Review of the activities of the PCI-Chemistry Unit of the IAEA's Seibersdorf Laboratories (2007-2009)

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Introduction

The Chemistry Unit of the Physics, Chemistry and Instrumentation Laboratory in the IAEA's Seibersdorf Laboratory in Austria, has the programmatic responsibility to provide assistance to Member State laboratories in maintaining and improving the reliability of analytical measurement results, both in trace element and radionuclide determinations. This is accomplished through the provision of reference materials of terrestrial origin, validated analytical procedures, training in the implementation of internal quality control, and through the evaluation of measurement performance by organization of worldwide and regional interlaboratory comparison exercises.

The use of reference materials and interlaboratory comparison exercises are among the most important tools for the production of reliable measurement results and for the achievement of a required quality level. Through the evaluation reports provided to the participating laboratories in the interlaboratory comparison exercises, the IAEA provides direct consultation and guidance on appropriate measurement techniques to be applied, and identifies gaps and problem areas where further development is needed. This helps participating laboratories to improve both their measurement techniques and performance. With the advent of "mutual recognition" on both a European and world wide basis, it is now essential that laboratories participate in proficiency testing schemes that will provide an interpretation and assessment of results which is transparent to the participating laboratory and its "customer".
The activities of the Chemistry Unit are also addressed to support global radionuclide measurement systems, in issues of international concern related to an accidental or intentional release of radioactivity in the environment. To fulfill this obligation and ensure a reliable worldwide, rapid and consistent response, the Chemistry Unit coordinates an international network of Analytical Laboratories for the Measurement of Environmental Radioactivity (ALMERA). The network, established by the IAEA in 1995 [1] [2] [3], makes available to Member States a world-wide network of analytical laboratories capable of providing reliable and timely analysis of environmental samples in the event of an accidental or intentional release of radioactivity. The network is a technical collaboration of existing institutions. It provides an operational framework to link expertise and resources, in particular when a boundary-transgressing contamination is expected or when an event is of international significance.

ALMERA currently (May 2009) consists of 118 laboratories representing 73 countries. The Agency's Seibersdorf Laboratory in Austria and its Marine Environment Laboratory in Monaco are members of the network.

ALMERA network activities

2007 Asia-Pacific regional ALMERA network coordination meeting

The 2007 Asia-Pacific regional ALMERA network coordination meeting took place in Daejeon (the Republic of Korea) from 10th to 12th December 2007 and was hosted by the Korea Institute of Nuclear Safety (KINS). The main aim of the meeting was to discuss the work plan for the development of rapid analysis method of Sr-90 in fresh milk.

The fifth ALMERA second coordination meeting

The fifth ALMERA (Analytical Laboratories for the Measurement of Environmental Radioactivity) network coordination meeting took place in Rio de Janeiro, Brazil, from 27 to 29 October 2008 and was hosted by the Comissao Nacional de Energia Nuclear, Instituto de Radioprotecao e Dosimetria (CNEN-IRD). [4]

The overall aim of the meeting was to evaluate the current status of the ALMERA network and to discuss the implementation of the current activities of the ALMERA network. The meeting was also addressed to define the future activities of the ALMERA network. ALMERA currently (November 2008) consists of 117 laboratories representing 72 countries. The Agency's Seibersdorf Laboratory in Austria and its Marine Environment Laboratory in Monaco are additional members of the network.

In 2008 the following eleven laboratories joined the ALMERA network:
- Comision Nacional de Energia Atomica (Argentina);
- Brazilian National Commission for Nuclear Energy (CNEN-IPEN);
- National Radiation Protection Institute (Czech Republic);
- ARPA-Lombardia (Italy);
- Japan Chemical Analysis Center;
- Instituto Peruano de Energia Nuclear (Peru);
- Laboratory of Radiometry of the Central Mining Institute (Poland);
- Universidad del Pais Vasco (Spain);
- Dirección Nacional de Energia y Tecnologia Nuclear (Uruguay);
- Ministerio del Poder Popular para la Energia y Petróleo (Venezuela);
- Centro de Estudios Ambientales de Cienfuegos (Cuba).

2009 Asia-Pacific regional ALMERA network coordination meeting

2009 Asia-Pacific ALMERA coordination meeting took place in Daejeon, the Republic of Korea from 20 to 23 April 2009 and was hosted by the Korea Institute of Nuclear Safety. The aim of the meeting was to evaluate current status of Asia-Pacific ALMERA activities and to discuss the preliminary test results of rapid method of Sr-89 and 90 in milk proposed by IAEA and to discuss pilot study for validation of the rapid method. For validation of the rapid method, IAEA prepared spiked milk powder with known activities of ^{89}Sr and ^{90}Sr and tested homogeneity of the sample, and then distributed it to 11 expert laboratories.

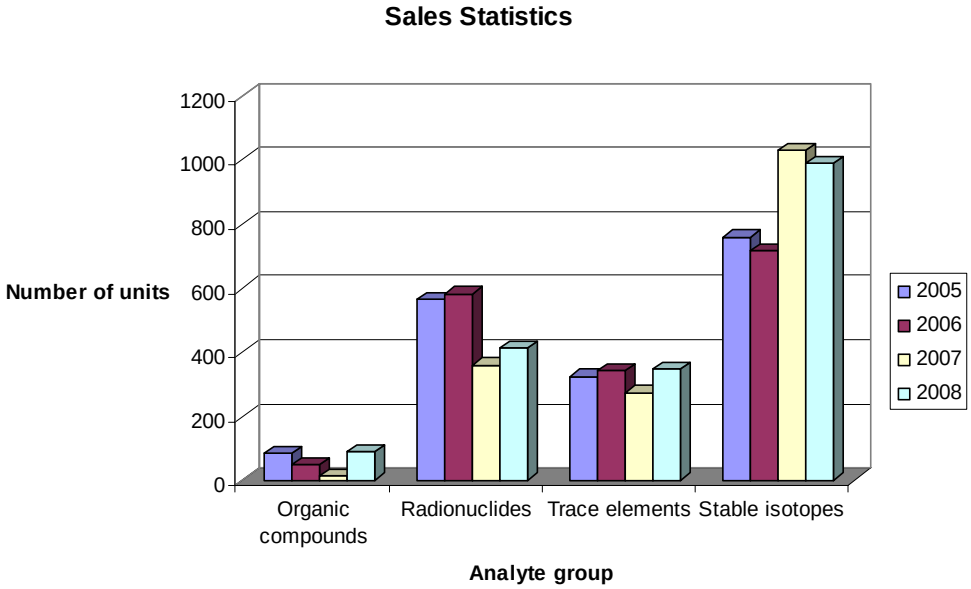
During the meeting, the following recommendations were proposed:

1. It was suggested that ALMERA network should be subdivided into three regional group:
    - Africa
    - Europe
    - Middle East
2. It was recommeded to take more active actions to involve institutions from Africa
3. It was recommended to involve institutions more linked with radioecological studies (modeling, environmental parameters definition, ect.) into ALMERA network
4. It was suggested that IAEA should verify the feasibility of collaboration with JCAC (Japan) for the production of reference materials with typical matrix of the Asia-Pacific Region
5. It was strongly recommended that ALMERA members should partecipate in the ALMERA Proficiency Tests and not in the IAEA World Wide Proficiency Tests
6. It was proposed that IAEA should develop reference materials and recommended procedures for NSC (Not- So-Common) radionuclides (e.g. Tc-99, Ni-63, Fe-55, Ca-41/45)
7. Next ALMERA coordination meeting (6th) will take place in Europe (4th quarter 2009)
8. KINS, KAERI, ANSTO, ARPANSA, NRL CNEN-IRD, BARC and JCAC will participate in the pilot study for validation of rapid method of $^{89+90}$Sr in milk with 4 kinds of spiked milk powders.
9. It was proposed that Asia-Pacific ALMERA members will be involved in the validation of recommended procedure of Ra-226/228 by LSC using simulated soil and real groundwater characterized by IAEA.

Reference materials

Reference materials selling and distribution

The sales statistics presented confirms the important role the IAEA play in the provision of matrix reference materials characterized for radionuclides, stable isotopes, trace elements and organic compounds. In 2007-2008 the IAEA Reference Materials Group sold around 3500 units of reference materials to laboratories from 95 countries around the world [5].



In 2007 a new central storage facility was put into operation in Seibersdorf for storing all matrix reference materials produced on the Agency's Laboratories of Monaco and Seibersdorf.

A new IAEA Reference Material Catalogue for 2007 was issued on a CD-Rom and is distributed to customers.

IAEA Reference Materials Certification Committee

On the basis of the recommendations made by the Advisory Group in 2006 an IAEA internal reference material certification committee has been established in 2007. The IAEA Reference Materials Certification Committee was established in line with the Clouse 5.15.1 of the ISO Guide 34:2000 *General requirements for the competence of reference materials producers* [6], which stipulate that the reference material producer will establish an independent group of experts whose responsibility is to check that all work, data and documents (related to a certain reference material) are fit for their purpose.

Functions of the IAEA Reference Materials Certification Committee:

- To overview all aspect of reference material characterization, including homogeneity testing, analyses of chemical and physical properties as well as stability testing of all reference materials produced by the Agency (internally or in the frame of the IAEA Technical Cooperation project);
- To review the quality status of reference materials in respect to its intended use and target values, when established;
- To assign certified, reference and/or information values for specified measurands;
- To decide on the status of material, e.g. certified reference material or reference material;
- To set up an adequate pricing and cost recovery policy for the Agency's reference materials;
- To assure that reference materials produced by the IAEA comply with the same quality criteria.

Advisory Group meeting on the production and characterization of reference materials of terrestrial origin

The 2008 meeting of Advisory Group on the production and characterization of reference materials of terrestrial origin took place at the Agency's Laboratories in Seibersdorf from 3 to 5 September 2008. The advisory group recommended as follows:

- To reconsider approaches used for characterization of the candidate reference materials of terrestrial origin.
- To be carried out the production and/or characterization of each reference material of terrestrial origin as a separate project.
- assigning the property values of the IAEA candidate reference materials of terrestrial origin through one of the approaches listed below,

1. From measurement results produced by a group of expert laboratories using the same or different well established, stable and validated measurement procedures, different methods and different calibrants. The property value derived according to this approach will be based on a consensus value;
2. From measurement results produced by one expert laboratory using well established, stable and validated measurement procedures, confirmed by results from two or more expert laboratories using the same or different validated methods/procedures. In this case one expert laboratory performs characterization of the material in reproducibility conditions and establishes the property value and its uncertainty. Results from other expert laboratories, obtained by the same or different validated methods/procedures using the same or different calibrant, are used for confirmation purpose only;
3. Formulation. In this approach the material is spiked with standard solution of the analyte(s) of interest, blended or diluted. The property value is calculated from the amounts used, and the associated uncertainty is derived from data given in certificate of relevant analyte (measurand) and uncertainty components arising from operations, such as dilution and weighing.
4. Interlaboratory comparison study (retroactively). The property value is assigned as a consensus value derived from results reported by participants using established statistical approaches.

Future plans for the production of matrix reference materials for terrestrial origin

In 2009-2010 following reference materials will be produced and certified for their content of radionuclides, namely:

- IAEA-360, IAEA-377 and IAEA-448 soil materials
- IAEA-434 phosphogypsum
- IAEA-444, spiked soil
- IAEA-445 spiked water
- IAEA-447 moss soil
- TENORM in contaminated environmental samples from oil industry
- Korean soil

Interlaboratory comparisons exercises

During 2007 to 2009 several proficiency tests were organized, where more than 500 laboratories from 90 Member states participated in these proficiency tests. The objectives of these proficiency tests were to (i) check the accuracy and precision of the analytical results produced by the

participating laboratories from all over the world, (ii) test the international comparability of radiological measurements and (iv) encourage the participating laboratories in finding remedial actions where shortcoming in analytical performance are detected. The following proficiency tests were conducted in 2007 and 2008, and are on going in 2009:

2007

- The IAEA-CU-2007-03 world-wide proficiency test on the determination of gamma-emitting radionuclides in water, soil and vegetation [7].
- The IAEA-CU-2007-04 ALMERA network proficiency test on the determination of gamma-emitting radionuclides in water, soil and vegetation [8].
- The IAEA-CU-2007-09 ALMERA network and world-wide proficiency test on the determination of Po-210 in water [9].

2008

- The IAEA-CU-2008-02 Determination of radionuclides in air filters in cooperation with US-DOE [10].

2009 (On going proficiency test)

- The IAEA-CU-2008-03 world-wide open proficiency test on the determination of natural radionuclides in phosphogypsum and spiked water.
- The IAEA-CU-2009-04 ALMERA network proficiency test on the determination of gamma-emitting radionuclides in simulated air filter.
- The IAEA-CU-2009-03 world-wide open proficiency test on the determination of natural and artificial radionuclides in moss-soil and spiked water.

More details can be found at http://www.iaea.org/programmes/aqcs/interlab_studies.shtml

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9. The IAEA-CU-2007-09 ALMERA Network and World-Wide proficiency test on the determination of Po-210 in water, Status: Draft of final report was sent for comments: Draft summary report was issued, June 2008.
10. The IAEA-CU-2008-02 proficiency test on the determination of radionuclides in air filters, Status: PT is concluded and draft summary report was issued, November 2008.

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