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Directorate-General **Joint Research Centre**

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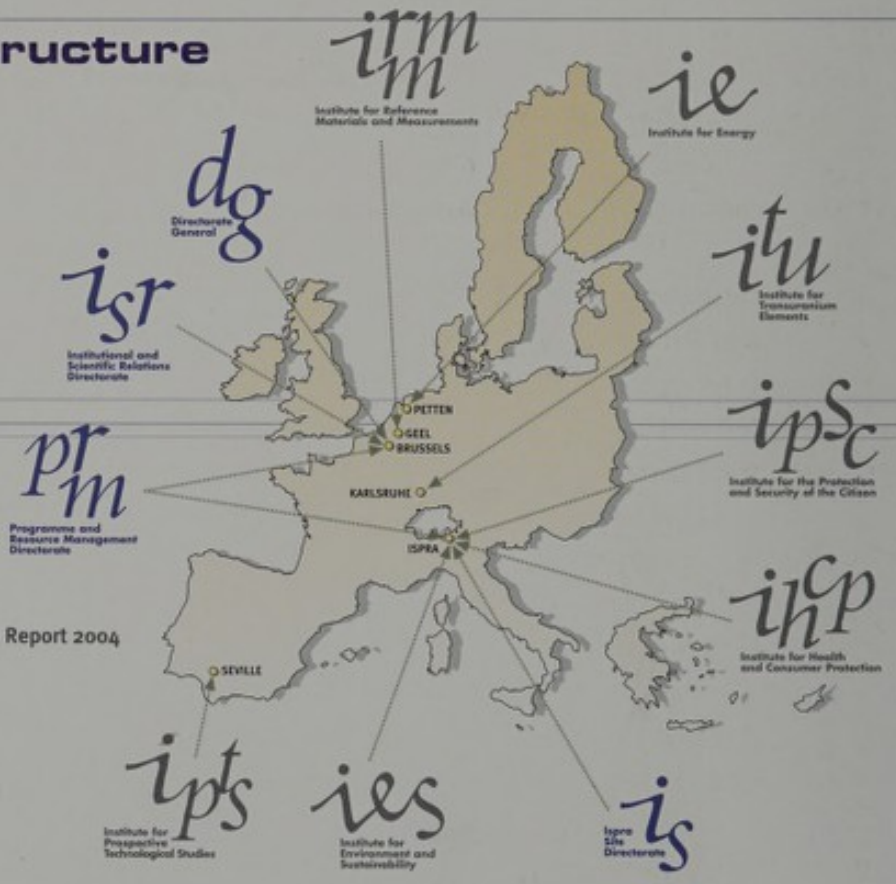
Mission

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

DG JRC **Structure**



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Abstract
Report on the activities, accomplishments and resources related to the JRC work carried out in 2004. An overview is given of the mission and its implementation, the scientfic activities and the relations with the outside world.

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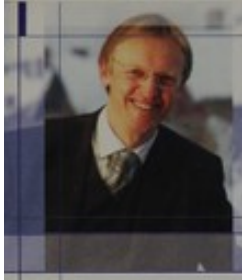


Foreword from the Commissioner for Science and Research

I am pleased to present to you the 2004 report of the Directorate-General Joint Research Centre (DG JRC). I place the utmost importance on its role in providing independent, customer-driven scientific and technical support to EU policies.

Mr Busquin, my predecessor, has left me a rich heritage. The field of science and research is firmly fixed on the European political agenda, the European Research Area is operational, the objective to reach 3% of the GDP at Union level for investment in science and research by 2010 is widely accepted. There is no need for revolution. There is, however, a strong need for evolution towards our ambitious goals for the EU.

My objective is to make European science the best and to have the world's best scientists working for its development for the benefit of European competitiveness, industry and

The Commissioner at his office in Brussels

its citizens. DG JRC will play a pivotal role here via its work programme, visiting staff and exchange programmes in tandem with its scientific expertise, facilities and networks. We will continue supporting the established priorities of the Sixth Framework Programme (FP6) and develop new ones for FP7. Science – the development and exploitation of knowledge – must become the key factor in the economic development of Europe, and the results of our scientific work must lead to an increase in the quality of life at the level of society and at the individual level for all European citizens.

I also want to ensure that the ten new Member States are integrated fully and on equal terms into the Union, in the field of science and research, as elsewhere. Although the integration has been progressing well so far, it is not yet finished. Through a comprehensive programme of hosting scientists, or-

Janez Potočnik visiting the Vehicle Emissions Laboratory, Ispra

ganising technical workshops and training courses, and actively involving national laboratories from the new Member States in its work programme, DG JRC is contributing significantly to accelerating compliance with the scientific and technical aspects of the *acquis communautaire*, and I am confident that it will continue to do so.

The Barroso Commission has given great emphasis to the re-launch of our ambitious Lisbon Agenda by focussing on growth and jobs. Knowledge and innovation is a key priority within this policy. The continual search for knowledge and discovery has defined Europe's soul, its identity and values. It has also allowed Europe to compete successfully on the world stage. DG Joint Research Centre will play an important role in our common efforts to achieve these ambitious targets.

JANEZ POTOČNIK

Observations from the **Board of Governors**

Board of Governors meeting at Brussels in November, 2004

As will be evident from the descriptions in this report, DG JRC provides essential scientific services in support of Commission policies. The Board advises on the management of DG JRC activities in fulfilment of that mission. The Board welcomes the increasingly constructive interaction of DG JRC with the High Level User Group in determining priorities. As an example of the contributions by DG JRC, the satellite applications work is especially noteworthy – in monitoring agriculture with remote sensing, in humanitarian aid work, and in crisis response, most recently in the case of the tsunami disaster.

Main issues in 2004

In accordance with the Framework Programme decisions, a panel of external experts carried out an evaluation of DG JRC in terms of a 5-Year Assessment (5YA) for 1999-2003. The Board acknowledged the excellent quality of the report and welcomed the positive evaluation confirming that DG JRC delivered research goals set out in 1999, showed real improvements from a sharper mission, has a significant role in the EU policy cycle, and needed to consolidate, not revisit, reforms. The Board received the initial DG JRC response to the 5YA recommendations and will continue to monitor progress on their implementation.

During 2004, the Board followed progress on the work programme and budget execution for 2004. It issued favourable opinions on the work programme and budget for 2005 and on plans for decommissioning and waste management of DG JRC's nuclear facilities. It welcomed a paper on DG JRC's exploratory research programme and noted the considerable progress on actions to assist the integration of new Member States. Increasing partnerships in research projects, and the training and opening up of DG JRC-led networks of competence were strongly acknowledged, as were information days and dedicated workshops.

Looking to the Seventh Framework Programme, the Board considered DG JRC's thematic strategy and its alignment with the Commission's policy strategy documents. It delivered a favourable opinion on the DG JRC's proposals.

The Board provided views to Commissioner Busquin about the arrangements for filling the position of Director-General (DG) and has been actively involved in the ongoing selection process. In July, the Board bade farewell to the outgoing Barry Mc Sweeney and expressed its appreciation for his substantial contributions to improving the effectiveness and raising the profile of DG JRC. In November, the Board had a fruitful exchange with the incoming Commissioner for Science and Research, Janez Potočnik, on his vision and future expectations for DG JRC.

Finally, on behalf of the Board, I wish to record our appreciation of the work of the acting DG and the JRC staff in fulfilling the DG's mission and in preparing the ground for the future.

FERNANDO ALDANA
Chairman of the Board

Message from the **Acting Director-General**

In April 2004, an independent multidisciplinary panel of 17 experts from 13 Member States published the results of their 5-Year Assessment (5YA). The panel was impressed with the progress made since the last 5YA, especially in realising DG JRC's new mission as a service to the Commission. In its view, "the clarity of this mission has reinvigorated DG JRC, giving a clear purpose to its work". The chairman, Prof. David Fisk, wrote that: "In several important cases [DG JRC] has been a champion of technical innovation in the EU's work and brought about effective implementation of policies that would not otherwise have happened". Further positive feedback from the High-Level Users Group (the Directors-General of policy DGs to whom DG JRC provides support) and the Board of Governors, are real indicators that DG JRC is on the right track.

The panel for the 5-Year Assessment of DG JRC

In the latter part of 2004, DG JRC received the two Commissioners for Science and Research, Louis Michel (interim) and Janez Potočnik (appointed), at its Ispra site. Both emphasised the important role of research in achieving the Lisbon Strategy, and DG JRC has now integrated this message, together with the political priorities of the new Commission, in defining its strategy for the Seventh Framework Programme (2007-2010).

DG JRC has continued to provide customer-driven scientific and technical support, and selected examples are documented in the 'Support to EU Policies' section of this report. Highlights from the seven Institutes are also included as well as DG JRC's contribution to enlargement, the integration of new Member States, technology transfer and the European Research Area (ERA). DG JRC's catalytic role in the development of ERA is exemplified not only through its extensive collaboration networks but also through its recruitment and exchange programmes for Europe's best scientists, its training programmes and use of DG JRC facilities. In line with this theme, a section of this report has been dedicated to young scientists' awards and their innovative achievements in 2004.

Roland Schenkel and Rainer Grohe, Executive Director of Galileo Joint Undertaking (GJU), at the signing of a third party work contract

To conclude, sincere thanks goes to ex-Director-General, Barry Mc Sweeney, who helped pave the way for DG JRC's future, to our customer DGs and partners for whom we provide S&T support, and last, but by no means least, to all DG JRC staff for their enthusiasm and commitment.

ROLAND SCHENKEL

Support to **EU Policies**

Examples of DG JRC support to EU legislation in 2004

1. Provided scientific leadership on Analytical Methodologies, Quality Assurance and Data Quality Objectives for the EC proposal on chemical pollution of surface waters by priority substances (in accordance with the Water Framework Directive **2000/60/EC**).

2. Contributed to the adoption of the Communication on ETAP - **COM (2004)38**, on "Stimulating Technologies for Sustainable Development: An Environmental Technologies Action Plan for the European Union".

3. Contributed to the review and update of the Waste Framework Directive **(75/442/ECC)** and provided data for energy recovery.

4. Contributed to the formulation of the waste incineration BREF, within the frame of implementation of the Integrated Pollution Prevention and Control Directive **(96/61/EC)**.

5. Contributed to the formulation of derogations from Article 5(5) and Article 7(2) of Directive **2002/96/EC** on waste electrical and electronic equipment.

6. Produced harmonised prediction methods for environmental noise from roads and railways as the European standard for noise-mapping, related to the European Noise Directive **(2202/49/EC)**.

7. Contributed to the development of the technical annex to the European Directive **2004/26**/EC on the transient test procedure for non road mobile machinery.

8. Provided technical field support to Council Regulation (EEC) **No 3906/89** concerning economic aid to certain countries of Central and Eastern Europe, as last amended by Regulation (EC) **No 807/2003**, under the PHARE programme in the field of nuclear safety.

9. Provided scientific and technical support to the Commission Proposal for a regulation concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) **(COM (2003)644 final)**.

10. Evaluated the compliance of the GM assessment methods for Regulations (EC) **No 1829/2003** and (EC) **No 1830/2003** in its role as a Community Reference Laboratory.

11. Technically supported Regulation **EC/882/2004** on Food Contact Materials.

12. Developed and validated a simple and reliable analytical approach to determine foreign fats in plain chocolate, in direct compliance with the new Chocolate Directive **2000/36/EC**.

13. Produced the guidelines for the technical characteristics of electronic identifiers and the structure of the network of laboratories for the implementation of Council Regulation **No 21/2004**.

14. Delivered the results of an evaluation study on the e-business readiness composite indicators in the framework of the Council Resolution **5197/03** on the implementation of the eEurope 2005 Action Plan **(COM (2002)263 final)**.

Double appointment as **Community Reference Laboratory**

In 2004, DG JRC was nominated as Community Reference Laboratory (CRL) on two occasions because of its expertise in the fields of feed additives and genetically modified organisms (GMOs).

CRL for the authorisation of feed additives

Nowadays, farmers either supplement natural feed, or feed their animals exclusively on compound feed. These are mixtures of grains, seed meals or by-products from food production, combined with feed additives such as vitamins and minerals. At present, some 700 feed additives are authorised under EU legislation.

According to Regulation (EC) No 1831/2003 on additives for use in animal nutrition, all feed additives shall undergo assessment by the European Food Safety Authority (EFSA). This assessment requires, amongst others, an evaluation of the analytical methods proposed by the applicant for determining the presence of the additive in feed and, in some cases, metabolites in food. In this task, EFSA is assisted by DG JRC which has now been appointed the CRL for feed additives authorisation.

The CRL's task is to assess and evaluate the analytical method. If the methodology is known, validated and scientifically sound, the CRL will give a favourable opinion to EFSA. However, if this is not the case, the CRL will arrange for laboratory testing and/or organise an inter-laboratory comparison study to validate it. To carry out these tasks, the CRL is assisted by a consortium of national reference laboratories from all EU Member States.

CRL for genetically modified (GM) food and feed

European Regulation (EC) No 1829/2003 lays down Community procedures for the authorisation and supervision, including provisions for labelling, of GM food and feed.

This requires event-specific quantitative detection methods to help monitor the presence of GM and assist labelling with respect to the EU's threshold value, i.e. all food and feed containing GMOs in concentrations above 0.9% must be labelled.

Samples of DG JRC reference materials for GMOs

To fulfil this mandate, DG JRC was nominated CRL on 18 April 2004. In this task, it will be assisted by a consortium of 74 national GMO enforcement control laboratories from each of the 25 Member States, i.e. the so-called European Network of GMO Laboratories (ENGL).

The principal task/responsibility of the CRL is the testing and validation of the method for detection and identification of the particular GMO transformation event. Evaluation reports are then submitted to EFSA. At the end of 2004, over 30 dossiers had been submitted to the CRL and validation has been completed for three of them (http://gmo-crl.jrc.it).

Monitoring agriculture with **remote sensing**

In Commission Regulation 796/04, agreed in April 2004, Member States are instructed how to use Geographic Information System (GIS) technology for the support, management, and control of the billions of euros paid each year to farmers through the common agricultural policy (CAP). This legislation forms a landmark that enables EU-wide geographical management of agricultural subsidy data. Farmers can now see directly which fields are registered to them, and determine more precisely the boundaries of the areas they cultivate. In 2004, more than 5 million farmers and farm businesses declared around 50 million fields in the nationally managed Land Parcel Identification Systems (LPIS).

The benefits are significant:

- the farmer has better information and so is able to produce a more reliable subsidy application;
- Member State authorities and the Commission can identify irregularities and help prevent fraud.

The CAP accounts for about half of the EU's annual budget, and the adoption of this technical approach – a process which started in 2000 with a Council Decision – has already had profound effects. For example, in 2004, agricultural sectors such as those dedicated to nuts and sugar beet were reorganised to be aligned with the GIS registration of farmers' fields.

DG JRC provided input to the technical guidelines leading to the development of the Commission Regulation, and technical support was provided to Member States – in particular the ten new Member States – to help ensure compliance with the regulations in as short a time frame as possible.

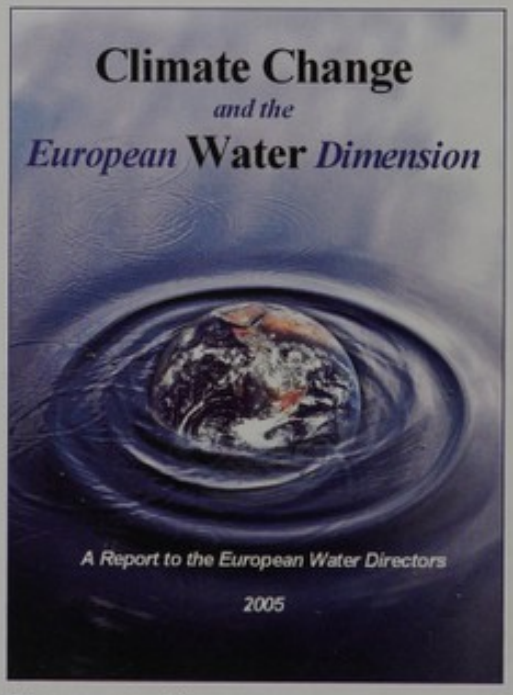
As part of this support, DG JRC coordinates and purchases (on behalf of the Agriculture DG) hundreds of detailed satellite images each year, covering farms in Member States. This year has seen the development of a prototype internet-based image server, currently loaded with around 8 000 images (in total around 2TB of data) acquired between the mid-1990s and 2004.

Quickbird Image-panmerge, PAN Resolution 60cm. TEUE.DE-2004 CwRS site. Image courtesy Eurimage

Climate change and the **European water dimension**

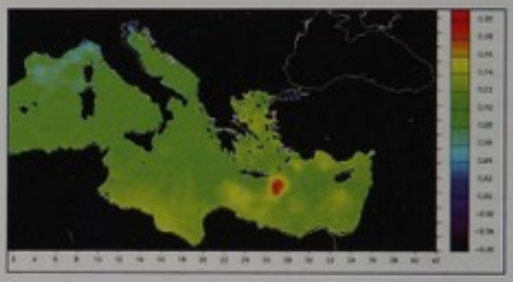
In 2001, the Intergovernmental Panel on Climate Change (IPCC) published an assessment document on climate change stating that "there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities". Since then, published literature has exploded with evidence of the extent and rate of climate change across our global system. However, this global picture is not always easily transposed down to regional and/or local level.

DG JRC was requested by the 'European Water Directors' to coordinate the preparation of a scientific synthesis on (1) climate change and (2) gaps in the water sector, with emphasis on the European inland and coastal aquatic systems. The document is to be used as the basis for a pan-European discussion on the implication of climate change on water policies. DG JRC published an extensive report on "Climate Change and the European Water Dimension", co-authored by more than 40 scientists from both DG JRC and throughout Europe.



The cover page of the water report

The report highlights the global and European dimension of climate change as reported by the IPCC in 2001. It accumulates knowledge acquired since then and analyses the real and potential impacts of climate change on aquatic ecosystems such as lakes, coastal systems and coastal lagoons. It describes the impact of climate change on European floods and droughts and the corresponding challenges to water use in agriculture. It also addresses how climate change may impact the implementation of the Water Framework Directive and the ecological status of Europe's water bodies.



An image of surface sea temperature, Mediterranean Sea

The report presents case studies on specific lakes, lagoons, and river basins. Here, it examines the influence of various factors including water-borne pathogens and disease. It explains how climate change can/will affect chemical pollutants in water under extreme situations (e.g. the mobilisation of dioxins and furans in floods), and how the biogeochemical cycle of mercury and polychlorinated biphenyls (PCBs) may adversely impact aquatic ecosystems.

The report offers convincing evidence to substantiate warming of the atmosphere, European lakes and seas. The Mediterranean Sea clearly shows a rising sea surface temperature, especially in the eastern part (see image). Other evidence includes alterations in biological, chemical and physical characteristics of European water bodies, and the dramatic impact that land, flora, fauna, and mammals in the region will undergo in response to rising sea levels, extreme events and warming.

Security and humanitarian **aid**

DG JRC has developed real-time disaster alert (http://dma.jrc.it/Services/gdas/) and damage analysis systems which have been applied to earthquakes, floods, forest fires, tropical storms and, more recently, the tsunami in Asia (http://tsunami.jrc.it/). These services are being used in humanitarian aid and crisis management operations both in the Commission (RELEX, ECHO, AIDCO, ENV and REGIO DGs), and in relevant UN agencies (OCHA, UNOSAT).

Assessment of refugee camps by satellite images to support humanitarian aid/ external relations

The EU is the biggest donor of humanitarian aid. A significant part of the aid is provided to support and sustain populations hosted in refugee camps. The figure below shows one refugee camp that has been in existence since 1994 in Lukole (Tanzania).

The imagery can detect family dwelling units inhabited by refugees in camps. Enumeration of the dwelling units together with household occupancy figures collected in the field are used to estimate the number of refugees that need assistance. DG JRC has been providing enumeration of dwelling units and refugees to several DGs involved in aid and assistance disbursement and control.

Current research is focusing on developing novel, robust, image-processing algorithms for detection and enumeration of both stable and temporary dwelling units, in testing and using data from newly available sensors including radar and optical imagery at submeter resolution, and in fusing data from multi-sensors.

The Lukole refugee camp in Tanzania as seen from the Ikonos satellite on 24 September 2000. The camp covers an area of approximately 11 km² and at the time the image was collected hosted over 130 000 refugees.

Monitoring crop-substitution programmes in Colombia

The European Commission's external relations service funds development projects in Colombia. The EC-funded projects aim to promote socio-economic development and to facilitate dialogue between the different parties in conflict. The European Commission also funds infrastructural programmes including the mapping of the territory of Colombia using satellite imagery.

Satellite image (January 2004) from the Colombian Andes showing the forest with some openings devoted to illicit crops.

In 2004, through DG RELEX's Rapid Reaction mechanism, DG JRC purchased multi-temporal imagery (from the Ikonos satellite) to monitor progress on EC-funded projects on the eradication of illicit coca crops. DG JRC developed image-processing techniques to identify illicit crops at different stages of growth. The statistics produced by DG JRC are also used to verify statistics on illicit crop production monitored by the United Nations Office for Drugs and Crime. A new image classification technique with a strong research component has been designed, implemented and validated using spectral, textural and multi-temporal information. Satellite imagery has proved to be a unique means of monitoring EC-funded projects in areas that are difficult to access and that present severe security constraints.

Ten years of TACIS in **nuclear safeguards**

2004 marked ten years of nuclear safeguards assistance and support to the Russian Federation via the TACIS programme. Celebrated on 12 November 2004, this successful co-operation has focused on training, the development of Nuclear Material Accountancy and Control (NMAC) systems and monitoring systems to survey nuclear inventories.

The importance of nuclear safety and security issues in the new Commonwealth of Independent States (CIS) became paramount in the early nineties, highlighted by the seizure of plutonium at Munich Airport in May 1994. The European Commission decided, in September of the same year, to include (via the TACIS programme) projects for transferring its safeguards methodology to the CIS countries. This task was entrusted to DG JRC.

While the US safeguards support focused on the removal and physical protection of weapon-grade material, the EC strategy focused on the sustainable development of a safeguards accountancy and control methodology with nuclear material measurements, internationally accepted procedures and reference materials. The TACIS projects on safeguards consisted of four basic lines:

- training on safeguards methodology;
- development of nuclear analytical capabilities for NMAC, nuclear forensics and reference materials;
- development of instruments in co-operation with the Russian industry; and
- enhancement of nuclear security at plant level.

DG JRC, in co-operation with Russian authorities, established the Russian Methodological Training Centre at Obninsk which trained over 2 000 nuclear experts from different nuclear facilities in the Russian Federation and from the nuclear regulatory body. The complete nuclear fuel cycle was mapped and regulations to control the nuclear material were derived. At Bochvar Institute, three analytical laboratories were set up to characterise nuclear material, and a joint database developed to trace it.

This ten-year anniversary facilitated the first tripartite information exchange forum with representatives from the Russian Federation, the European Commission and the US Department of Energy. Over the last ten years, the EC-CIS relationship has evolved from an assistance-driven to a co-operation-driven strategy.

Collecting samples for nuclear forensic analysis

In future projects, the four lines in the area of NMAC will be combined into one pillar which will help sustain safeguards instrumentation and methodology development while addressing the bottlenecks identified in the Russian fuel cycle. A new second pillar will focus on the 'Mton to MWatt initiative' and assist in the safeguards aspects of down-blended weapon-grade nuclear material. A third pillar will tackle illicit trafficking and support nuclear security and environmental monitoring issues.

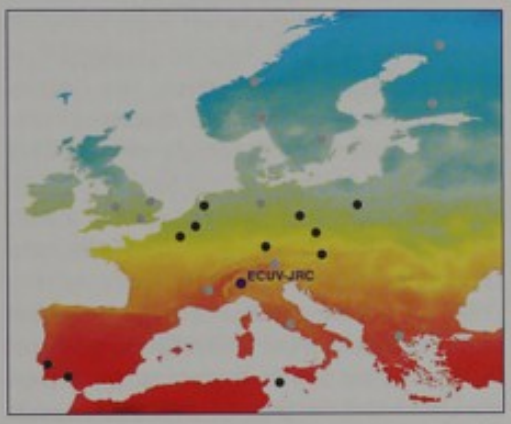
UV monitoring

During the last decade, a large number of UV monitoring stations have been established worldwide for monitoring the spectrum of solar UV reaching the earth's surface. UV monitoring is important because UV radiation plays a role in atmospheric chemistry, resulting in the observed decreases in stratospheric ozone. This, combined with the impact of solar UV radiation on the environment and on human health, has triggered the necessity to perform high-quality spectral UV measurements. Because UV radiation represents only a very small part of the solar spectrum, its measurement is technically difficult and requires specialised instrumentation and procedures.

The need for quality control and quality assurance of UV measurements had already been acknowledged in the early 1990s. Meanwhile, the establishment of international databases of solar UV measurements, e.g. the European UV Database (EUVDB), the World Ozone and UV Database (WOUDC), etc., require the strict application of QC/QA procedures in order to ensure the quality and comparability of the data.

Quality assurance measurements at the Station of Climate Observations "Roberto Sarao" of the Italian National Agency for New Technologies (ENEA) at Lampedusa, Italy from 19 to 23 April 2004

The European Reference Centre for UV Radiation Measurements (ECUV), developed by and hosted at DG JRC, was created in 2001 in response to a formal request by leading scientists from Europe's UV community. The original aim was to coordinate and harmonise UV radiation measurements in Europe by creating an independent facility with a travelling reference spectroradiometer system. However, through the involvement of the European UV community, a basis for EU policy development on UV radiation was also created. The latter was deemed important, especially in view of UV exposure assessment studies, personal exposure and validation of satellite models which both require harmonised and quality-assured UV measurements on a European scale.



Year mean UV Index map (courtesy J. Verdebout). The bullets represent quality assurance visits to European monitoring sites by the traveling reference spectroradiometer of ECUV-JRC (Gray - 2002 and 2003, black-2004).

Since 2002, more than 25 European UV monitoring sites have been quality assessed by ECUV's travelling reference spectroradiometer. In 2004 alone, it was transported to 11 European UV monitoring stations to check the absolute calibration and the overall performance of local spectroradiometers. The measurements obtained by each instrument, as well as the status of each station's calibration standards, were checked and certified by ECUV.

In June 2004, the solar irradiance scale used by ECUV's travelling reference spectroradiometer was directly traced to the primary irradiance standard (black body BB3200pg) held at the Physikalisch-Technische Bundesanstalt (PTB) in Braunschweig, Germany. This represents an important step towards validating the absolute scale of ECUV's solar ultraviolet radiation measurements.

N. Gobron

Young scientist of the year

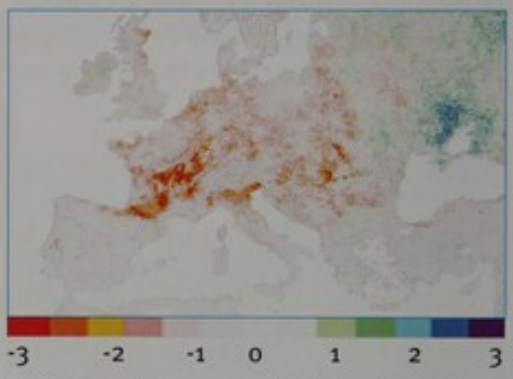
***Nadine Gobron**, DG JRC Institute for Environment and Sustainability*

Nadine was selected as best young DG JRC scientist in 2004 for her outstanding work on documenting the photosynthetic activity of global terrestrial vegetation to a degree, and with accuracy, never attained before. With 38 refereed papers already and some 40 other publications in her short scientific career, Nadine developed practical algorithms to characterise quantitatively the nature, state and evolution of the terrestrial biosphere on the basis of remote-sensing data acquired by various optical sensors. These methods have been prototyped and evaluated both locally and internationally, and transferred to the European Space Agency (ESA) for implementation. The primary land surface product of the MERIS (MEdium Resolution Imaging Spectrometer Instrument) on the ENVISAT (ENVIronmental SATellite) platform has been derived from her algorithm, and forms the basis of new environmental indicators to be proposed to the European Environment Agency (EEA) as part of their portfolio on environmental monitoring.

The significance of these achievements, which were carried out in close co-operation with the ESA, relates to policy-making and compliance verification issues in fields such as climate change and environment degradation, where international disputes on the causes, consequences and responsibilities of the observed evolution are bound to occur, and where peaceful settlement will require internationally agreed and scientifically sound information.

However, the most interesting application of Nadine's innovative approach was the characterisation of the dramatic impact made by the major drought that struck Western Europe during the spring and summer of 2003. Together with her colleagues, she documented the response of the European biosphere before, during and after, the drought event. The summer of 2003 was one of the hottest, driest and the most lethal on record: a new temperature record of 38° centigrade was reached in the United Kingdom by mid-August (source: NCDC/NOAA, United States), major European rivers experienced a record low in June, and in France alone, around 15 000 casualties were attributed to the heatwave (source: National Institute of Health and Medical Research, INSERM, France). Overall, the estimated economic losses were estimated to exceed €13 billion (source: UNEP, Switzerland).

The 2003 scenario can be considered as a forerunner to the possible consequences of climate change in Europe. In this context, Nadine's research work indicates that this climatic event was detectable, over some agricultural regions, as early as March 2003. This stimulates hope for the design and implementation of prediction/warning systems in the framework of the European initiative on Global Monitoring for Environment and Security.



FAPAR anomalies 2003 map is displayed over Europe for August using the based period 1998-2002. This map illustrates where and how vegetation activity responses depend on vegetation species, and land cover management and water availability

[REFERENCE: N. Gobron, B. Pinty, F. Mélin, M. Taberner, M.M. Verstraete, A. Belward, T. Lavergne and J.-L. Widlowski. The state of vegetation in Europe following the 2003 drought. International Journal of Remote Sensing Letters, *in press (2005).]*

Nadine Gobron, a physicist from the University Blaise Pascal in Clermont-Ferrand (France), completed her 'Doctorat d'Université' in 1997 and joined DG JRC in 2000. As a research scientist, she is now working on exploiting remote-sensing data to characterise the state and evolution of terrestrial environments. Nadine is currently acting as vice-chair of Commission A3 'Land Processes and Morphology' on the Committee for Space Research (COSPAR).


M. Saisana


M. Buchgraber

Young scientist prize for major contribution to econometrics and statistical analysis

Michaela Saisana, *DG JRC Institute for the Protection and Security of the Citizen*

In today's changing and fast-moving society, there is an ever-increasing need to integrate warning and alert signals into our daily lives. In this regard, composite indicators are increasingly being seen as the 'summary statistic' because they can capture reality. They are recognised as useful tools for policy-making and public communications in conveying information and benchmarking performance on environmental, economical or societal issues.

Composite indicators are built via an articulate chain of methodologically challenging steps, including the selection of indicators, treatment of missing data, weighting of indicators, and the choice of aggregation model. These steps introduce and propagate uncertainty in the chain, and the resulting uncertainty, for example in countries' scores, needs to be assessed in a transparent fashion.

Uncertainty analysis of a composite indicator

Michaela has been using global sensitivity analysis for building composite indicators, and her DG JRC state-of-the-art report on composite indicators offers an agile compendium of methodological issues and current practices. Furthermore, the DG JRC-OECD website on composite indicators (http://farmweb.jrc.cec.eu.int/ci), also produced by Michaela and her colleagues, is a useful source for researchers, PhD students and developers.

Some European Commission services (Research, Economic and Financial Affairs, Internal Market and others) have already put these methodologies into practice with the support of DG JRC. Furthermore, Michaela and her colleagues have collaborated with Yale and Columbia Universities (US) in the development of the Environmental Sustainability Index, disseminated at the World Economic Forum, Davos, in January 2005. The application of the global sensitivity analysis in the context of composite indicators is innovative and has considerable potential given the present hype surrounding composite measurements of competitiveness, welfare, and other complex policy themes.

[REFERENCE: M. Saisana, S. Tarantola, A. Saltelli. Uncertainty and sensitivity techniques as tools for the analysis and validation of composite indicators, Journal of the Royal Statistical Society, *A 168 (2), 1-17 (2005).]*

Michaela graduated in 1998 from the National Technical University of Athens with a degree in chemical engineering and went on to complete her PhD in geostatistics. She joined DG JRC in 1998 and has been working as a grant holder and research assistant.

Young scientist prize for major contribution to food science

Manuela Buchgraber, *DG JRC Institute for Reference Materials and Measurements*

According to the new Chocolate Directive (2000/36/EC), a number of specified vegetable fats (so-called cocoa butter equivalents or CBEs) other than cocoa butter may be added to chocolate products up to a maximum of 5% of the product's total weight. If CBEs are added, the product has to be labelled accordingly, but the Directive does not address the methods of analysis required to implement such labelling. This may invite fraudulent malpractice.

As a direct response to this new Directive, DG JRC has developed and validated an integrated approach for determining CBEs in chocolate. As the task is difficult, because of


A. Valsesia


F. Rossi


P.Colpo


T.Meziani

similarities in the composition of cocoa butter and CBEs, Manuela and her colleagues have developed an analytical toolbox named 'CoCal' consisting of:

- 1 validated method for detection of CBEs in plain chocolate;
- 1 validated method for quantification of CBEs in plain chocolate;
- 1 certified cocoa butter reference material to calibrate analyst's instruments; and
- 1 electronic evaluation sheet to calculate the final result.

This toolbox enables enforcement of the new Directive and has been made available to the scientific analytical community via publication on http://irmm.jrc.cec.eu.int/. The work supports official control laboratories in implementing the new Directive.

[REFERENCE: M. Buchgraber, F. Ulberth, E. Anklam. Method validation for detection and quantification of cocoa butter equivalents in cocoa butter and plain chocolate. J. AOAC Internat. *87 (5), 1164-1172 (2004).]*

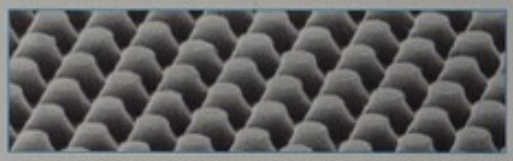
Manuela graduated in food science and biotechnology from the BOKU University of Natural Resources and Applied Life Sciences in Vienna (Austria) in 1997, completed her PhD in 2000 and joined DG JRC as a research fellow in 2002 where she is now working as a research scientist.

Best peer-reviewed scientific paper award

Andrea Valsesia, *DG JRC Institute for Health and Consumer Protection*

A major bottleneck in the development of analytic tools for biological analysis, such as biosensors, for example, lies in the difficulty of designing reliable transducer surfaces that interact properly with biological media while preserving the biomolecules in a non-altered form. This ensures the device's good properties, such as specificity and sensitivity.

Andrea's paper, which won the award, describes a novel experimental method enabling the improvement of biosensor characteristics. The method involves creating some polymeric structures at the nano-scale with controlled chemical properties on biosensor transducer platforms. These nano-structures can induce the specific adhesion of the biomolecules to the biosensor's surface. The technique opens the door to the successful design of analytical tools used for environmental and heath applications. This work is in direct line with the institutional 'nanobiotech' project which aims to develop biosensor platforms for total exposure monitoring. His paper, published in *Nano Letters*, which is one of the major journals on nanotechnology, was also highlighted in the magazine *MRS Bulletin*. The review underlines the innovative 'top-down' approach in the nanostructuring process of a polymeric surface for biosensing devices.


Scanning Electron Microscope image of the polymeric nano-structures

[REFERENCE: A. Valsesia, P. Colpo, M. Manso Silvan, T. Meziani, G. Ceccone, F. Rossi. Fabrication of Nanostructured Polymeric Surfaces for Biosensing Devices. Nano Letters *(Vol.4, No. 6, (2004) pp. 1047-1050).]*

Andrea graduated in Physics from the University of Pavia in 2001 and joined DG JRC in 2002 to complete a Masters degree in the physics and chemistry of nanostructured materials. He is now doing his PhD at DG JRC and with the University of Pavia.

Intellectual property and technology transfer award

Francois Rossi, Pascal Colpo *and* ***Tarik Meziani,*** *DG JRC Institute for Health and Consumer Protection*

New applications which require large-area substrate processing, such as flat-panel displays and solar cells, place high demands on the development of large-area, high-density plasma sources. Both applications require plasma etching and a deposition operation that must be rapid and uniform over a large area. The development of a plasma source of such a large area is very challeng-


A. Saturnio

ing – currently, no such high-density plasma source, larger than 300 mm in diameter, is available.

Picture of the lapir reactor

Francois, Pascal and Tarik have developed a new plasma source – enabling large-area plasma processing – called the magnetic pole enhanced ICP (Ma-ICP) (Patent: US 6321681, US 6682630). The plasma source consists of a special arrangement comprising a special inductor embedded in a magnetic core to create a concentrated and homogeneous magnetic field over large areas.

The technology was licensed to FHR Anlagenbau GmbH, Germany in 2003. FHR added DG JRC's technology to their product list this year and it is now being installed in a pilot in-line machine (15m) for solar cell fabrication.

[REFERENCE: P. Colpo, T. Meziani, and F. Rossi. Inductively coupled plasmas: Optimizing the inductive-coupling efficiency for large-area source design, J. Vac. Sci. Technol. *A 23, (2) Mar/Apr 2005.]*

Francois Rossi, PhD in Material Science, is the action leader of the 'nanobiotechnology' institutional project. Pascal Colpo, PhD in physics, and Tarik Meziani, PhD in plasma physics, are both research scientists at DG JRC.

The technical support and assistance award

Antonio Saturnio, *DG JRC Institute for Energy*

A fuel cell testing facility is used to develop harmonised testing procedures and methodologies applicable to fuel cell stacks and systems. It can provide direct comparisons between competing fuel cell technologies in terms of performance and operational characteristics.

Antonio and his team are building a fuel cell testing facility. In 2004, after preparing the laboratory space, several major pieces of equipment were installed, including:

- a Six-Degree-of-Freedom (6DoF) vibration table housed in an environmental chamber;
- the 40-tonne reaction mass supported by air dampers seating underneath the table; and
- ancillary equipment for the chambers, such as a 450 l/hr high-purity deionised water treatment plant, a 400 kg/hr clean steam generator, a DC/AC inverter, and a 37 Nm^3/hr geothermal cooling system.

In addition, tendering and offer evaluation was completed for a fuel and purging gas lines supply and control installation, a gas detector and alarm system, safety and risk assessment services and an on-site 60 Nm^3/h hydrogen on demand production apparatus.

The Fuel Cell Testing Facility at JRC-IE Petten

Antonio did a Masters degree in automation and microelectronics at the 'University du Travail', Belgium.

The Sixth Framework Programme (FP6)

The DG JRC Multi-Annual Work Programme (Commission Decision C(2003) 819) will run until 31 December 2006. It consists of four core areas, namely:

1. Food, chemical products and health;
2. Environment and sustainability;
3. Nuclear safety and security; and
4. Horizontal activities: technology foresight, reference materials and measurements, and public security and antifraud.

Activities within these core areas, selected to represent the best match between policy needs and DG JRC competencies, are categorised according to Integrated Scientific Areas (ISAs). The ISA structure was developed for the Sixth Framework Programme (FP6) so that activities are shared between the Institutes,

thereby enhancing the cohesion and focus of DG JRC. The ISA breakdown per Institute is shown on the following page.

Looking towards the Seventh Framework Programme (FP7)

The Commission's Communications on the policy challenges for the next decade, combined with the existing long-term demands from the Commission, present the main framework for developing the DG JRC strategy for FP7.

The proposed objectives and deliverables for FP7 are clearly demand-oriented while preserving the necessary prospective activities to be ready for future policy developments. DG JRC's thematic strategy is presented along the lines of the Commission's policy strategy documents, except for the nuclear activities which are covered by a separate specific programme under the EURATOM Treaty. The preparation of the specific programmes is under way.

Integrated
Scientific Areas

① Food, Chemical Products and Health

Safety and quality of food and feed	IRMM
Food chain: from agriculture to consumer protection	IPSC, IPTS
GMOs in food, feed, seeds and the environment	IHCP, IRMM, IPTS
Assessment of chemicals and exposure	IHCP
Alternative methods to animal testing	IHCP
Technologies for health applications	IE, IRMM, IHCP, ITU, IPTS
Health and Environment: addressing exposure via human envirogenomics	IHCP

② Environment and Sustainability

Air quality and environmental radioactivity	IES, IRMM
Water quality and aquatic ecosystems	IES, IRMM
Soils and waste management	IES, IRMM
Land resources	IES
Integration of sustainability into other policy areas	IPTS, IES
Climate change: the Kyoto protocol and beyond	IES, IPTS
Monitoring and assessing ecosystem sustainability	IES
The Sustainable Energy Technologies Reference & Information System	IE, IES, IPTS
Renewable energies and advanced energy conversion technologies	IE, IES

③ Nuclear Safety and Security (EURATOM Programme)

Management of spent fuel and of radioactive waste	ITU, IE
Nuclear security (safeguards and non proliferation)	ITU, IRMM, IPSC
Reactor and nuclear fuel safety	IE, ITU
Radiation monitoring	ITU, IRMM
Basic actinide research	ITU

④ Horizontal Activities

Technology foresight in other DG JRC priorities	IPTS
Cross-cutting techno-economic foresight	IPTS
Statistical methods for analysis of economic indicators	IPSC, IPTS
Reference materials and methods in other DG JRC priorities	IRMM
BCR and industrial certified reference materials	IRMM, IHCP
Metrology in chemistry and radionuclide metrology	IRMM
Metrology in physics: neutron data measurements	IRMM
Antifraud and monitoring compliance with EU Regulations in selected policies	IPSC, IHCP
Support to cybersecurity	IPSC, IPTS
Technological and natural risks	IPSC, IES
Contribution to Commission objectives in humanitarian aid and assistance	IPSC
Promotion of innovation, technology transfer and management of intellectual property rights	ISR Directorate, Brussels

Note: The designation of Institutes above is strictly according to the actions laid down in the Multi-Annual Work Programme 2003-2006.

DG JRC Institute for Reference Materials and Measurements

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

Foreword

JRC-IRMM plays an important role in the harmonisation and standardisation of testing methods. The many tasks of JRC-IRMM in 2004 ranged from organising inter-laboratory comparisons for radionuclides in the environment to validating methods to analyse allergens in food or cocoa butter equivalents in chocolate. To maintain its knowledge base, JRC-IRMM has allocated a certain amount of resources to projects exploring new technical and scientific challenges, like that of enhancing the comparability of CO_2 monitoring data.

In addition to many scientific achievements, two major events have marked the year 2004. In May, the European Reference Material initiative was launched at the Analytica Conference in Münich (DE), and in October, the Community Reference Laboratory for Feed Additives Authorisation at JRC-IRMM commenced operation. The accreditation of the Reference Materials unit in accordance with two complementary standards, the ISO Guide 34 for reference materials production and the ISO Standard 17025 for quantification of genetically modified organisms, is a world premiere.

Combating BSE

In the EU, all slaughtered healthy cattle above 30 months and all fallen stock above 24 months have to be tested for mad cow disease (BSE). In 2004, seven additional rapid tests evaluated by JRC-IRMM received the recommendation for approval by the expert panel of the European Food Safety Authority (EFSA), and can be taken up in the legislation.

To prevent BSE from spreading, feeding ruminants with mammalian processed animal proteins is prohibited. In 2001, this ban was extended to cover meat and bonemeal for all farm animals. One of the reasons for the extensive ban is the lack of methods for selectively detecting mammalian proteins in the presence of proteins from other animals. In 2004, JRC-IRMM organised an inter-laboratory comparison study on the detection of those proteins and meat and bonemeal in feed. It showed that both microscopy and the immunoassay methods have been improved since a similar study conducted in 2003, but the latter still requires further development and full validation.

Labelling allergens and GMO-containing products

Appropriate labelling of allergens in food is essential, especially for people who are sensitive or completely allergic to certain allergens. To enable implementation of the related legislation, methodologies for the detection of traces of allergens need to be established. So far, IRMM has focused on the analysis of peanut allergens. For instance, enzyme-linked immunosorbent assay (ELISA) test kits have been assessed and validated. In 2004, analysis procedures were improved and new methods developed, and the effects of conventional processing on the allergenicity, detectability and quantification of peanut traces in various food commodities were investigated.

A dry mixing technique is applied for processing GMO reference materials to avoid DNA degradation

European regulations also cover the labelling of foodstuffs containing genetically modified organisms. In 2004, IRMM produced three new reference materials to help monitor the labelling rules.

Improved data in neutron physics

The ^{10}B reaction cross-section is one of the most important standards used in neutron measurements. Over the years, JRC-IRMM has improved the data and, in 2004, this work resulted in better branching ratio values solving the discrepancy observed for the ^{10}B (n,alfa) reaction during the latest standards' evaluation. Other nuclei studied at JRC-IRMM are those whose cross-sections are essential for the modelling of lead-bismuth cooled accelerator driven systems for the transmutation of nuclear waste. In 2004, the inelastic scattering and (n,2n) cross-sections were measured for ^{207}Pb, resulting in unique high-resolution data just above the energy thresholds for these reactions.

Radioactivity in the environment

Monitoring of radioactivity in the environment is addressed in the Euratom Treaty, and EU Member States are obliged to submit radioactivity monitoring data to the European Commission. Ensuring the quality of the data collected in this database is important, for example when modelling the atmospheric dispersion of material released accidentally. To evaluate the comparability of data collected by DG JRC Institute for Environment and Sustainability (JRC-IES), JRC-IRMM organises an annual exercise whereby all participating laboratories receive a test sample certified by JRC-IRMM. In 2004, the participants were asked to analyse ^{137}Cs in air filters.

Analysis of isotopes to identify carbon sources

Analysis of the stable carbon isotopes in carbon dioxide helps to identify the sources and sinks of CO_2 in the atmosphere caused by fossil fuel combustion or forest fires, for example. Such data are also used for developing models for CO_2 global budget analysis. To enable a comparison to be made of data from different sources, JRC-IRMM has prepared a reference CO_2 gas for determining the $^{13}C/^{12}C$ ratio. This will help the calibration of the different instruments via absolute ratios in well-known CO_2 samples.

The IRMM catalogue contains more than 500 different reference materials. (photo of packages)

DG JRC Institute for Transuranium Elements

The mission of JRC-ITU is to protect the European citizen against risks associated with the handling and storage of highly radioactive elements.

Towards enlargement

An important part of our activities in 2004, especially those in Safeguards, Radioactivity in the Environment, and the Safety of Nuclear Fuels, were directed to the enlargement programme. Border-crossing exercises to help prevent illicit nuclear trafficking were held in two countries (Poland and Slovakia), in addition to a workshop on this subject in Vilnius. A workshop on 'Radioactivity in the Environment' attracted some 46 scientists from the new Member States. JRC-ITU scientists presented, for example, some new techniques including synchrotron radiation and fission-track analysis for characterising radioactive particles found in the environment. Two courses were held on 'Radioactivity, Radionuclides, and Radiation', with a total of 75 participants, the majority of whom came from the new Member States. A book has now been published as a result of these courses.

An important achievement in advancing the recognition of our analytical facilities was the accreditation, in November, of many techniques at JRC-ITU to the elevated industrial standard of ISO 17025. This is especially important in view of the example we set when we assist the new countries joining the EU, as well as for the increasing number of 'high-priority' samples being sent, especially by the International Atomic Energy Agency (IAEA), to JRC-ITU for analysis.

Preparing plutonium samples for age determination

Characterisation and safety of nuclear fuel

For the first time, experiments at JRC-ITU measured the thermal diffusivity as a function of pellet radius in an irradiated fuel so that these variations can be accurately included in models related to predicting the safety of the fuel. These and other results were presented at a workshop on 'High-Burn-up Structure', hosted at JRC-ITU, and were discussed extensively.

Leaching experiments on irradiated fuel and samples enriched in the highly active ^{238}Pu to simulate long-lived fuel have shown conclusively that fuel corrosion due to the radiolysis effect in water is greatly suppressed when hydrogen is present. This conclusion has important consequences for the long-term storage of spent fuel.

Partitioning and transmutation of nuclear fuels

An important achievement was the start of active operation in the Minor Actinide Laboratory on 6 July. A batch of americium oxide was introduced into the boxes for the fabrication of pellets and pins for the CAMIX/COCHIX project. After irradiation, these fuel pins will give valuable information on the transmutation of americium, one of the longest lived and highly active actinide isotopes.

An interesting research tangent is the potential to transmute nuclear waste with high-intensity laser beams. A workshop on 'Lasers and Nuclei' was jointly organised by the University of Jena and JRC-ITU. This is a new field and some 50 scientists attended the first such meeting. JRC-ITU, together with the University of Jena and other laboratories, has taken the lead with recent demonstrations of nuclear fission driven by lasers.

Basic research in actinides

In April, the Basic Research Group organised the annual 'Journées des Actinides' (JdA) in Heidelberg, and the biannual school for young scientists at JRC-ITU. Some 35 students attended the school, and 116 participants attended the JdA, making it the largest ever held. An important achievement of JRC-ITU presented at the meeting was the successful growth and first measurements of single crystals of the transuranium so-called 115 compounds, which are the centre of intense research activity worldwide. An evening round-table discussion was held on the future of the Actinide User Laboratory at JRC-ITU, and there were many positive comments on the opportunities for actinide research. Some 15 presentations at the meeting reported work performed at the UserLab. The 'Actinide Agreement', involving exchange of information and joint projects, was signed between the Japanese Atomic Energy Research Institute (JAERI), the CEA (France), and JRC-ITU in March 2004.

Visit of Mr. Pöttering (2nd from the right), Member of the European Parliament, to JRC-ITU on 20 March, 2004

In September, at Karlsruhe Castle, the 11th 'Symposium on the Thermodynamics of Nuclear Materials' was held at which some 120 specialists discussed the latest results and trends in the thermodynamics of nuclear materials. Of special interest were the sessions on pyrochemistry and advanced fuel, because of their increasing importance in the long-range plans for nuclear energy.

Medical applications

In collaboration with the University of Düsseldorf and the German Cancer Research Centre, JRC-ITU organised the 4th 'Alpha-Immunotherapy Symposium' in Düsseldorf, where more than 70 experts from all over the world discussed fundamental and applied aspects of alpha-immunotherapy. Some of the new procedures developed at JRC-ITU were presented as well as joint successes from Australia, the United States, and European hospitals. Constructive collaborations involving irradiations to produce the isotopes used in the treatments were started with the cyclotron groups at JRC-IHCP (Ispra) and the Czech National Research Centre at Rez.

The mission of JRC-IE is to provide scientific and technical support for the conception, development, implementation and monitoring of community policies related to energy.

In 2004, the JRC-IE reinforced its strategic planning through the establishment of the Scientific Advisory Groups for both nuclear safety and cleaner energies. In these groups, industry, academia, regulators, authorities, national research organisations and policy Directorates-General, together with the JRC-IE, are represented. In two meetings of both groups in 2004, the Institute's strategies were discussed and the groups made their recommendations for Institute activities in the Seventh Framework Programme (FP7) and beyond.

Support to clean energy

In the area of cleaner energy, JRC-IE has prepared a number of techno-economic studies related to the transition towards a hydrogen-based economy, in support of the EC Growth initiative and the Hydrogen and Fuel Cell Technology Platform. These studies covered hydrogen penetration scenarios, hydrogen production, cogeneration of hydrogen and electricity, and hydrogen communities. Additional work was performed in support of initiatives and legislation for alternative fuels (one workshop, and studies on hybrid vehicles and bioheat) and security of the energy supply (workshop on cogeneration, and studies on geopolitical risks, the future of diesel as automotive fuel, and enhanced oil recovery). Some of these studies have been performed in co-operation with the Institute for Prospective Technologies, JRC-IPTS. These actions also contributed to the DG JRC enlargement/integration action by hosting visiting staff from new Member States and organising a number of dedicated workshops. In the frame of the International Partnership for the Hydrogen Economy (IPHE), the first-ever IPHE workshop on fuel cell testing and review of codes and standards activities was held in October in collaboration with the US DoE, with participants from the EU, US, Japan and Korea.

Full-scale permeation test at JRC-IE's fuel storage testing facilities

Improved measurements during waste incineration

Activities in support of the Waste Incineration Directive (2000/76/EC) culminated in the successful proof of concept of an innovative integrated sensor that is able to measure physical and chemical parameters directly *in situ*. In December 2004, CO measurements were made for the first time ever on the grate of an operating incinerator. This successful validation of the concept of the integrated sensor opens the door to a completely new type of sensor for *in situ* characterisation and subsequent fine-tuning of combustion processes in order to make them cleaner and more efficient.

Promoting nuclear safety

A number of partnership projects and tasks were carried out to support the safe operation of existing nuclear power plants in new Member States and candidate countries. For example, JRC-IE participated in a 'Plant Life Management Project' for the VVER-440 reactor which was co-founded by the Hungarian government and was also involved in the development and supply of reference VVER-1000 steels for surveillance programmes (CZ, HU). To exemplify integration, the Bulgarian Nuclear Regulatory Agency (NRA) has asked to perform an assessment of the 'qualification process' used for in-service inspection of the VVER-440 reactor.

Picture of the Barsebek nuclear power plant

Support to TACIS

JRC-IE provides support to the TACIS (Technical Assistance to the Commonwealth of Independent States) programme. In 2004, the institute provided on-site assistance for 14 nuclear power plants in Russia, Ukraine, Armenia and Kazakhstan. Areas of focus were design safety, reactor pressure vessel neutron embrittlement and integrity, regulatory assistance, industrial waste management, including Chernobyl and North-West Russia, and the dissemination of TACIS results. Typical deliverables include a state-of-the-art synthesis report on VVER RPV materials embrittlement, technical assistance to Ukrainian entities with regard to Chernobyl Radwaste facilities, and the review of the technical specifications of large-scale TACIS projects for the safety upgrading of nuclear power plants.

As a spin-off from the TACIS work, DG JRC developed the SENUF (Safety of Eastern European Nuclear Facilities) network. The Kozloduy Nuclear Power Plant in Bulgaria has joined the network, which is now composed of ten organisations. Work in 2004 focused on status reports related to 'Advanced Maintenance Strategies' and the development of a database for 'Specific and Advanced Maintenance Tools and Devices'.

An innovative medical application

A new phase II clinical trial on BNCT started at the HFR in July 2004 with the treatment of a patient suffering from malignant melanoma in the brain induced by a specific type of skin cancer. A second patient was treated later in the year. This was the first time that such a trial had been performed in Europe as a prospective cure and, indeed, the first time that a patient had been treated with five separate radiation beams given sequentially on two consecutive days. Initial results are very positive. The BNCT project was also one of the projects presented at the joint Dutch/EU event entitled 'Reinforcing Cancer Research in Europe', held at the VU medical centre in Amsterdam on 4 October 2004. Over 70 media articles were generated in the European press as a result of the event.

Boron Neutron Capture Therapy at DG JRC

DG JRC Institute for the Protection and Security of the Citizen

JRC-IPSC's activities support EU policies related to enhancing the security of the citizen. In particular, the work of JRC-IPSC is concentrated in the areas of security, risk and anti-fraud.

Global Crisis Atlas

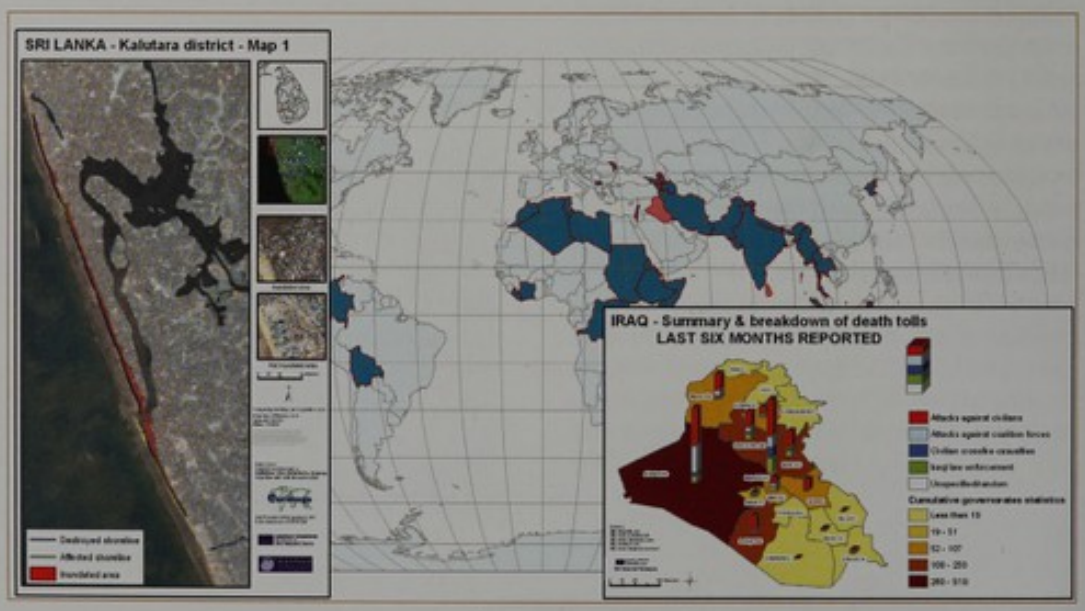
In 2004, JRC-IPSC developed the Global Crisis Atlas in co-operation with the EU Satellite Centre (EUSC) at the request of DG External Relations. The aim of the Atlas is to gather detailed geographic information covering sensitive areas of the world, to allow effective operational planning of crisis response, and to develop new ways of illustrating complex data for EU decision-makers. This project has proved to be a very good example of technical collaboration between the Commission and the Council services. Its success underlines the importance of pooling EU assets to support the work of crisis management under both pillars.

The Global Crisis Atlas provides baseline and security-related information on countries of the world that impinge upon, and/or are of high relevance to, European Union External Relations policies. Information is derived from open sources, geo-spatial data and satellite imagery, and is combined in atlases customised for EU use. The maps provided within the Atlas are used in reports, for briefing by desk officers to get synoptic views of security events, and to follow the evolution of political crises. Using this tool, detailed maps can be produced at short notice for project and programme planning, and can also be combined with ancillary data to allow detailed analysis for policy-making purposes. This Atlas also proved very useful for delivering timely damage assessments of the tsunami disaster on 26 December 2004.

Europe Media Monitor

DG JRC has developed a system for automatically monitoring media reports in real time, called the Europe Media Monitor (EMM). EMM has become the core electronic system handling all the Commission's news monitoring needs (http://press.jrc.it). Both the Council and European Parliament have become regular users of EMM. The Maritime Safety Agency has based its 24-hour incident alert system on it, and other organisations, such as the European Investment Bank, have asked for new alerts relevant to their area of work.

During 2004, DG JRC developed an EMM-based Health-related Threats monitoring system (MEDISYS) for the Commission's Safety and Consumer Protection DG. It monitors over



100 public health sites around the world, and tracks disease outbreaks and bio-terrorist threats and incidents in order to detect and assess such threats rapidly, so that advance warning can be provided.

European Root Certification Authority (ERCA)

Commission Regulation 1360/2002 introduced the digital tachograph into the road transport industry. All new goods vehicles registered after August 2005 will be fitted with a digital tachograph, and the paper charts used to record drivers' working hours will be replaced by Smart cards.

IPSC established a European Root Certification Authority (ERCA) to produce the digital signatures and encryption keys needed by the Member States for implementing the upcoming Commission Regulation on the digital tachograph.

The main function of ERCA is to authenticate national-level keys which will be inserted in tachograph units and cards.

Near Real-Time Nuclear Safeguards Accountancy

Inspectors in large nuclear facilities need an intelligent monitoring system to analyse, in a continuous way, the industrial process from a nuclear safeguards perspective. In 2004, DAI (Data Analysis and Interpretation) software was designed and developed to monitor the various steps in a nuclear reprocessing plant.

The DAI analysing kernel supports the inspector directly by verifying both the coherence in material flow and the conformity to prescribed procedures. This software has been installed for the Commission's Energy and Transport DG at La Hague reprocessing plant and is used by the Euratom inspectorate for monitoring solution transfers.

PUMACOM Bridge

The PUMACOM Bridge is made from advanced composite materials. It is the first vehicular highway bridge of its type to be installed in Europe. The installation took place in northern Spain and DG JRC carried out full-scale destructive tests on a section of the bridge for the Spanish Ministry of Development.

The first European fully vehicular highway carbon fibre composite bridge was installed in Spain

By using carbon fibre sandwich beams, combined with glass-fibre formworks, the actual weight of the bridge superstructure has been reduced to just 18 tonnes. The technical proposal was based on the research work conducted in various collaborative research projects carried out by DG JRC European Laboratory for Structural Assessment (ELSA). Through the transfer of technology from materials science into effective, working, civil engineering structures, DG JRC has helped place a key sector of European industry at the forefront of this technology.

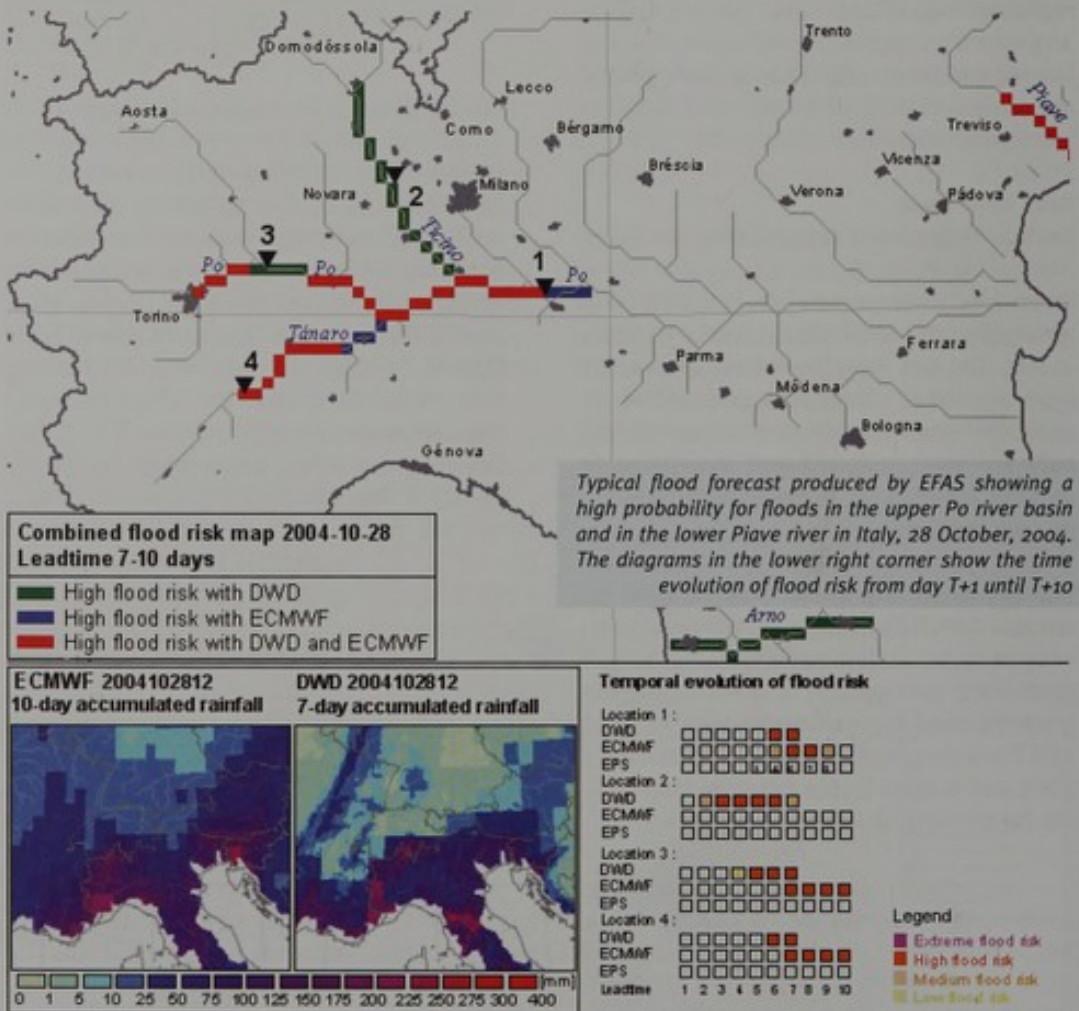
DG JRC Institute for Environment and Sustainability

The aim of JRC-IES is to provide scientific and technical support to European Union strategies for the protection of the environment and to contribute to sustainable development in Europe.

The JRC-IES offers expertise in environmental sciences and earth observation, ranging from state-of-the-art analytical chemistry to advanced computer-based modelling of the environment. Its research supports a large number of EU regulations, strategies and communications in the fields of global environmental change, emissions, air quality and health, water, terrestrial and natural resources, and renewable energies, reflecting the priority areas of the 6th Environment Action Programme. The Institute hosts large-scale experimental facilities and laboratories such as the Vehicle Emissions Laboratory (VELA), the European Reference Laboratory for Air Pollution (ERLAP) and the European Solar Testing Installation (ESTI). Furthermore, JRC-IES provides key European and global reference data sets such as the Global Land Cover Database, the European Soil Database and the European River and Catchments Database. In 2004, JRC-IES and the European Environment Agency agreed on a strategic partnership, which is reflected in a joint Work Programme for the year 2005.

Network of intercalibration sites established for benchmarking ecological water quality in Europe

In 2004, JRC-IES compiled an intercalibration register of sites for the first reporting obligation as stipulated in the Water Framework Directive. This register contains infor-



Typical flood forecast produced by EFAS showing a high probability for floods in the upper Po river basin and in the lower Piave river in Italy, 28 October, 2004. The diagrams in the lower right corner show the time evolution of flood risk from day T+1 until T+10

● Rivers ● Coastal Waters
● Lakes ● Transitional Waters

mation on more than 1 500 water bodies in Europe and it covers both inland and coastal waters. These represent the 'good ecological quality status' based on national evaluations of the EU Member States, Romania, Bulgaria, and Norway. This is the first time that such a register has been made via fully automated electronic submissions from all countries. The results were highly acknowledged by the Water Directors and the register is expected to be officially adopted in early 2005.

European Flood Alert System

DG JRC is testing and refining a pan-European Flood Alert System (EFAS). The aim is to provide national authorities with an early-warning and modelling capacity for flood events. A new collaboration agreement, between the European Centre for Medium-Range Weather Forecasts (ECMWF) and DG JRC, grants IES access to real-time ECMWF weather forecast products, including the Ensemble Prediction System. Twice a day, 50 different ten-day weather forecast scenarios are inserted into EFAS. This will increase the added value of EFAS for national and regional water authorities in pre-alerting responsible staff and double-checking the systems and procedures involved in crisis management.

Memorandum of Understanding for vehicle laboratories

A Memorandum of Understanding (MoU) has been signed between the US Environmental Protection Agency's National Vehicle and Fuel Emissions Laboratory, Japan's National Traffic Safety and Environment Laboratory, China's Vehicle Emission Control Centre, and the JRC-IES' Vehicle Emissions Laboratory. The partners mutually recognise their role as reference centres for scientific and technological expertise in the field of vehicle and engine emissions. The scope of the co-operation is the establishment of a platform to promote common activities in support of policy development in the respective jurisdictions.

The Vehicle Emissions Laboratory (VELA) at JRC-IES

The first annual meeting of the partners took place on 18 October 2004 in Beijing. For the coming year, four emission projects have been identified, namely; new fuels, H_2-vehicles, a Portable Emissions Measurement System (PEMS), and On-Board Diagnostics (OBM).

Accreditation of the European Solar Testing Laboratory

The European Solar Testing Laboratory (ESTI) at JRC-IES was granted the ISO norm 17025 and the prestigious status of being nominated 'Laboratoire d'étalonnage' (N° 2-1671) by the French Accreditation Body (COFRAC) for photovoltaic device calibration – this accreditation makes ESTI the first laboratory of its kind worldwide. For the certification of photovoltaic cells and modules, ESTI operates calibration and testing facilities for primary evaluation, industrial evaluation and technology assessment. This means that the ESTI laboratory is the single independent reference point for establishing fair and transparent markets in this field.

DG JRC Institute for Health and Consumer Protection

The mission of JRC-IHCP is to provide scientific support for the development and implementation of EU policies related to health and consumer protection.

In 2004, JRC-IHCP made real progress in the three main areas of its work programme, namely biotechnology, chemicals, and health. By so doing, direct and effective support has been provided on topics of high public and policy concern, such as GMOs, tobacco smoke, food packaging and the authenticity of beverages. Substantial emphasis has been placed on industrial chemicals, exposure assessment, and support for the implementation of alternative methods to animal testing. In addition, the developing science on nano-biotechnologies is increasingly being used to provide horizontal support to the main areas of the Institute's work.

Support for the legislation of Genetically Modified Organisms (GMOs)

European Regulation (EC 1829/2003) provides the basis for ensuring a high level of protection of human life and health, animal health and general welfare in relation to GM food and feed. As part of the overall authorisation procedure, methods capable of reliably detecting and quantifying the presence of GMOs are required. In this regard, the JRC-IHCP has been appointed as the 'Community Reference Laboratory (CRL)' for genetically modified food and feed.

Reaction for the detection of Genetically Modified (GM) proteins

The CRL is assisted by a consortium of 74 national GMO enforcement control laboratories established within the existing European Network of GMO Laboratories (ENGL). At an inaugural ceremony in April 2004, representatives from all new Member States signed the ENGL agreement to become full members.

DG JRC contributes to the world trade debate on GMOs and has consolidated its role as the EU's focal point for the Biosafety Protocol. Furthermore, the research activities on biotechnology have led to significant contributions in the areas of sampling protocols, method validation and bioinformatics.

Implementing REACH (Registration, Evaluation and Authorisation of Chemicals)

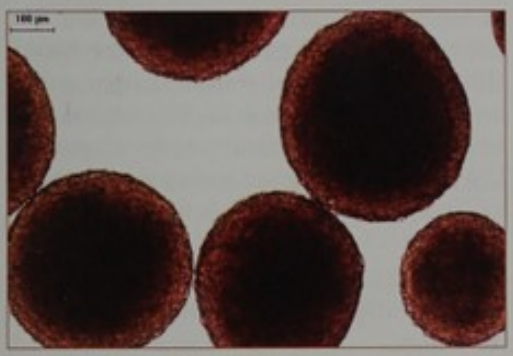
JRC-IHCP actively supports the implementation of the REACH (COM(2003)644) programme. A joint plan of 'REACH Implementation Projects' has been agreed with the Enterprise and Environment DGs for the period 2004-2007. One of the first results concerned producing the design for IUCLID 5 – a new database endorsed by industry and the OECD to provide a harmonised global format for storing data related to chemicals.

In preparation for REACH, the European Chemicals Bureau (ECB) has streamlined its activities on risk assessment of chemical substances, and DG JRC has taken the responsibility for developing guidance documents for the stakeholders who will enact the legislation.

Alternatives to animal tests

JRC-IHCP published an important report showing that test animals, potentially required under REACH, could be reduced by one-third with the acceptance of alternative test methods (*in vitro*, (Q)SAR, read-across, etc). This would also lead to a cost reduction of almost 40%.

In 2004, the acknowledged potential for (Q)SAR methods led DG JRC to double the size of this action and to co-locate it with the REACH activities. Within the European Centre for the Validation of Alternative Methods (ECVAM), the work programme in 2004 has been structured into two main actions: validation activities and coordination of research (to eventually support the validation activities). Both actions are supported by a third and separate action which provides a database service on alternative methods.



Re-aggregating brain cell cultures

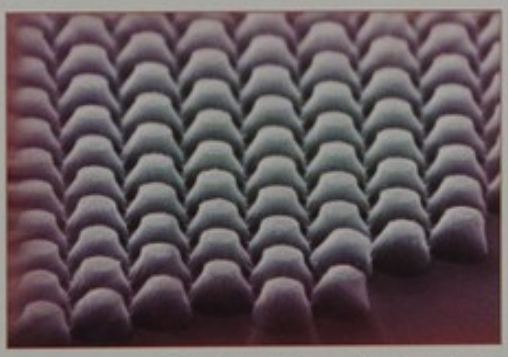
Exposure assessment

The Physical and Chemical Exposure unit works towards eliminating existing deficiencies in data on human exposure to chemicals. Together with the Safety and Consumer Protection DG, an exposure assessment 'toolbox' is being developed to evaluate more accurately the overall risk for European citizens when exposed to chemicals from various sources (ingestion, inhalation, skin contact, etc).

During 2004, the 'Harmonoise' project was completed. This produced harmonised prediction methods of environmental noise from roads and railways. It will be used as the European standard for strategic noise mapping which supports implementation of the European Noise Directive (2002/49/EC).

Nano-biotechnology for health applications

The Biomedical Systems unit at JRC-IHCP develops applications at the nano-scale and has a central role in defining the joint research programme in the first FP6 Network of Excellence related to nano-biotechnology. The Nano2Life activity focuses on understanding the nanoscale interface between biological and non-biological entities, and its possible application in the area of sensor technologies, for health care, pharmaceuticals, environment and food safety.



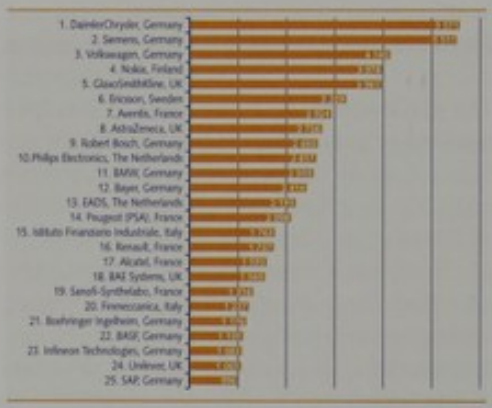
Scanning electron microscopy image of the nano-structured surface

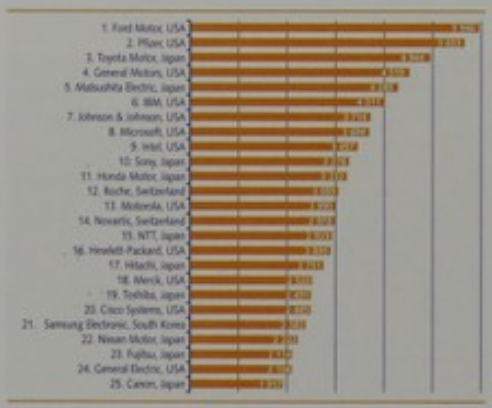
DG JRC Institute for Prospective Technological Studies

The mission of JRC-IPTS is to provide customer-driven support to the EU policy-making process, by researching science-based responses to policy challenges that have both a socio-economic as well a scientific/technological dimension.

First EU industrial R&D investment scoreboard

In 2004, JRC-IPTS provided support for the implementation of the EU action plan entitled 'Investing in research: an action plan for Europe COM(2003)226'. This action plan aims to raise investment in research to up to 3% of GDP – to support this, JRC-IPTS in collaboration with DG Research, published the first 'EU Industrial R&D Investment Scoreboard'.





Ranking of top EU and non-EU companies and their location, by worldwide R&D investment (million EUR) in 2003

The scoreboard (http://eu-iriscoreboard.jrc.es/) lists the research investments of the top 500 EU and top 500 non-EU corporate R&D investors, calculated at the consolidated group level. It provides instructive, up-to-date comparisons between companies, sectors, and geographical areas, as well as a picture of the competitive situation of EU firms in the global R&D environment. This scoreboard exercise will be repeated annually.

Support to EU efforts to encourage Russia to ratify the Kyoto Protocol

The ratification of the Kyoto Protocol on climate change has been a major objective of the EU's environmental diplomacy over the past few years. In particular, the EU has been encouraging the Russian Federation to ratify the Protocol so that it could enter into force. To support the EU's arguments, JRC-IPTS provided the Environment DG with a quantitative analysis of the likely effects of ratification on the Russian economy. The analysis was carried out using the POLES (Prospective Outlook for the Long-term Energy System) model. A DG JRC report, entitled 'Russian arguments against ratifying the Kyoto Protocol: an analysis', describing the work, was published in May 2004.

Modelling coexistence between Genetically Modified (GM) and conventional crops

JRC-IPTS pioneered the formation of multidisciplinary research teams to approach the issue of coexistence between GM and conventional crops and has developed a tool for estimating the adventitious admixture of GM and conventional crops in a given region. Currently, JRC-IPTS is coupling agro-ecological models that estimate gene flow (using the MAPOD model developed by the National Institute for Agricultural Research (INRA, France)) with geographical information systems data (facilitated by JRC-IPSC). The resulting picture of actual agricultural landscapes allows the JRC-IPTS to evaluate the cost-efficiency of agronomical measures proposed to ensure coexistence.

In the example presented below, the agricultural landscape of the French region of Poitou-Charentes was used to study coexistence between conventional and GM maize crops. The MAPOD model produces an estimation of the adventitious presence of GM maize grains (in %) in conventional maize grain harvested in each of the neighbouring plots. A close-up of a cluster of fields, in which different plots are devoted to conventional (green) or GM (pink) maize, is shown in this figure.

Supporting enlargement

JRC-IPTS performed research on the future outlook for the information society, especially ICT production and ICT use in new Member States and candidate countries. This research was geared to support the economic and social development of these countries, and the results were presented and discussed at the Krynica Economic Forum in Poland in September 2004. Several thematic studies on the development of the information society in new Member States and candidate countries were published in the course of the year. (http://fiste.jrc.es/pages/enlargement.htm).

EU-US scientific seminar on 'New Technology Foresight, Forecasting & Assessment Methods'

In May 2004, JRC-IPTS hosted a scientific seminar in Seville that brought together many of the world's top specialists in foresight methodologies and related studies. The event provided a valuable platform for sharing research results and exchanging experiences based on the most recent foresight exercises performed worldwide.

Situation 4, with 50% of GM Maize (in pink) in the Landscape

Support to enlargement and **integration of new Member States**

2004 has been an historical year for the European Union, with its unprecedented enlargement of ten new Member States (NMS), namely Cyprus, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Malta, Poland, Slovak Republic and Slovenia. DG JRC has undertaken extensive efforts to integrate researchers, organisations and experts from both the ten NMS and the four candidate countries (CCs), namely Bulgaria, Croatia, Romania and Turkey. Following the accession of the NMS, DG JRC is now adapting its enlargement activities to focus on integration of the latter while continuing to promote collaboration with the four remaining CCs and potential candidate countries (Western Balkans).

DG JRC's 'Enlargement and Integration Action' aims to stimulate S&T collaboration, hosting temporary staff at DG JRC Institutes, organising workshops and training courses and disseminating information within the NMS and CCs. Some achievements in 2004 are listed below:

- 98 workshops and training courses on various S&T aspects of EU policies were organised by DG JRC Institutes. About 4 000 experts attended from ministries, authorities, research institutes and control bodies, mostly from the enlargement countries, but also from the old MS and neighbouring countries. A strategic collaboration started with DG Enlargement's Technical Assistance and Information Exchange unit (http://taiex.be) with the launch of a pilot action of five joint workshops.

- The number of researchers and experts from NMS and CCs working at DG JRC increased to 154 in December 2004. In addition, a competition was organised to recruit permanent research staff from the NMS.

"JRC Welcoming New Member States: from Enlargement to Integration" (Ispra, 22-23 April, 2004)

- Several information days on the benefits of DG JRC collaboration were held in the NMS in 2004, including the Czech Republic, Poland, Slovak Republic, Slovenia, Bulgaria, Romania and Lithuania and, with financial support from the PHARE programme, information days were also held in the CCs.

- After the European Council recognised the Western Balkan countries as potential CCs (namely Albania, Former Yugoslav Republic of Macedonia (FYROM), Serbia-Montenegro, Bosnia and Herzegovina and Croatia – now an official CC), DG JRC opened some 30 of its 2004 workshops to include experts from these countries.

- In support of the implementation of the European Neighbourhood Policy, DG JRC has commenced collaboration with the External Relations DG.

Contribution to the **European Research Area** and **technology transfer**

The European Research Area (ERA) and the Sixth Framework Programme

Two years into the Sixth Framework Programme, DG JRC has strengthened its contribution to the European Research Area through participation in an important number of collaborative projects. Institutes participate in more than 50 Integrated Projects and Networks of Excellence and in over 60 smaller research and coordination projects.

In addition, and in line with the recommendations in the DG JRC ERA Action Plan, involvement in horizontal activities such as training and access to research infrastructures has increased. Research training networks have been set up in the fields of hydrogen and basic pulmonary biology. Individual Marie Curie fellows will join DG JRC to work on health reference materials and seismic design of structures. DG JRC's reference laboratory for neutron measurements will be opened up to scientists and industry for experiments on nuclear safety and waste transmutation.

In 2004, together with national metrology institutes from 14 countries, DG JRC joined a new network called ERA-NET. This will enable the national governments of the participating countries to increase the impact of their investment in R&D in measurement science. This collaboration will eventually lead to a European metrology research programme.

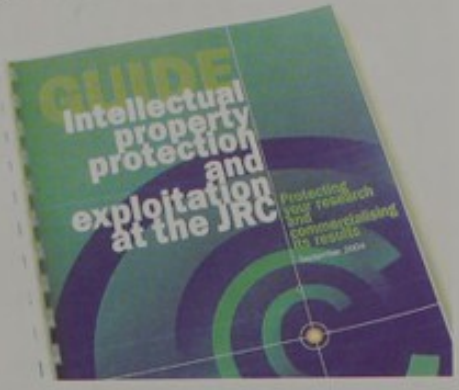
Technology transfer

The European Research Area also aims to increase awareness of the importance of research innovation in a competitive, knowledge-driven economy. In this respect, DG JRC generates a number of research results with commercial potential, and has a policy of protecting and exploiting such results. Working with industrial partners capable of taking up DG JRC results and transforming them into products, is key to achieving success.

Examples of contracts signed in 2004 with technology companies include a project on plasma coating technology and a robotic surgical arm. Both technologies are applications of results from the work programme, one in the field of consumer protection, the second an offshoot of DG JRC work on nuclear safety.

DG JRC ran entrepreneurship training for its researchers in 2004, providing an introduction to basic management skills and business planning for would-be entrepreneurs. A number of seminars were also held on intellectual property issues.

Finally, DG JRC is responsible for managing the intellectual property of the European Union. In 2004, this involved assisting 20 Commission services on a range of intellectual property issues from electronic copyright to protection of new trademarks. Eighteen new applications for patents and software copyright were filed on behalf of DG JRC researchers.



2004 brochure on intellectual property protection and exploitation

Management of **Nuclear Facilities**

Decommissioning of DG JRC nuclear installations

In 2004, DG JRC continued its Decommissioning and Waste Management (D&WM) Programme to dispose of the obsolete nuclear installations and related waste. As requested by the Court of Auditors, the D&WM programme was reviewed by an external body and updated in 2003. Based on this external assessment, a Communication to the Council and Parliament was issued by the Commission. Its presentation was very well received by the Council Working Group. In 2005, a formal presentation will be made to the European Parliament.

At Ispra, the 'clearance plant' was commissioned thereby permitting the clearing of materials whose radioactive content is so negligible that it allows free release. Work to treat waste continued at other 'waste management facilities' and the PETRA (Process Evaluation and Testing for Radwaste management) facility was dismantled to make space for the dry storage of nuclear materials. Finally, new staff members joined the team to compensate for the staff who had retired in 2003.

At Karlsruhe, the dismantling of gloveboxes, along with the permanent removal of operational waste, reduced the nuclear inventory and made space for research activities. At Petten, a contract to remove some 420 spent fuel elements of the reactor was prepared and plans were made to ship out the first batch of 210 in mid 2005. At Geel, some nuclear materials have been moved thus reducing the nuclear inventory.

From a financial point of view, the credits for investments and running cost were used according to plan for a total amount of €16 million.

High Flux Reactor (HFR)

The re-licensing of the HFR continued and, after public hearings in March 2004, and publication of the draft licence in September, the final licence was signed by the requested ministers. Since 22 February 2005, the licence is no longer open to appeal and the new licence holder is the NRG, the current operator of the facility. Meanwhile, DG JRC has reviewed its scientific strategy and this includes more activities on GEN IV concepts, more fundamental research, and the continuation of the BNCT (refer to page 23) application.

Applications to cancer diagnosis and therapy

The JRC-IHCP, together with Amersham Health, has set up production facilities for one of the key substances for cancer diagnosis: ^{18}F-fludeoxyglucose (18F-FDG). The location of tumours can be detected using Positron Emission Tomography (PET) medical imaging after 18F-FDG has been administered to patients. However, because of its short half-life, 18F-FDG must normally be produced either locally or on-site at the hospital using it. The DG JRC Cyclotron facility hosts the first radiopharmaceutical laboratory in Italy licensed to produce an isotope-labelled substance for medical use.

View of the High Flux Reactor, Petten

DG JRC exploratory research helps to anticipate science and technology needs, and to chart new paths for undertaking projects designed to support complex future policy issues. Some 6% of DG JRC's budget is devoted to exploratory research. On 14 December 2004, a review of eight 2004 projects took place during the DG JRC Exploratory Research Symposium. Here, we describe just one of these projects.

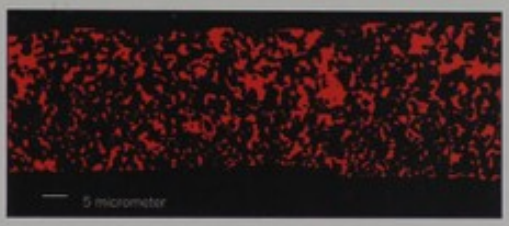
SIMLAB – a microscopic modelling approach

Fluid flow in porous media occurs widely in nature and in man-made processes. However, complex fluid dynamics problems in the micrometer to nanometer size range are currently not amenable to conventional simulation methods. This capability would significantly support the design and testing of micro-chemical components and systems, such as fuel cells (FC), and hydrogen production reactors. Within DG JRC, a promising microstructure-based simulation tool is being developed for gaining insight into details of fluid flow at this scale.

Conventional computational fluid dynamics methods, based on 'continuum fluid' equations of motion, do not apply in microscopic scales where kinetic effects are significant, or even dominant. Therefore, a 'discrete fluid' dynamics approach is employed, namely, the Lattice-Boltzmann Equation method (LBE). Advantages of the new technique are the simplicity of the algorithms employed, the intrinsic stability of the solver, and the capability to deal with multiple phases, bulk and surface reactions, and arbitrarily shaped geometrical boundaries, as found for example inside FC porous electrodes.

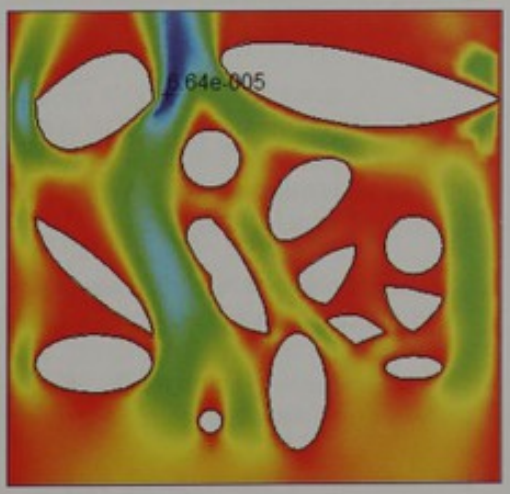
The LBE approach considers particle distributions, rather than individual fluid particles that reside on the nodes of a discrete, fixed and equidistant grid (lattice). The particles move from one lattice node to the adjacent ones, according to their discrete velocity. Then the particles collide and acquire a new velocity. Hence, the simulation alternates between particle streaming and collisions.

A statistical approach using low-order correlation functions, which are extracted from microscopic imaging methods, was used to characterise pore structures. Two-dimensional digital images of the real porous material are thus created (see figure below) which subsequently generate a 3-D geometrical model that very accurately reproduces the structure of real electrodes.



Digital, 2D image of the pore matrix. Pores are depicted in red

In 2004, the simulation tool was applied to understand the complex flow phenomena within the gas diffusion layer of a porous FC electrode. The electrochemical performance of FC electrodes depends to a large extent on their microstructure. A typical result showing the detailed single-phase flow field within a representative sample of a porous electrode, when a pressure difference is applied, is shown in the following figure. Future work will accommodate multiphase, multicomponent flow together with surface adsorption and electrochemical reactions relevant to FC transport phenomena.



Computed velocity pattern inside a 2D porous microstructure (solid matrix in white). Maximum and minimum velocity (m/s) is indicated

Promoting science awareness among **young Europeans**

DG JRC sites, and in particular Ispra in Italy, organise regular visits for groups of students. Such visits are usually linked to specific on-site activities, for example, the European Science Week each November, or during so-called 'open days' when members of the local community are invited to visit.

To mark the 54th anniversary of the Schuman declaration, DG JRC organised and hosted an 'Open Schools Day' at its Ispra site on 15 May 2004. It was attended by 1 352 visitors who followed an organised schedule of laboratory and seminar presentations. A shuttle network of 26 buses was used to transport pupils and teachers to and from DG JRC facilities.

Visits to the scientific laboratories gave an insight into DG JRC's research on:

- 3-D visualisation and robotics;
- renewable energies, vehicle emissions, global land cover maps, soil maps and air pollution exposure;
- structural assessment studies (e.g. for earthquakes), minefield detectors and the linear synthetic aperture high-resolution radar system;
- indoor air pollution, nano-biotechnology and the validation of alternative methods for testing chemicals (without using animals).

In parallel with the visits, DG JRC staff organised interactive presentations involving the pupils (with hands-on games, gadgets, displays, etc.); the topics included:

- global land cover estimation where pupils could allocate certain colours according to percentage land cover (e.g. forest, dessert, wetland, etc.) – using the DG JRC global land cover map as a reference;
- the Greenhouse Gases (GAS) project – where students could input data into a computer programme to see how their lifestyle influences climate change;
- safety aspects of tattoos and body piercings – identifying the most adverse health risks and explaining the importance of safe, pure and sterile substances and materials;
- earth's climate change – how we are changing it and the technical and political options to maintain a favourable climate for its 9 billion inhabitants;
- eating chips and chocolate – the dangers of allergens and acrylamide;
- safety of food packaging and consumer goods – what are phthalates?;
- automatic subtitle generation at the VOICE laboratory – for people with hearing impairments.

Schools Day Web Page, May 2004

A special website and brochure was created to promote the event, and feedback, from pupils and teachers alike, was extremely positive culminating in a highly successful event.

On a similar plane, other events have been organised within DG JRC such as summer schools in JRC-ITU, Karlsruhe and in Venice, not to mention regular interaction (presentations, workshops, etc.) between DG JRC Institutes and their neighbouring European schools.

DG JRC will continue to take such initiatives as it places great importance on bringing science to the future citizens of Europe.

DG JRC Directors

Director-General, Barry Mc Sweeney
(until 31 August 2004)

Acting Director-General, Roland Schenkel
(from 01 September 2004)

From left to right:
Director JRC-IES, Manfred Grasserbauer
Director JRC-IS, David R. Wilkinson
Director JRC-IPSC, Jean-Marie Cadiou
Director* JRC-ISR, Michael Francis Fahy
Director JRC-IPTS, Peter Kind
Director-General*, Roland Schenkel
Director JRC-IE, Kari Törrönen
Director JRC-ITU, Gerard Lander
Director JRC-IRMM, Alejandro Herrero-Molina
Director JRC-IHCP, Kees van Leeuwen
Director* JRC-PRM, Freddy Dezeure
* *Acting*

Figures on staff, budget and publications

Core staff

The core staff of DG JRC (M-male, F-female) is composed of the following categories:

CORE STAFF (END-OF-YEAR SITUATION)

	2003			2004		
	M	F	Total	M	F	Total
OFFICIALS	794	262	1056	1116	360	1476
TEMPORARY AGENTS ON 5-YEAR RENEWABLE CONTRACTS	344	123	467	62	41	103
TEMPORARY AGENTS ON 3-YEAR NON-RENEWABLE CONTRACTS	39	10	49	44	8	52
TOTAL	1177	395	1572	1222	409	1631

Of the 1 631 in total, 998 staff members are working on scientific projects and 633 are doing administrative work.

Commission policy for the 'integration of research staff into the mainstream of the Commission's personnel policy' is reflected in a decrease in the number of temporary agents on five-year renewable contracts.

Nevertheless, a margin of flexibility of between 10 and 35% of permanent research posts will be maintained for the recruitment of specialised staff to cope with needs that have a strict time limit.

CORE STAFF DISTRIBUTION (END-OF-YEAR SITUATION)

	2003			2004		
	M	F	Total	M	F	Total
INSTITUTE FOR REFERENCE MATERIALS AND MEASUREMENTS	128	46	174	131	53	184
INSTITUTE FOR TRANSURANIUM ELEMENTS	168	40	208	180	40	220
INSTITUTE FOR ENERGY	127	20	147	131	28	159
INSTITUTE FOR THE PROTECTION AND SECURITY OF THE CITIZEN	171	45	216	174	41	215
INSTITUTE FOR ENVIRONMENT AND SUSTAINABILITY	192	55	247	200	55	255
INSTITUTE FOR HEALTH AND CONSUMER PROTECTION	87	54	141	98	62	160
INSTITUTE FOR PROSPECTIVE TECHNOLOGICAL STUDIES	33	18	51	45	19	64
DG, ISR, PRM AND IS	271	117	388	263	111	374
TOTAL	1177	395	1572	1222	409	1631

Visiting staff

In addition to its core staff, DG JRC has an active policy of hosting grant holders, visiting scientists, seconded national experts, auxiliaries and trainees, primarily from the Member States and candidate countries. Visiting scientists bring skills, knowledge and expertise to help resolve current scientific challenges, while benefiting from the cultural diversity, multidisciplinary research domains and extensive research networks at DG JRC.

VISITING STAFF (END-OF-YEAR SITUATION)

	2003			2004		
	M	F	Total	M	F	Total
TRAINEES	19	20	39	25	17	42
POSTGRADUATE GRANT HOLDERS	42	36	78	41	31	72
POSTDOCTORAL GRANT HOLDERS	48	22	70	57	34	91
VISITING SCIENTISTS	21	10	31	16	6	22
SECONDED NATIONAL EXPERTS	29	9	38	37	22	59
AUXILIARIES	211	227	438	200	241	441
CONTRACTUAL AGENTS	0	0	0	6	11	17
TOTAL	370	324	694	382	362	744

Equal opportunities

DG JRC takes a proactive stance with regard to promoting equal opportunities and, in particular, gender equality in its working environment. The JRC-wide network on 'Women and Science', set up in 2000, continued to monitor gender equality in the organisation.

Achievements in 2004 included publishing a gender perspective report, an annual report, and a new leaflet, in addition to holding seminars for new DG JRC staff. The network also presented its activities at the workshop 'The Future of European Research', held in Brussels in December 2004.

Gender parity continued to improve with women making up 48.7% of visiting staff and 25.1% of core staff by the end of 2004.

Budget (budget and expenses – institutional activities)

The available credits to DG JRC are subdivided into staff expenses, means of execution (maintenance of buildings and equipment, electricity, insurance, consumables, etc.) and specific cred-

Figures on staff, budget and publications

its (direct scientific procurements). The credits come from the institutional budget, made available directly from the European budget to DG JRC for the Sixth Framework Programme. The following sums were committed from the institutional budget:

In million Euro			
2001	2002	2003	2004
Staff expenses			
160	163	168	197
Means of execution			
49	49	53	56
Operational appropriations (FWP)			
40	38	35	36
TOTAL (rounded)			
249	**250**	**256**	**289**

In addition, a total of €16 million was made available to finance an action programme to shut down and decommission nuclear installations and manage the waste activities related to the EURATOM Treaty.

Additional credits of €19.3 million came from contributions from countries associated to the Framework Programme.

DG JRC competitive activities

The table below shows the value of contracts signed and inscribed in the 2001, 2002, 2003 and 2004 accounts.

Contracts signed *(in million Euro)*			
2001	2002	2003	2004
Indirect actions			
14.1	2.3	4.1	16.7
Competitive activities outside the Framework Programme (FP)			
9.3	13.8	17.3	21.8
Third party work			
11.4	5.2	4.5	6.4
TOTAL (rounded)			
34.8	**21.3**	**25.9**	**44.9**

A portion of DG JRC's income comes from participation in FP6 indirect actions, performing additional work for Commission services, and contract work for third parties such as regional authorities or industry. These competitive activities complement the tasks outlined in DG JRC's own work programme and are seen as an essential tool for acquiring and transferring expertise and know-how.

Halfway into FP6, DG JRC is enjoying a 50% success rate and has been awarded a total of 130 projects, 51 of which were granted in 2004. Institutes participate in 16 Networks of Excellence (NoEs) and 38 Integrated Projects, both of which are new FP6 instruments. DG JRC also participates in 31 Specifically Targeted Research projects, 19 Specific Support Actions and 15 Coordination Actions. Examples of projects that started in 2004 are:

- European transmutation
- Integrated Risk Assessment of Chemicals in Europe
- Thresholds of Environmental Sustainability
- Nano-biotechnology for the coating of medical devices
- Gas-Cooled Fast Reactor
- Harmonisation for a sustainable hydrogen and fuel cell technology
- Energy research

Competitive activities outside the FP include additional work to Commission services that is not covered by DG JRC's own work programme. The importance of this type of work increased again in 2004 with 28 new contracts signed amounting to over €21.8 million.

Table of the 2004 publications (draft)

	Monographs and EUR reports	Articles [1]	Conference proceedings [2]	Conferences [3]	Special publications [4]	Total
General Management						
3	2	3	5	25	**38**	
JRC-IRMM						
34	118	76	119	6	**353**	
JRC-ITU						
3	94	34	97	26	**254**	
JRC-IE						
21	55	86	20	19	**201**	
JRC-IPSC						
47	80	105	93	100	**425**	
JRC-IES						
75	237	125	99	44	**580**	
JRC-IHCP						
25	85	25	119	24	**278**	
JRC-IPTS						
43	25	12	70	7	**157**	
TOTAL						
251	**696**	**466**	**622**	**251**	**2286**	

1 articles include papers published in periodicals and oral presentations subsequently published in periodicals
2 oral presentations published in proceedings
3 oral or poster presentations
4 special publications including newsletters, public relations documents, manuals, bulletins, theses, websites and presentations, CD-ROMs, videos, etc.

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