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ALMERA Activities

ALMERA (Analytical Laboratories for the Monitoring of Environmental RADIOactivity) is a world-wide network of analytical laboratories, established by the IAEA, which could provide radioanalytical data that would be accepted internationally in support of the Agency's activities in the field of radiation protection and radiological assessment of areas affected by accidental or intentional release of radioactivity.

Without standard procedures and a common understanding, responses to radiological emergencies may differ markedly from country to country, and it may be difficult for countries to interpret and use each other's data. The resulting confusion and public mistrust could hamper recovery operations and catalyse severe socio-economic and political consequences. In addition there is an ever-increasing need for rapid and accurate analytical methods to assess radionuclides levels in environmental samples for emergency preparedness reasons.

It is not easy to develop recommended analytical procedures that all laboratories can accept, as a large number of various analytical procedures have been developed and published by many scientists and analytical procedures are being continually improved with upgrading of the instruments and materials for measurement of radionuclides. Understandably, most laboratories prefer to retain analytical procedures which they have used for a long time and which have been proved to be reliable, unless there is a strong reason to make a change.



Preparation of a spiked milk powder reference material

However, one of the most frequent requests which Member State laboratories make of the Chemistry Unit, Seibersdorf is that for recommended analytical procedures. Some laboratories that are undertaking a type of analysis which is new for them would like a reliable source of procedures, so that they do not have to 'reinvent the wheel'. They would like a readily-available reference which they can quote. If possible, they would like to have procedures available that are used at a large number of laboratories and therefore could be regarded as having been widely tested. In some cases, for example for sample collection, the final result may be strongly dependent on the method used, and use of a widely-accepted method may be important to assure comparability of results between different laboratories.

One important source of such information to date has been the IAEA Technical Reports Series No. 295 [1]. However, this guidebook is now 17 years old and so the information has become somewhat dated. Some other publications have addressed various aspects, for example quantifying uncertainty in nuclear analytical measurements [2] but a consistent and more complete set of procedures would be desirable.

Therefore, since 2004 the IAEA's programme related to the terrestrial environment has included activities aimed towards the development of a set of procedures for determination of radionuclides in environmental samples. It is intended that as these are developed, they will be made available to users, for example by publication in IAEA series and/or by placing them on the IAEA website. The latter option would allow those who are interested in a reliable source of procedures to search for them according to their requirements e.g. by analyte and/or sample type. It is not intended that the analytical procedures included should be regarded as 'recommended' or 'endorsed' by the IAEA for any particular purpose, nevertheless it is expected that the information will be a useful resource and starting point for analysts.

The approach being taken for development of specific procedures and methods is to first review the literature on a given topic, and then based on this review develop a method written in accordance with ISO guidelines. The activities mentioned above are meant to be of general use to a wide range of laboratories. In parallel, a set of procedures and methods needs to be developed for the ALMERA network of laboratories.

The activity started with the publication of review papers on the development and validation of an analytical method for ^{210}Po in water [3], and a rapid method for Pu isotopes and ^{241}Am in soil and sediment. The procedure for ^{210}Po introduces two alternative procedures using (a) DDTc solvent extraction and (b) Sr-resin extraction chromatography and the validation result of the procedure in terms of trueness, repeatability and

reproducibility with water samples spiked with a known amount of ^{210}Po .

The procedure for the rapid determination of Pu isotopes and ^{241}Am in soil and sediment by alpha-particle spectrometry provides accurate and reliable results for the activity concentrations of elevated levels of $^{239,240}\text{Pu}$, ^{238}Pu and ^{241}Am in soil and sediment samples over the course of twenty four hours.

In addition to these activities, a rapid method for $^{89}\text{Sr}/^{90}\text{Sr}$ in milk is being developed. Milk, an essential constituent of the human diet, is an important indicator of the transfer of radionuclides from the environment to humans. The analysis time is an important economic factor, rapidly identifying whether milk is contaminated with radioactive materials and whether the decision maker should take protection and intervention actions for protecting the public from radiation hazards. The analytical determination of radiostromium is not an easy task as ^{89}Sr , ^{90}Sr and its daughter ^{90}Y are pure beta emitters, and prior to measurement they must be separated from the sample. To overcome this difficulty, the development of a rapid method of ^{89}Sr and ^{90}Sr in milk was proposed in 2007 by the Asia-Pacific ALMERA Regional Group. The IAEA reviewed relevant papers and three candidate procedures were selected. Five laboratories from the Asia-Pacific ALMERA regional group, together with the Hungarian Agricultural Authority (HAA, an IAEA Collaborating Centre) and the IAEA laboratories in Seibersdorf, validated these candidate procedures and selected the most promising in terms of chemical recovery, accuracy and precision. On this basis a pilot study was organized by the IAEA to verify the selected recommended procedure with four kinds of spiked milk powders with different activities. Twelve ALMERA laboratories from Europe, Asia-Pacific and Latin America regions have participated in the pilot study. The pilot study will conclude at the end of 2009.

In addition review papers will published in 2010 related to analytical procedures for ^{228}Ra and ^{226}Ra determination in water, and the methodology for indoor radon surveys.

References

- [1] Measurement of radionuclides in food and the environment: A guidebook. Technical Reports Series No. 295, 1989, IAEA, Vienna.
- [2] Quantifying uncertainty in nuclear analytical measurements, 2004, IAEA-TECDOC-1401, IAEA, Vienna.
- [3] K.M. Matthews, C-K. Kim, P. Martin, Determination of ^{210}Po in Environmental Materials: A Review of Analytical Methodology. Appl. Radiat. Isotopes, 2007, 65, 267.

The new IAEA-372 grass certified reference material for ^{40}K and ^{137}Cs

A new grass certified reference material characterized for ^{137}Cs and ^{40}K has been issued by the Reference Material Group of the IAEA Laboratories in Seibersdorf (Austria). Characterization of this material was conducted by a group of National Metrological Institutes and expert laboratories within the frame of a supplementary comparison exercise in the frame of the Mutual Recognition Arrangement of the International Committee for Weights and Measures, Consultative Committee for Ionizing Radiation, Section II - Measurement of Radionuclides.

The assignment of the property values of the reference material and the associated uncertainties were provided through the application to the measurement results of the probability density function [1]. The property values of ^{40}K and ^{137}Cs in grass were certified with relatively small uncertainties. The highest possible metrological traceability was achieved.

The CRM is supplied in 100g units. It is recommended to users to use a minimum of 5 g for analysis. Analysts are reminded to take appropriate safety precautions in order to avoid spread of the material during handling. This CRM can be used for quality assurance/quality control of the analysis of radionuclides in vegetation, for the development and validation of analytical work and for training purposes with two certified values (^{40}K , ^{137}Cs).

The material is available for laboratories by contacting the Reference Materials Group at the Chemistry Unit, Seibersdorf laboratories.

References

- [1] D.L. Duewer, A robust approach for the determination of CCQM key comparison reference values and uncertainties. Working document CCQM/04-15, BIPM, 2004. www.bipm.info/cc/CCQM/Allowed/10/CCQM04-15.pdf

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

In following the latest developments in standardization and metrology area and to address all requirements of the ISO Guides 34 [1] and 35 [2], the Agency's Laboratories in Seibersdorf, Austria, have established a multi-institutional Advisory Group on the production and characterization of reference materials of terrestrial origin. This Advisory Group should create an integral part of the organizational structure related to IAEA reference materials of terrestrial origin. It should elaborate all aspects of the production and characterization reference materials of terrestrial origin. The Advisory Group should meet on annual basis and directly collaborate with the Chemistry Unit of the Physics, Chemistry and Instrumentation Laboratory on the following issues:

- Identification of needs and technical requirements for new reference materials;
- Identification of studies related to reference materials and common projects;
- Production of new matrix reference materials of terrestrial origins. Arrangement should be made to allow for sharing the produced reference material within the frame of this collaboration;
- Characterization of matrix reference materials of terrestrial origins;

- Review characterization procedures as well as procedures for assigning values to new reference materials of terrestrial origin;
- Review of certification reports of reference materials of terrestrial origin;
- Organization of interlaboratory comparisons;
- Review of interlaboratory comparison reports;
- Preparation of quality documentation, such as Standard Operating Procedures (SOPs) and instructions;
- Drafting documents related to the technical part of the quality system
- Exchanging of expertise and know-how;
- Publications of scientific papers in scientific journals.

Current members of the Advisory Group on the production and characterization of reference materials of terrestrial origin are:

- Mr. Rafaat Al Mery, Atomic Energy Commission of Syria (AECS);
- Ms. Maria Belli, Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), Italy;
- Mr. Almir Faria Clain, Instituto de Radioproteção e Dosimetria-Comissão Nacional de Energia Nuclear , (IRD-CNEN), Brazil;

- Mr. Yongjae Kim, Korea Institute of Nuclear Safety (KINS), the Republic of Korea;
- Mr. Matjaz Korun, Institute Jožef Stefan (IJS), Slovenia;
- Ms. Rosella Rusconi, ARPA Lombardia, Italy;
- Mr. Sándor Tarjan, Hungarian Agricultural Authority (HAA), Hungary;
- The Section Head of the Physics, Chemistry and Instrumentation Laboratory;
- The Head of the Chemistry Unit of the Physics, Chemistry and Instrumentation Laboratory;
- The Reference Material Group leader of the Chemistry Unit of the Physics, Chemistry and Instrumentation Laboratory;
- The Quality Systems Manager of the Agency's Laboratories in Seibersdorf and Headquarters.

References

- [1] ISO Guide 34, General requirements for the competence of reference materials producers, Second Edition 2000, International Organization for Standardization, Geneva, 2000.

- [2] ISO Guide 35, Reference materials — General and statistical principles for certification, International Organization for Standardization, Geneva, 2006



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

ALMERA COORDINATION MEETINGS

Minutes of the 2009 ALMERA Asia-Pacific Regional Coordination Meeting, Daejeon, Republic of Korea

The ALMERA Asia-Pacific regional meeting took place in Daejeon, the Republic of Korea, from 20 to 22 April 2009 and was hosted by the Korea Institute of Nuclear Safety (KINS). The meeting took place in the frame of the 20th anniversary workshop between KINS (Korea Institute of Nuclear Safety) and JCAC (Japan Chemical Analysis Centre) on the measurement of environmental radioactivity and in connection also with the IAEA seminar on uptake of radionuclides into staple crops in the Asian region organized in Daejeon, in collaboration with the Korea Atomic Energy Research Institute (KAERI), on 16 and 17 April 2009.

The meeting was officially opened by Mr. Byung Soo Lee, the Director of Emergency Preparedness & Environment Division of KINS and by Ms. Gabriele Voigt, Director of IAEA's Laboratories, Seibersdorf and Headquarter, Austria. In this occasion Ms. Voigt gave a special lecture on the future trend of the IAEA environmental programme and delivered an official plaque to KINS in recognition of its role as coordinating centre of the ALMERA Asia-Pacific group.



Ms. Gabriele Voigt, Director of the Agency's Seibersdorf Laboratories, hands the IAEA plaque to Mr. Byung Soo Lee, Director of Emergency Preparedness & Environment Division of KINS.

The meeting was attended by the following participants from 10 countries, representing 28 different institutions:

IAEA	Gabriele Voigt	IAEA, Seibersdorf Laboratories, Austria
	Umberto Sansone	IAEA, Seibersdorf Laboratories, Austria
	Chang Kyu Kim	IAEA, Seibersdorf Laboratories, Austria
Australia	Atun Warliah Zawadzki	Australian Nuclear Science and Technology Organization (ANSTO)
	Sandra Sdraulig	Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
Brazil	Ana Cristina de Melo Ferreira	Instituto de Radioprotecao e Dosimetria (IRD)
China	Yong Li	Chinese Academy of Agricultural Sciences (CAAS)
Hungary	Sandor Tarjan	Hungarian Agricultural Authority (HAA)
India	Devender Rao Deverneni	Health Physics Division, B.A.R.C.
Indonesia	Dadong Iskandar	National Nuclear Energy Agency
Japan	Kaneaki Sato	Japan Chemical Analysis Center (JCAC)
	Tetsuya Sanada	Japan Chemical Analysis Center (JCAC)
	Shigeru Bamba	Japan Chemical Analysis Center (JCAC)
New Zealand	Jean Gary Decaillon	National Radiation Laboratory
Pakistan	Perveen Akhter	Pakistan Institute of Nuclear Science and Technology
Korea (Republic of)	Byung Soo Lee	Korea Institute of Nuclear Safety
	Ju-Yong Yun	Korea Institute of Nuclear Safety
	Jung Whan Row	Korea Institute of Nuclear Safety
	Sang-Kuk Lee	Korea Institute of Nuclear Safety
	Seok-Won Choi	Korea Institute of Nuclear Safety
	Yong Jae Kim	Korea Institute of Nuclear Safety
	Sangmyeon Ahn	Korea Institute of Nuclear Safety
	Seong A Yim	Korea Institute of Nuclear Safety
	Ji Yon Lee	Korea Institute of Nuclear Safety
	Jung-Seok Chae	Korea Institute of Nuclear Safety
	Dong-Myung Lee	Korea Institute of Nuclear Safety
	Byung-Uck Chang	Korea Institute of Nuclear Safety
	Won-Jong Park	Korea Institute of Nuclear Safety
	Hong Mo Park	Korea Institute of Nuclear Safety
	Kil-Woo Lee	Korea Institute of Nuclear Safety
	Hee-Yeoul Choi	Korea Institute of Nuclear Safety
	Chang-Su Park	Korea Institute of Nuclear Safety
	Byoung-Jik Kim	Korea Institute of Nuclear Safety
	Suk-Gun Kwon	Korea Institute of Nuclear Safety
	Sang-Hun Park	Korea Institute of Nuclear Safety
	Won-Yong Yun	Korea Institute of Nuclear Safety
	Sung-Jae Han	Korea Institute of Nuclear Safety
	Sung-Myeong Woo	Korea Institute of Nuclear Safety
	Gun-Sun Auh	Korea Institute of Nuclear Safety
	Jong In Byun	Korea Institute of Nuclear Safety
	Mi-Suk Song	Korea Institute of Nuclear Safety
	Seok-Won Yoon	Korea Institute of Nuclear Safety
	Dong-Hye Heo	Korea Institute of Nuclear Safety
	Hwa Yong Lee	Korea Institute of Nuclear Safety
	Myunghan Song	Korea Institute of Nuclear Safety
	Jiyeon Kwak	Korea Institute of Nuclear Safety
	Minju Yang	Korea Institute of Nuclear Safety
	Youngeun Kwon	Korea Institute of Nuclear Safety
	Jaiki Lee	Hanyang University
	Gi-Nam Kim	Korea Hydro and Nuclear Power Co.
	Young-Sik Jang	Korea Hydro and Nuclear Power Co.
	Yun-Seong Jung	Korea Hydro and Nuclear Power Co.
	Duk-Ho Yoon	Korea Hydro and Nuclear Power Co.
	Jung-Gun Yoon	Korea Hydro and Nuclear Power Co.

Kyu- Won Kim
Sik-Hae Kim
Yoh-Shik Nam
Hung-Gon Chung
In-Suk Kim
Kun-Ho Chung
Yong-Dae Kwon
Hyo-Kuk Park
Wan-Row Lee
Sang-Han Lee
Hyun-Moon Kim
Hyuk Cho
Moon-Su Kim
Mi-Jung Ahn
Jung-Hae Lee
Hyung-A Row
Kwan-Je Cho
Eh-Jung Jung
Yong-Woo Cho
Hyun-Kun Oh
Son-Yeu Na
Sang-Yong Kim
Hyun-A Heo
Byung-Sub Han
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Korea Hydro and Nuclear Power Co.
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Korea Atomic Energy Research Institute
Korea Research Institute of Standards and Science
Korea Research Institute of Standards and Science
Chungnam National University
Gangneung Regional Monitoring Station
Seoul Regional Monitoring Station
Chungju Regional Monitoring Station
Daejeon Regional Monitoring Station
Wolsung NPP Environmen Monitoring Committee
Uljin NPP Private Environment Supervisory
Korea Radiation Technology Institute Co.
Korea Radiation Technology Institute Co.
NEOSIS Corporation
NEOSIS Corporation
NEOSIS Corporation
ENESYS Co.
Satrec Initiative
G&G Radcon Co.
FNC Co

Objectives of the meeting

The overall aim of the meeting was:

- to discuss the implementation of the current activities of the ALMERA Asia-Pacific group;
- and to define the future activities of the ALMERA network.

Current activities of the ALMERA Asia-Pacific group

Mr. Chang Kyu Kim presented the current status of the development of a rapid method for the determination of ^{89}Sr and ^{90}Sr in milk samples and it was agreed to perform a pilot study for the validation of the method using milk powder spiked with known activity of ^{89}Sr and ^{90}Sr .



*ALMERA Asia-Pacific regional meeting
Korea Institute of Nuclear Safety (KINS)
Daejeon (Republic of Korea), 20-22 April 2009.*

KINS, KAERI, ANSTO, ARPANSA, NRL CNEN-IRD, BARC and JCAC will participate in the pilot study for the validation of the method. 4 different samples of spiked milk powders will be used as reported in the following table:

No.	Samples	Sample weight	Replicates of analysis
1	Spiked milk powder with ^{90}Sr	500 g/lab	5*
2	Spiked milk powder with ^{89}Sr	500 g/lab	5*
3	Spiked milk powder with $^{89+90}\text{Sr}$ with different activity ratio of $^{89}\text{Sr}/^{90}\text{Sr}$ (1-5)	500 g/lab	5*
4	Spiked milk powder with $^{89+90}\text{Sr}$ with different activity ratio of $^{89}\text{Sr}/^{90}\text{Sr}$ (10 – 15)	500 g/lab	5*
5	Blank	400 g /lab	
6	^{90}Sr standard solution	5 mL/ampoule	
7	^{89}Sr standard solution	5 mL/ampoule	

* Triplicate measurements for the rapid method proposed by IAEA and duplicate measurements for the own method.

Table 1. Composition of pilot study samples for the validation of the rapid method for determination of $^{89+90}\text{Sr}$ in milk sample

The work plan for the validation of the method, reported in Table 2. was proposed and agreed between the participants.

Period	Work scope	Institute
January–April 2009	Preparation of spiked milk powders - blank - milk powder spiked with ^{89}Sr - milk powder spiked with ^{90}Sr - milk powder spiked with ^{89}Sr and ^{90}Sr ($^{89}\text{Sr}/^{90}\text{Sr}$ ratio ; 1 ~ 5) - milk powder spiked with ^{89}Sr and ^{90}Sr ($^{89}\text{Sr}/^{90}\text{Sr}$ ratio ; 10 ~ 15) - Improve accuracy of results at over 10 of $^{89}\text{Sr}/^{90}\text{Sr}$ ratios using Cerenkov and scintillation counting.	IAEA/ Hungary
20 April 2009	Test of the rapid method using real milk spiked with ^{90}Sr ALMERA Asia-Pacific regional meeting - Presentation and discussion about test results of proposed method	all all
1 May 2009	Distribution of the 4 spiked milk powders and 1 blank to the institution participating in the validation of the method	IAEA/ Hungary
30 June 2009	Analysis of the 4 spiked milk powder samples (5 replicates for each sample) and reporting to the IAEA	all
October/November 2009	6 th ALMERA coordination meeting in Budapest, Hungary - Presentation and discussion about analysis results of 4 spiked milk samples - Discuss and share work scope for preparation of paper or IAEA internal report	all
November 2009– June 2010	- Preparation of paper or IAEA report - Publication of the paper	all

Table 2. Work plan for method validation of proposed rapid method of $^{89+90}\text{Sr}$ in milk

Future activities of the ALMERA network

Mr. Chang Kyu Kim proposed to involve also the Asia-Pacific ALMERA members in the validation of a procedure for the determination of $^{226/228}\text{Ra}$ in simulated

soil and real groundwater using Liquid Scintillation Counting (LSC) For this activity, a work plan was proposed and agreed as described in Table 3.

Time schedule	Work scope	Role	
		IAEA	ALMERA members
October 2009	Definition of the candidate recommended procedure	O	
May 2010	Preparation of simulated soil and real ground water	O	
	Testing the candidate recommended procedure		O
August 2010	Analyze 10 replicate measurements for each simulated sample for the validation of recommended procedure	O	O
October 2010	Preparation of the final report	O	O

Table 3. Work plan for validation of the recommended procedure of ^{228}Ra and ^{226}Ra in soil and water by Liquid Scintillation Counting

Mr. Devender Rao D., from the Environmental Survey Laboratory, Health Physics Division, Bhabha Atomic Research Centre, Tarapur Atomic Power Station 1-4, India, proposed for considerations the following activities to be performed in future in the frame of the ALMERA network.

1. Evaluation of MDA, photo peak area and associated uncertainty from HPGe detector gamma ray Spectra

Gamma Ray Spectrometry using high resolution HPGe detector is one of the most widely used analytical tools for the determination of specific activity due to gamma emitters in various environmental samples. The evaluation of MDA (Minimum Detectable Activity), Photo Peak Area and the associated uncertainty are the integral parts of gamma spectra analysis and also important parameters in the overall gamma ray spectrometry analysis. The approach of analytical Laboratories in the evaluation of these parameters may have quite large variations as different computational soft wares or manual methods are applied. To evaluate the existing degree of differences and also for the purpose of harmonizing the evaluation methodologies, the following programme schedule is proposed:

- Generation of typical background spectra for about 100,000 secs using a ~ 30-50% N- and/or P- type HPGe detector.
- Generation of two typical source spectra, one containing a complex spectra having several radionuclide peaks including multiplets and other containing a few well defined peaks of radionuclides.

- The spectral data (Channel verses Counts) of the above spectra in spread sheet form to be submitted to the participating Laboratories through On-Line ALMERA Website network under an intercomparison exercise programme.
- The participants will be asked to evaluate MDAs in terms of photo peak area counts for several important radionuclides such as ^{241}Am , ^{210}Pb , ^{144}Ce , ^{131}I , ^{133}I , ^{134}Cs , ^{137}Cs , ^{60}Co , ^{58}Co , ^{54}Mn , ^{40}K , ^{212}Pb , ^{214}Pb , ^{228}Ac etc. using their Laboratory methodology and the typical background spectra information.
- Participants will be asked to compute net photo peak area counts using the typical source spectra and the associated uncertainty for the identified peaks. The participants should also subtract the background spectra form the source spectra with appropriate stripping factor.
- Analysis and evaluation of the Laboratories data under the intercomparison programme and determine the degree of differences from the reference peak areas.
- Standardization and recommendation of a methodology in the form of a IAEA document, after having a consultants/experts meeting under IAEA/ALMERA programme.
- Conduct of a repeat inter-comparison exercise to evaluate the implementation of harmonized methodology among the ALMERA Laboratories.

Details of time schedule, generation of typical spectra, preparation of intercomparison exercise and consultants/experts meeting can be worked out after the

consideration of the proposal. However, tentatively the exercise may begin in 2011 as other exercises are already in progress.

2. Determination of NSC (Not-So-Common) radionuclides such as ^{99}Tc and ^{63}Ni in seawater and ground water

^{99}Tc and ^{63}Ni are two important pure Beta emitting radionuclides generally found in the discharges of radioactive waste treatment plant discharges and possibly could be migrated to ground water from the radioactive waste repositories. They being low energy beta emitters, their determination at low levels by direct methods is not possible. A standardized radio-analytical method is very essential for evaluating these nuclides for the long term impact assessment of these nuclides. Although, the nuclides are not related to radiological emergency monitoring, but the ALMERA members must have the capability of estimating them as most of the member

Laboratories are attached to nuclear facilities. The programme may consist of:

- A Proficiency Test under IAEA/ALMERA for the determination of ^{63}Ni and ^{99}Tc at low levels using radiochemical separation methods in seawater and ground water.
- Performance evaluation of P.T. exercise.
- Standardization, Validation and Recommendation of procedure.

Details of time schedule may be worked out later, however it may be included in the recommendations for future activities.

Note: As mentioned by the participant from KAERI for ^{55}Fe and ^{45}Ca , they appear to be non-beta emitters and also are short half life nuclides. The properties of these nuclides and also of ^{99}Tc and ^{63}Ni are as given below for information:

Nuclide	Half Life	Emission Type	E_{max}	Emission Probability %
^{63}Ni	100.1 years	Beta	65.87 keV	100%
^{99}Tc	213000.0 years	Beta	293.6 keV 204.2 keV	99.9999% 0.0015%
^{55}Fe	2.7 years	No beta Photon	-- 5.899 keV	-- 16.2%
^{45}Ca	162.7 days	Beta	25.69 keV	99.99%

3. Determination of OBT (Organically Bound Tritium) in biological samples

OBT (Organically Bound Tritium) is an important component of tritium in biological samples such as marine fish and vegetable samples. Its estimation is also as important as TFT (Tissue Free water Tritium) particularly in the PHWR environment. The readiness/capability of ALMERA members to analyze OBT is also essential. In view of this, the following programme may be included in the future programme recommendation.

- A Proficiency Test exercise for the determination of OBT in Fish powder and/or vegetable powder.
- Performance evaluation of P.T. exercise.

Details of time schedule may be decided later. Tentatively it can start in 2011 as 2009 and 2010 programmes are already in progress.

Recommendations

The ALMERA participants suggested that ALMERA network should be subdivided into additional three regional groups:

- Africa;
- Europe;
- Middle East.

The ALMERA participants highly recommended IAEA to take more active actions to involve into the ALMERA network, institutions from Africa. It was also recommended to involve into the ALMERA network institutions linked with radioecological studies (modeling, environmental parameters definition, ect.).

The ALMERA members suggested to verify the feasibility of collaboration of IAEA with JCAC (Japan Chemical Analysis Centre) for the production of reference materials with matrices typical for the Asia-Pacific Region.

The ALMERA participants strongly recommended that ALMERA members should participate in the ALMERA proficiency tests rather than in the IAEA World Wide Proficiency Tests.

The ALMERA participants agreed to have the 6th ALMERA coordination meeting in Budapest, Hungary, from 23 to 25 November 2009 and hosted by the Hungarian Central Agricultural Office, Food and Feed Safety Directorate.



*ALMERA Asia-Pacific regional meeting
Korea Institute of Nuclear Safety (KINS)
Daejeon (Republic of Korea), 20-22 April 2009*

ALMERA INTERLABORATORY COMPARISON EXERCISES

As it is known, a primary requirement of the ALMERA members is participation in the IAEA proficiency tests which are specifically organized for analytical laboratories of ALMERA network on a regular basis. These proficiency tests are designed to monitor and demonstrate the analytical performance and analytical capabilities of the network members, and to identify gaps and problematic areas where further development is needed. Continued membership has benefits in training and educational opportunities, enhanced mutual trust in results and methodology and objective evidence for accreditation purposes.

The performance evaluation results of the proficiency tests performed in the frame of the ALMERA network are not anonymous for those laboratories nominating to participate as ALMERA members.

During the last four years four proficiency tests were organised within ALMERA activities. These are namely:

The IAEA-CU-2006-04 proficiency test on the determination of gamma emitting radionuclides in soil, grass and water

In this proficiency test 677 results were reported to the IAEA from 38 laboratories belonging to 29 different countries. The participants' data along with the statistical performance evaluation were compiled and reported to all participants. 30 laboratories reported within the agreed deadline for the rapid reporting measurement (three working days). The overall evaluation showed that 78% of all reported results fulfilled the proficiency test.



Examples of the proficiency test samples.

The IAEA-CU-2007-04 proficiency test on the determination of radionuclides in soil, spinach and water

In this ALMERA proficiency test 1546 measurement results in rapid and long term reporting modes were submitted to the IAEA from 58 laboratories belonging to 46 different Member States.

Given the degree of difficulty of the proficiency test and the wide range of analytes, the overall evaluation showed a good level of performance, where 78% of all reported results including the transuranic nuclides fulfilled the proficiency test criteria.

The IAEA-CU-2007-09 proficiency test on the determination of ^{210}Po in Water

The ^{210}Po poisoning event which occurred in November 2006 brought into focus a number of issues, including the capacity of laboratories of ALMERA to rapidly and accurately determine ^{210}Po in environmental samples. A number of requests were received from ALMERA members to address this issue. Responding to these requests, the IAEA-CU-2007-09 Proficiency Test on the Determination of ^{210}Po in Water was conducted in the frame of the ALMERA network. The aim was to gather information on the current state of practice for ^{210}Po measurements at various levels in aqueous samples.



^{210}Po set of samples.

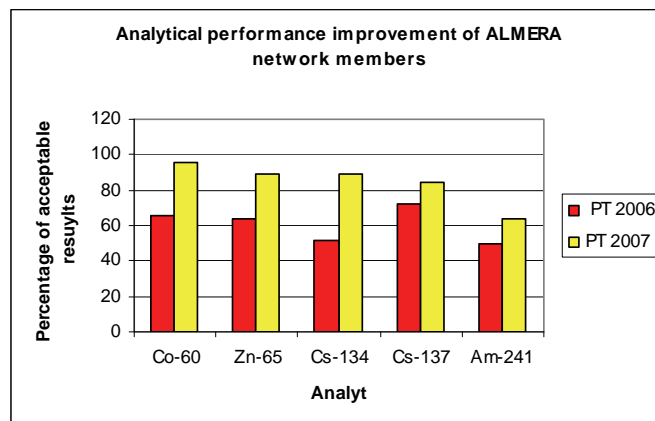
The IAEA-CU-2008-04 proficiency test on the determination of naturally occurring radionuclides in water and phosphogypsum

The participating laboratories were requested to analyse gross alpha, gross beta, ^{226}Ra , ^{234}U and ^{238}U in water samples and ^{210}Pb , ^{226}Ra , ^{230}Th , ^{234}U and ^{238}U in a phosphogypsum sample.

This proficiency test provided the possibility to improve the ALMERA members comparability and reliability of their analytical determinations of natural radionuclides in environmental matrices.

In conclusion it is important to mention that in all organized proficiency tests it was evident that the ALMERA laboratories performance was better than the population of laboratories world wide in terms of rapid responding and the accuracy of the results. The proficiency test results showed that further efforts should be invested in the development of standard and rapid methods to improve analytical performance of ALMERA network.

For specific radionuclides, from 2006 to 2007, there was a substantial improvement in the analytical performance of the network as reported in the following graph.



Level of improvement of the analytical performance.

All summary reports of ALMERA proficiency test are available at the IAEA website.

OTHER NEWS

IAEA Seminar on 'Uptake of radionuclides into staple crops in the Asian Region' held at the Korea Atomic Energy Research Institute (KAERI) in Daejeon, the Republic of Korea, from 16 to 17 April 2009

Countries of the Asia-Pacific region consider nuclear energy deployment as the most efficient way to fulfill

energy needs in the 21st century in a sustainable manner. Thus, it can be anticipated that energy generated by

nuclear power in the countries can be greatly extended within several next decades. Although a deployment of nuclear power helps to alleviate the environmental burden caused by other forms of energy production, potential ecological effects related to the discharges of radionuclide to the Environment should be scrutinised and the appropriate information should be made public available. For many years, the International Atomic Energy Agency (IAEA) has been supporting its Member States in the assessment of the radiation impacts on both human beings and the environment. However, existing data were mainly limited to temperate climatic zones because of lack of relevant information. To enhance capabilities of Member States located in the Asia-Pacific Region to predict radionuclide transfer in the environment and, thereby, to assess exposure levels of the public and biota in order to ensure an appropriate level of protection from the effects of ionizing radiation, associated with radionuclide releases and from existing radionuclides in the environment a seminar was organised in the framework of the IAEA Project Terrestrial Radioecology. The seminar continued the IAEA activities on radioecological assessment and modelling that were aimed at refining information to be applied for assessing radionuclide transfer in the Environment. The seminar has provided a good summary of the current radioecological research in the region and identified existing gaps in radioecological research in the Asia-Pacific region. Based on this analysis some

recommendations on further studies to be carried out in the region to increase robustness in environmental assessments in the Asia-Pacific region were proposed. The seminar recommended that more attention is be paid to retain experience in environmental assessment practice including creation of the network of the centres of excellence, organisation of training for young researchers in sampling, radioactivity analysis, data evaluation, transfer parameters evaluation, radioecological models and tools applications.



Participants to the IAEA Seminar on 'Uptake of radionuclides into staple crops in the Asian Region'.

Consultants Meeting on the 'Use of intentionally discharged radioactive tracers to study surface water processes'

A consultants meeting on the 'Use of intentionally discharged radioactive tracers to study surface water processes' took place from 29 June to 3 July 2009 at the IAEA Headquarters in Vienna, to up-date and discuss the recent advances in this area.

Intentionally discharged tracers are widely used in environmental investigations because they allow detailed observations of individual components of complex systems. Such investigations enhance the qualitative understanding of the transport of water and contaminants (dissolved and suspended) through ecosystems; contribute to the evaluation of numerical transport models and hence to the robustness of their predictions; and facilitate advances in the fundamental science underpinning the transport processes.

A wide range of chemical and radioactive tracers is available. Concern is often expressed about the use of radioactive isotopes in environmental research and decision makers generally favour the use of non-radioactive alternatives if available. Despite this, radioactive tracing has proved resilient for the following reasons:

A wide variety of radionuclides and labelled compounds are commercially available, making it likely that a specific tracer will be available for the task in hand.

Radioactive isotopes can be measured with high sensitivity at high dilution, and in the case of gamma emitting nuclides, with remotely deployed probes.



Participants to the IAEA consultants meeting on the 'Use of intentionally discharged radioactive tracers to study surface water processes'.

In the last analysis, all tracers are contaminants discharged to the environment, and the process of justification involves an assessment of the benefits of the information obtained from the investigation against any consequential detriment. Of primary concern are any potential health effects to operators or the public. In

addition, the detriment may extend to the impact of dose on the environment.

Participants: P. Martin (IAEA), J. Bandeira (CNEN-Brazil), P. Brisset (CEA-France), A. Gondin (IAEA), C. Hughes (ANSTO- Australia), A. Worman (KTH-Sweden), Sung-Hee Jung (KAERI- Republic of Korea).

IAEA/WMO technical meeting on sources and measurements of radon and radon progeny

The naturally occurring radionuclide radon (^{222}Rn), together with its radioactive progeny (in particular ^{210}Pb), have been widely used to study a variety of atmospheric processes and to test and validate comprehensive global chemical transport models. Several time series datasets exist of ^{222}Rn and ^{210}Pb concentrations in the planetary boundary layer (PBL), although observations of their vertical profiles are sparse. In recent years the increased availability of relatively low cost high-precision detectors have made gathering of radon datasets more affordable. An example of such a data collection is the use of radon monitors as a part of the World Meteorological Organization's Global Atmosphere Watch (WMO-GAW) network.

A Technical Meeting on this topic, jointly organised by the IAEA Seibersdorf laboratories and the WMO, was held from 22 to 24 June 2009 at the IAEA Headquarters in Vienna. The meeting brought together scientists and engineers involved in the following areas of research:

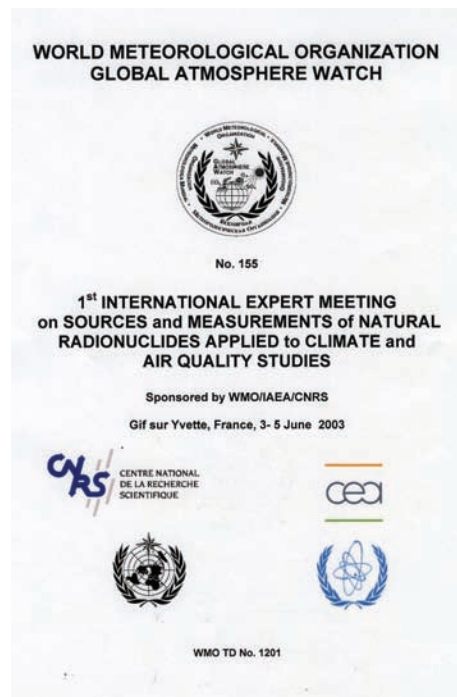
- Measurement and modeling of radon exhalation flux densities from Earth's surface,
- Measurement of atmospheric radon and radon progeny concentrations, and
- Development and use of high-resolution atmospheric transport models.



Participants to the IAEA/WMO technical meeting on sources and measurements of radon and radon progeny.

This meeting was a follow-up to a meeting organized in 2003 by WMO in cooperation with the IAEA. The participants at the 2003 meeting identified that the effective use of radionuclide observations is limited by the accuracy of source functions used by models and by a globally uncoordinated approach to measurements, data archiving and data quality assurance. Consequently, a major focus of the 2009 meeting was on moving towards agreed approaches to estimating radon exhalation flux densities, and to improving quality assurance of measurements both of radon exhalation flux densities and of concentrations of radon and radon progeny in the atmosphere.

Further information is available from: <http://www-pub.iaea.org/MTCD/Meetings/Announcements.asp?Co nfID=37743>



Report of 2003 meeting

The report is available online from: <ftp://ftp.wmo.int/Documents/PublicWeb/arep/gaw/gaw155.pdf>

ALMERA IN MEMBER STATES

The Korea Institute of Nuclear Safety

The Korea Institute of Nuclear Safety (KINS) is the ALMERA coordinating centre for the Asia-Pacific region and member of the IAEA Advisory Group for the production and characterization of reference materials of terrestrial origin.

KINS was founded on February 14, 1990 based on the Act on the Korea Institute of Nuclear Safety (Law No. 4195). Its mission is to preserve the environment, and to protect the public from radiological disasters caused by the production or use of nuclear energy (Article 1 of the Act on the Korea Institute of Nuclear Safety)

To accomplish its mission, KINS is committed to:

- the performance of safety reviews and inspections of the safety of nuclear facilities or radiation facilities using radioactive sources and radiation generating devices

- the conducting of research on nuclear and radiation safety regulations and development of the related technical standards and criteria
- the monitoring and assessment of environmental radioactivity levels throughout the country
- providing technical support for protection against radiological disaster and train public officials of the central and local government, personnel of the emergency preparedness organizations and radiation workers to respond properly and take necessary preventive measures in a radiological disaster.
- the management of nuclear and radiation related license examinations
- collecting, managing and disseminating various nuclear safety related information

The key services provided by the Korea Institute of Nuclear Safety are reported in the following table.

Nuclear safety regulation	Conduction of regulatory safety reviews and inspections of nuclear facilities under construction or in operation	Radiological emergency preparedness	Establishment of technical support and response system for a nuclear accident or incident
	Conduction of periodic safety review of nuclear power plants in operation		Establishment of radiological emergency preparedness system
Radiation safety regulation	Regulation of radiation facilities using radioactive sources and radiation generating devices	Development of safety standards, criteria & regulatory technologies	Development of safety standards, criteria and guidelines for nuclear and radiation safety regulation
	Regulation of transportation of radioactive sources and nuclear materials (fission and fertile materials)		Development of nuclear and radiation safety regulation technologies
Environmental monitoring	Conduction of earthquake monitoring services for nuclear power plant sites	Establishment of technology bases for regulating nuclear & radiation safety	Training of regulatory experts for nuclear and radiation safety
	Conduction of nationwide monitoring of environmental radioactivity levels		Strengthening of the radiological emergency preparedness infrastructure

KINS and environmental radioactivity monitoring

In the early 1960's, global fallout radioactivity was increased over vast territories of the earth because of the atmospheric nuclear weapon test explosions carried out by powerful countries. In 1963, the Korean government launched the systematic environmental radioactivity monitoring to evaluate the influence of the radioactivity in fallout. Like other countries, the Korean environmental radiation monitoring activities were strengthened after the Chernobyl accident in 1986. In addition, it became more systematic and extensive including marine environment since confession about radioactive waste dumping into the northwest Pacific Ocean through the White Book of the former Soviet Union and Russian Federation in 1993. The September 11 attack occurred in the United States in 2001 became the important motivation to reinforce environmental radiation and radioactivity monitoring as an important part of the preparedness of national disaster management against the radioactive terrorism and nuclear accidents. After the Democratic People's Republic of Korea's underground nuclear weapon testing in October, 2006, the environmental radiation and radioactivity monitoring framework in the Republic of Korea was faced with new paradigm about monitoring nuclear activities.



*The Korea Institute of Nuclear Safety
(KINS in Daejeon (Republic of Korea)).*

Meanwhile, 20 units of nuclear power plants as well as research and educational reactors and nuclear fuel cycles facilities in the Republic of Korea are in operation and 6 units under construction. In addition, the number of nuclear facilities in China rapidly increases. 56 units of nuclear power plant in Japan are also in operation.

Because of these reason, to protect the public from radiological accidents occurred by domestic and neighbouring countries, KINS has dedicated to performing the environmental radiation monitoring as well as safety regulation on nuclear facilities. The

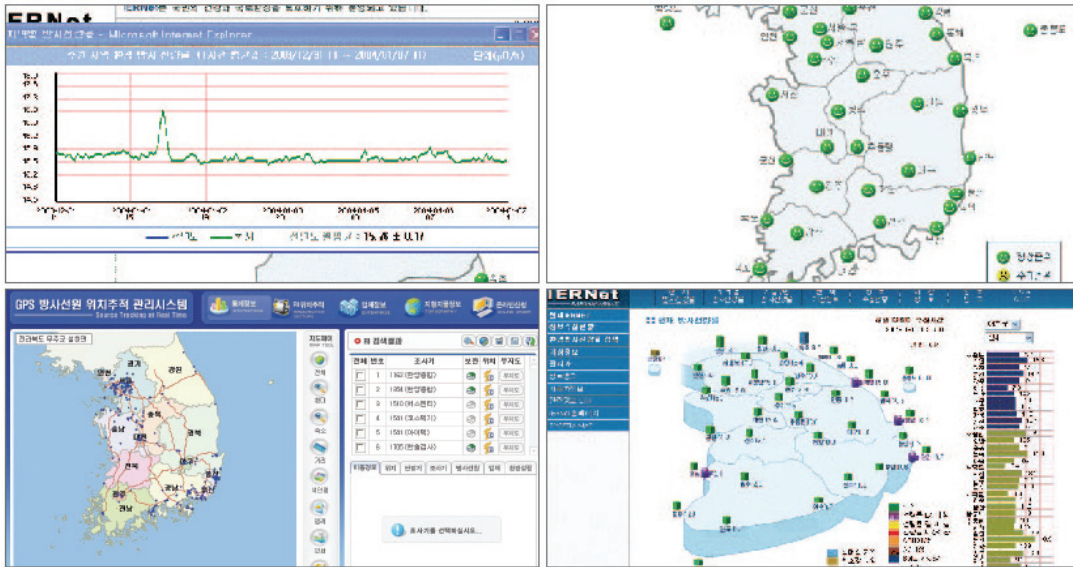
framework of the environmental radiation monitoring is divided into three groups according to the objective and purpose, as followings; the nationwide territorial and marine radiation monitoring and the nuclear facility site monitoring, although the nuclear operators have the primary responsibility for monitoring the environmental radiation near the facilities.

In order to early detect radiological abnormality in the Republic of Korea and neighboring countries, to protect the public, and to preserve the environment of the Republic of Korea, KINS established the nationwide environmental radiation monitoring network, namely the Integrated Environmental Radiation Network (IERNet, <http://iernet.kins.re.kr>), that consists of a Central Monitoring Center (CMC) at KINS, 12 Regional Monitoring Stations (RMS) installed in densely populated major city areas across the country, and 26 Unmanned Monitoring Posts (UMP) installed on such remote island as Ulleung-do and Baengyeong-do and around nuclear power plant sites. In particular, KINS monitors ambient gamma dose rates through the country by deploying IERNet as part of its enhanced effort to monitor environmental radioactivity levels efficiently. All data of the ambient gamma dose rate monitored by RMS and UMP are automatically sent through the internet to the main server computer of the CMC and opened to the public.

The 12 RMS periodically take the environmental samples such as the airborne-dust, fallout, precipitation, tap water and surface water from the public water supply sources, and measure the gross beta activities and gamma emitters in these samples.

Meanwhile, very low level artificial gamma emitting nuclides are monthly analyzed in airborne-dust, fallout, and precipitation collected by the CMC of KINS. The accumulated dose rates are quarterly assessed with TLDs at 39 locations throughout the Republic of Korea in order to assess the annual effective dose. The concentrations of ^3H are also analyzed in the precipitation samples which are collected at 12 RRM and 3 UMPs and sent to the CRMC. Agricultural and fishery products are purchased and radionuclides in them are analyzed to compile basic data for assessing internal exposure dose of public due to foodstuff intake.

The nationwide environmental radioactivity motoring program consists of the normal monitoring program and the emergency monitoring program. For normal situation, CMC, RMSs and UMPs routinely carry out monitoring under the normal surveillance program. For emergency situations such as nuclear accident or nuclear weapon testing in neighboring countries, CMC immediately establish the emergency monitoring plan based on the accident type; CRC, RMSs, and UMPs will operate the emergency monitoring program.



< Integrated Environmental Radiation Network >

The Korean Integrated Environmental Radiation Network.

To preserve the environment of Korean Sea from radiological contamination by illegal nuclear activity in marine, KINS has semiannually taken surface and deep sea water, sediment, and marine biological samples from the 21 fixed sampling locations with the help of NFRDI (National Fisheries Research and Development Institute of Korea), and analyzed ^3H , ^{90}Sr , $^{239+240}\text{Pu}$ and ^{137}Cs in them since 1994.

To confirm whether the level of exposure of radioactive materials released from nuclear facilities is well below the limit prescribed in the Atomic Energy Act, KINS also monitors artificial radionuclides including ^3H , ^{14}C , ^{90}Sr , Pu isotopes, U isotopes, ^{60}Co , ^{137}Cs , etc. in the environmental samples, and assess the tendency of radionuclide accumulation and prediction on the impact of unexpected radionuclides on the nearby environment, although the nuclear operators have the

primary responsibility for monitoring the environment near the facilities.

To implement the environmental radiation monitoring and analyze the radionuclides in environmental samples, KINS has been equipped with various facilities for sample pre-treatment and chemical separation and sophisticated instruments such as α -spectrometry, HPGe γ -spectrometry, Liquid scintillation counters, low background α/β counter, HR-ICP-MS (High Resolution Inductively-Coupled-Plasma Mass Spectrometry). In 2008, KINS installed new MC-ICP-MS (Multi-Collector Inductively-Coupled-Plasma Mass Spectrometry), which is expected to analyze the ultra low level Pu, efficiently.



HPGe γ -spectrometry at the Korea Institute of Nuclear Safety.

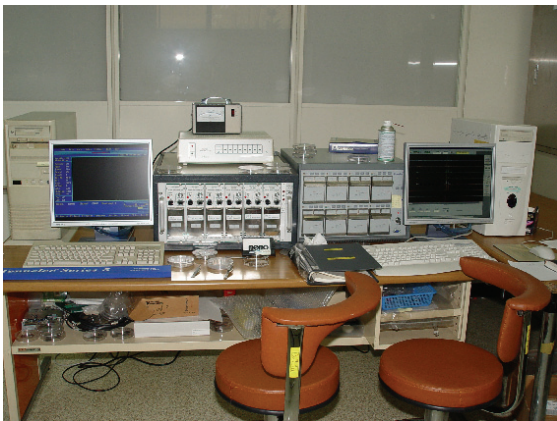


Liquid scintillation counters at the Korea Institute of Nuclear Safety.

Equipment available at the Institute of Nuclear Safety:

Instruments	No. of systems	Target nuclides
α -Spectrometers	14 ch	U, Pu, Th, etc.
HR-ICP-MS	1	Pu, U, Ra, Th, etc.
MC-ICP-MS	1	Pu atomic ratio
Low background α/β counter	3	^{90}Sr , gross α & β ^{137}Cs
Liquid Scintillation	3	^3H , ^{14}C , ^{222}Rn , ^{226}Ra
HPGe γ -Spectrometers	11	γ -emitters
PERALS (Photo Electron Rejecting Alpha Liquid Scintillation)	1	^{222}Rn , ^{226}Ra , etc.

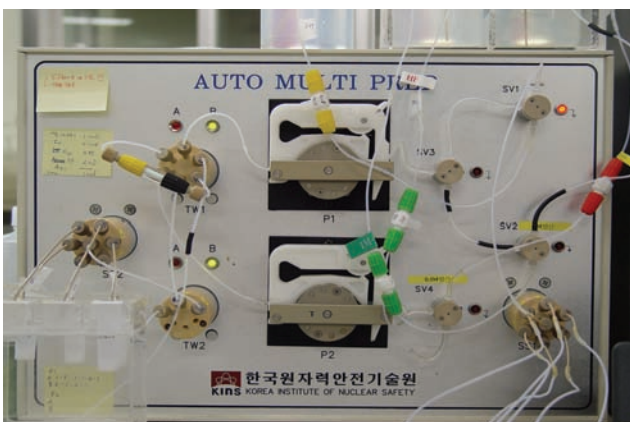
Meanwhile, in routine analysis of Pu, α -spectrometry has been most commonly used to date, employing the chromatographic separation, which is still a time consuming process. In order to shorten the separation time of Pu from the samples matrix and save operator time in chromatographic column work, KINS developed an on-line sequential injection system, which can be automatically operated to separate Pu from the acid matrix using TEVA resin. This system was modified and the application of the system was extended to the sequential separation for ^{210}Po and ^{210}Pb by IAEA.



α -Spectrometry at Korea Institute of Nuclear Safety



HR-ICP-MS at the Korea Institute of Nuclear Safety



On-line sequential injection (SI) system.



MC-ICP-MS at the Korea Institute of Nuclear Safety.

New ALMERA member

The Sarayköy Nuclear Research and Training Center in Ankara, of the Turkish Atomic Energy Authority, joined the ALMERA network in July 2009. ALMERA currently (October 2009) consists of 119 laboratories representing 74 countries.

Publications of potential interest to ALMERA members

Determination of Pu isotope concentrations and isotope ratio by inductively coupled plasma mass spectrometry: a review of analytical methodology. Kim, C.-S., Kim, C.-K., Martin, P., Sansone, U., Journal of analytical atomic spectrometry, v. 22, 2007, p. 827-841.

Development and application of an on-line sequential injection system for the separation of Pu, ^{210}Po and ^{210}Pb from environmental samples. Kim, C.-K., Kim, C.-S., Sansone, U., Martin, P., Applied radiation and isotopes, v. 66, 2008, p. 223-230.

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A., Sansone, U., Applied radiation and isotopes, v. 66, 2008, p. 1722-1725.

Quantification of measurement uncertainty in the sequential determination of ^{210}Pb and ^{210}Po by liquid scintillation counting and alpha-particle spectrometry. Kim, C.-K., Martin, P., Fajgelj, A., Accreditation and quality assurance, v. 13 (12), 2008, p. 691-702.

A soil sampling intercomparison exercise for the ALMERA network. Belli, M., De Zorzi, P., Sansone, U., Shakhashiro, A., Gondin da Fonseca Azeredo, A. M., Trinkl, A., Benesch, T., Journal of Environmental Radioactivity, v. 100, 2009, p. 982-987.

Method validation of a procedure for determination of ^{210}Po in water using DDTC solvent extraction and Sr resin. Kim, C. K., Lee, M. H., Martin, P., Journal of radioanalytical and nuclear chemistry, v. 279 (2), 2009, p. 639-646.

Rapid method for the determination of actinides in soil and sediment samples by alpha spectrometry. Vajda, N., Törvényi, A., Kis-Benedek, G., Kim, C.-K., Bene, B., Mácsik, Zs., Radiochimica acta, v. 97 (8), 2009, p. 385-401.

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