological support to governmental regulatory agencies** (Agricultural Service, Fisheries Service, etc.) in relation to the measurements quality of the local field laboratories network.

b) R&D activities of public interest

- Continuous development (R&D) of analytical methods using new technologies.
- Development, preparation and certification of **reference materials** tailored to Chilean needs.

c) Metrological services to laboratories and industries

- Reference materials dissemination
- Organization and implementation of Proficiency Testing scheme for field laboratories
- Technical assistance in analytical methods, method validation and other metrological activities according to ISO requirements for Chilean laboratories.
- Training seminars and workshops for local and other Latin-American laboratories

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Centre of Chemical Metrology for waters and foods: Current situation

- **Officially nominated as Designated Laboratory for waters and foods (March 2007)**
- **New infrastructure and equipments (Gas-chromatography/MS; HPLC/MS/MS; ICP-MS, among others)**
- **Well qualified staff, trained in Metrological Institutions from USA, Canada, UK and expert Dutch and German laboratories.**



Centre of Chemical Metrology for waters and foods: Current situation

Succesful International Peer Review (December 2006)

Quality system approved by the QSTF of SIM in the frame of Mutual recognition Agreements (September 2007)

Participation in international comparison studies with successful results (CCQM and SIM)

SISTEMA INTERAMERICANO DE METROLOGIA

Certificate of Approval

The Quality System of

Centro de Metrología Química de Aguas y Alimentos de Fundación Chile

in support of Calibration and Measurement Capabilities for Chemical Metrology

was approved within the framework of the CIPM Mutual Recognition Arrangement by the SIM Quality System Task Force on Wednesday, September 26, 2007

Humberto S. Brandi
President, SIM

William E. Anderson
Chair, SIM QSTF

CCQM-K43.1As, Hg and Me-Hg in marine fish (swordfish), year 2007

Mercury

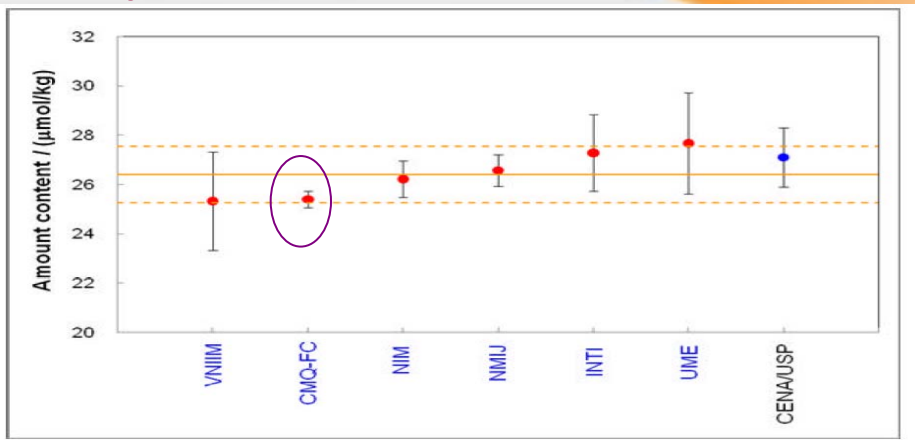


Figure 2 CCQM-K43.1: Hg in marine fish (swordfish), (The results of CMQ-FC: *k=2.18*)

Arsenic

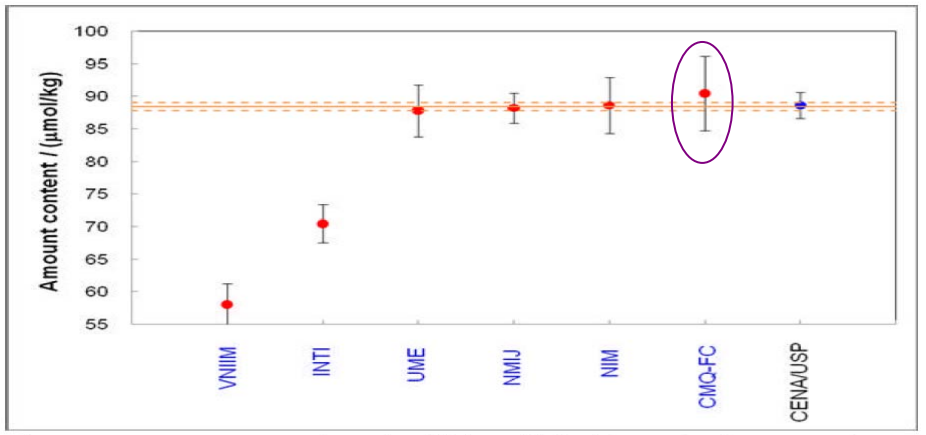


Figure 1 CCQM-K43.1: As in marine fish (swordfish), (The results of CMQ-FC: *k=1.96*)

CCQM-P12.1 Cu, Fe, Pb and Cd in wine, year 2006

Iron

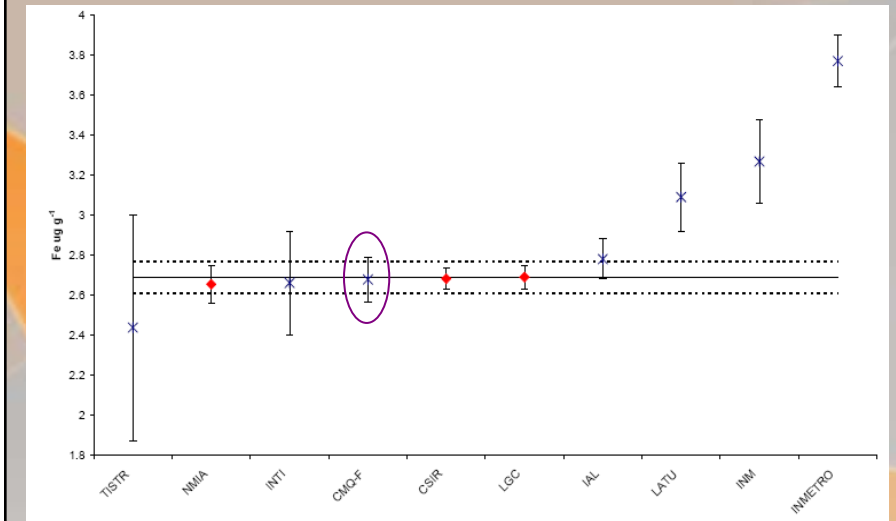


Figure 2: CCQM-P12.1 participants' measurement results for iron

The horizontal lines represent the KCRV and associated uncertainty. Solid, red diamonds represent results obtained using IDMS.

Copper

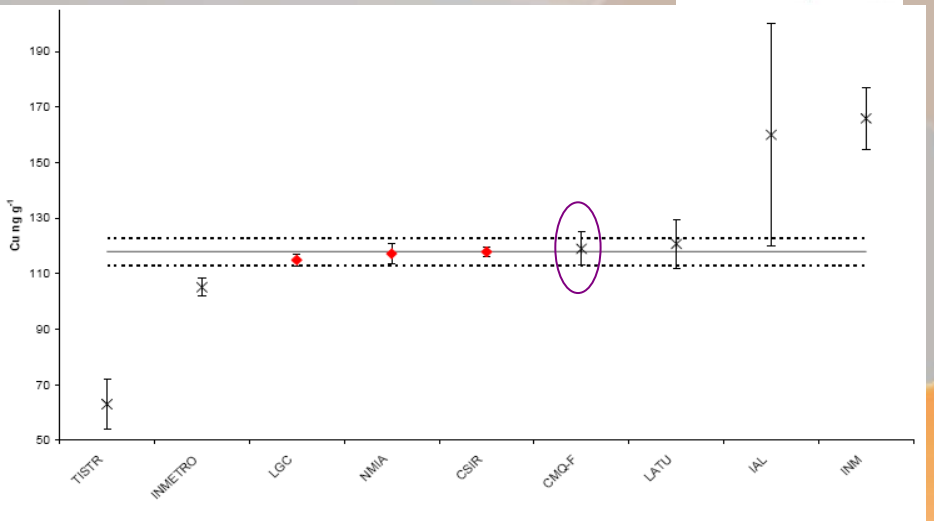
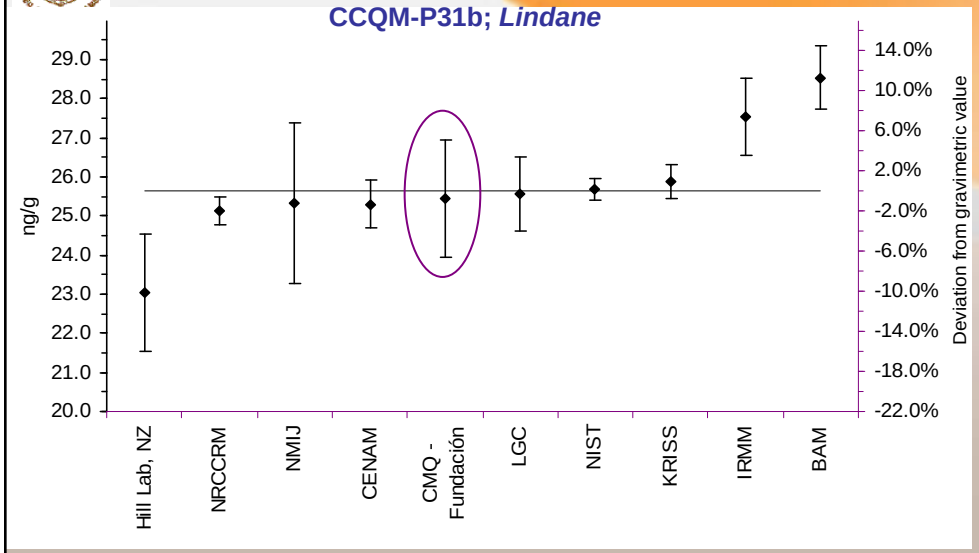


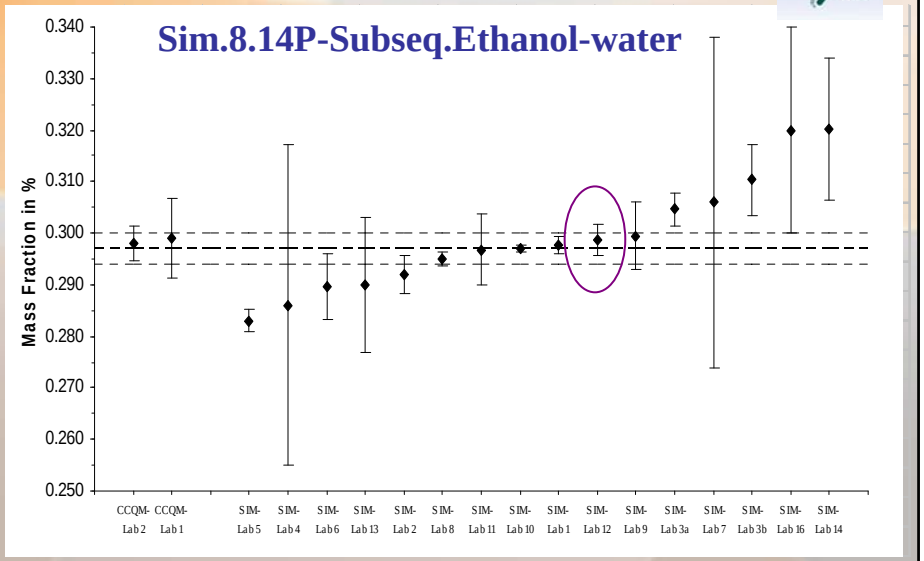
Figure 3: CCQM-P12.1 participants' measurement results for copper

The horizontal lines represent the KCRV and associated uncertainty. Solid, red diamonds represent results obtained using IDMS.

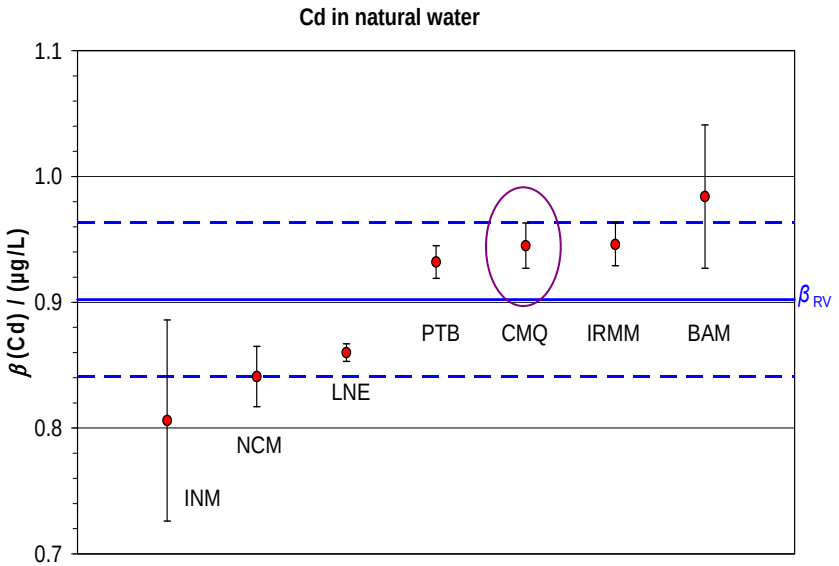
Year 2003

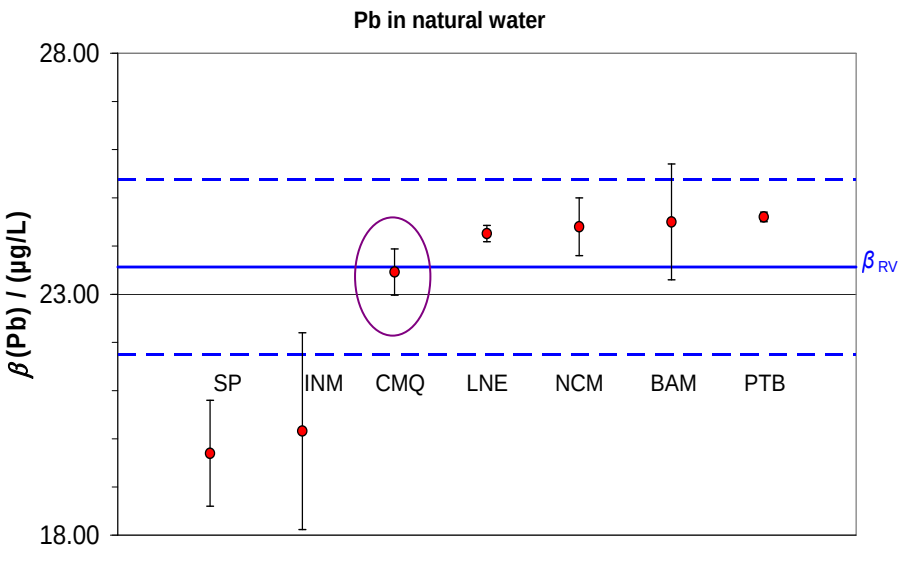


Year 2004



EURAMET.QM-S2: "Determination of Hg, Cd, Pb and Ni in pure and natural Water Year 2008





CENTRE OF CHEMICAL METROLOGY

FINANCIAL SUSTAINABILITY MODEL AND PERSPECTIVES

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METROLOGY: A PUBLIC GOOD

- **The rejection of export products for quality deficiencies from an individual producer, cause adverse effects in the whole sector. This constitutes a negative externality that spoils the individual certification effort.**
- **Analytical methods validation and the production of reference materials have a costly R&D component that is not (generally) covered by services provision income.**
- **The Metrological Centers should not be financed by the private sector (a direct user) since maintaining the institution's independence ensures the transparency when commercial controversies arise.**
- **The latter point strongly support the need of a public policy and funding form the State.**
- **The above condition is fulfilled throughout the world.**

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PROPOSED SCHEME SINCE 2008

FOUNDING SOURCES	%
DIRECT PUBLIC FUNDING	50%
PROJECTS R&D AND GOVERNMENT CONTRACTS	30%
METROLOGICAL SERVICES	20%

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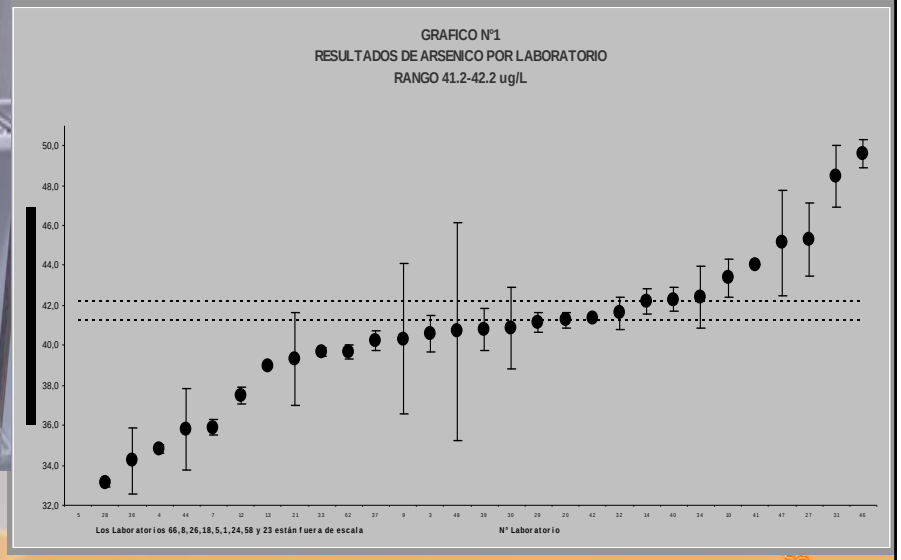
INTERNATIONAL FUNDING MODELS

Country	Ownership	Direct Financing	Other Types of Financing
Germany	Public	80%	20% I+D and Metrological services
Australia	Public	50%	50% I+D and Metrological services
Canada	Public	80%	20% I+D and Metrological services
Korea	Public	60%	40% I+D and Metrological services
Eslovenia	Public	70%	30% metrological services
Israel	Public	80%	20% I+D contracts and Metrological services
Japan	Public	80%	10% Metrological services, 10% Others
México	Public	85%	15% Metrological Services
Tailandia	Public	90%	10% Metrological Services
UK	Private	0%	90% 3-years- contracts with the government, 10% Metrological services
USA	Public	65%	15% contracts with Public Agencies, 15% Metrological Services, 5% Others

CENTRE OF CHEMICAL METROLOGY
FIELDS OF ACTIVITIES



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FIELDS OF ACTIVITIES

1.Preparation and certification of Reference Materials

The CMQ has prepared and certified 86 Reference Materials such as:

Metals and anions in aqueous matrixes

Heavy metals in wines.

Under development processes, there are Reference Materials of Quinolones in Salmon and Pork and heavy metals in sea-food.

Several Reference samples have been prepared for Proficiency Tests in Salmon, wines and organic solutions.

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CMQ FIELDS OF ACTIVITIES

2. Technical transference and Training

- **Analytical methods validation**
- **Metrological concepts**
- **Quality assurance**
- **Statistical analysis of measurement results**
- **Assessment of uncertainty**
- **Others**

From year 2000 on, more than 250 field laboratories from public and private institutions have participated in the above mentioned activities

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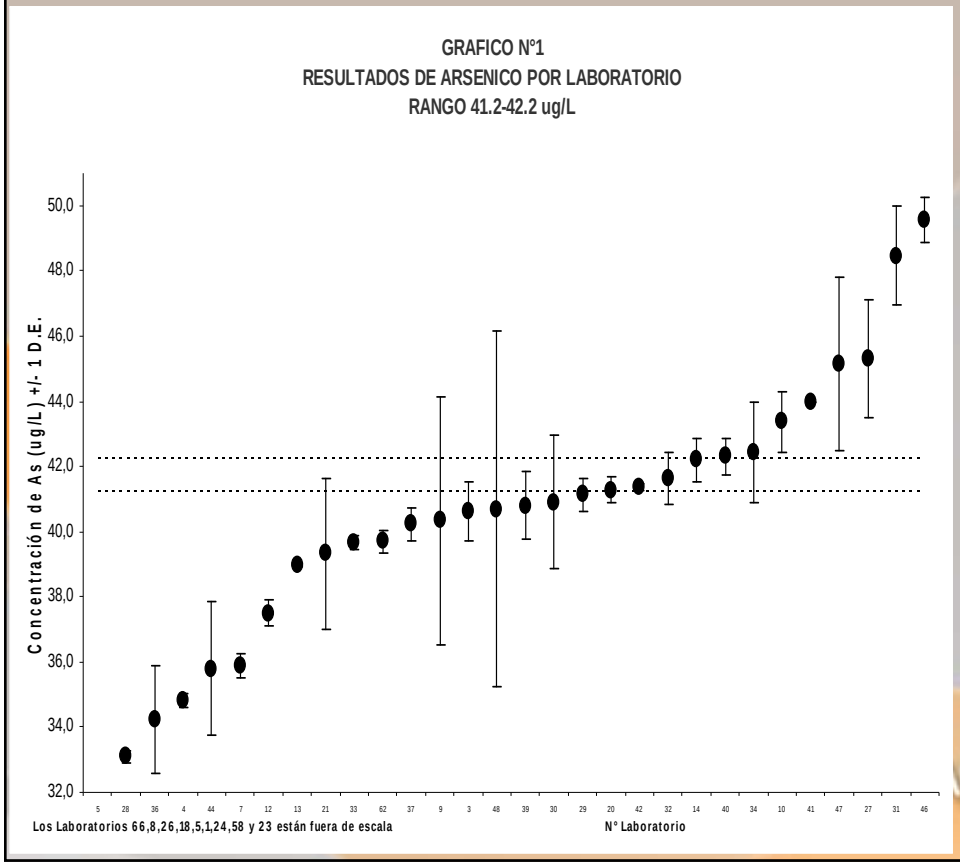
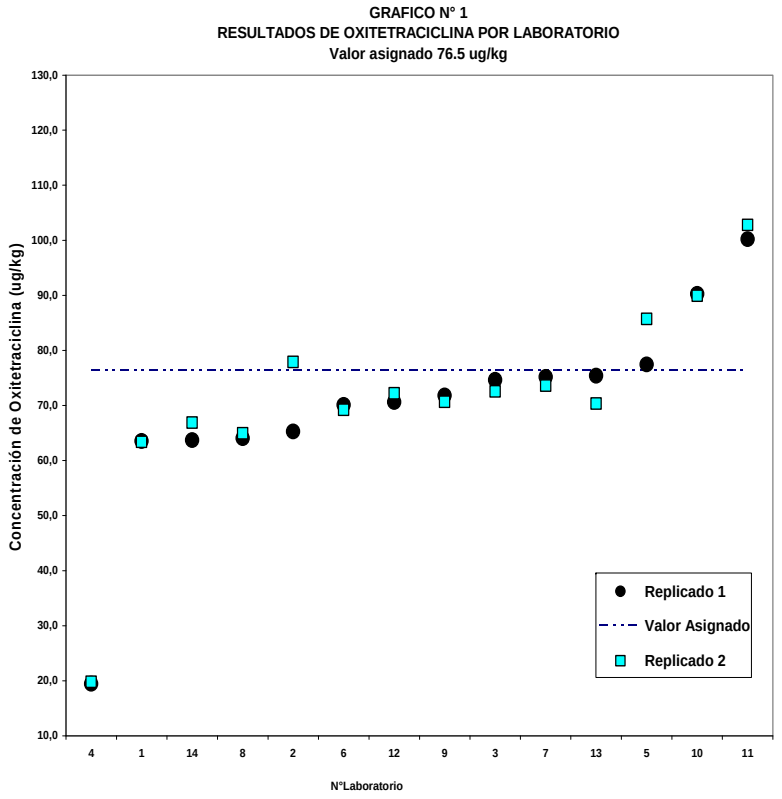
CMQ FIELDS OF ACTIVITIES

3. Organization of Proficiency testing

- **The CMQ organized and carried out 50 Proficiency tests using Reference Materials prepared at the Centre.**
- **More than 100 local laboratories have participated as well as 35 laboratories from Argentina, Peru, Brazil, Panamá, Nicaragua, Ecuador among others.**

Arsenic in aqueous solution





HOW THE SYSTEM WORKS

CMQ provides metrological support to public agencies and help to establish priorities

BIPM / CCQM

CMQ demonstrates its measurement capabilities at the CCQM to support the CMCs

Regulatory agencies

Centre of Chemical Metrology (CMQ) for waters and foods

CMQ provides laboratories with:

- **Training**
- **Reference materials**
- **Proficiency tests**

- **Develope quality systems of quality assurance (ISO 17025) with metrological support**
- **Receive training in analytical methods and chemical metrology.**
- **Demonstrate measurement capabilities before the CMQ participating in the PTs**

Field Laboratories

Agroindustrial products

Water

Wines

Fruits

Dairy products

Meat

Salmon, other fishes and seafood

CMQ RESOURCES

a) Human Resources. The staff is composed of:

3 Ph.Ds (Chemistry)
1 Chemist, Biochemist with a post-grade in Statistics
3 Chemists
1 Biochemist
2 Pharmacists
1 Ph.D. (Chemistry) with post-doctoral studies acting as external consultor
3 Technicians
1 Secretary and one Auxiliary person.

b) Infrastructure

600 m2 of laboratories following the international requirements

b) Equipment.

An important project jointly funded by the European Union and the Chilean Government allowed the Centre to acquire new equipment addressed to develop analytical methods that are needed by the export activities. (HPLC-MS-MS; ICP-MS, GC-MS among others).

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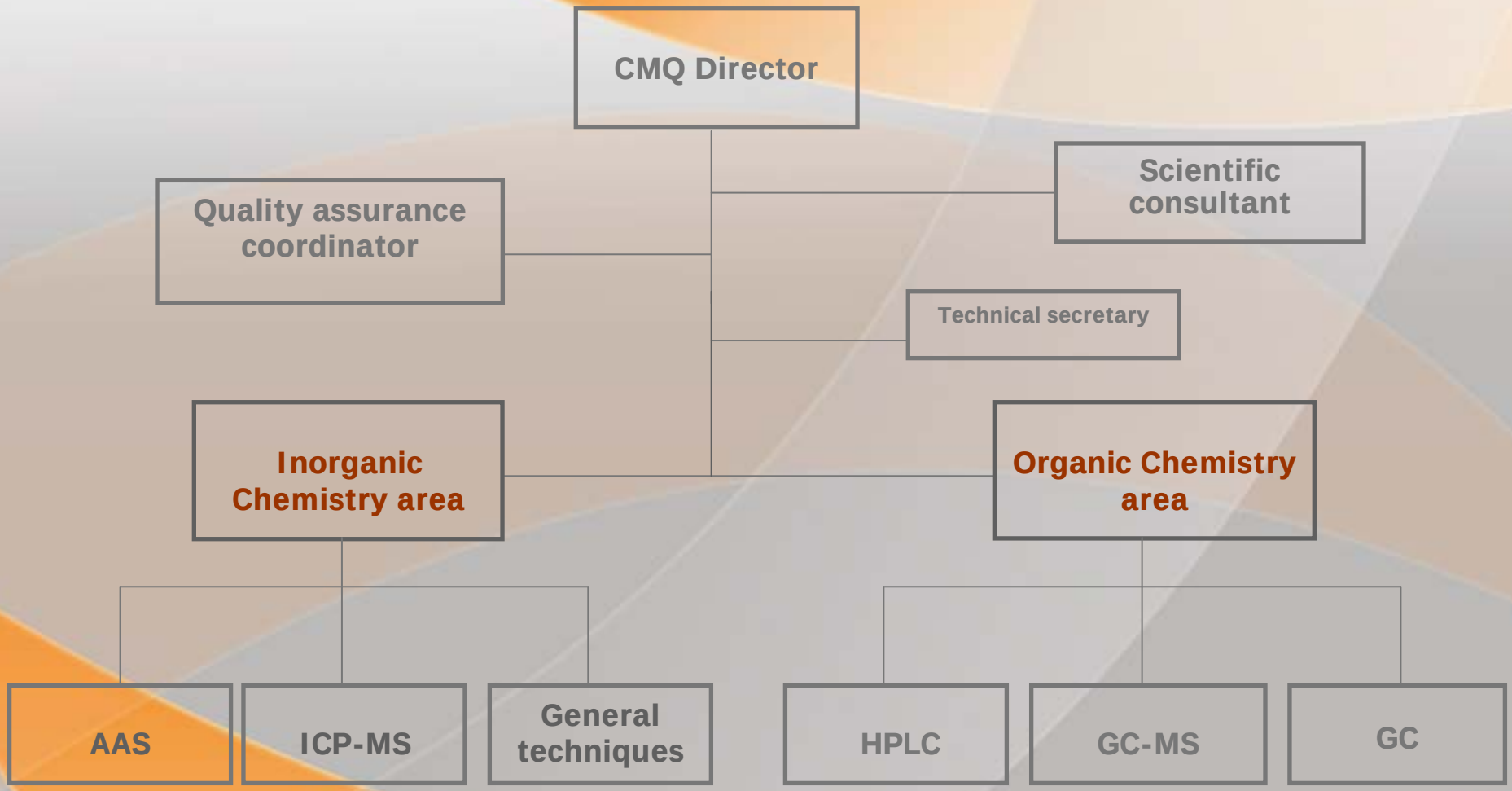
CMQ ORGANIZATION



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CONCLUSIONS

- **Over the last 10 years, the CMQ has been actively developing its metrological capabilities.**

- **The CMQ has successfully implemented 15 Development projects addressed to improve its measurement capabilities of trace metals, chemical residues in foods and different types of water. These projects included the active participation of public agencies, field laboratories and industries**

- **The CMQ has demonstrated its measurement capabilities at the SIM and CCQM levels with successful results.**

- **The CMQ has prepared 110 Reference Materials in cations, anions, wines and antibiotics in different matrixes according to the international requirements.**

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CONCLUSIONS

- **Over the last 10 years, the CMQ organized 40 Proficiency Test studies in different matrixes such as aqueous solutions, organic solutions, bovine liver, wines, fish and pork. Some of these PTs have been specifically required by the public regulatory agencies.**

- **The CMQ has trained more than 250 local chemists in metrological concepts, quality assurance, analytical methods, etc.**

- **The CMQ has Human resources, infrastructure and equipment to cope with the continuously increasing international requirements**

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CASOS DE
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THE ROLE OF A NATIONAL METROLOGY INSTITUTE (NMI)

- Establish national measurements standards
- Disseminate internationally acknowledged traceability to industries, laboratories and other interested parties.
- Production and Certification of reference Materials.
- Value assignment to “in house” reference materials for the customers
- Reference value assignment for Proficiency Test studies.
- Purity Analysis
- Development and validation of analytical methods
- Uncertainty assessment
- Development of primary methods
- Technological transference.

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