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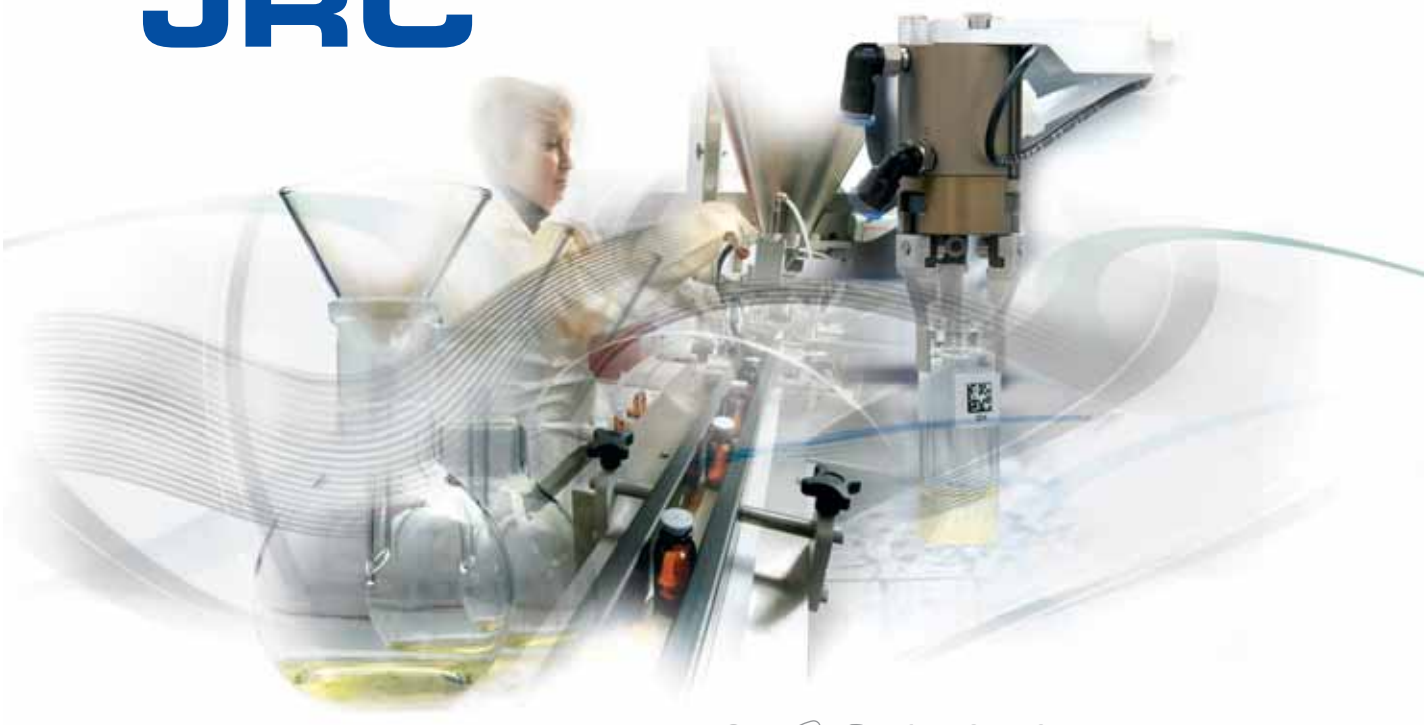
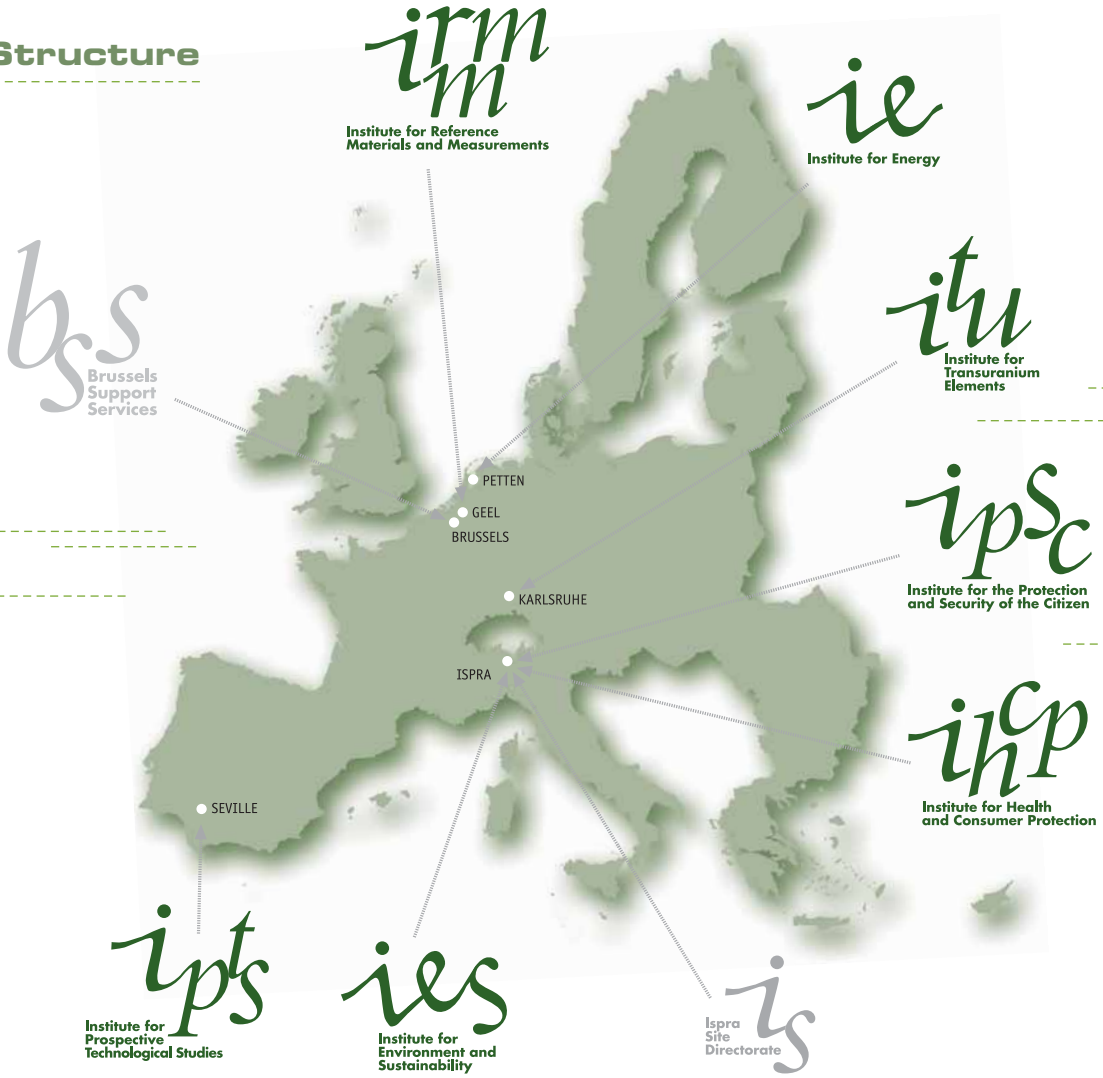


Institute for Reference Materials and Measurements

ANNUAL REPORT 2007

JRC
EUROPEAN COMMISSION
Report EUR 23337 EN

JRC Structure



The Institute for Reference Materials and Measurements

IRMM – Confidence in measurements®

The vision for the JRC-IRMM is to be the European Commission reference, providing confidence in measurements in support of EU policies.

The mission of the JRC-IRMM is to promote a common and reliable European measurement system in support of EU policies.

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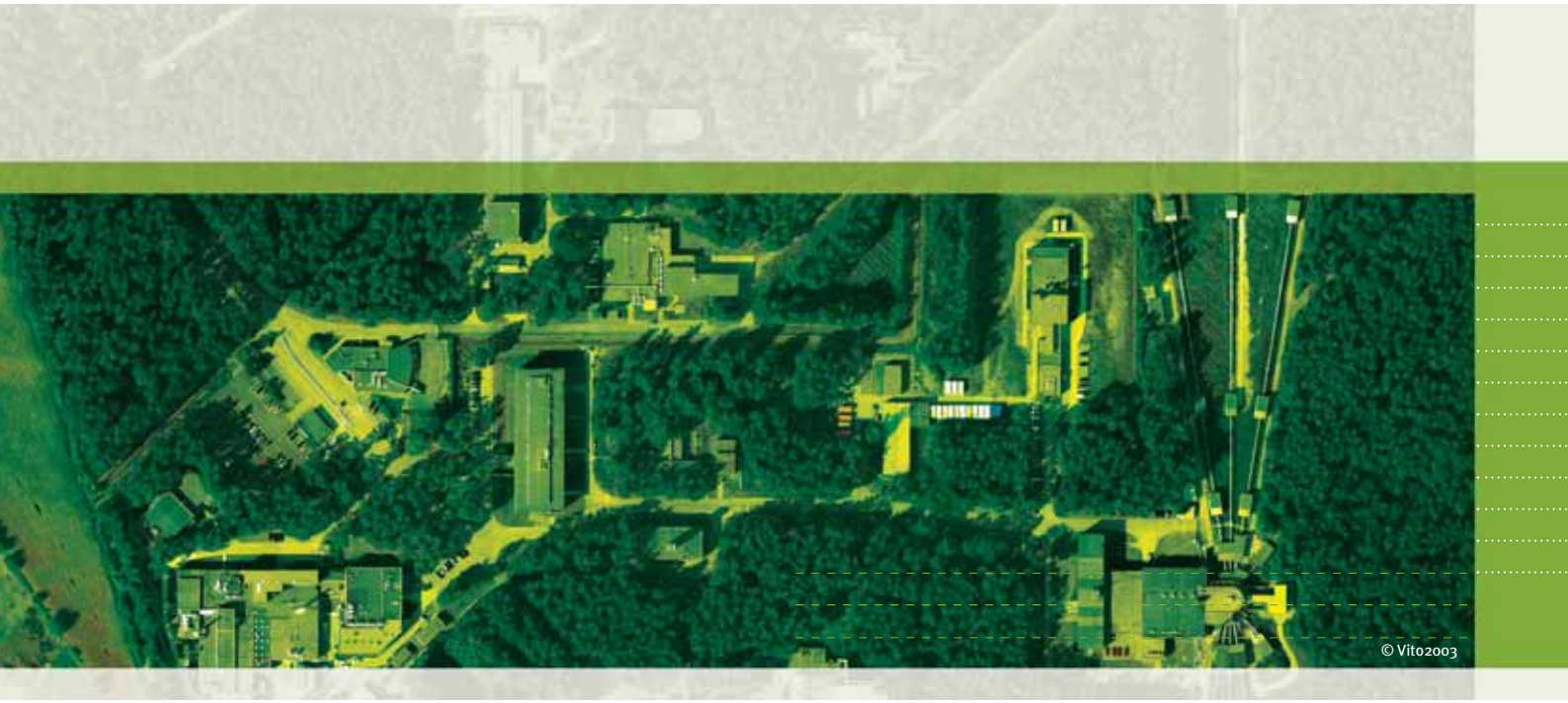

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Alejandro Herrero
Director JRC-IRMM

Message from the Director

The JRC-IRMM is committed to supporting the EU Member States in the monitoring and control of the implementation of EU legislation which, in many policy areas, is based on measurement results. The reliability and comparability of those testing results is as important for the individual citizen, who wants to know that the controls made are fit for his/her protection, as it is for trade and industrial operators, who want to know that the infrastructures controlling their activities are reliable. Therefore, the JRC works continuously to improve the quality of laboratory testing results in the Member States and beyond.

In 2007 many long term projects of JRC-IRMM were bearing fruit. In March, our three new Community Reference Laboratories were inaugurated by Markos Kyprianou, European Commissioner for Health and are now fully operational. They tap on our key competences and underline the importance of the work of JRC-IRMM in providing reference for Europe in different areas. A record number of reference material development projects were brought to an end, and our underpinning research work has resulted in the Commission introducing glyceroltriheptanoate (GTH) as a compulsory marker for those animal by-products that can not be used for animal nutrition. Many other successful projects are highlighted in this annual report.

On a more general note I am happy to acknowledge the comeback of Metrology in the European research landscape. The planning of a European Metrology Research Programme (EMRP) under Article 169 of the Treaty is well advanced and we are participating in its pilot phase 'iMERA+'. The Institute has, throughout its existence, integrated in its work the principles of Metrology and we will of course participate in the EMRP too. Metrology is the basis on which we have built our measurement systems and we will actively promote the awareness of policy makers about measurement issues. We will do this by means of a Commission inter-service working group on Measurement Standards for European Legislation (MSEL) where, early in the policy making process, the officials working on legislative proposals can meet to discuss relevant measurements issues. The goal is to anticipate any problems related to the reliability and comparability of measurements which hinder the smooth policy implementation and complicate trade in Europe and globally.

Collaboration is a lifeline for an institute like ours that has limited resources but a wide range of scientific fields to cover. This year we have concluded a collaboration agreement with EUROLAB, the European Federation of National Associations of Measurement, Testing and Analytical Laboratories. Another collaboration agreement signed in 2007 with the Chemical Science and Technology Laboratory (CSTL) of the National Institute of Standards and Technology (NIST, USA) demonstrates further the global dimension of the kind of work we do. We have strengthened our scientific collaborations also via the transnational access project NUDAME that started in 2005 and opened the JRC-IRMM nuclear accelerator laboratories to other European research teams. By the end of 2007 the NUDAME project enabled 14 European research teams to carry out an experiment at the JRC-IRMM accelerator laboratories. The need for such a project is clearly demonstrated by the fact that the programme advisory committee could accept only 43% of the total measurement time requested by the many proposers. A new project has been initiated in the Euratom-FP7 programme and I trust it will be again highly appreciated by the scientific community.

Towards the end of the year our Quality Management System successfully passed the triple audit for an integrated certification under the ISO 9001/ISO 14001/ OHSAS 18001 standards. While the JRC-IRMM is an organisation that provides standards in many ways in our fields of competence, we have now demonstrated that we apply them in our own processes as well. We shall, however, not rest on our laurels but will strive to continuously improve, according to the principles of quality management. With great interest I am looking forward to new research challenges and to sharing the future successes with my dedicated and enthusiastic staff and with all our excellent collaborators.

Alejandro Herrero

The Institute in 2007

The Institute for Reference Materials and Measurements (IRMM) is one of the seven Institutes of the Joint Research Centre (JRC), a Directorate-General of the European Commission, providing independent scientific and technical support to Community policy-making. The JRC-IRMM was founded in 1957 under the Treaties of Rome and started operation in 1960 under the name of the Central Bureau for Nuclear Measurements (CBNM). It promotes a common and reliable European measurement system in support of EU policies. The primary task of JRC-IRMM is to build confidence in the comparability of measurement results through the production and dissemination of internationally accepted quality assurance tools, including validated methods, reference materials, reference measurements, inter-laboratory comparisons and training.

The role of JRC-IRMM

A new Triton mass spectrometer has been installed in the JRC-IRMM nuclear safeguards laboratory in 2007.

As an institute of a Directorate-General of the European Commission JRC-IRMM performs tasks complementary to those of the Member States, especially where an independent approach at European level is needed.

The research programme of JRC-IRMM is focussed on areas of policy relevance, and serves many Directorates-General e.g., for Health and Consumer Protection, Environment, Agriculture, Energy and Transport, Enterprise and Industry, Trade, Taxation and the Customs Union, Enlargement and External Relations. All Commission services can also request JRC-IRMM to carry out specifically targeted research projects outside its annual programme under a special administrative arrangement.

Passing on the best practices and experience is essential in all areas where JRC-IRMM is working. Training courses are regularly organised by the specialists of the institute e.g., on the use of reference materials and the estimation of measurement uncertainty or on measuring of radioactivity and neutron cross sections. The JRC-IRMM runs a training programme on metrology in chemistry and employs a large number of PhD students, post doctoral fellows and young and senior visiting scientists, national experts and trainees.

Networking – promoting better measurements together

Building and maintaining reference measurement systems is a global effort and optimising the use of resources worldwide is beneficial to all. Therefore JRC-IRMM works in close collaboration with national and international research organisations, other metrology institutes, public authorities, universities as well as with industry. JRC-IRMM staff are members in numerous committees, their working groups and scientific boards of international organisations. As the metrology institute of the European Commission the JRC-IRMM participates in the activities of international metrology organisations such as the International Committee for Weights and Measures (CIPM) and the European Association of National Metrology Institutes (EURAMET e.V.). JRC-IRMM staff also contribute actively to the work of standardisation bodies like the European Committee for Standardization (CEN) and the International Organization for Standardization (ISO), and the Association of Analytical Communities (AOAC) International and has a formal collaboration agreement with the European Co-operation for Accreditation (EA). In the field of neutron data, JRC-IRMM is represented in the committees and working groups of the Nuclear Energy Agency (NEA) of the Organization for Economic Co-operation and Development (OECD) and the

JRC-IRMM representation in selected international committees and working groups

Association of Analytical Communities - AOAC International
- Executive Board of Technical Division on Reference Materials
- Europe Section
- Low Land Section

Cooperation on International Traceability in Analytical Chemistry (CITAC)

European cooperation for Accreditation (EA)
- Laboratory Committee, working group for inter-laboratory comparisons in the field of testing

European Committee for Standardization (CEN)

CEN Technical Committee 275 Food analysis – Horizontal methods
- General considerations working group
- Sweeteners working group
- Biotoxins working group
- Trace elements working group
- Genetically modified foodstuffs working group
- Food allergens working group
- Neoformed contaminants

CEN Technical Committee 327 Animal feeding stuffs – Methods of sampling and analysis
- Organic contaminants working group
- Composition working group
- Feed additives and drugs working group
- Heavy metals, trace elements and minerals working group

European Safeguards Research and Development Association (ESARDA)
- Destructive Analysis working group

EURACHEM
- Measurement Uncertainty and Traceability working group
- Qualitative Analysis working group
- Education and Training working group
- Proficiency Testing (EURACHEM and joint with EA and Eurolab) working groups

EURAMET
- Technical Committee - Quality
- Technical Committee - Ionising radiation
- Technical Committee - Interdisciplinary metrology
- Technical Committee - Time and frequency
- Technical Committee - Mass and related quantities
- Technical Committee - Metrology in Chemistry
- EMRP Research Council

International Atomic Energy Agency (IAEA)
- International Nuclear Data Committee
- Coordinated Research Project Nuclear Reactions
- Coordinated Research Project Minor Actinide Neutron Reaction Data
- Coordinated Research Project Database for Neutron Activation Analysis

International Committee for Radionuclide Metrology
- Associate Board Member
- Low-level measurement techniques working group
- Alpha-particle spectrometry working group
- Radionuclide metrology techniques working group

International Committee for Weights and Measures (CIPM)

Consultative Committee for Ionising Radiation - Section II (CCRI (II)); measurement of radionuclides
- Realization of the becquerel working group
- Key comparisons working group
- Extension of the SIR to ß-emitters using liquid scintillation working group

Consultative Committee for Ionising Radiation - Section III (CCRI(III)); neutron measurements
- Key comparison working group

Consultative Committee on the Amount of Substance (CCQM)
- Inorganic analysis working group
- Bioanalysis working group
- Organic analysis working group

Consultative Committee for Mass and Related Quantities (CCM)
- Working group on Avogadro Constant

Joint Committee for Traceability in Laboratory Medicine (JCTLM)
- Steering committee
- Working Group on Reference Materials and Reference Procedures

International Federation for Clinical Chemistry
- Scientific Division

International Organization for Standardization (ISO)
- Committee on Reference Materials (REMCO) and its working group ISO/WD Guide 34 (General requirements for the competence of reference material producers) and ad-hoc group Certified Reference Materials for qualitative analysis (testing of nominal properties)
- Technical Committee 69 - Applications of statistical methods
- Technical Committee 212 - Clinical laboratory testing and in vitro diagnostic test systems
- Technical Committee 229 - Nanotechnologies

International Union of Pure and Applied Chemistry (IUPAC)
- Division on Chemistry and the Environment
- Inorganic Chemistry Division, Commission on Isotopic Abundances and Atomic Weights and Subcommittee on Isotopic Abundance Measurements

Nuclear Energy Agency of the Organization for Economic Co-operation and Development (OECD-NEA)
- Nuclear Science Committee
- Joint Evaluated Fission and Fusion (JEFF) library - Scientific Committee
- Working Party on International Nuclear Data Evaluation Co-operation subgroup C/High-Priority List

VAMAS - Versailles Project on Advanced Materials and Standards
- Steering Committee

European Reference Materials (ERM®) is a product line of JRC-IRMM, LGC (UK) and Bundesanstalt für Materialforschung und –prüfung (BAM, DE).

International Atomic Energy Agency (IAEA). All in all JRC-IRMM has about 60 formal collaboration agreements and numerous other partners via informal and competitive activities. In addition, the JRC-IRMM operates now four Community reference laboratories, each of which coordinates a network of 30-40 national reference laboratories.

In 2007 the institute signed collaboration agreements with the Chemical Science and Technology Laboratory (CSTL) of the National Institute of Standards and Technology (NIST, USA) and Eurolab, the European Federation of National Associations of Measurement, Testing and Analytical Laboratories. The collaboration agreement with CSTL/NIST will advance the development and availability of international measurement standards in the fields of chemistry, life sciences, and emerging technologies and this will include co-operative research on modern measurements and their quality assurance and technical co-operation in the preparation and characterisation of reference materials. The memorandum of understanding with Eurolab intends to ensure information exchange in relevant matters e.g. between the JRC's Community reference laboratories and the Eurolab community, coordinate contents and programming of workshops and seminars of mutual interest, coordinate participation in European and international fora for standardisation and conformity assessment of measurements. The more technical topics concern cooperation in organising comparative testing schemes to assess competencies of measurement laboratories, establishing reference values or reference materials for those campaigns, and promoting the use of reference materials like the European Reference Materials (ERM®s) together. Training of staff and laboratory practitioners in very specific technical matters related to measurements is also included.

Certification and accreditations

In 2007, JRC-IRMM's management system successfully passed an integrated inspection audit for ISO 9001/ISO 14001/OHSAS 18001 carried out by TÜV Rheinland (DE). Certification according to these three ISO standards demonstrates that a management system is compliant with international quality, safety and environmental protection standards. As for many organisations, certification is a milestone in continuously improving the overall quality at JRC-IRMM. Transparency and efficient management greatly benefit the Institute's research and development activities geared towards highest quality measurement standards.

The Reference Materials unit of JRC-IRMM was the first European reference material producer to obtain accreditation according to ISO Guide 34 'General requirements for the competence of reference material producers' in 2004. Today, the institute's units have also several accreditations according to ISO/IEC 17025 'General requirements for the competence of testing and calibration laboratories' and ISO Guide 43 on 'Organising inter-laboratory comparisons'. These serve especially those partners and customers who need to fulfil the requirements of their own quality systems.

ISO 9001 Quality management systems
ISO 14001 Environmental management systems
OHSAS 18001 Occupational health and safety management systems

Work programme in 2007

In December 2006 the European Parliament approved the 7th Framework Programme (FP7) of the European Community for research, technological development and demonstration activities for 2007-2013, and of the European Atomic Energy Community (EURATOM) for nuclear research and training activities for 2007-2011.

The specific programme of the JRC in FP7 is structured in policy themes and agendas. Due to the horizontal nature of JRC-IRMM's work, its activities fall under three of them:

- the policy theme 1 'Prosperity in a knowledge intensive society', the agendas on competitiveness and innovation, the European Research Area, life sciences and biotechnology are relevant for JRC-IRMM,
- policy theme 2 'Solidarity and the responsible management of resources' contains topics like agriculture and climate change where tasks on analytical method development, validation and analytical quality assurance are assigned to JRC-IRMM, and
- policy theme 3 'Freedom, security and justice' contains research on food and feed safety and quality, which are core activities of the JRC-IRMM.

The nuclear work programme of JRC-IRMM is included in the specific programme for the nuclear research at the JRC. To complement the institutional research programme, the JRC-IRMM can participate in other projects of the 7th Framework Programme through the selection procedure. It also runs exploratory projects to develop new knowledge and new competencies.

Projects at JRC-IRMM in 2007 within the specific programme of the JRC in the 7th Framework Programme

- European reference materials – technology developments and quality management
- Support to European measurement infrastructure and Community reference laboratory for heavy metals
- Reference materials for biotechnology and life sciences
- Environmental reference materials
- Isotopic measurements for environmental support
- Feed safety and Community reference laboratory for feed additives authorisation
- Reference materials for food safety and microbiology
- Food safety and quality control and Community reference laboratories for mycotoxins and polycyclic aromatic hydrocarbons
- Basic research in nuclear physics and nuclear data standards
- Nuclear data for waste transmutation and safety of innovative concepts
- Radionuclide metrology for primary standardisation and policy support
- Providing metrological tools to support nuclear safeguards activities

Selected exploratory projects at JRC-IRMM in 2007

- Quantification in GMO certified reference materials: towards a new approach for PCR performance quality control of DNA extracts
- Screening of existing trichothecene reference materials for the occurrence of masked (conjugated) mycotoxins
- Metal solid phase extraction from natural, saline and waste waters using TiO_2 nano-particles: method development
- Investigation of possibilities to quantify allergenic proteins, in particular major peanut allergens in the presence of natural enzyme inhibitors
- High temperature liquid chromatographic analysis of PAHs in foods
- Detection of allergenic peptides derived from milk hydrolysates by proteomic and immunochemical approaches
- Production of uranium particle reference materials
- Developing a neutron source in the energy range between 8 and 14 MeV for Van de Graaff accelerators
- Measurement of neutron activation cross section curves using moderated neutron fields
- Study on the use of a high efficiency array of C6D6 detectors for absolute capture cross section measurements in the thermal and epi-thermal energy region

European projects and networks for research in which the JRC-IRMM participated in 2007

Networks of excellence	
EUROFIR	European food information resource network
EUROGENTEST	Genetic testing in Europe
MONIQA	Monitoring and quality assurance in the food supply chain
NEUROPRION	Prevention, control and management of prion diseases
Integrated projects	
BIOCOP	New technologies to screen multiple chemical contaminants in foods
CO-EXTRA	GM and non-GM supply chains: Co-existence and traceability
EUROTRANS	European research programme for the transmutation of high level nuclear waste in an accelerator driven system
TRACE	Tracing the origin of food
Specific targeted research projects	
SAFEED-PAP	Detection of presence of species-specific animal proteins in animal feed
ANCIENT CHARM	Analysis by neutron resonant capture imaging and other emerging neutron techniques: new cultural heritage and archeological research methods
EAQC- WISE	European analytical quality control in support of the Water Framework Directive via the water information system for Europe
HORIZONTAL-ORG	Horizontal standards on organic micropollutants for implementation of EU directives on sludge, soil and treated bio-waste
SWIFT-WFD	Screening methods for water data information in support of the Water Framework Directive
Intelligent Energy - Europe - Programme	
QUOVADIS	Quality management organisation, validation of standards, developments and inquiries for solid recovered fuels
Integrated infrastructure initiatives	
ILIAS	Integrated large infrastructures for astroparticle physics
EFNUDAT	European facilities for nuclear data measurements
Coordination actions	
CANDIDE	Coordination action on nuclear data for industrial developments in Europe
iMERA ERA-NET	Implementing metrology in the European Research Area
EMERALD	Empowering the microarray-based European Research Area to take a lead in development and exploitation
Trans-national access scheme (EURATOM)	
NUDAME	Neutron data measurements at JRC-IRMM

Improving laboratory testing in the EU – record number of new reference materials

Comparability of measurement and testing results from around the world depends on a framework of international measurement standards. Reference materials are needed for calibrating instruments and test kits, validating measurement procedures and monitoring the performance of laboratories. Today, reference materials are increasingly needed to fulfil the criteria of laboratory accreditation schemes.

JRC-IRMM is one of the world's leading reference material producers specialising in policy support. It runs a systematic development programme based on up-to-date knowledge of the needs of the testing laboratories and the demands of European legislation. In 2007, many reference material development projects were completed and 60 new certified reference materials for life sciences, food control, engineering applications and for the analysis of nuclear materials were released for distribution. Many of the reference materials of JRC-IRMM are produced under the European Reference Materials (ERM®) label, which guarantees the use of best practices in production and certification.

JRC-IRMM has storage facilities for a variety of different kinds of reference materials.

New reference materials raise quality of GMO testing

Legislation in the European Union requires labelling of food and feed products containing more than 0.9% genetically modified organisms (GMOs), provided the GMO has been placed on the market in accordance with Community legislation. Implementing the legislation requires suitable quality assurance tools, and laboratories need certified reference materials to be in accordance with lab accreditation schemes. The JRC-IRMM was the first to produce reference materials for the analysis of GMOs, and is the only one accredited under ISO Guide 34 for the production of certified GMO reference materials.

JRC-IRMM is the world' s leading producer of certified reference materials for the analysis of GMOs.

In 2007, three new series of matrix reference materials for the analysis of GM soya and maize were completed and the JRC-IRMM introduced a new set of reference materials for testing GM maize line MON 810 in food and feed products, the first-ever available set of certified quality assurance tools for GMO measurements expressed in the new measurement unit as laid out in the EC Recommendation 2004/787/EC in 2004.

The new series for the analysis of soya event 356043 (ERM-BF425), the soya event 305423 (ERM-BF426) and the maize event 3272 (ERM-BF420) contain four certified reference materials in each set. Soya event 356043 is engineered to express two new proteins conferring glyphosate and acetolactate synthase-inhibiting herbicides tolerance, whereas soya event 305423 is engineered to contain more oleic acid and less palmitic, linolenic and linoleic acids to enable producing a more stable oil that does not require chemical hydrogenation. The latter is also tolerant to acetolactate synthase-inhibiting herbicides. The maize event 3272 expresses a thermostable α-amylase protein, aimed at degrading the starch during the production of bio-ethanol from maize. Additionally, the plant selectable marker *manA*, coding for phosphomannose isomerase, has been inserted in the event 3272 maize. Each set of these reference material powders was prepared by mixing gravimetrically GM and non-GM seed powders. The GMO contents were confirmed by real-time polymerase chain reaction (PCR) analysis after DNA extraction from the powders.

The JRC-IRMM has introduced the first set of reference materials for the analysis of genetically modified MON 810 maize, certified for GM content expressed in the new measurement unit i.e. the copy number ratio.

The polymerase chain reaction (PCR) technique is used for identification of plant species.

The new EC recommendation of 2004 proposes to express quantification results for food and feed products containing genetically modified products in DNA copy numbers. Modern analytical techniques such as real-time PCR measure copy numbers of DNA sequences in the GM event relative to a DNA sequence of the biological species. Its sensitivity and the ability to detect GM products also in processed food and feed have made real-time PCR the method of choice for the quantification of GM content. This has resulted in a recommendation of the European Commission to change the expression of the quantification results from mass fractions (mass of GM material per total mass of the species) to copy number ratios (number of GM DNA sequences per number of DNA sequences of the species). The implementation of the recommendation, however, depends on the availability of suitable measurement tools. For correct application of the detection methods (e.g. the international standard methods) and to comply with laboratory accreditation schemes (e.g. ISO/IEC 17025) laboratories need reference materials certified for their GM content expressed in the same measurement unit, i.e. the copy number ratio. Therefore, JRC-IRMM has now developed a new calibrant and certified an existing reference material ERM-BF413d for its MON 810 copy number ratio.

The ERM-BF413d matrix material is a mixture of ground MON 810 GM seeds and ground non-GM maize seeds, and is intended for the quality control of the MON 810 quantification method of the International Organization for Standardization (ISO 21570:2005, Annex D2). To provide an independent calibrant, the reference material ERM-AD413 made up of plasmid DNA has been certified to contain one copy of each of the two DNA sequences targeted by the ISO MON 810 quantification method. Prior investigations have demonstrated that for this specific method plasmid DNA is a suitable calibrant, i.e. it is commutable. Together, the two certified reference materials can ensure correct implementation of the entire MON 810 measurement procedure and form the first set of GM reference materials available world-wide certified for their copy number ratio. Due to the novelty, the two reference materials were released together with an ERM application note describing the correct use of the calibrant and the matrix material.

Reference materials for HbA1c detection help diabetes patients

The long-term glycaemic status of patients with diabetes mellitus is monitored via the level of HbA1c in blood, the major isoform of non-enzymatically glycated haemoglobins. Monitoring of glycated haemoglobin levels allows improved follow up of diabetes patients, decreasing the risk of suffering from severe long term effects.

The JRC-IRMM has released two certified reference materials for the calibration of the reference measurement procedure established by the International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) or other analogous methods based on the quantification of the N-terminal hexapeptide of the β-chain carrying the stable glycation. These certified reference materials form the basis for the internationally accepted reference system for glycated haemoglobin measurements.

The new material IRMM/IFCC-466 is a deep frozen buffered solution containing HbA1c and was prepared from whole blood of diabetic donors. The IRMM/IFCC-467 was prepared from whole blood of healthy donors and is a deep frozen buffered solution containing HbA0 (the non-glycated form of haemoglobin). Both materials have been processed and certified according to the ISO Guides 34 and 35.

Supporting the implementation of the RoHS-Directive – reference materials for flame retardants and elements in plastics

The RoHS Directive (2002/95/EC) bans the use of Pb, Cd, Hg, hexavalent Cr and certain polybrominated flame retardants, especially polybromobiphenyls (PBBs) and polybromodiphenyl ethers (PBDEs) in electric and electronic equipment. Similar legislation has been adopted in several American and Asian countries and in Australia. Enforcement of this directive requires testing of materials and products for their content of the restricted substances.

In an inter-laboratory comparison organised by JRC-IRMM, 37 laboratories from Europe, America and Asia determined PBDEs and PBBs in a poly(ethyleneterephathalate) (PET) granulate. The results demonstrated that there is a need for improvement in analytical methodology to allow proper implementation of the Directive. For instance, 25% of the participants falsely judged the test sample as complying with the RoHS Directive, despite a content of polybrominated flame retardants twice as much as the legal limit. As a result of this exercise the test material used was made immediately available as a quality control material. The IRMM-310 consists of poly(ethyleneterephtalate) (PET) granulates fortified with mixtures of technical grade PBDEs and PBBs. Laboratories can now use this material to identify gross errors in their methodologies. This is the first commercially available polymer material having assigned values for a number of different flame retardants. Work on the certification of two reference materials, which will finally allow reliable assessment of method performance is ongoing.

In 2007, JRC-IRMM has also produced two new materials for the analysis of low density polyethylene (LPDE). ERM-EC680k and ERM-EC681k consist of LDPE granulates that are certified for the mass fractions of As, Br, Cd, Cl, Cr, Hg, Pb and S. The contents of these elements are very similar to those of the previously available materials. The mass fraction of Sb has also been certified and indicative values for Sn and Zn were assigned. Apart from the RoHS directive, these materials help to implement European legislation aiming at minimizing the flux of trace elements to the environment which comprises e.g., the Packaging Directive (94/62/EC) and End of Life Vehicles (ELV) Directive (2000/53/EC).

ERM-EC680k and ERM-EC681k are low density polyethylene granulates that can be used for the quality assurance of measurements related to the implementation of the RoHS Directive.

New reference materials for engineering applications

In 2007, JRC-IRMM certified the first reference material for high temperature thermal conductivity and diffusivity measurements on thermally insulating materials. BCR-724 was prepared from a batch of Pyroceram 9606 glass-ceramic. The material and its certified value were shown to be stable at elevated temperatures up to 1025 K. The reference material can be used for assessing method performance and also for control charts or validation studies.

JRC-IRMM has also released new batches of IRMM-521 (Co in Ni), BCR-261 (Ta_2O_5 on Ta-foil) and Charpy impact test reference materials (ERM-FA013, ERM-FA016 and ERM-FA415). The new IRMM-521R is a certified reference material for neutron dosimetry applications, consisting of a nickel metal foil where the maximum cobalt content is certified to be less than 0.26 $mg \cdot kg^{-1}$. Such a relatively small amount of cobalt enables to reduce the uncertainty of dosimetry measurement results by eliminating spectral interference caused by the cobalt impurity. The new BCR-261T, tantalum pentoxide on tantalum foil, was released to aid in the analysis of microelectronic device behaviour, the understanding of oxidation and corrosion phenomena, the technology of protective and decorative coatings, and of surfaces for adhesion. BCR-261T can be used as calibrant for the evaluation of the sputtering rate (as an indirect depth scale) and for the optimisation of depth

Scanning electron microscopy is used for the characterisation of candidate reference materials.

resolution capability of surface analysis instruments. This reference material may also be used to calibrate or validate oxygen thin film analysis by nuclear reaction analysis (NRA), Rutherford backscattering spectroscopy (RBS), elastic recoil detection analysis (ERDA) and other techniques.

The demand for Charpy impact test reference materials has increased as a result of upcoming laboratory quality assurance demands, reflected in the revised ISO-148 series of documentary measurement standards on Charpy pendulum impact tests on metallic materials. The JRC-IRMM has continuously improved and adapted its Charpy reference material certification procedures to these developments. Therefore, JRC-IRMM is able to provide today the Charpy reference materials in compliance with tomorrow's requirements.

References for nuclear safeguards

IRMM-086 is a highly enriched ^{239}Pu spike certified for plutonium amount content and isotopic composition. This isotopic reference material is applied for the quality control of measurements in the nuclear fuel cycle.

Correct measurements of nuclear materials are at the heart of security and safeguards of nuclear installations in Europe and the world. In Article 8 and Annex V of the Euratom Treaty the need for isotopic standards is stated recognising the essential part that reference materials play in measurements of nuclear materials.

The JRC-IRMM offers over 40 reference materials for nuclear safeguards measurements. In 2007 it produced two new sets of isotopic uranium reference materials whose specifications are up-to-date and tailored for the demands of modern analysis techniques. The isotope ratios in these new materials cover a wide range, especially useful for measuring uranium isotope ratios typically found in the nuclear fuel cycle and in the environment, and are also suitable for geochemistry applications. Two new highly enriched ^{239}Pu spikes have been prepared and certified for plutonium amount content and isotopic composition and a new batch of large-sized dried spikes for uranium and plutonium, labelled IRMM-1027j has been completed. These spikes are applied by European and international inspection authorities and other customers world-wide. They form a fundamental part of the fissile material control of irradiated nuclear fuel because of their clear technical advantages.

Analysing mycotoxins more accurately

Aflatoxins are naturally occurring contaminants in food and feed of plant origin, which are produced by fungi. They are potent liver carcinogens and in particular aflatoxin B1 has been proven to be mutagenic, teratogenic and to cause immunosuppression in animals as well. Therefore, aflatoxins have to be monitored to make sure that they only occur in food and feed below legal thresholds.

In 2007, JRC-IRMM certified four reference materials consisting of pure aflatoxins in acetonitrile solution: aflatoxin B1 (ERM-AC057), aflatoxin B2 (ERM-AC058), aflatoxin G1 (ERM-AC059) and aflatoxin G2 (ERM-AC060). The new materials will allow calibration of detection systems like fluorescence detectors, mass spectrometers and enzyme-linked immunosorbent assays (ELISA). Their use will enhance comparability of analytical results by removing the bias introduced by inaccurate calibrants.

A defatted peanut meal certified for the aflatoxin B1 content (BCR-262R) has been also released for distribution in 2007. This material is based on an earlier material (BCR-262) and provides improved homogeneity characteristics, essential for the intended use of the material. BCR-262R can be used as a blank for establishing the recovery of methods through spiking experiments, to check the specificity of the method by providing a typical matrix and to determine the limit of detection and quantification of methods of analysis.

Reference materials released by JRC-IRMM in 2007

Code	Material	Certified property
BCR-162R	soya-maize oil blend	fatty acid content
BCR-176R	fly ash	content of trace elements
BCR-261T	two lots of tantalum pentoxide on tantalum foil	areal density of oxygen atoms and thickness ratio between lots
BCR-262R	defatted peanut meal	aflatoxin B1 blank
BCR-632	butter fat	triglycerides
BCR-724A to BCR-724D	glass-ceramic	thermal conductivity, thermal diffusivity
ERM-AD413	plasmid DNA	DNA fragment
ERM-BD273	toasted bread	content of acrylamide
ERM-BF413d	MON 810 GM maize	copy number
ERM-BF425a to ERM-BF425d	356043 GAT GM soya	GMO mass fraction
ERM-BF426a to ERM-BF426d	305423 OH GM soya	GMO mass fraction
ERM-EC057	aflatoxin B2 in acetonitrile	aflatoxin concentration
ERM-EC058	aflatoxin B1 in acetonitrile	aflatoxin concentration
ERM-EC059	aflatoxin G1 in acetonitrile	aflatoxin concentration
ERM-EC060	aflatoxin G2 in acetonitrile	aflatoxin concentration
ERM-EC680k	polyethylene	toxic elements
ERM-EC681k	polyethylene	toxic elements
ERM-EF211	petrol	sulfur content
ERM-FA013at	Charpy V-notch reference test pieces of 30 J nominal absorbed energy	impact toughness
ERM-FA013ax	Charpy V-notch reference test pieces of 30 J nominal absorbed energy	impact toughness
ERM-FA415k to ERM-FA4150	Charpy V-notch reference test pieces of 150 J nominal absorbed energy	impact toughness
ERM-FA016at	Charpy V-notch reference test pieces of 120 J nominal absorbed energy	impact toughness
ERM-FA016av	Charpy V-notch reference test pieces of 120 J nominal absorbed energy	impact toughness
IRMM-310	poly(ethyleneterephthalate)	assigned values for PBBs and PBDEs
IRMM-435	pharmaceutical glass	alkali leaching and release; certified for release of sodium (and Na^2O) per volume leachate and indirectly for total alkali release
IRMM-448	genomic DNA of *Campylobacter jejuni*	identity (mass per vial)
IRMM/IFCC-466	glycated haemoglobin	HbA1c
IRMM/IFCC-467	haemoglobin	HbAo
IRMM-521R	nickel foil	cobalt content
IRMM-804	rice flour	contents of trace elements
IRMM-075	mixtures of ^{236}U and ^{nat}U	isotope amount ratios
IRMM-081a	^{239}Pu spike	isotope amount content and isotopic composition
IRMM-086	^{239}Pu spike	isotope amount content and isotopic composition
IRMM-1027j	U/Pu dried spike	isotope amount content
IRMM-3183 to IRMM-3187	isotopic material	uranium isotope amount ratios
QCM-GHa500	BSE generic homogenate (1:10 positive/ negative dilution)	
QCM-tgMB-147	BSE transgenic mouse brain (147 days)	
QCM-tgMB-220	BSE transgenic mouse brain (220 days)	
QCM-tgMB-98	BSE transgenic mouse brain (98 days)	

Test samples for inter-laboratory comparisons on the analysis of mycotoxins.

Evaluating capabilities and competencies of testing laboratories

It is important for a testing laboratory to know that the measurement results it produces are reliable. It is equally important to be able to demonstrate these competences against reliable benchmarks. Many laboratories have acquired accreditation of their services/activities and increasingly the laboratory accreditation schemes require proof of proficiency. The testing laboratories can demonstrate their capability by participating in proficiency testing exercises organised by recognised national or international providers.

The JRC-IRMM organises proficiency tests for designated laboratories e.g. the national reference laboratories. It also organises inter-laboratory comparisons open to all laboratories that wish to benchmark their capabilities and pilot and key comparisons of the committees of the International Committee for Weights and Measures (CIPM) in its competence areas. The inter-laboratory comparisons organised by JRC-IRMM are closely related to new or modified European legislation or policy or monitoring policy implementation across the EU. In 2007 the JRC-IRMM was running 21 campaigns.

Measurement evaluation programmes

JRC-IRMM organises International Measurement Evaluation Programmes (IMEPs) to assess the measurement capabilities of testing laboratories.

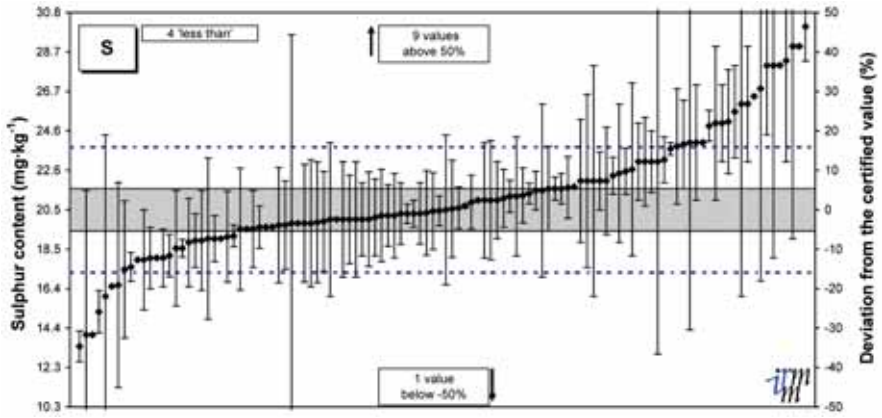
The JRC-IRMM runs an International Measurement Evaluation Programme (IMEP), a Regular European International Measurement Evaluation Programme (REIMEP) for nuclear measurements, an International Measurement Evaluation Programme for Nuclear Signatures in the environment (NUSIMEP) and an evaluation programme on the comparability of data collected by the JRC Institute for Environment and Sustainability from laboratories measuring radioactivity in the environment.

In 2007 the IMEP-22 on measuring sulfur in petrol was completed and IMEP-23 on eight polycyclic aromatic hydrocarbons (PAHs), set as priority substances for the Water Framework Directive, in ground water was commenced. Other IMEP campaigns running in 2007 were IMEP-102 and IMEP-103 for national reference laboratories on analysing Cd, Pb and Hg in mineral water and feed. The campaign on measurements of ^{40}K, ^{137}Cs and ^{90}Sr in milk powder was completed and a new campaign on measuring $^{226, 228}Ra$ and $^{234, 238}U$ in three mineral waters with 46 laboratories was started.

The IMEP-22 campaign on sulfur in petrol is a representative example of what such a programme can achieve. In many cases implementation of international and national legislation is based on high quality chemical measurement results. Therefore laboratories need to be able to demonstrate that their measurement results are reliable and comparable. By doing so, they also comply with international recognition arrangements that support the goal 'measured once, accepted everywhere' of the CIPM. One of the aims of the IMEP-22 was specifically to determine the state-of-the-practice of 127 Member States laboratories involved in routine measurements of sulfur. 20 customs laboratories involved in the activities of the Directorate-General (DG) for Taxation and Customs Union participated in IMEP-22. Based on the results, the DG can now evaluate the measurement capabilities of the national customs laboratories measuring sulfur in petrol at the relevant concentration level as prescribed in the legislation (2003/17/EC).

In the frame of a collaboration agreement between the JRC-IRMM and the European Co-operation for Accreditation (EA), 77 nominated laboratories participated in the campaign. Results of these laboratories enable EA to assess the measure-

ment capabilities of accredited laboratories and enforce corrective actions when required. In addition, the IMEP offers EA a means to evaluate the accreditation practices in the various countries that have signed the multilateral agreement (MLA) aiming at worldwide recognition and international acceptance of measurement results, across borders in Europe and in the world. Signatories of the MLA (national accreditation bodies) recognise that they operate in an equivalent way and that they deliver equivalent accreditations, providing the same level of competence and confidence.



Results from all participants of the IMEP-22 campaign measuring sulfur content in petrol. The grey band represents the reference interval (X_{ref}±2u_{ref}), the dashed lines delimit the target interval (X_{ref} ± 2σ).

Inter-laboratory comparisons organised by JRC-IRMM in 2007
(started, on-going or completed; reference material certification campaigns are not included)

Topic	Type of comparison
sulfur in petrol	international measurement evaluation - IMEP-22
eight WFD priority PAHs in ground water with added humic acids	international measurement evaluation - IMEP-23
analysis of total Cd, Pb and Hg in mineral water	proficiency test for national reference laboratories for heavy metals in feed and food - IMEP-102
analysis of total Cd, Pb, Hg and extractable Cd and Pb in feed	proficiency test for national reference laboratories for heavy metals in feed and food - IMEP-103
activity concentration of the radionuclides ^{40}K, ^{137}Cs and ^{90}Sr in milk powder	evaluation of comparability of data collected from Member State laboratories monitoring radioactivity in air, water and foodstuffs
^{226,228}Ra and ^{234,238}U in three mineral waters	evaluation of comparability of data collected from Member State laboratories monitoring radioactivity in air, water and foodstuffs
analysis of 15+1 EU priority PAHs in edible oil and solvent solution	proficiency test for national reference laboratories for PAHs
EU 15+1 PAHs in acetonitrile	proficiency test for national reference laboratories
quantitation of PAHs in primary smoke condensate	proficiency test
analysis of PAHs in edible oils	proficiency test
analysis of acrylamide in crisps	proficiency test
analysis of aflatoxins in a peanut material	proficiency test for national reference laboratories
aflatoxins B1, B2, G1, G2 in acetonitrile	proficiency test for national reference laboratories
analysis of ochratoxin A in spices	proficiency test for national reference laboratories for mycotoxins in food
analysis of methionine	pilot study CCQM-P75 for CIPM
analysis of strontium	five inter-laboratory comparisons - harmonising exercises within the TRACE project
isotopic ratios of strontium in wine	pilot study CCQM-P105 for CIPM

PAH
polycyclic aromatic hydrocarbon

CIPM
International Committee for Weights and Measures

CCQM
Consultative Committee on the Amount of Substance

An inductively coupled plasma mass spectrometry (ICP-MS) laboratory of JRC-IRMM.

JRC-IRMM benchmarks its own capabilities

The JRC-IRMM's own capability to perform reference measurements is a key factor for organising inter-laboratory comparisons. Therefore, the JRC-IRMM regularly participates in inter-laboratory comparisons organised by others as well. The measurement capabilities of JRC-IRMM are often benchmarked against the best achievable measurements via the key comparisons of committees of the International Committee for Weights and Measures (CIPM).

In 2007 JRC-IRMM laboratories participated in a number of campaigns. The radiometrology laboratory measured ^{210}Po in five water samples for an IAEA proficiency test in good agreement with reference values within 4% measurement uncertainty. The purpose was to evaluate the capacity of laboratories to perform determinations of ^{210}Po under conditions where rapid analysis and reporting of results - within only one week after receipt of the samples - is required.

JRC-IRMM experts have submitted results to a proficiency test for environmental radioactivity i.e. gamma-emitters in two radionuclide solutions and in concrete samples, organised by the National Physical Laboratory (NPL, UK), CCQM comparisons measuring lead in wine (CCQM-K30) and mercury in water (CCQM-P100) and to Euromet-924 for Hg, Cd and Pb.

Metrology in chemistry

Confidence in measurement results is essential for international trade. To a large extent this confidence already exists and is based on the SI-units where possible. Many quality standards for chemical and biochemical measurements are well established and today the role of metrology in the measurement quality infrastructure is becoming better known as complementing quality assurance measures with a solid basis for a reliable infrastructure.

The JRC-IRMM has a long tradition in applying the concepts of metrology, i.e. measurement science, in its work and in realizing a traceability chain in chemical, radiochemical/radioactivity measurements. It also carries out research on applying metrological principles to modern measurement needs like bioanalysis and measurements at the nanoscale. It is a signatory of the Mutual Recognition Arrangement of the CIPM and involved in the preparation of the European metrology research programme (EMRP). EMRP is an initiative in the field of metrology identified by the Commission as potentially fulfilling the selection criteria for a complementary research programme under the Article 169 of the Treaty, to be managed by EURAMET e.V. The Article 169 provides a legal basis for the European Community to support the integration of national research programmes by means of participation in research and development programmes undertaken by several EU Member States.

High accuracy measurements are performed at JRC-IRMM for an international Avogadro project aiming to redefine the unit of mass.

Metrology support programme

In today's EU internal market and globalised economy, quality is a must to stay competitive in all areas. This is an issue also for the countries in South East Europe. The establishment of a free trade area in the Balkans as well as free trade agreements with EU require a functioning metrology system, which will also fulfil the requirements set on quality of environment and safety and quality of food. Developed countries require specialised quality infrastructure, which involves many actors (testing and calibration laboratories, notifying bodies, bodies responsible for metrology, accreditation, standardisation, legislation). Today, countries in South East Europe are receiving funding e.g. via EU support programmes like the Community Assistance for Reconstruction, Development and Stabilisation (CARDS) Programme and the instrument for pre-accession (IPA) for capacity building in the area of quality infrastructure.

JRC-IRMM assists Albanian and Croatian metrology institutes via CARDS Programme.

In the past the JRC-IRMM has assisted representatives of the new Member States and Candidate Countries in setting up their metrology infrastructure. Projects are now being carried out in Albania and Croatia addressing institutional problems linked to state-funded activities in standardisation, metrology, conformity assessment and the accreditation system. Within these projects JRC-IRMM provides expert advice in capacity building and training with the aim of building the capabilities of selected laboratories, and helps upgrading the legal framework. The TrainMiC programme and the IMEP were available for laboratories of Albania and Croatia.

The CARDS project in Albania was completed in 2007. The JRC-IRMM has provided expert support in drafting the strategy for the Albanian metrology institute. In 2007 JRC-IRMM set up a close collaboration between the Albanian metrology institute and the World Bank and the Physikalisch-Technische Bundesanstalt (PTB, DE), also actively involved in quality infrastructure related activities in Albania. Within the CARDS project in Croatia, an elaborated economic needs analysis has been conducted and the Croatian stakeholders were familiarised with a distributed national metrology system. JRC-IRMM also assisted in drafting technical specifications for equipment derived from the national investment

strategy and in making of the Croatian national strategy for metrology, which has been submitted to the government for approval after inter-ministerial consultations.

From TrainMiC to AcadeMiC

A high-quality, well functioning measurement infrastructure in Europe depends largely on those implementing it. The JRC-IRMM provides training in metrology in chemistry for practitioners in regulatory bodies and industry. The TrainMiC programme started in 2001 and was first designed for the laboratory staff in the Candidate Countries, later joining the EU. It is organised as a network of national providers, all trained by the TrainMiC team and deals with topics like validation, calibration, uncertainty reporting and more. By the end of 2007, 3670 participants have attended a TrainMiC course, and in 2007 alone 28 training events were organised in 15 countries reaching 758 participants. The TrainMiC has developed into a full training programme for metrology in chemistry and makes part of a lifelong learning to maintain key competencies of laboratory personnel. A special 'training the TrainMiC trainers' programme enables providing this training also in the language of the country.

The AcadeMiC platform, launched in 2005, extends promoting measurement science to the academia. While the TrainMiC programme addresses laboratory personnel, the AcadeMiC is directed to a professional audience already active in the educational sector. In 2007, the JRC-IRMM organised the second summer school in Wieliczcka (PL), with some 35 participants. A consortium of universities will now assemble around a Joint Degree Programme and make a EUROMASTER application called 'Measurement science in chemistry' to the European Chemistry Thematic Network Association. The EUROMASTER initiative also promotes mobility of researchers. All these activities are in support of the planned creation of the European Higher Education Area by 2010.

TrainMiC
Training in Metrology in Chemistry

New and improved methods of analysis for food control and environmental studies

Safe food and a cleaner environment are the goal of numerous existing and planned Community regulations and measures, responding to the basic needs of the European citizen. The monitoring of compliance with those rules is based on measurement results. Validated and reliable methods of analysis are not always available for all substances that need to be monitored. In some cases, also the development of a reference material for quality assurance of testing results may require development and validation of alternative or very accurate methods for characterisation.

The JRC-IRMM develops, validates and tests analytical methodologies and methods for measurements of food and environmental samples where European legislation is in place or being planned. The research topics range from analysis of mycotoxins in food to authenticity of organically grown crops to isotope analysis of nitrate in waters. Many testing methods validated by JRC-IRMM together with its collaborators have been later reviewed by international standardisation bodies and turned into standards.

Analysing coccidiostats in feed.

A glyceryltriheptanoate (GTH) marker for animal by-products was developed at JRC-IRMM.

Reliable analysis of food additives

EU rules on food additives state that only authorised additives may be used in the manufacture of foodstuffs. Sweeteners for instance are regulated by Directive 94/35/EC and its amendments. At present, eight high intensity non-nutritive sweeteners are authorised in the EU, i.e. acesulfame-K, aspartame, aspartame-acesulfame salt, cyclamate, neohesperidine dihydrochalcone, saccharin, sucralose and thaumatin. They may be added up to defined limits (maximum usable dose) to specified groups of foodstuffs. The EU Member States are required to establish a system of regular surveys to monitor sweetener consumption. To obtain this information reliable quantitative methods of analysis are required. As intense sweeteners are today used in combination with others, methods for the analysis of several sweeteners simultaneously are needed.

The JRC-IRMM has developed a high performance liquid chromatographic method with evaporative light scattering detection, which was validated by collaborative trial. This method is capable of simultaneous identification and quantification of six authorised sweeteners, and of three unauthorised sweeteners in beverages, canned or bottled fruits and yoghurts. To facilitate deployment of the method for the analytical chemist a toolbox has been established, containing a description of the validated method and an electronic evaluation sheet to calculate the results. The method offers means to assess compliance with labelling provisions and is suitable for the cost effective analysis of large numbers of samples. This method has now been accepted for consideration as a candidate European Standard by the working group on sweeteners of the CEN Technical Committee 275 (Food analysis – Horizontal methods). In 2007 also a simple method of analysis for sucralose in beverages, based on the application of thin layer chromatography without sample clean-up, was developed and validated in a collaborative trial.

Other additives studied at JRC-IRMM are smoke flavourings. Their use in food is regulated via Regulations (EC) No 2065/2003 and No 627/2006. In 2007, the JRC-IRMM published the results of a collaborative study for a quantitative high performance liquid chromatography (HPLC) method for determination of the 15 European priority PAHs in smoke condensates.

JRC-IRMM studies PAHs in smoke flavourings.

New European legislation was introduced in early 2005 to respond to food contamination problems, based on data collected by the EU Member States and assessment by the Scientific Committee on Food (SCF) in 2002. The SCF assessed 33 PAHs and recommended 14 of them to be monitored in addition to benzo[a]pyrene (BaP), which was the only compound required at that time. This is reflected in Commission Recommendation 2005/108/EC. In 2005, the Joint FAO/WHO Expert Committee on Food Additives (JECFA) brought up another PAH that is not covered by the Commission Recommendation 2005/108/EC. Therefore, EFSA and the European Commission have drawn up a priority list of the 15 PAHs mentioned in the recommendation complemented with the one specified by JECFA. The EU Member States are requested to provide monitoring data on these 16 PAHs to enable long-term exposure assessment. To distinguish this set of 16 PAHs from another set of 16 PAHs that was prioritised by the US Environmental Protection Agency (US EPA), the term '15+1 EU priority PAHs' is used.

Milling of feed samples.

New methods for the analysis of contaminants in feed and food

Contaminants in feed and food can pose a threat to human health. To ensure that food on the European market is safe, the EU has set rules to keep the levels of certain substances as low as possible. Community measures have been taken for mycotoxins (aflatoxins, ochratoxin A, fusarium-toxins and patulin), metals (cadmium, lead, mercury and inorganic tin), dioxins and PCBs, polycyclic aromatic hydrocarbons (PAH), 3-MCPD and nitrates. Acrylamide and furan are now being studied to assess the need of Community measures.

To implement this legislation or to establish monitoring databases for exposure assessment, reliable methods of analysis and analytical quality assurance tools are needed. JRC-IRMM develops and validates new methods for the analysis of contaminants in feed and food that derive either from the environment or food processing such as cooking, frying, smoking or packaging. The JRC-IRMM organises inter-laboratory studies, not only for validation of analytical methods according to internationally harmonised protocols but also for assessment of the proficiency of testing laboratories. Presently the JRC-IRMM works on topics such as analysis of mycotoxins in feed and food, acrylamide and furan in various heat treated food products and polycyclic aromatic hydrocarbons in smoke flavourings.

Following the findings of acrylamide in foodstuffs in 2002, the JRC-IRMM has developed reliable methodology for acrylamide analysis and produced a certified reference material to help the analyst. In 2007, the JRC-IRMM has developed an on-line sample preparation method based on liquid chromatography in combination with tandem mass spectrometry (LC-MS/MS) for determination of acrylamide in a broad range of foods. A method validation study by collaborative trial on acrylamide in coffee was completed and a proficiency test for acrylamide in potato crisps was organised. The method developed by the JRC-IRMM, together with work carried out by the National Food Administration of Sweden, has now been published as a Standard by the Nordic Committee for Food Analysis (NMKL).

Like acrylamide, furan as a food contaminant has become topical only recently. Furan has been detected in a number of foodstuffs that undergo heat treatment such as canned and jarred foodstuffs and the Commission Recommendation on the monitoring of the presence of furan in foodstuffs (2007/196/EC) recommends that Member States perform monitoring of the presence of furan in such foodstuffs. In that context, the JRC-IRMM has been commissioned to carry out a proficiency test to evaluate the state-of-the-art-in furan analysis in Europe. In 2007, the JRC-IRMM already conducted a survey among European food control laboratories on details of analytical methods for furan in food. This information will be used together with scientific literature reports to prepare a best practice guide on furan analysis in food. The JRC-IRMM has also carried out a feasibility study testing the potential of using an electronic nose for furan determination in food.

Analysis of mycotoxins, natural toxins produced by fungi, is a long-term research interest at JRC-IRMM and since 2006 the Institute also hosts the Community reference laboratory for mycotoxins. In 2007, the JRC-IRMM has developed analytical methods for the mycotoxins zearalenone and deoxynivalenol in animal feed, which were validated by collaborative trials. Both have been selected to be evaluated as a CEN standard. Also methods to determine the mycotoxins T-2 and HT-2 and fumonisins contents were developed and validated by a collaborative trial.

New means for implementing the labelling requirements for food allergens

About 8% of children and 2% of adults suffer from food allergies. For some of them the intake of even small amounts of an allergen can cause serious health problems. For this reason, the presence of food ingredients derived from commonly allergenic foods needs to be declared on the product label and this is required by European legislation (Directive 2000/13/EC as amended by Directive 2003/89/EC and Directive 2007/68/EC). Correct labelling in turn requires that suitable analytical methodology for the detection of allergen traces is established.

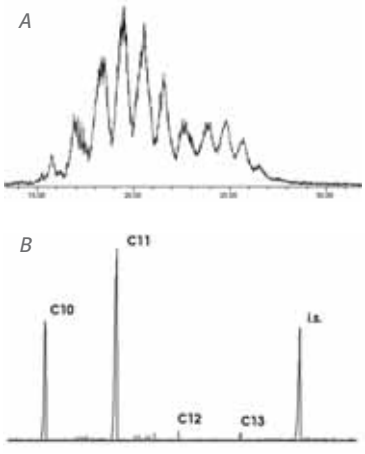
The JRC-IRMM develops and validates methods for allergen detection. In 2007, the JRC-IRMM has completed the development of a quantitative liquid chromatography – mass spectrometry (LC-MS) method for determination of milk proteins and of a quantitative PCR based method for determination of peanut allergens. Development of methodology for detection of lupin has started. Reports on the detection of peanut proteins in complex foodstuffs by a quadrupole – time-of-flight mass spectrometry (Q-TOF-MS) based method, and on the development and validation of real-time PCR methodology for the detection of peanuts were published.

Detectability of allergens in food often is affected by cooking, which could result in false negative results. Due to this effect the potentially fatal presence of allergens in food products might escape most of the currently applied detection methods. The JRC-IRMM has investigated the effect of food processing on both allergenicity and detectability and developed three real-time PCR assays to detect peanut allergen residues in processed food. The effect of heat treatment on the detection of the bovine milk protein lactoglobulin was investigated and a study on a proteomics-based approach to detect and identify major allergens in processed peanuts was published.

Proteins in complex foodstuffs are analysed with a quadrupole – time-of-flight mass spectrometer.

Analysis of short chained chlorinated paraffins: a possible way forward

Short chained chlorinated paraffins (SCCPs, C10 – C13 chloroalkanes with a chlorination degree of 30 to 70%) are used as metal working fluids, plasticisers in polyvinylchloride (PVC) and as flame retardants. The widespread use has lead to a significant release of SCCPs into the environment. Due to their physico-chemical properties and toxicity especially towards aquatic organisms, they are classified as persistent organic pollutants and are included in the list of the priority substances of the Water Framework Directive (WFD) 2000/60/EC. Monitoring of these compounds is required since the beginning of 2007. Analytical methodology for reliable analysis of SCCPs, however, is not readily available. This is mainly due to the high number (up to 6300) of individual substances contained in this class of compounds. At present, there is neither analytical instrumentation nor a procedure available that could separate these individual substances from each other and to allow quantification. The JRC-IRMM has been developing a method that has the potential to overcome these problems. By dehydrochlorination, the SCCPs are reduced to alkanes, thus largely reducing the number of individual substances to be measured and facilitating greatly the quantification of the compounds. If widely used as a standardised method, comparability of SCCPs monitoring results could be improved. Work on this method continues to demonstrate its applicability to a range of environmental samples.



The chromatogram A (gas chromatography using flame ionisation detection) shown above encompasses over 6000 individual substances of SCCPs, which are reduced to only four substances and the internal standard in the second chromatogram B by applying dehydrochlorination prior to analysis.

To push the limits of attainable accuracy, the physics laboratories at the JRC-IRMM develop special particle spectrometers. A two-arm time-of-flight spectrometer (VERDI) for high resolution fission-fragment spectrometry is being built to allow studying the production of delayed neutron pre-cursor isotopes in fission. Using artificial diamond detectors a timing resolution as low as 100 ps may be reached with VERDI.

Accurate nuclear data and nuclear reference measurements

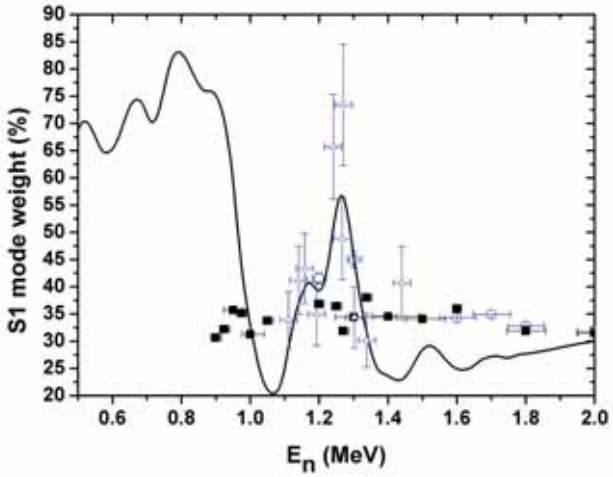
Knowledge of nuclear reactions is of great importance when evaluating the safety and risks related to the operation of nuclear power plants, nuclear waste management or new concepts of nuclear power production and waste management. Improving our knowledge of the many nuclear reactions and properties of nuclei is necessary to enable further technological development in those fields. For instance, Generation IV reactors envisage the possibility of transmuting minor actinides in the core. Understanding transmutation in the core requires knowledge of fission properties such as the fission cross section and the fission product distribution of the nuclei.

The JRC-IRMM measures neutron reaction cross-sections of the relevant nuclei and provides other nuclear reference data.

JRC-IRMM operates a 150 MeV linear electron accelerator (GELINA) and a 7 MV light-ion Van de Graaff accelerator. The two accelerators of JRC-IRMM, used for neutron production, are complementary in their experimental conditions and among the best such installations in the world. Since 2005 the two accelerators can accommodate external users via a project on access to large scale facilities (NUDAME).

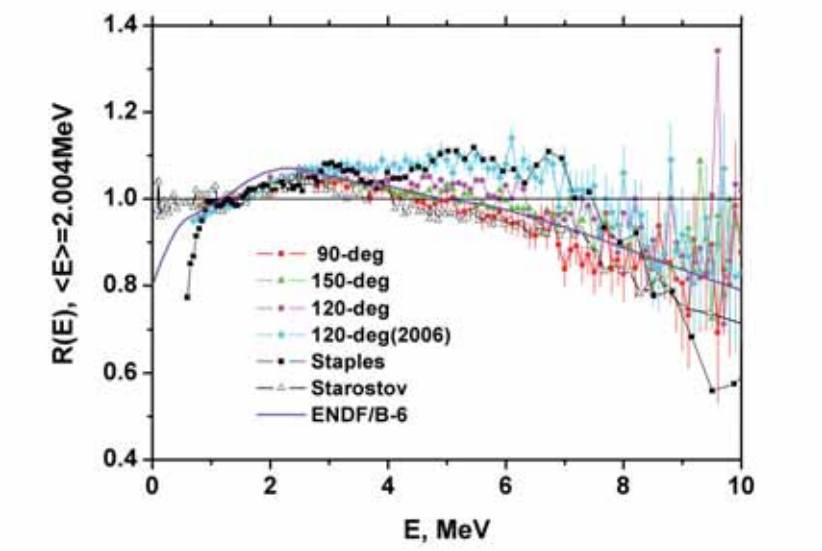
Investigations of nuclear reactions of uranium

For many of the minor actinides the fission properties are extremely difficult or even impossible to measure, so fission models need to be trusted to provide the necessary data. To confidently extrapolate fission models to these nuclei, fission models have to be validated on the fission properties of nuclei that can be measured, such as those of ^{238}U. In 2007 the JRC-IRMM completed an investigation on the fission fragment properties of ^{238}U(n,f). These measurements were done using a double-sided Frisch-grid ionisation chamber as fission fragment detector. A highly enriched ^{238}U (99.9997%, 132 µg·cm^{-2}) target prepared at JRC-IRMM was used and the incident neutron energy ranged from 0.9 MeV up to 2 MeV. At the lowest incident neutron energy the fission cross-section was about 10 mb. The ^{7}Li(p,n)^{7}Be and T(p,n)^{3}He reactions were used to produce the mono-energetic neutrons. The predictions of the theory for a strong change of the contributions of the different fission modes at the vibrational resonances in ^{238}U(n,f) could not be verified. An improved fission model using the new results is now being developed.



Weight of the S1 fission mode of the compound nucleus formed in ^{238}U+n reaction as a function of incident neutron energy. The line gives the theoretical prediction and the full circles mark the results obtained at JRC-IRMM. The open circles mark literature data showing fluctuations of the fission mode yields, not confirmed by the measurements at JRC-IRMM.

In 2006, the JRC-IRMM investigated the energy spectrum of neutrons emitted after fission of ^{235}U. An improved experiment was set up in 2007 using three detectors at different angles. This set-up, where the detectors were carefully shielded against scattered neutrons, was used in a four week measurement campaign at the IRMM Van de Graaff facility. The prompt fission neutron energy spectra were corrected for detector efficiency measured relative to the ^{252}Cf standard, for neutron multiple scattering in the sample and for time resolution and plotted as a ratio to a Maxwellian distribution with the same average energy. Discrepancies were found over the neutron energy range of 1-4 MeV in 2006 and a comparison of the new data with a theoretical model reveals discrepancies in the emitted neutron energy range below 2 MeV. A difference between the data obtained at 120 degrees in 2006 and 2007 needs yet to be clarified to possibly account for sample to source distance. Angular anisotropy of the prompt fission neutron spectrum was observed and cannot be explained by the fission-fragment angular anisotropy in the laboratory system. Agreement with other experimental data can be demonstrated within the statistical uncertainties given.

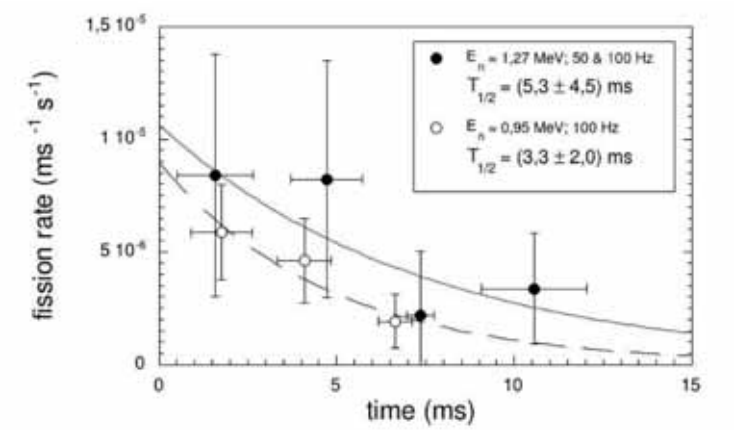


Analysis of shape isomers of actinide isotopes gives information on fission barriers relevant for better understanding and modelling of the nuclear fission process. Fission isomers exist due to a second minimum in the nuclear potential energy surface of actinide nuclei and have been discovered in a variety of nuclei ranging from ^{234}U to ^{245}Bk since the early 1960s. However, one of the problems persisting still today is the lack of shape-isomer half-life data for odd-mass-number uranium and neptunium isotopes. Only for ^{239}U the population of the super-deformed ground state in a neutron-induced capture experiment was observed. Expected half-lives in the order of several hundreds of micro seconds or even longer, make the detection with commonly used pulsed particle beams very difficult. The extremely low production cross-section for shape isomers, typically in the order of a few micro barn, as well as half-life predictions ranging in some cases over five orders of magnitude make the measurement of shape-isomer decay data difficult. Nevertheless, recent theoretical work, giving reliable predictions for half-lives for isomeric fission in the reaction ^{234}U + n, has motivated an experiment, which was performed at the isomer spectrometer NEPTUNE of the JRC-IRMM. NEPTUNE is an electrostatic beam chopping device based on an electric deflection system integrated into the 0° beam line at the accelerator. It provides pulsed proton or deuteron beams ideal for the measurement of the decay processes at this time frame. From the delayed fission events observed for two different settings of the NEPTUNE spectrometer and at mean incident neutron energies E_n = 0.95 and 1.27 MeV the isomeric fission half-life for ^{235}U could be determined to be $T_{1/2}$ = (3.6 ± 1.8) ms. The corresponding cross sec-

The analysing magnet at the IRMM Van de Graaff accelerator.

The prompt fission neutron energy spectra of ^{235}U as a ratio to a Maxwellian distribution with the same average energy; comparison between results obtained at JRC-IRMM at several angles with literature data (Staples and Starostov). The full line shows the evaluated data file ENDF/B-VI.

tion was determined to be σ_{if} = (10 ± 8) µb. With these results an experimental confirmation for the existence of a super-deformed shape isomer in odd-mass-number uranium isotopes is given for the first time.



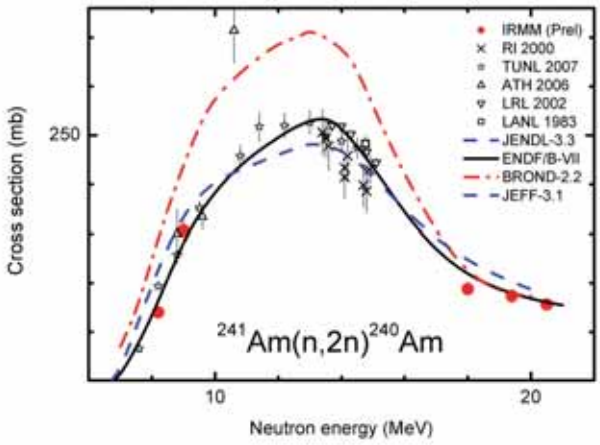
Fission decay of the ^{235}U shape isomer measured with two different NEPTUNE settings.

ENDF - American Evaluated Nuclear Data File

Neutron cross sections of ^{241}Am

^{241}Am is a long-lived component of the radioactive waste produced through the operation of nuclear power plants. Although it makes up only a small fraction of such waste, it is considerably more radiotoxic than uranium ore. Transmutation, a process in which the most radiotoxic and long-lived spent nuclear fuel components are recycled as fuels of advanced nuclear power reactors, could be applied to reduce the amount of ^{241}Am. This process of recycling would then reduce the final volume of high level radioactive waste.

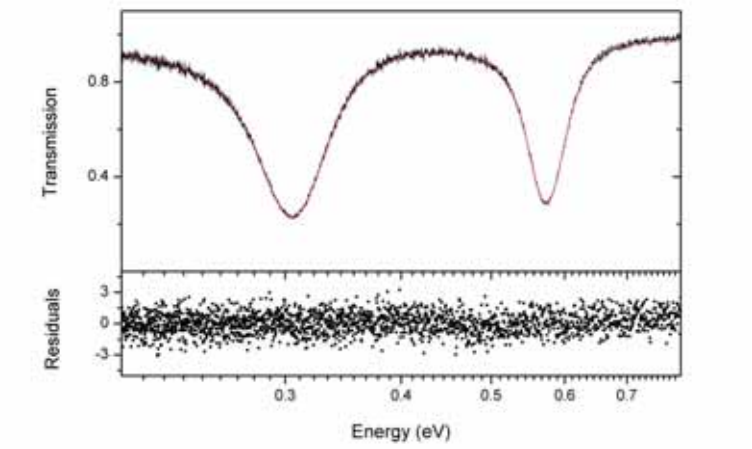
A full understanding of the benefits of recycling ^{241}Am as part of the fuel of advanced reactors, requires the study of total interaction probabilities of the neutron and the probabilities of specific processes such as fission and formation of other long-lived radiotoxic isotopes, e.g. by capture or (n,2n) reactions. Therefore, the JRC-IRMM has started a study of neutron cross sections of ^{241}Am.



The new results obtained at JRC-IRMM for the ^{241}Am(n,2n)^{240}Am reaction. The newly measured cross sections are compared with those obtained elsewhere. Good agreement is found in the domain of overlap. Curves correspond to recent evaluations. The ENDF/B-VII result (2006) was obtained at Los Alamos National Laboratory (US).

The (n,2n) reaction is one of the processes that eliminate ^{241}Am. It has not been well known except at neutron energy of 14 MeV but recently new measurements were performed for the n_TOF-ND-ADS project and in the USA Triangle Universities National Laboratory for nuclear security research based at Los Alamos National Laboratory (US). The total cross section governs the overall probability that a neutron will interact with a nucleus. Accurate total cross sections for the first resonances of ^{241}Am are therefore of key importance for its behaviour as a nuclear fuel and also for normalisation of other cross section measurements on this isotope.

In 2007 JRC-IRMM carried out the first measurements of the total cross sections of ^{241}Am and of the cross section for the ^{241}Am(n,2n)^{240}Am reaction for neutron energies in the range from 14 to 21 MeV with the activation technique. Since the first resonances have very high peak cross sections, thin but very homogeneous samples were used to avoid artificial resonance broadening that would mask the true resonance shape. The samples of $^{241}AmO_2$ needed for this project were prepared in 2006 at the JRC Institute for Transuranium Elements (DE). The results are in excellent agreement with state-of-the-art calculations, recently performed at the Los Alamos National Laboratory.



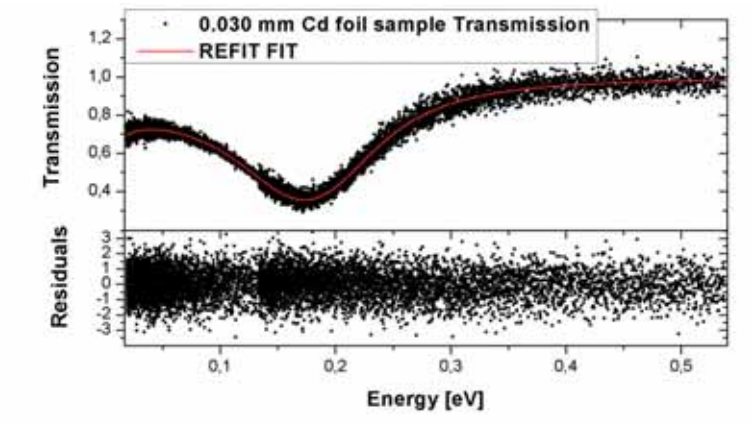
Neutron transmission for the first two resonances of ^{241}Am at the 25 m station of the GELINA time-of-flight facility. An excellent model description is obtained using a crystal lattice model to account for the Doppler effect associated with the thermal motion of the nuclei in the sample.

Study of the total cross section of Cd for thermal and epithermal neutrons

Cadmium is frequently used as neutron absorber in neutron experiments, such as integral benchmark and neutron activation measurements. The very large absorption cross section of ^{113}Cd, due to the resonance in ^{113}Cd at 0.178 eV, make it a suitable material when elimination of neutrons with energies less than 0.1 eV is required. A correct analysis and interpretation of experiments that use ^{nat}Cd absorber needs to account for the influence of cadmium on the measured quantity. Consequently, reliable neutron induced cross section data for ^{nat}Cd are essential.

Measuring stations at the flight paths of the IRMM linear accelerator facility.

The neutron induced total, capture and scattering cross sections in cadmium have not been studied much. Therefore, new measurements of the neutron induced total and capture cross section for ^{nat}Cd in the energy region from 0.025 eV (thermal) to 2500 eV have been carried out at GELINA. These measurements were performed as part of a NUDAME project proposed by the IAEA. The results of neutron transmission measurements are well described by the R-matrix fit code REFIT.



Neutron transmission for a natural cadmium sample in the energy range below 0.55 eV. The resonance analysis using the R-matrix code REFIT shows excellent agreement with the experimental data.

The results of these measurements will be used to perform a re-evaluation of the neutron induced total cross section for ^{nat}Cd. Also measurements on ^{55}Mn have been initiated to improve the consistency between energy-dependent cross sections and integral constants used in neutron activation analysis. These studies are part of the contribution of the JRC-IRMM to a Coordinated Research Project 'Reference Database for Neutron Activation Analysis', which is organised by the nuclear data section of the IAEA.

Nuclear reference measurements

JRC-IRMM is operating an underground laboratory at the Belgian Nuclear Research Centre SCK•CEN in Mol (BE).

In 2007, the JRC-IRMM has taken part in developing a new technique for detecting charged particles leaking from fusion plasma at JET, the Joint European Torus operated under the European Fusion Development Association (EFDA). It is this loss that ultimately determines the confinement time of the plasma. Because of the harsh environment in a Tokamak there are few types of detection systems that can be placed inside it. In this experiment 36 small disks made of B_4C, Ti, W or LiF of (1x1) cm^2 were used. The very low activities of the charged particle induced reactions were measured in JRC-IRMM's underground gamma-spectrometry laboratory located at the Belgian Nuclear Research Centre SCK•CEN in Mol (BE) and in two other European underground laboratories making part of the network CELLAR. JRC-IRMM co-ordinated these measurements and for the first time nuclear fusion researchers can now obtain values from measurements of the loss of charged particles from the plasma. Based on the present findings a new experiment is being prepared and will take place first half of 2008.

The JRC-IRMM's capability of measuring extremely low levels of radioactivity in its underground laboratory is employed in the GERDA project. The GERDA (germanium detector array) collaboration aims to detect the neutrinoless double beta decay of ^{76}Ge. As its half-life is more than 10^{25} years, the background radiation of the detector array needs to be as low as possible. Therefore every component placed in the detector, which is ~ 10 m in diameter, needs to be analysed for radiopurity. The JRC-IRMM has analysed in its underground laboratory items like welding rods, steel plates, cables and electronic components. These measurements have been supplemented by weekly updates on progress of the measurements, which last up to 7 weeks to enable faster design decisions by the GERDA construction team. The results will be used both for accepting or rejecting materials as well as in calculations that simulate the total background of the detector system. They are also available to a wider scientific community within the ILIAS consortium (Integrated Large Infrastructures for Astroparticle Science) and this way can be used for construction of other large scale detectors for rare events.

Four Community Reference Laboratories at JRC-IRMM

Following food safety crises in Europe a system of Community reference laboratories (CRLs) has been set up to support national authorities in their efforts to keep food and feed free from dangerous substances. The CRLs can be considered as a main pillar of the EU risk management system for food safety and help make the EU regulatory system more efficient and effective, with the same high level of laboratory performance across the EU. Their main tasks - defined in the European regulations - are evaluating, developing and validating methods of analysis, producing documentary standards, as well as organising comparative studies and proficiency tests for the networks of national reference laboratories assisting the CRLs. When needed, the CRLs provide the Directorate-General for Health and Consumer Protection with other technical assistance. The CRLs are also required to have knowledge of international standards and practices and keep lists of reference substances and reagents and their suppliers. With their networks of national laboratories the CRLs provide a platform for experts to share knowledge and best practices.

The JRC-IRMM operates four CRLs. The CRL for feed additives authorisation and control has assisted the European Food Safety Authority (EFSA) in the authorisation process since 2004 and in 2006 its mandate was extended to cover control too. The CRLs for heavy metals in feed and food, for mycotoxins and polycyclic aromatic hydrocarbons (PAHs) - substances with potentially harmful health effects that can be found in food - validate testing methods, develop reference measurement procedures and provide training and other tools to national laboratories so that food and animal feed can be kept safe across the EU. These three new CRLs started operation in 2006. In March 2007, Markos Kyprianou, the European Commissioner for Health inaugurated them.

CRL

European Union legislation with relevance to the CRLs operated by JRC-IRMM	
Regulation (EC) No 776/2006 with regard to the Community reference laboratories; designates the JRC Institute for Reference Materials and Measurements as the Community reference laboratory (CRL) for feed additives, heavy metals, polycyclic aromatic hydrocarbons and mycotoxins	Directive No 2002/32/EC of the European Parliament and the Council on undesirable substances in animal feed
Regulation (EC) No 1831/2003 on additives for use in animal nutrition nominates the Joint Research Centre (JRC) as the CRL for Feed Additives	Regulation (EC) No 1126/2007 amending Regulation (EC) No 1881/2006 setting maximum levels for certain contaminants in foodstuffs as regards Fusarium toxins in maize and maize products
Regulation (EC) No 378/2005, as last amended by Regulation (EC) No 850/2007, details the rules for the implementation of Regulation (EC) No 1831/2003 and provides the practical conditions for the duties and tasks of the CRL	Regulation (EC) No 401/2006 laying down the methods of sampling and analysis for the official control of the levels of mycotoxins in foodstuffs
Regulation (EC) No 882/2004 on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules	Commission Decision 2002/657/EC on implementing Council Directive 96/23/EC concerning the performance of analytical methods and the interpretation of results
Regulation (EC) No 1881/2006: setting maximum levels for certain contaminants in foodstuffs	Commission Regulation (EC) No 1754/2006 laying down detailed rules for the granting of Community financial assistance to Community reference laboratories for feed and food and the animal health sector
Regulation (EC) No 333/2007: laying down the sampling methods and the methods of analysis for the official control of the levels of lead, cadmium, mercury, inorganic tin, 3-MCPD and benzo(a)pyrene in foodstuffs	Commission Recommendation 2005/108/EC: requests further investigation into the levels of polycyclic hydrocarbons in certain foods

Feed additives	Heavy metals	Mycotoxins	PAHs
Feed additives are an integral part of modern animal husbandry, which aims to improve animal production, performance and welfare. Such additives may not be put on the market without authorisation by the European Commission. The authorisation can only be granted after a scientific evaluation demonstrating that the additive has no harmful effects on human and animal health and on the environment. The European Food Safety Authority (EFSA) is responsible for conducting the scientific evaluation prior to authorisation.	Heavy metals are present in all foodstuffs. Their amount in food and feed depends on the natural content and on the conditions under which food and feed are produced and processed. Some heavy metals have nutritional functions and are essential to the health. But others such as lead, cadmium and mercury have no nutritional relevance and can cause serious illnesses. To reduce the risk to human health associated with high heavy metal content in food and feed, maximum allowed limits in several commodities have been laid down in the European legislation.	Mycotoxins are substances produced by certain fungi growing on food and feed. Estimates show that up to 20% of food products may contain mycotoxins, which can cause anything from mild to serious illness. To protect the consumers, European legislation sets maximum limits for the content of harmful mycotoxins in certain foodstuffs.	Polycyclic aromatic hydrocarbons (PAHs) are a group of about ten thousand compounds. Some of the PAHs are of particular concern for human health due to carcinogenicity and mutagenicity or because they may enhance the adverse effects of another compound. We are exposed to PAHs via air and drinking water, but mostly by intake of food. Contamination of food by PAHs largely arises from production practices. For instance, grains and raw products for the production of edible oils may be contaminated with PAHs through drying or food from animal origin can be contaminated through charcoal grilling, roasting or smoking.

Samples of feed additives.

Community Reference Laboratory for Feed Additives

The CRL for feed additives evaluates if methods of analysis, proposed by those applying for authorisation of an additive, are suitable for the determination of the feed additive in animal feed within the frame of official control. It reports to the EFSA, which sends a complete evaluation report to the European Commission who will decide, whether authorisation of the feed additive can be granted or not. The CRL is supported by a consortium of 35 European national reference laboratories, which contribute to the evaluation procedure with their expertise on specific analytical methodologies. After publication the evaluated methods enable the Member States' official laboratories to check whether feed samples comply with the conditions of use of the feed additive such as target concentrations or legal limits of the additive.

In 2007, the CRL for feed additives submitted final reports on the assessment of analytical methods for 24 dossiers to EFSA. The CRL's work is reflected in 22 opinions of the EFSA on the scientific assessment of the feed additives and in 23 Commission Regulations granting authorisation to specific products, to which the CRL had delivered an evaluation of analytical methods. It also participated in the making of a new Commission guideline for the applicants specifying the preparation and the presentation of applications and the assessment criteria for the authorisation of feed additives.

Community Reference Laboratory for Heavy Metals in Feed and Food

The CRL for heavy metals facilitates the implementation of Community rules establishing the maximum levels of heavy metals such as lead, mercury and cadmium in different foods. It deals with three types of matrices i.e. wild caught fish, food of plant origin and animal feed.

The CRL for heavy metals organises proficiency tests for the appointed national reference laboratories within the International Measurement Evaluation Programme (IMEP®) of JRC-IRMM. In 2007 the CRL for heavy metals organised two campaigns: one assessed the performance of the national reference laboratories in determining total Cd, Pb and Hg in mineral water and the other of total Cd, Pb, Hg and extractable Cd and Pb, according to Directive No 2002/32/EC in feed. The CRL also provided support to the Directorate-General for Health and Consumer Protection in clarifying discrepancies between Irish and Italian official control laboratories regarding the reports of high concentration of cadmium in crab. It reviewed the sampling and testing of crab meat in the laboratories in both Italy and Ireland.

Inductively coupled plasma mass spectrometry (ICP-MS) is commonly used to analyse contents of metals in food and feed samples.

Community Reference Laboratory for Mycotoxins

The CRL for mycotoxins at JRC-IRMM co-ordinates activities related to the development and improvement of methods of analysis for the official control of maximum levels and organises comparative tests for the network of national reference laboratories. The aim of the CRL is to facilitate the implementation of current and future European legislation for mycotoxins, e.g. Commission Regulation (EC) No 1881/2006 setting maximum levels for certain contaminants in foodstuffs.

In 2007, the CRL for mycotoxins tested the performance of national reference laboratories in the analysis of ochratoxin A in paprika and aflatoxins in a peanut material. It initiated a method validation study for ochratoxin A in liquorice, a collaborative trial to validate a method for determination of ochratoxin A in animal feed and the development of a multi-analyte method for mycotoxins. It also addressed technical questions from the Directorate-General for Health and Consumer Protection concerning calibrant verification procedures and trained representatives of national authorities from developing countries.

Extraction of paprika, breakfast cereals and milk powder for the analysis of mycotoxins.

Community Reference Laboratory for Polycyclic Aromatic Hydrocarbons

The CRL for PAHs assists the national laboratories of the Member States by developing and validating methods of analysis of these substances and by helping harmonise official controls. The CRL coordinates a network of national reference laboratories across the EU, organises proficiency tests for the assessment of the comparability of analysis data and identifies needs for method development. In 2007, the CRL for PAHs organised a proficiency test on the analysis of EU priority PAHs in edible oil. Development work within the mandate of the CRL for PAHs resulted in a chromatographic method that allows sensitive detection of all EU priority PAHs. It assisted the Directorate-General for Health and Consumer Protection on questions on suitability of certain containers for sampling of food to be analysed for PAH content and on sampling of large fish for PAH analysis.

The CRL for PAHs has tested the proficiency of national reference laboratories in analysing PAHs in e.g. edible oil.

The JRC-IRMM laboratories welcomed 530 visitors during its open day in October.

Markos Kyprianou, the European Commissioner for Health, opened three Community reference laboratories at JRC-IRMM in March.

Jorge González-Bergantiños received the JRC technical support prize for the development of a new time-to-digital converter for time-of-flight measurements.

Events

The JRC-IRMM organises numerous workshops, seminars and meetings every year. In 2007 the JRC-IRMM welcomed over 600 visitors and 19 seminar lectures were given by staff and visitors. The annual seminars presenting exploratory projects and the work of JRC-IRMM fellows took place in March and June, respectively. The fourth workshop on neutron measurements, evaluations and applications, NEMEA-4, was held in Czech Republic and an expert workshop on the feasibility of source region identification of conflict diamonds using analytical techniques was organised together with the Directorate-General for External Relations at the JRC-IRMM in Geel. To mark the change in EU presidency a German-Portuguese event was coordinated by the German and Portuguese staff members on the 29th of June together with the annual barbecue for staff.

The event of 2007 was the inauguration of the three new Community Reference laboratories by Markos Kyprianou, European Commissioner for Health, in March. After the official opening, the Commissioner made a tour of the laboratory facilities and had the opportunity to perform tests himself.

In October the JRC-IRMM organised its second open doors day during the Open Bedrijvendag of Flanders. 530 visitors participated in testing biscuits and GM soya, compared the power of the human nose to that of an electronic one, measured radioactivity in every-day objects, took a tour of the accelerator installations and exercised with the fire brigade. In the exhibition area the jobs corner proved to be useful and many interested visitors were introduced to recruitment in the European Commission. The JRC Institute for Energy attracted both young and old with the miniature model of the hydrogen car and an energy quiz, and also the European School of Mol had an information stand. The day before the staff could also invite their families and about 300 of them took on the opportunity.

Awards

The JRC Excellence Awards are given every year in recognition of the efforts and passion the JRC staff have put in their everyday work. In 2007 Jorge González-Bergantiños from the JRC-IRMM received the JRC technical support prize for the development of a new time-to-digital converter for time-of-flight measurements.

Every year the JRC-IRMM selects also its own award winners in addition to those who were awarded the JRC prize. The JRC-IRMM best young scientist award was given to Ruth Kips for her work on a new type of reference materials for nuclear safeguards. The best peer-reviewed scientific paper award was given to a series of publications on applying metrological principles to analysis of GMOs authored by Philippe Corbisier and Diana Charels et al. and to a paper on using transgenic mice brains as quality control materials for BSE detection by Wolfgang Philipp et al. The CRL for feed additives received the prize in the category of support to EU policies.

Facts and figures

Human resources

At the end of year 2007 the total number of staff at JRC-IRMM was 318 persons. The staff is composed of Commission officials and employees on fixed-term contracts. Approximately 30% of posts are non-permanent to ensure flexibility, gaining of new knowledge and the ability to host PhD students, post-doctoral fellows and visiting experts. The staff on non-permanent posts are hired as contractual agents or seconded national experts. 40% of all staff are women.

Core staff (end-of-year situation) in 2007	
Officials	184
Temporary agents on 5-year renewable contracts	4
Temporary agents on non-renewable contracts	25
TOTAL	213

Staff on fixed-term contracts	
Seconded national experts	7
Contractual agents	95
Trainees	3
TOTAL	105

Budget

The Institute is funded by the JRC budget from the EU Framework Programmes for Research and Technological Development, both of the European Community and the European Atomic Energy Community (EURATOM). The Institute budget consists of institutional credits coming directly from the JRC budget for the 7th Framework Programme and the competitive income. The institutional credits contain staff expenses, technical and administrative support and operational appropriations. The competitive income comes from the distribution of reference materials, from participation in the indirect actions of the Framework Programmes and other competitive contracts with the Commission and work for third parties.

10-15% of the Institute's budget is competitive income. The competitive income almost doubled during the 6th Framework Programme and continued to increase in 2007. Success rate in filing for competitive contracts in 2007 was 62 %.

Competitive income (k€) in 2007	
Contracts with other DGs	1 786
Operation of CRLs	693
Participation in indirect actions	233
Work for third parties	1 097
Reference material distribution	1 874
TOTAL	5 683

Publications

A large part of the research done at JRC-IRMM is reported in scientific publications and is publicly available. In addition to articles published in refereed scientific journals and conference proceedings, valuable information can be found in the EUR reports. For instance, reports on certification of reference materials and the results of many inter-laboratory comparisons are published in the EUR Scientific and Technical Research series.

Pubblications in 2007	
Books	1
Monographs with JRC editorship	1
Article contributions to monographs	6
Article contributions to peer reviewed periodicals	83
Article contributions to other peridicals	8
Scientific and technical reports	52
Contributions published in conference proceedings	31
TOTAL	182

Selected published work in 2007

Article contributions to peer reviewed periodicals

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