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European Commission



ANNUAL REPORT 2009

JRC Structure



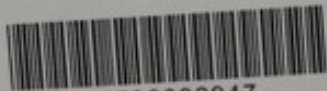
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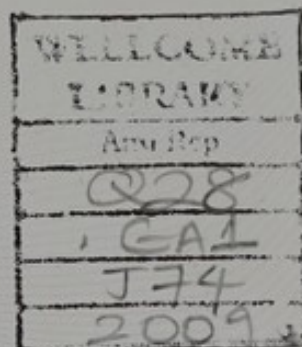
Internal and External Communication Unit
Tel: +32 (2) 29 74181
Fax: +32 (2) 29 96322
E-mail: jrc-info@ec.europa.eu
Website: www.jrc.ec.europa.eu

Mission

The mission of the Joint Research Centre is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies. As a service of the European Commission, the Joint Research Centre 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.



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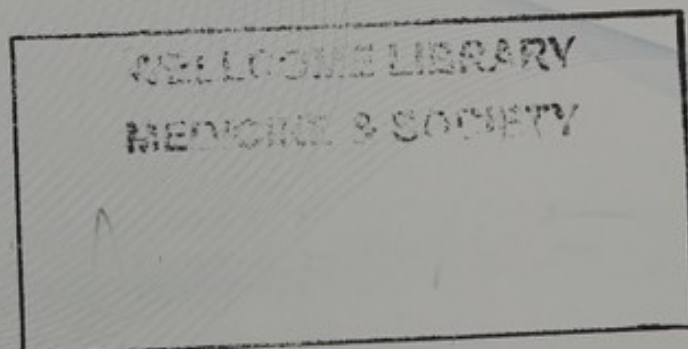


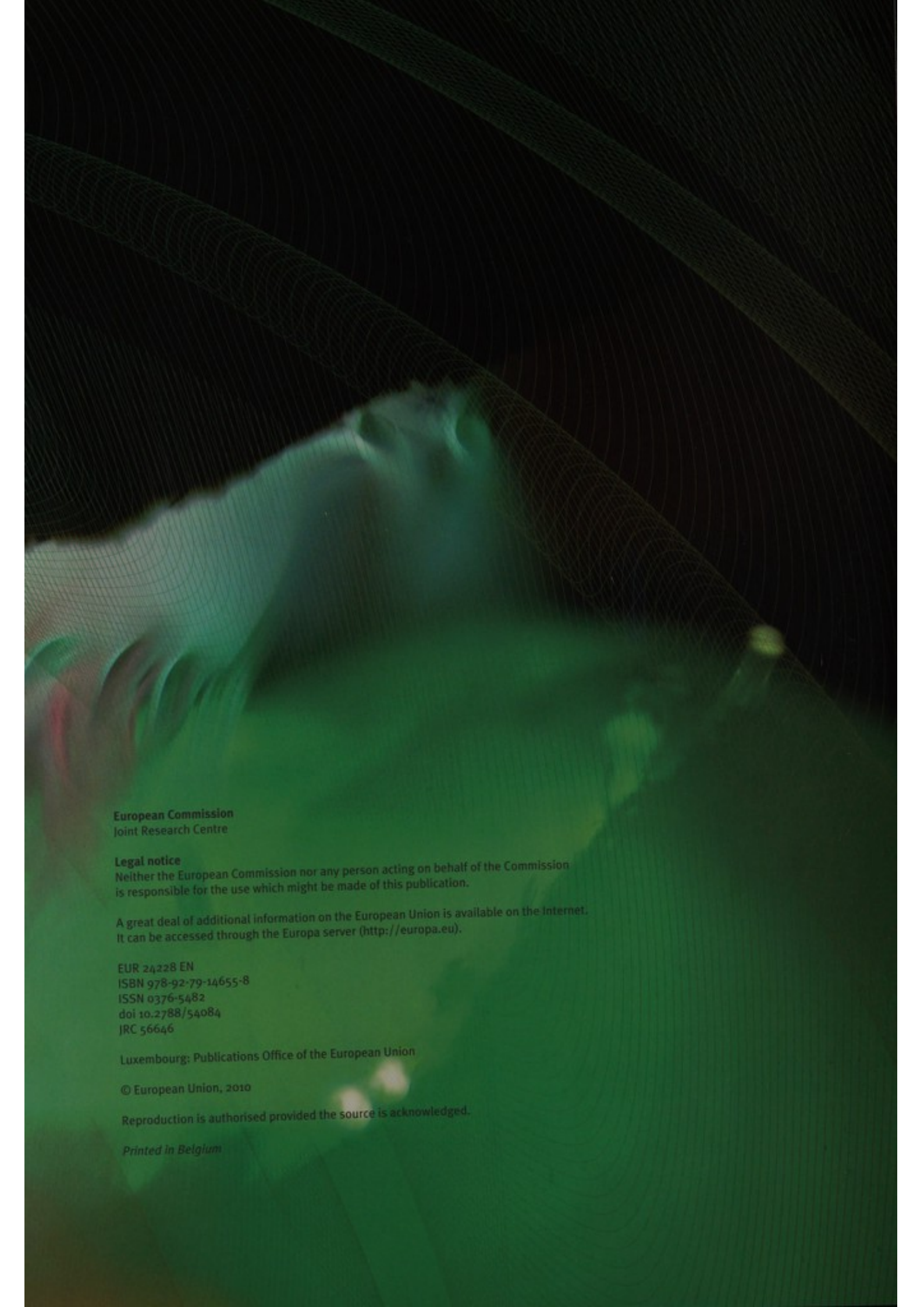
JRC

Annual Report 2009

Joint Research Centre

European Commission





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Foreword from the Commissioner for Science and Research



Janez Potočnik, Commissioner for Science and Research.

European and international collaboration. The European Research Area is the key to Europe's response to these challenges and international collaboration will be the solution for all. Collaboration will drive innovation and new ideas which in turn will help create new jobs and tackle the challenges of ensuring a sustainable living environment as mentioned above.

The JRC will also have to prioritise and in last year's annual report, I mentioned that it was about to develop a Corporate Strategy, focusing on core work areas and outlining, in consultation with stakeholders and customers inside and outside the Commission, how best to implement a new global vision for the JRC. They will deliver on this promise in 2010, taking into account the European policy objectives outlined in the Europe 2020 strategy.

In this report there are many examples of S&T support provided by the JRC in 2009 and I invite you to read through and get to know the JRC for yourself.

From my side, my role as European Commissioner for Science and Research has now come to an end. I will miss the close contact with the JRC and the diversity of research it conducts, but I do look forward to continued collaboration in my new role as Environment Commissioner. I now entrust the JRC to my successor, Máire Geoghegan-Quinn, who I'm sure will continue to support and lead the JRC in its quest to provide timely and high-quality S&T support to EU policies.

JANEZ POTOČNIK
MEMBER OF THE EUROPEAN COMMISSION

In my five years as EU Commissioner for Science and Research, I have noted that the independent scientific and technical (S&T) support which the JRC provides is becoming increasingly influential in the policy-making process as reflected through the ever-growing demands from our customers in the Commission, EU institutions and the Member States. The JRC has evolved into an organisation that can easily adapt to changing needs yet quickly react to urgent requests – it is an organisation that takes action, it delivers on what it promises and it is well embedded in the EU policy-making process.

However, when looking at scientific research from both European and global perspectives, the news is not all positive. The challenges that lie ahead for European research are immense. Now that our global economy is going through a crisis, both public and private resources are more scarce and so have to be used in the most efficient and effective manners. Businesses have meanwhile become more keenly aware of the importance to prioritise research and innovation in these difficult times. But even before the crisis, we have had the even bigger challenges of climate change, energy and food supplies, pandemics and an ageing population. When examining these together, the word 'sustainability' becomes crystal clear and echoes an urgent need for



Commissioner Potočnik at conference entitled 'Sustainable Development – a Challenge for European Research', 26 May 2009.



Commissioner Potočnik visiting the nuclear safety stand during the JRC Open Day 2009.

Message from the Director-General

In 2009, the JRC took on the challenge of reinvigorating its organisation by the creation of a new vision and strategy for 2010-2020. This was necessary to address key societal challenges ('grand challenges') facing the EU and the world where the approach requires integrated, pro-active and cross-policy action. As part of this, the JRC developed a new vision that will serve to guide the organisation over the coming years.

The JRC's vision is to be a trusted provider of science-based policy options to EU policy makers to address key challenges facing our society, underpinned by internationally-recognised research.

The strategy process was initiated through a combined bottom-up and top-down consultation process, involving 12 expert working groups, which represented 12 core competence areas of the JRC. The proposed strategy represents significant challenges for the JRC; it identifies new goals and objectives and sets a scheme for better addressing policy options at EU and global levels. An implementation plan will be defined by mid-2010 after final approval of the strategy and will begin to be applied during the 2010-12 transition period in an incremental fashion. This will place the JRC in a position to initiate its preparation for the 8th Framework Programme under a new profile.

Also in 2009, a series of events with the American Association for the Advancement of Science (AAAS) were organised and concluded with the signing of a Memorandum of Understanding between the JRC and AAAS. This three-year agreement will see the JRC and the AAAS collaborating more intensely through organising joint workshops, collaborating on the publication of reports and sharing information on key issues. The High-level Trans-Atlantic Science for Policy Workshop, which made up part of the AAAS events, was a unique setup drawing together twenty-two experienced leaders from the scientific community, policy makers, industry, and Non-governmental organisations (NGOs) from both sides of the Atlantic, for a day, engaging in a lively, open debate without



*Roland Schenkel,
Director-General, JRC.*

any taboos, and coming up with recommendations on the do's and don'ts when providing science-based advice to policy makers. It was a truly remarkable experience which benefited all present.

I wish to thank the Board of Governors, our customers and partners and all JRC staff for their hard work, enthusiasm and dedication. I extend a special thanks to Alejandro Herrero (Director JRC-IRMM) who retired in October after many years of service and I wish Megan Richards (Director Resource Management), who left the JRC, luck in her new position with the Directorate-General for Information Society and Media (DG INFSO).

Finally, I extend a big thanks to Commissioner Janez Potočnik for his support, guidance and leadership since 2004. We look forward to continued collaboration with him in his new role as Environment Commissioner.

I warmly welcome our new Commissioner for Research, Innovation and Science, Máire Geoghegan-Quinn. We see this as a moment for new opportunities and we look forward to working closely with her in the future.

ROLAND SCHENKEL



Roland Schenkel at the 33rd International Symposium on Remote Sensing of Environment, 5 May 2009.



The Director-General at the JRC Open Day 2009.

Observations from the Board of Governors



Killian Halpin,
Chairman of the Board.

The JRC Board of Governors: an important and active year

The JRC Board of Governors discussed and commented on the key decisions made in the JRC during the year, particularly those aimed at profiling and positioning the JRC and its institutes to respond ever more efficiently and effectively to the evolving needs of the EU's policy-making customers. The Board met in March, June and November in order to discuss a range of priority topics, including the actions in response to the system of JRC reviews.

First and foremost, the Board wishes to compliment the JRC on the progress made in the development of its new Corporate Strategy 2010-20 which followed on from the 2008 Sir David King Review of the JRC. The process employed both top-down and bottom-up approaches. Staff at all levels were involved, with the inclusion of expert groups in the key competence areas as well as all of the important stakeholders. The fundamental basis of the process was transparency and openness. The Board itself was involved from the very beginning, acting as a sounding board by providing advice and countries' reflections. A dedicated ad-hoc working group was set up by the Board which put forward recommendations to the Board and JRC management throughout the strategy formulation process.

The implementation of the new Corporate Strategy will help position the JRC for the next decade by providing an appropriate

reference for setting the JRC's future work programme priorities, thus also marking an important step towards defining the JRC part in the EU's next Framework Programme for Research and Development.

In early 2009, the Board endorsed the JRC's 2009 Annual Management Plan, having already contributed to the formulation of its general objectives through the inputs of an assigned ad-hoc working group of the Board at the end of 2008.

The Board emphasised the need to strive towards a greater international role, recognition and visibility of the JRC. Its members believe that both globalisation and the need for scientific communities worldwide to come together and seriously address pressing issues like competitiveness, energy and climate change will naturally pull the JRC in this direction. In the process, the JRC should increase its networking with 'the best' (both in Europe and globally) in its areas of competence and properly balance and reconcile its proactivity and customer orientation.

From several independent sources the Board recognised positive feedback on significant scientific and technical contributions made by JRC staff across a wide spectrum of EU policies. The Board commends the new structure of the 'Support to EU Policies' section (pages 8-23) of this *Annual Report*, where examples of JRC support to all policy stages are described. For example, it can clearly be seen how JRC research in the areas of genetically modified crops, greener transport, and security of the gas supply has supported policy anticipation. In terms of



The Board believes that the implementation of the new Corporate Strategy is an important step towards defining the JRC part in the EU's next Framework Programme for Research and Development.



89th Meeting of the Board of Governors in Malta on 19 November 2009.

policy formulation and adoption, examples include JRC research work on biofuels, land use and nuclear non-proliferation, to name but a few. Examples of JRC support work to policy implementation cover, inter alia, the mapping of current research efforts into low-carbon technologies across the EU and research on alternative testing methods for detecting skin and eye irritants. Support work at policy evaluation stage is well illustrated by the results of the Soil Conservation project and JRC assistance to UN FAO in global forest monitoring. Also in this section, the timely and much appreciated policy-support work the JRC did in 2009 on responding to crises, can be found.

The Board wishes to reiterate the need to keep up a modernisation programme of the buildings and support infrastructures in all the JRC sites. Acknowledging the great strides that have been made in this direction despite considerable organisational and budgetary challenges, the Board will continue its support and monitoring of the key decisions that will enable the JRC to retain its status of a modern research centre with state-of-the-art facilities.

The Board also re-emphasises that it is essential for the JRC to have fast and flexible access to scientific and technical expertise to be able to deliver its mission and therefore it must retain high flexibility in the recruitment processes for temporary staff.

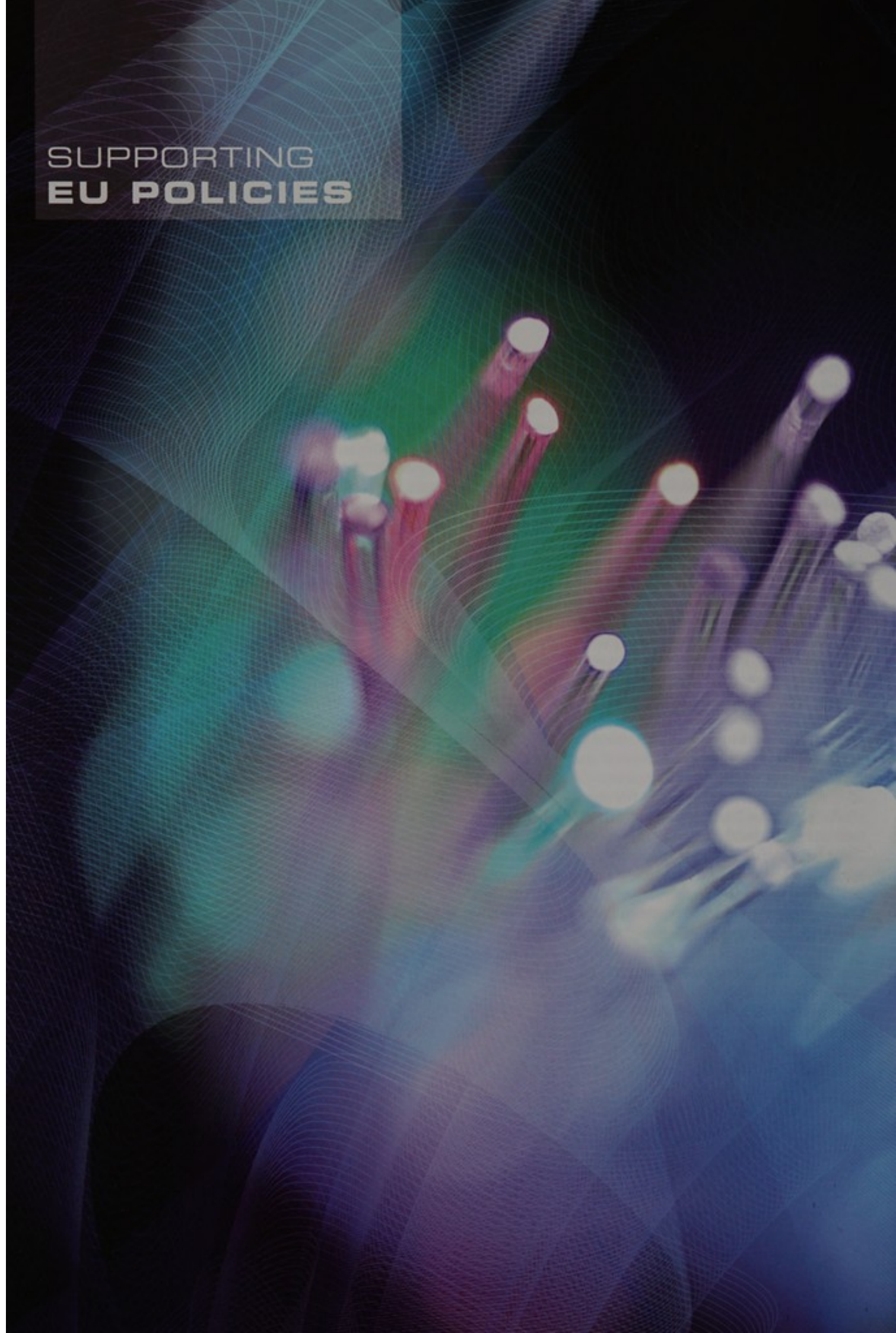
This flexibility is indispensable for the JRC since it needs to attract young talented scientists in a highly competitive environment. The passing of every year brings with it senior personnel change. The Board wishes to record its appreciation for the many years of service and dedication given by Alejandro Herrero Molina, Director of JRC-IRMM, who retired in October 2009. Likewise, we wish to acknowledge the work of Megan Richards, Director of Resource Management, who moved from the JRC to the Directorate-General for Information Society and Media (DG INFSO).

Finally, the Board wishes to express its appreciation for the work of Commissioner Janez Potočnik during his entire mandate. His leadership and vision played a pivotal role in the process of change undertaken by the JRC over the past five years, embedding the JRC's work in the construction of the European Research Area (ERA).

The Board looks forward with both confidence and enthusiasm to the further advancement of the JRC under the newly appointed Commissioner for Research, Innovation and Science, Máire Geoghegan-Quinn.

**KILLIAN HALPIN,
CHAIRMAN OF THE BOARD**

SUPPORTING
EU POLICIES





QUOTATIONS

JRC Ispra (6-7 April 2009)

"It's a great pleasure for us to visit the JRC and to have fruitful discussions about the establishment of a European institute in the context of the JRC. I'm really impressed by the quality of scientific work which is carried out in Ispra and I congratulate the personnel for its capability to carry out original work."

FILIPPOS TSALIDIS, *Greek Secretary-General for Research and Technology, Ministry of Development*



JRC Ispra (14 October 2009)

"Thank you so much for a very inspiring day at the JRC! So much knowledge gives me a lot of hope for a new sustainable common fisheries policy! Tack!"

ISABELLA LÖVIN, *Member of the European Parliament, Group of the Greens*



JRC Ispra (5 May 2009)

"On behalf of the South African Government, I, Phil Mjwara, am very happy to be hosted here at the JRC. I am also delighted that the collaboration between Africa and Europe will be strengthened by this visit in the areas of science, technology and space."

PHIL MJWARA, *Director-General of the South African Department of Science and Technology*

JRC Petten (27 April 2009)

"I am delighted with the exemplary convergence of our activities and results which show an undeniable mutual benefit and contribution towards Nuclear safety."

DOMINIQUE RISTORI, *DG TREN*



JRC Ispra (16-17 March 2009)

"Dear Sirs, I take this opportunity to thank you for your excellent welcome to the JRC. For all my team, this was a unique experience. With best wishes of success!"

EVA BARTOŇOVÁ, *First Deputy Minister for Education, Youth and Sport of the Czech Republic*

Response to crises in 2009



JRC final damage assessment for the Gaza strip on 21 January 2009.



Left: Propping up the San Paolo Apostolo Church in Onna; right: Damage to the Prefecture building in L'Aquila.

Responding to humanitarian crises

During the armed conflict in Gaza between December 2008 and January 2009, at the request of the European Commission's Directorate-General for External Relations (DG RELEX), the JRC regularly provided situational updates of the extent and characteristics of related damage in the conflict, based on the analysis of satellite data. The results of the analysis were aggregated in the form of maps, damage statistics and situation reports, including a final report that was submitted to DG RELEX. The intermittent and final situation assessments were also shared with the European Commission's delegation in Jerusalem and United Nations agencies. The analyses, maps and reports provided DG RELEX with an independent assessment of the related damage, which was used by the EC crisis response field assessment missions and the delegation that went there after the conflict.



Fabio Taucer

"Response to crisis in the aftermath of a disaster requires effective pooling of available resources at local, national and international levels. The MIC field mission to the area affected by the L'Aquila earthquake showed that co-operation between EU Member States can become a reality."



Thomas Kemper

"Over the years the JRC has been playing an increasingly important role in the field of situation assessments for natural disasters and humanitarian crises with its timely provision of independent scientific support."

Support to disaster management: assessment mission following the L'Aquila earthquake

Following the earthquake of 6 April 2009 near L'Aquila in the Abruzzo region of Italy, the EC Monitoring and Information Centre (MIC) closely followed the situation on the ground in an effort to support management of the disaster. In the first phases of the event, maps and situation reports produced by the JRC were used in order to give an overall assessment to the MIC and to all civil protection agencies in Europe.

In response to a request for assistance by the Italian Department of Civil Protection, JRC experts participated – together with an international team of engineers from France, Germany, Greece, Portugal, Slovenia and Spain – in a field mission organised by MIC with the purpose of providing technical expertise in the assessment of the stability of buildings, assessing further needs, anticipating problems and suggesting solutions with regard to buildings damaged by the earthquake. The experience and lessons learned from the field mission were discussed at the Civil Protection Forum held in Brussels on 25-26 November 2009, and demonstrated that sharing capabilities and expertise of the civil protection organisations of different European States is beneficial.

Responding to disasters in the Asia-Pacific region

In the aftermath of natural disasters that struck the Asia-Pacific region in September and October 2009, the JRC supported the European Commission's Monitoring and Information Centre (MIC) in coordinating a response from the EU.

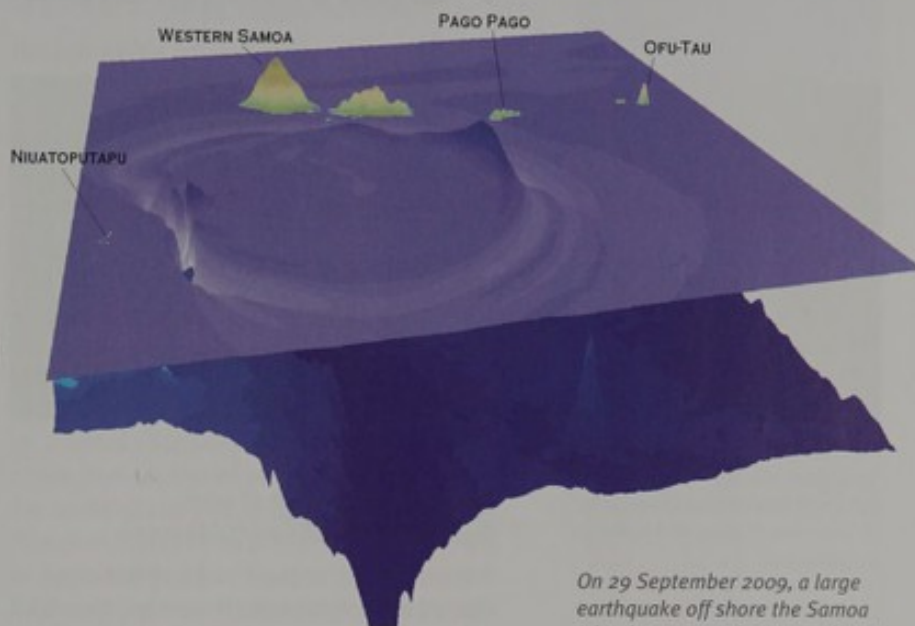
The Global Disaster Alert and Coordination System (GDACS, www.GDACS.org) supported responses to the tsunami in Samoa, the earthquake in Indonesia and the tropical cyclones in the Philippines. Updated information was published on GDACS and alerts for the earthquake events were sent out via SMS, fax and email to 10 000 GDACS users. The JRC also delivered situation maps and estimated potential impact to the MIC and the United Nations Office for Coordination of Humanitarian Affairs (OCHA).

GDACS is a web-based platform developed by the JRC together with the United Nations. It aims at facilitating coordination and decision making primarily among bilateral responders and the affected country through reliable and timely alert notifications, automatic impact estimations, and the provision of a platform for structured information exchange between responders and coordinators.

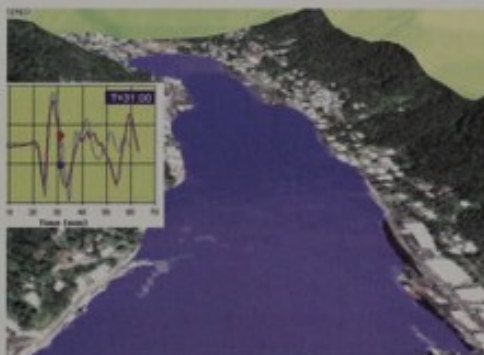
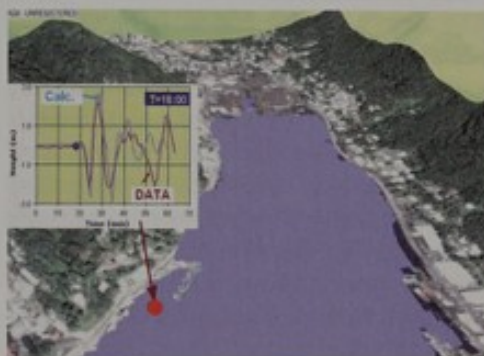


Alessandro Annunziato

"I take great satisfaction from the fact that our expertise in European research and technology is helping to alleviate the burden in crises-afflicted areas throughout the world."

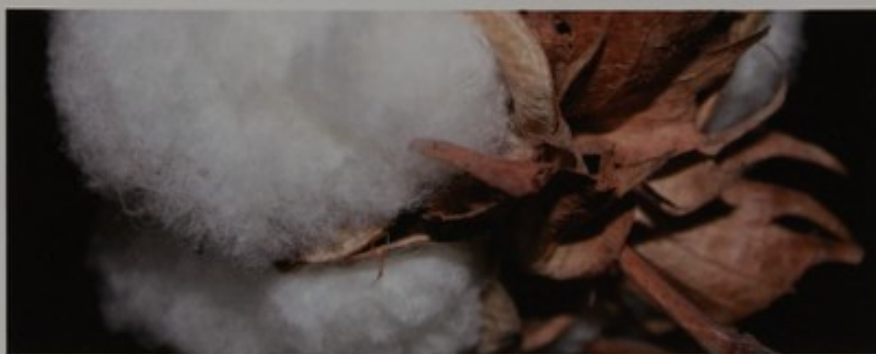


On 29 September 2009, a large earthquake off shore the Samoa Islands generated a tsunami that destroyed several villages and caused more than 160 fatalities. The figure shows how the wave (created as a consequence of the earthquake) is approaching the various islands composing the Samoa archipelago. The figure represents the situation 15 minutes after the earthquake.



The city in Pago Pago bay was hit by a wave of 2.5m in height which was measured by tidal gauge measurement devices. The figure above includes the comparison of the measured and the calculated values. The two pictures represent the situation at 20 minutes and 30 minutes after the earthquake.

Policy anticipation



For cotton, the number of so-called 'transgenic events' in commercial GM crops may increase from 12 to 27 from now to 2015 (© Stephanie Berghäuser).

* Regulation (EC) No. 1829/2003 of the European Parliament and of the Council on genetically modified food and feed.

** Regulation (EC) No. 595/2009 of the European Parliament and of the Council on type-approval of motor vehicles and engines with respect to emissions from heavy duty vehicles (Euro VI) and on access to vehicle repair and maintenance information.

The global pipeline of new Genetically Modified (GM) crops

The number of commercialised GM crops in the world is foreseen to multiply four fold from about 30 today to over 120 in 2015. This is the forecast presented in the report 'The global pipeline of new GM crops: implications of asynchronous approval for international trade', published in 2009 by the JRC. It compiles a list of new GM crops to be commercialised and analyses their possible impact on international trade.* Their increasing number may cause trade disruptions between countries due to their asynchronous approval (different countries do not approve genetically modified organisms at the same time).

This report presents the results of an international workshop organised by the JRC and summarises the different views expressed by the participants. The seminar brought together national regulators, industry representatives, research institutes and participants from the agri-food supply chain.



Emilio Rodríguez Cerezo

"By 2015 half of the new GM crops will come from technology providers in Asia and South America."



Giorgio Martini

"We are already using VELA-7 intensively, to assess new technologies developed by the European heavy-duty vehicle industry and to quantify improvements in fuel economy and CO₂ emissions."

Participants concluded that the increasing number of new GM crops will intensify the effects of asynchronous approval and isolated foreign approval (GM crops are authorised by just one country). Therefore, the likelihood of crop shipments being rejected at the EU border because of low-level presence of unapproved genetically modified organisms could become considerably higher in future, causing trade disruptions at international level.

Contributing to greener transport

The capabilities of the JRC's Vehicle Emissions Laboratories (VELA) were significantly extended by inaugurating the new VELA-7 laboratory on 13 March 2009. It is one of Europe's most advanced installations for testing fuel consumption and related emissions of full-size trucks and buses under simulated road driving conditions within a broad, realistic temperature range.



VELA-7 can host vehicles weighing up to 30 tons, and 12 metres long, simulating wind drag, tyre/road friction as well as full drive cycles.

VELA-7 provides sound scientific data needed to support new legislation such as the upcoming EURO VI guideline aimed at reducing heavy-duty vehicle emissions.** The VELA laboratories' work now covers more CO₂ measurements, allowing anticipatory studies in support to future energy efficiency regulations. Moreover, a new test procedure for non-road mobile machinery (e.g. excavators, etc.), was developed by JRC scientists with experts from Europe, Japan and the United States, and now this procedure has been adopted as a global technical regulation by the United Nation's Economic Commission for Europe (World Forum for Harmonisation of Vehicle Regulations) in November 2009.

Towards stronger international guarantees of nuclear non-proliferation

The verification of declared nuclear activities and the detection of undeclared ones are the core tasks of international safeguards authorities.* A powerful verification tool is the analysis of dust samples taken at nuclear installations. In support to the Directorate-General for Energy and Transport (DG TREN)¹ and the International Atomic Energy Agency (IAEA), the JRC has established a programme, based on mass spectrometric measurements, to analyse dust samples from inspection campaigns.



Swipe sampling technique used to collect dust at a nuclear facility.

To further strengthen this activity, both on the European and international scale, the JRC and DG TREN decided to jointly establish a high-sensitivity particle analysis laboratory at the JRC. Its core facility will be a highly sensitive and state-of-the-art mass spectrometer. It will allow the detection speed and sensitivity of nuclear material to be increased by at least a factor of 10. The minor isotopes of uranium will become accessible, which is important for identifying the source of the material. The new laboratory is a crucial element to move towards in-depth characterisation and nuclear forensics of micro-particles. This will play an important role in preparedness for upcoming challenges in non-proliferation.

Understanding the vulnerabilities of Europe's energy supply systems

Natural gas is important for Europe's future energy mix, since it complements renewable energy sources and has lower emissions than other fossil fuels. However, a high percentage of European gas will need to be imported, for example from northern Africa, Norway, Qatar, Russia or Turkmenistan. In January 2009, a trade dispute between Russia and Ukraine led to the most severe supply disruption in recent history, cutting 30% of European gas imports, causing massive economic damage and leaving households in several countries without heating. This crisis demonstrated an urgent need to better understand the supply system across Member States. The European Commission is proposing rules** as to how Member States can assess their vulnerability to supply disruptions outside their national borders. The JRC has helped develop these indicators and has simulated future disruption scenarios using computer models of the European gas supply network based on data supplied by DG TREN. The modelling is combined with sensitivity analysis and probabilistic risk assessment, and identifies the best strategies for operators, national governments and EU policy makers. This will help avoid future disruptions and/or minimise their impact. It further identifies the most cost-effective infrastructure projects as well as ways to improve co-operation without unnecessary investments.



There is an urgent need to better understand the energy supply system across EU Member States.

* Regulation (EC) No. 1717/2006 of the European Parliament and of the Council establishing an Instrument for Stability.

** COM(2009) 363 final: proposal for a regulation concerning measures to safeguard security of gas supply and repealing Directive 2004/67/EC.



Klaus Lützenkirchen

"The JRC contributes to strengthening the nuclear non-proliferation and verification regimes."



Henryk Faas

"Recent events have highlighted the vulnerability of our energy supplies. Tackling this problem is a huge challenge for the JRC which works to evaluate different geopolitical, environmental, and economic scenarios and their impacts on energy security."

¹ From 17 February 2010, DG TREN has been split into DG Mobility and Transport (DG MOVE) and DG Energy (DG ENER).



Roadside check of the driving times and rest periods of truck drivers to study in-field enforcement practices and vulnerabilities of the digital tachograph. The JRC participated as an observer together with 'gendarmes', controllers, local and national authorities near Montpellier, France.



Less favoured agricultural land (© M. Siikonen).

* Directive 94/19/EC of the European Parliament and of the Council and its amendment 2009/14/EC, which sets the minimum level of reimbursement to EUR 50 000.

** Commission Regulation (EU) No. 1266/2009 adapting for the tenth time to technical progress Council Regulation (EEC) No. 3821/85 on recording equipment in road transport from heavy duty vehicles (Euro VI) and on access to vehicle repair and maintenance information.

***COM(2009) 161 final: towards a better targeting of the aid to farmers in areas with natural handicaps.



"The protection of citizens' savings is essential to maintain financial stability and to sustain economic growth."

Policy formulation

Protecting consumers' accounts

Deposit Guarantee Schemes (DGS) are funds set up with the goal of protecting consumers' accounts in the event of a bank failure. Following the 2008 financial crisis, the Directive* on DGS underwent a comprehensive review and the JRC is in charge of the impact study of different policy options, ranging from an increase in the level of coverage to a reduction of the payout period.

The JRC performed a number of quantitative studies for the Commission's Directorate-General for the Internal Market and Services (DG MARKT) to assess DGS efficiency, the adequacy of the protection level, and the impact of harmonising the funding mechanisms.

Moreover, in 2009 the JRC investigated potential models to charge DGS members on the basis of their risk profile, in line with the explicit requirement of the amending Directive on DGS. The JRC worked out three different approaches and assessed their potential impact across Member States.

Enhanced security for the Digital Tachograph

From 1 May 2006, the digital tachograph, a new control device for road vehicles, became mandatory on newly-registered commercial trucks and buses. The tachograph is an electronic device that records data concerning driving times, breaks and driver rest periods. The security of the digital tachograph system, and the authenticity and integrity of electronic data recorded, are the key for providing trustworthy information to enforcers, and ensuring the enforcement of some of the European social legislation in road transport.



"Maintaining an adequate level of security of the digital tachograph is fundamental for the trustworthiness of the recorded data."

In 2009, the JRC researched efficient counter-measures to reduce the risk of in-field physical attacks against the digital tachograph to prevent it from functioning correctly. This research, which was conducted with industry and enforcers, led to the publication of new legal requirements** to ensure adequate protection of the motion sensor of the digital tachograph against tampering, such as by the use of magnets, and corroboration of vehicle movement by additional and independent movement sources. Additionally, the JRC prepared a report on the vulnerability and controllability of the digital tachograph, and animated a stakeholder conference, which launched a public consultation to seek opinions of interested parties on the possible review of the EU legislation on tachographs.

Common criteria for areas with natural handicaps in agriculture

Three years of scientific support by the JRC to the Directorate-General for Agriculture and Rural Development (DG AGRI) led to a Commission Communication***. It underpinned the revision of the legislation on Intermediate Less Favoured Areas, now called Natural Handicap Payments (NHP). Eight indicators on soil, climate and terrain characteristics were derived in collaboration with international scientific experts. The JRC is mentioned in the main text of the communication and prepared guidelines for Member States to test the methodology and to map areas with natural handicaps. Furthermore, the JRC carried out a spatial pan-European impact assessment of the application of the proposed common criteria, contributing to the Commission's staff working document presented to the High-level Impact Assessment Board (Secretariat General).



"Clarifying the policy discussion through scientific and technical evidence was key in our support to the Less Favoured Areas scheme of the Common Agricultural Policy."

Enabling consensus on regulatory documents for INSPIREing Europe

The JRC facilitated drafting the implementing rules for the INSPIRE (Infrastructure for Spatial Information in the European Community) Directive,* involving experts from Member State organisations. Through stakeholder consultation and expert meetings, organised by the JRC's Spatial Data Infrastructures team during 2009, the specifications for the INSPIRE data themes were drafted. Hundreds of comments on the drafts were then collected and elaborated. The JRC reached a significant milestone, when on 14 December 2009 the INSPIRE Committee, a formal representation of Member States, approved the Implementing Rules for 'Interoperability of spatial data sets and services' and the amendments of the 'Network Service Regulation for download and transformation'. The first set concerns harmonising data themes like geographical grid systems, coordinating reference systems, transport networks, hydrography, and protected sites. By consensus across the EU, Member States now provide data within the scope of INSPIRE using the same definitions and a common exchange format. This facilitates pan-European and cross-border aggregation and analysis, application development (e.g. information systems, reporting systems, forecasting models) as well as data access.



The INSPIRE Forum – facilitating participation in the development of the INSPIRE infrastructure.



Trees have often been at the centre of climate negotiations.

Land use, land use change and forestry in view of climate change

During the United Nations' (UN) conference on Climate Change in Copenhagen, 7-18 December 2009 (COP15), JRC scientists provided direct input to the Commission's delegation and EU Member States, including:

- the question of how much CO₂ may be removed by European forests in the future. The JRC coordinated, with a set of leading forest research groups (including the International Institute for Applied Systems Analysis and the European Forest Institute), the projection of net CO₂ removals from forests by 2020. Results suggested that a significant decline in CO₂ removal from EU forests is to be expected – about 20% less in 2020 compared to 2000. This was illustrated and discussed in a side event held during COP15. Most of the EU Member States used these projections to set the reference level for their forest sector, i.e. the level of CO₂ removals by forests against which future removals will be compared, generating either emission 'credits' or 'debits';
- assessment of different accounting rules on potential emission credits/debits: for the Land Use, Land use Change and Forestry (LULUCF) sector,** the JRC produced a spreadsheet application, incorporating all available data (historical and projected) and all the complex accounting options under debate. This allowed assessments of different accounting options for the post-Kyoto LULUCF regime, and in fact provided a main quantitative assessment tool for EU negotiators.

* Directive 2007/2/EC of the European Parliament and of the Council establishing an Infrastructure for Spatial Information in the European Community (INSPIRE).

** Paragraph 33 of the Council conclusions on the EU position for the Copenhagen Climate Conference (21 October 2009) on LULUCF, and in particular on the accounting rules for forest management.



Paul Smits

"INSPIRE is building solid bridges between islands of essential, geospatial information. This will improve and create new understanding of the challenges we face and will help us to meet our responsibilities towards each other and future generations."



Giacomo Grassi

"Seeing the tools and numbers we produced becoming a key element in many European Member States' negotiation position has been an exciting example of how JRC's work can feed policy making."



The JRC's Biofuels task force considers all issues related to the production and use of biofuels.

* Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources and Directive 2009/30/EC on fuel quality.

** COM(2009) 519 final on investing in development of low carbon technologies (SET-Plan).

Ensuring sustainable biofuels

The JRC Biofuels Thematic Programme continues to provide strong support to the Commission in fulfilling its legal obligations regarding biofuels and reporting requirements of the directives.*

During 2009, the JRC's contribution to the policy process and implementation of these directives included:

- input to the preparation of the Commission's report and possible legislative proposal on indirect land use change, supporting the policy and regulatory analysis (assessing how land use change affects greenhouse gas emissions and ways to address this impact). Three reports on this issue were delivered during 2009 to the interservice working group:
 - 'Modelling indirect land use change effects of biofuels policy';
 - 'Biofuel modelling with the agricultural sector';
 - 'Spatial allocation of agricultural land demand';
- calculation of greenhouse gas emissions and life cycle of biofuel pathways. The Renewable Energy Directive contains a list of biofuels/biofuels production pathways with typical and default values for their greenhouse gas saving. The JRC is continuously calculating new sets of default values or updating existing ones;
- preparation of a 'Guide for the calculation of land carbon stocks'.

Policy adoption

Strategic Energy Technology Plan Information System – Supporting Europe's master plan for energy technology development

JRC, as the coordinator and operator of SETIS (the Information System of the European Strategic Energy Technology Plan – SET-Plan), significantly contributed to the development of a Commission Communication.** The JRC, in collaboration with all relevant stakeholders, estimated the financing gap which needs to be bridged in order to bring the SET-Plan prioritised low carbon energy technologies to market by 2020. It assessed the policy options for restructuring innovation for Europe's energy technology and for its optimal financing of Research & Development (R&D) and deployment activities. The JRC authored two key reports, which accompany the communication: an in-depth analysis of current R&D investments in energy technologies, and a set of roadmaps for the development of low carbon energy technologies in Europe, which identify and cost prioritise R&D and demonstration actions that are framed by a set of key performance indicators. These roadmaps are the first-ever attempt to provide Europe with a coherent and integrated master plan for energy technology development, and are among the very first to be developed worldwide.



The SETIS website was presented during the launch of the SET-Plan financing communication.



Luisa Marelli

"The complex area of biofuels is a perfect example of the need for robust science to provide sustainable options for the policy makers."



Estathios Peteves

"The SET-Plan is Europe's masterplan in revolutionising the energy system in the transition to a sustainable low carbon economy and the JRC, through SETIS, plays a vital role in its implementation."

In addition, the JRC published an update of the SET-Plan Technology Map and launched the SETIS website – setis.ec.europa.eu – serving as the Commission's information point for validated, up-to-date information on energy technologies and providing the required openness and transparency to the decision-making processes for the EU's energy technology policy.

Policy implementation

Developing international standards

A method developed by the JRC to measure vegetable fats in milk chocolate became the first such method to be adopted as an international standard by the International Organisation for Standardisation (ISO). The method was developed to enable the enforcement of the so-called Chocolate Directive (2000/36/EC) which stipulates that European chocolate must not contain more than 5% vegetable fats, other than cocoa butter.

Prior to the development of the JRC method, no validated methodology existed in this field. It was therefore not straightforward to check whether manufacturers were correctly reporting the amount of vegetable fats other than cocoa butter in milk chocolate, as their chemical composition and physical properties resemble those of cocoa butter very closely, thus making them extremely difficult to quantify or even detect. This left the door open for disputes and uncertainty as to whether or not milk chocolate products fulfilled legal requirements.

In close contact with the European Commission's Directorate-General for Agriculture and Rural Development, the JRC successfully developed reliable analytical methods to detect and quantify so-called Cocoa-Butter Equivalents (CBEs) in milk chocolate. The JRC submitted its milk chocolate testing methods to the ISO in 2007. After a two-year independent peer review process, the method has been adopted by ISO as standard 11053:2009.

The JRC also coordinated the revision of ISO Guide 34 entitled 'General requirements for the competence of reference material producers', and contributed technical expertise to this process. The new guide defines, in detail, which management and technical requirements must be fulfilled to ensure that reference materials are reliable and trustworthy. It serves as a benchmark for refer-



The chemical composition and physical properties of vegetable fats resemble those of cocoa butter very closely, thus making them extremely difficult to quantify or even detect.

ence material production and has become the main document for the accreditation of reference material producers. The revised ISO Guide 34 was unanimously approved by ISO members and was published on 20 November 2009.

Two analytical methods developed at JRC to determine mycotoxins* in animal feed also became international standards adopted by the European Committee for Standardisation (CEN). Mycotoxins are toxic metabolites that can naturally occur in food and feed, potentially present in about 20% of food products. European legislation therefore sets maximum limits** for mycotoxin content in certain foodstuffs and animal feed to protect consumers. The methods adopted by CEN are 'Determination of deoxynivalenol in animal feed – High Performance Liquid Chromatographic (HPLC) method with immunoaffinity column clean-up' (EN 15791:2009), and 'Determination of zearalenone in animal feed – HPLC method with fluorescence detection and immunoaffinity column clean-up' (EN 15792:2009).

* The work on mycotoxins is specifically designed to support current and future European legislation for mycotoxins, which is based on Council Directive 85/591/EEC and Council Regulation (EEC) No. 315/93.

** In 2003 the JRC validated a method for determination of patulin in baby food at the new maximum level of 10 ng/g set in Commission Regulation (EC) No. 1425/2003.



"The JRC's work on the detection of chocolate fraud helps to safeguard the fine and longstanding tradition in Europe for producing high-quality chocolate."

Proficiency tests to support policy

Following the discovery of contaminated sunflower oil imported from Ukraine in April 2008, the European Commission imposed restrictions* on the import of sunflower oil from Ukraine. The JRC was requested by the EC's Directorate-General for Health and Consumers (DG SANCO) to scrutinise the capabilities of official control laboratories and industrial food laboratories to measure mineral oil in sunflower oil.



The JRC was requested by the EC's Directorate-General for Health and Consumers to scrutinise the capabilities of official control laboratories and industrial food laboratories to measure mineral oil in sunflower oil.

Mineral oil is a by-product of the distillation of petroleum. Food may come into contact with mineral oil, such as lubricants or binding agents, during harvesting, storage, processing or packaging. However, the levels of mineral oil measured in the sunflower oil imported from Ukraine were much higher than those which could be expected from atmospheric or other background sources of contamination.

A total of 55 analytical laboratories from 17 EU Member States plus Switzerland and Ukraine participated in the exercise, and the JRC determined that between 78% and 85% of the laboratories were able to measure satisfactorily, depending on the test material.

DG SANCO also asked the JRC to benchmark the ability of laboratories to measure melamine in food samples, in the wake of the Chinese tainted milk scandal in 2008.** Although the EU does not import milk or other dairy products from China, processed food such as chocolates or biscuits might contain contaminated milk powder.

A total of 31 countries participated in the proficiency test, including Australia, China, India, Japan, New Zealand, the United States of America and 21 of the 27 EU Member States. In summary, 74% of the 114 results for milk powder and 73% of the 112 results for the baking mix were within the acceptable range (defined by common international measurement guidelines). There was some scope for improving the reported measurement uncertainties – around a quarter of the uncertainty values (23% milk powder, 22% baking mix) were underestimated. The study also indicated that, amongst the measurement methods reported, isotope dilution mass spectrometry with a stable isotope labelled melamine was generally the most accurate method.

* Commission Regulation (EC) No. 1151/2009 imposing special conditions governing the import of sunflower oil originating in or consigned from Ukraine due to contamination risks by mineral oil.

** Commission Decision 2008/798/EC imposing special conditions governing the import of products containing milk or milk products originating or consigned from China.



"The correctness of analytical results is imperative for the protection of our fellow citizens."

Reference materials for flame retardants

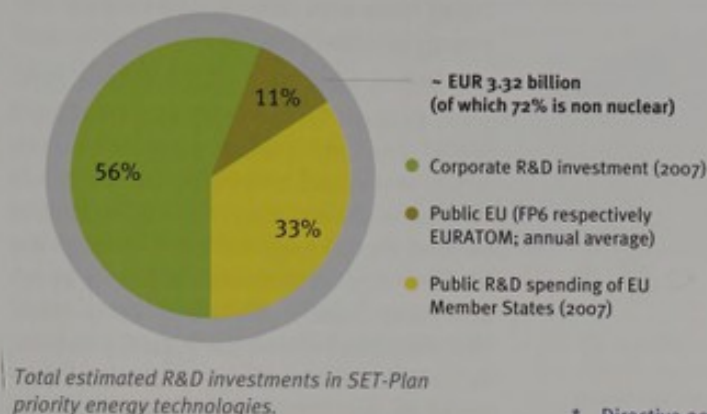
Two new Certified Reference Materials (CRMs) were developed to help analytical laboratories better detect two classes of flame retardants banned under the Restriction of Hazardous Substances (RoHS) Directive.*

Polybrominated flame retardants are used to inhibit or resist the spread of fire, in products like paper, furniture upholstery and electrical and electronic devices. These chemicals can bio-accumulate in blood, breast milk, and fat tissues, and they are reported to impair the development of the nervous system and cause hormonal imbalances.



Certified reference materials were developed to help analytical laboratories better detect two classes of flame retardants banned under the RoHS Directive.

The EU decided to ban the use of two classes of flame retardants, namely polybrominated diphenyl ethers (PBDEs) and polybrominated biphenyls (PBBs) in electric and electronic devices, setting an upper limit of 1 g/kg for the sum of PBBs and PBDEs. The JRC therefore produced the reference materials with all relevant PBDEs and PBBs at levels close to the legal limit. The materials are intended as quality control tools for analytical laboratories, and their use will contribute to an effective implementation of the RoHS Directive.



R&D investment in the priority technologies of the European Strategic Energy Technology Plan

How much additional research is needed to develop technologies that can contribute to the target set by the European climate and energy policies? As a starting point for answering this key question, the JRC mapped current research efforts into low-carbon technologies across the EU.

The JRC Capacities Map found that in 2007, public and private European investors together dedicated EUR 3.3 billion to R&D (Research and Development) on technologies identified as a priority in the EU Strategic Energy Technology (SET) Plan: wind energy, photovoltaics, concentrating solar power (CSP), bioenergy, carbon dioxide capture and storage (CCS), smart grids, nuclear fission, hydrogen and fuel cells and nuclear fusion. Out of this, EUR 2.38 billion was invested in R&D on non-nuclear low-carbon energies, of which EUR 1.66 billion came from the private sector. R&D expenditure on nuclear energy technologies reached EUR 940 million and was almost equally split between reactor-related fission and fusion research.

A novel bottom-up approach to estimate corporate R&D investments was developed as part of this work, combining data on overall R&D investments of individual companies with information on patents and R&D personnel. The results of this research contributed to the impact assessment of an EC Communication** and are published as a Staff Working Paper (SEC(2009)1296) and JRC Reference Report (EUR 23944).

* Directive 2002/95/EC of the European Parliament and of the Council on the restriction use of certain hazardous substances in electrical and electronic equipment.

** COM(2009) 519 final on investing in the development of low-carbon technologies.



Thomas Linsinger

"Imported goods must also conform to European standards and reliable measurements are needed to check compliance. JRC scientists produce certified reference materials to check the reliability of results and to improve measurement methods worldwide, to ensure that all goods sold in Europe conform to European laws."



Tobias Wiesenthal

"Bringing together the expertise from various units across the JRC and closely collaborating with the clients was crucial for supporting the policy process at the right moment."

Doing more with less – support for EU energy efficiency policies

The JRC is providing scientific and technical support to the Covenant of Mayors (CoM). The CoM is a European initiative by which towns and cities voluntarily commit themselves to reducing their CO₂ emissions beyond the EU target of 20%, through the implementation of Sustainable Energy Action Plans (SEAPs). More than 1 000 towns and cities have joined the initiative to date. In 2009 an extensive guidebook, a SEAP template, was finalised and a technical help desk service for the towns and cities committing to the CoM was initiated.



Covenant of Mayors logo.

cific equipment and technologies (lighting, domestic appliances, electric motors, etc.) and the impact of past, present and future energy efficiency policies. The monitoring report is published every two years and it correlates variations in energy consumption with improvements in energy efficiency, and other factors such as gross domestic product (GDP) growth, number of households, and climatic conditions. As part of this research, a detailed analysis on residential lighting consumption was carried out, which contributed to the Eco-Design Regulation* that in 2009 started the phase-out of the light bulbs.

The JRC also supports the Energy Service Directive** through the evaluation of the Member States' National Energy Efficiency Action Plans. The JRC assessment was adopted as a Commission Staff Working Paper in 2009. Additional JRC studies will be used as input to the new Commission Energy efficiency Action Plan (foreseen for 2010) and for the possible revision of the Energy Efficiency and Energy Service Directive.



Improving the efficiency with which energy is consumed by end-users is a central theme of Energy Policy within the EU.

The JRC monitors and analyses the electricity consumption in different final end-uses and the progress in energy efficiency due to policies and technological development. This analysis is needed to assess the remaining energy efficiency potential of spe-

* Commission Regulation (EC) No. 244/2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for non-directional household lamps.

** Directive 2006/32/EC of the European Parliament and of the Council on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC.



Paolo Bertoldi

"The JRC's work on energy efficiency, especially the input to 'Codes of Conduct', has a direct effect on citizens' lives and helps in reducing energy costs for companies, while bringing significant contribution to the global fight against climate change."



The JRC's analysis on residential lighting contributed to the phase out of incandescent lighting.

Support to the Russian Federation in securing nuclear material

The international community recognises the importance of nuclear safety and security in the Commonwealth of Independent States (CIS). Upon request of the Member States, in 1992 the European Commission established a Technological Cooperation programme with CIS countries (TACIS). Under this programme, several tasks were identified where the Russian Federation and the European Union are today collaborating in securing nuclear material, improving Nuclear Material Accountancy and Control (NMAC), strengthening the non-proliferation regime and countering threats related to illicit trafficking of nuclear and radioactive material and other terrorist acts in the Russian Federation.* In accordance with its mission and its long-standing competencies in the field, the JRC was entrusted with the implementation of the corresponding projects. The latest achievement was the enhancement and modernisation of NMAC at the Mayak RT-1 reprocessing plant, the success of which was acknowledged by the Joint Steering Committee on Safeguards between ROSATOM (State Atomic Energy Corporation of Russian Federation) and JRC.



In the framework of the TACIS project, the nuclear material accountancy measurement system at the RT-1 reprocessing facility in Mayak (Russia) was upgraded. The picture shows a Hybrid K-Edge instrument with sample changer, suitable for measuring the U and Pu concentration in spent fuel solutions. The instrument is installed in a hot cell.



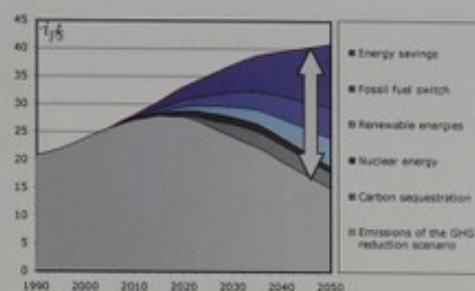
A view inside the hot cell, showing the sample changer which takes the spent fuel samples to the measurement point.

The road to Copenhagen: 'Economic Assessment of Post-2012 Global Climate Policies'

The report 'Economic Assessment of Post-2012 Global Climate Policies' presented in detail the economic estimations upon which Commission Communications in Copenhagen** were based. By 2020, annual costs in energy and industrial sectors would be EUR 150 billion, with additional costs of about EUR 25 billion that would be borne by land-use related sectors, amounting to a total cost of EUR 175 billion.

The report gave an estimate of some EUR 666 billion to the global cumulative cost of mitigation policies, which aim to reduce the effects of climate change by curbing greenhouse gas emissions, for the eight-year period following the Kyoto protocol (2013-20). The JRC's estimations mean that most countries would face costs ranging from 0.4% to 1.2% of their respective gross domestic product (GDP).

The report also highlighted the strategic importance of technology deployment and flexible policy instruments as contributors to emission reduction targets. The energy sector is pivotal for climate policies and the report gives evidence of the crucial importance of energy efficiency improvements in achieving the overall emission reduction targets. For the period 2020-30, energy-saving measures can account for 50% of the necessary emission reductions. In developing countries the contribution of these measures to the reduction has an even higher share of up to two thirds.



The greenhouse gas reduction scenario includes energy efficiency and dedicated climate change policies aiming at global emission reductions of 25% by 2050 compared to 1990 levels.

* Council Regulation (EC, EURATOM) No. 99/2000 concerning the provision of assistance to the Partner States in eastern Europe and central Asia and the subsequent regulation (EC) No. 1638/2006 of the European Parliament and of the Council laying down general provisions establishing a European Neighbourhood and Partnership Instrument.

** COM(2009) 39 final: Towards a comprehensive climate change agreement in Copenhagen. COM(2009) 475/3: Stepping up international climate finance: a European blueprint for the Copenhagen deal.



Jean Galy

"The JRC is transferring significant knowledge and experience to CIS countries to achieve the successful implementation of measures to combat illicit trafficking of radioactive and nuclear material."



Peter Russ

"The JRC provides important economic analysis and impact assessments as an input for European climate policy making."



JRC-IHCP Director Elke Anklaam (first row, second from right) signed the Memorandum of Cooperation between the leading international bodies validating alternative test methods.

Alternative testing and ECVAM

The JRC's European Centre for the Validation of Alternative Methods (ECVAM) developed and validated *in vitro* methods for detecting skin and eye irritants. The adoption of two OECD (Organisation for Economic Cooperation and Development) test guidelines for identifying corrosive and severe eye irritants marks the final step in the regulatory acceptance process at international level of two alternative tests. The regulatory acceptance of two ECVAM-validated methods within one year was possible due to the cooperation with its US sister organisation ICCVAM (Interagency Coordination Committee on the Validation of Alternative Methods). There was also progress towards adoption of a test guideline for an *in vitro* method to identify skin irritants, already implemented in EU test-method regulation.*

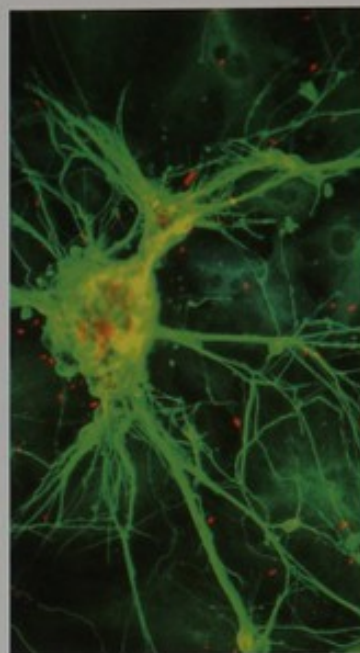
* Council Regulation (EC) No. 440/2008 on test methods pursuant to Regulation (EC) No. 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

** Council Directive 86/609 (EEC) on the protection of laboratory animals.



Sharon Munn

"This international agreement has two major objectives: reducing animal testing, whilst ensuring consumer safety."



Testing on human neurons (derived from NT2 cell line) as an alternative to animal testing. The European Centre for the Validation of Alternative Methods (ECVAM) coordinates the validation of alternative test methods at the EU level and performs research on the development of advanced testing methods. The tests are performed on *in vitro* models.

ECVAM also intensified collaboration with many different industrial sectors and with the leading international bodies tasked with the validation of alternative test methods.** ECVAM, together with its equivalents in the US (ICCVAM), Japan (JACVAM – Japanese Center for the Validation of Alternative Methods) and Canada's Environmental Health Science and Research Bureau, signed a Memorandum of Cooperation (ICATM – International Cooperation on Alternative Test Methods), in order to give more impetus to the worldwide availability of alternatives to animal test methods that are at least as good as existing methods.

Policy evaluation

Sustainable Agriculture and Soil Conservation (SoCo)

In 2009, the JRC launched the final report of the SoCo project carried out by the JRC in collaboration with scientific institutes from several Member States. It is based on a comprehensive review of the risk of soil degradation processes most closely linked to agriculture, of soil-friendly farming practices, and of existing policy measures* available at EU national and regional levels. This was complemented by 10 case studies analysing the links between these three elements in greater detail.



Soil conservation by using reduced tillage.

The SoCo project has shown that the existing range of policy measures such as cross-compliance, rural development instruments and support/advice mechanisms are adequate for addressing soil degradation in Europe. However, their effectiveness concerning soil conservation could be significantly increased if soil quality levels were clearly defined and if policy measures were more targeted towards soil conservation. Results also suggested that more advice and support should be provided to farmers. A stronger commitment to monitoring the relevant indicators is needed in view of strengthening the knowledge base for policy making, and ultimately responding to society's needs.

Together with the final report, the SoCo team developed a series of fact sheets in 22 EU languages summarising the core project findings for farming advisers:
soco.jrc.ec.europa.eu

JRC assists UN FAO's global forest monitoring

In 2009, JRC supported the UN Food & Agriculture Organisation's (FAO)** Global Forest Resources Assessment (FRA). Being a main partner and co-publisher of FAO's FRA 2010 Remote Sensing Survey, JRC scientists collaborated with remote sensing and forestry experts from Tropical and European countries, including largely-forested ones like Brazil, Democratic Republic of the Congo, Indonesia and Russia. The main results in 2009 were:

- producing tree-cover maps for hundreds of sample sites regarding large regions in the tropics, e.g. approximately 700 sites in Brazil, 1 200 sites in central Africa (in collaboration with the University of Louvain), and 300 sites in insular Southeast Asia;
- organising the first workshops in Brazil, central and eastern Africa, and in Italy (JRC Ispra) for experts from South America, Africa, insular Southeast Asia and Europe. This was done in order to train them on the methods for the validation of the initial tree cover maps, developed at the JRC;
- the first results on Forest Cover Change (1990-2005) for the central African region were presented during COP15 (the fifteenth United Nations Climate Change Conference) in Copenhagen during a side-event coorganised by the JRC in the EU Pavilion.



Tropical forest in Bolivia
 (© F. Achard, April 2007).

* Council Regulation (EC) No. 73/2009 establishing common rules for direct support schemes for farmers under the Common Agricultural Policy and establishing certain support schemes for farmers.

** Memorandum of Understanding between the Food and Agriculture Organization (FAO) of the United Nations and the Commission of the European Communities 'Concerning the establishment of a Strategic Partnership between the FAO and the Commission of the EC in the field of development and humanitarian affairs'.



Stephan Hubertus Gay

"A stronger commitment to monitoring of relevant indicators is needed in view of strengthening the knowledge base for policy making, and ultimately responding to society's needs."



Frédéric Achard

"Working with FAO for the Global Forest Resources Assessment 2010 is important and challenging for the JRC. It is expected to be the most comprehensive assessment ever made at global level."

HIGHLIGHTS FROM THE JRC INSTITUTES 2009



JRC Ispra (19 June 2009)

"We thank the JRC most sincerely for this opportunity to visit the centre. It has indeed helped us to appreciate the linkage between the JRC, the EC and the African, Caribbean and Pacific Group of States (ACP). We look forward to further collaboration in the future."

JOHN KAPUTIN, *ACP Secretary General*



JRC Ispra (4-5 May 2009)

"My first, and overdue, visit to Ispra. As expected, I am greatly impressed – the range and quality of work, the willing, friendly and professional approach of the staff, and the wonderful campus. I expect to return to this source often in the future."

PATRICK CUNNINGHAM,
Chief Scientific Adviser to the Irish Government

JRC Ispra (4-5 May 2009)

"I had the privilege to visit and to participate in intense debates on the JRC site in Italy. I'm amazed and admire the excellent work made by the various teams there. I wish this visit will have an impact for the European Union and African Union relationship."

COMMISSIONER JEAN-PIERRE ONVEHOUN EZIN,
African Union Commission

At the opening ceremony for the Swedish semester in Ispra
(2 July 2009)

"Thank you for a well organised, educating and very interesting day at the JRC, Ispra. The work you do here is extremely important for Europe as well as for Member States. I look forward to intensified contacts between Sweden and the JRC."

PETER HONETH, *Swedish State Secretary for Research
(deputy Minister of Education)*





JRC Institute for Reference Materials and Measurements (JRC-IRMM)



Certified Reference Materials (CRMs) are required for the quality control of GMO measurements carried out by GMO testing laboratories.

Reference materials

The JRC-IRMM released a new reference material certified for C-Reactive Protein (CRP), which is a very sensitive marker of inflammation and tissue damage. CRP is frequently used to diagnose bacterial and viral infections, to assess disease activity in inflammatory conditions like rheumatoid arthritis, and to determine long-term risk of cardiovascular disease and heart attacks, making it one of the most important analytes in clinical chemistry.

The reference material, ERM-DA472/IFCC, is the successor of the ERM-DA470 which was used worldwide as the standard for CRP. After the release of ERM-DA470, manufacturers of medical devices (IVD) began referencing their calibrants and controls to that material, and the measurement discrepancy between laboratories became substantially lower. The new material will ensure continuity in the standardisation of CRP, which is crucial in clinical chemistry.

The reference material is intended to be used to assign values to calibrators that are an integral part of *in vitro* diagnostic medical devices (IVD). The EU Directive on *in vitro* diagnostic medical devices (IVD-MD) (Directive 98/79/EC) requires traceability of calibrants and control materials to reference measurement procedures and/or reference materials of higher order. The International Federation of Clinical Chemistry (IFCC), which actively supports standardisation in clinical chemistry, has collaborated with the JRC-IRMM on the development of ERM-DA472/IFCC.

The JRC-IRMM also released a series of new GMO (Genetically Modified Organism) matrix reference materials for the GM event GHB119 cotton (ERM-BF428) consisting of three different mass fractions levels of GHB119 cotton seeds. This genetically modified cotton carries an insect resistance and glyphosate ammonium herbicide tolerance. Moreover, four new Certified Reference Materials (CRMs) with different concentrations of 98140 maize (ERM-BF427) were released by the JRC-IRMM in 2009. The GM 98140 maize was engineered to express two new genes that confer tolerance to the

glyphosate herbicide and to acetolactate synthase-inhibiting herbicides. Legislation in the European Union requires labelling of food and feed products containing more than 0.9% GMOs, provided the GMO has been authorised in Europe. Consequently, CRMs are required for the quality control of GMO measurements carried out by GMO testing laboratories.

In 2009, the JRC-IRMM also initiated and hosted the first global gathering of institutes producing chemical reference materials in Geel. During the meeting, metrology institutes from Australia, Canada, China, Germany, Japan, South Africa, South Korea, the United Kingdom and the USA agreed to set up a global consortium with the JRC-IRMM for exchanging early-stage information on their development programmes. The participants also laid the groundwork for further scientific and technological co-operation.

International Measurement Evaluation Programme (IMEP)

Upon request of European Accreditation (EA), the JRC-IRMM carried out a study of the competence of testing laboratories in measuring eight heavy metals whose safety limits are set out by the Toy Safety Directive (88/378/EEC) and specified in the harmonised European Standard EN71-3:1994. The EU's Toy Safety Directive aims at protecting children from harmful substances in toys, as well as harmonising standards to enable the free movement of toy products.



The JRC-IRMM carried out a study of the competence of testing laboratories in measuring eight heavy metals whose safety limits are set out by the Toy Safety Directive, 88/378/EEC (© Radius Images).

The exercise enabled laboratories performing tests on toy products to monitor their performance and to compare with other laboratories from Europe and abroad. The study raised concerns about how the participants would interpret their results to approve or reject a toy product for the market. In about a third of the cases, participants were interpreting their own measurement data incorrectly either by erroneously accepting a value or by rejecting it unnecessarily/unreliably.

The JRC-IRMM carried out two other IMEP campaigns in 2009: one on the analysis of total Cd, Pb and As and extractable Cd and Pb in mineral feed, and the other on the determination of total Cd, Pb, As and Hg in food supplements.

Pre-accession assistance in metrology

A new three-year project was launched in 2009 under the stewardship of the JRC-IRMM, which will bring together European and Turkish experts in measurement science. The project is funded by the European Union under the Instrument for Pre-Accession Assistance (IPA), and it aims at providing Turkey's citizens with an increased quality of life through an enhanced measurement infrastructure in areas such as environment, health, food safety and consumer protection. A well-functioning measurement infrastructure is also necessary for the adoption of the body of European laws known as the *acquis communautaire*, thus supporting the accession of Turkey to the EU.

Through the project, the JRC-IRMM will provide consultancy, training and support to the highest metrological institutes of Turkey, i.e. the National Metrology Institute (TÜBİTAK-UME) and to the Sarayköy and Çekmece Nuclear Research and Training Centers (SANAEM and ÇNAEM) of the Turkish Atomic Energy Authority (TAEK). The JRC-IRMM will also provide training in the field of chemical and ionising radiation metrology to laboratories and universities, in order for them to optimise the use of services they obtain from the National Metrology Institute, and to help them incorporate metrology-related subjects into educational curricula.

Nuclear data

In 2009, the refurbished Geel Electron Linear Accelerator facility (GELINA) was officially inaugurated by the JRC Director-General, Roland Schenkel. The inauguration marked the completion of a series of improvements made over several years. GELINA is now equipped with modern state-of-the-art systems adapted to the high demands of present-day neutron data experiments, offering significant operational advantages such as increased throughput of neutron data measurements and more precise measurements.



JRC Director-General, Roland Schenkel, inspects a control panel of the refurbished linear accelerator during its inauguration, 12 October 2009.

The European project EUFRAT (European Facility for Innovative Reactor and Transmutation Neutron Data) which enables external researchers to access the JRC-IRMM's accelerators, held its second meeting of the programme advisory committee in November 2009. Ten new experiments were allocated beam time at the JRC-IRMM's accelerators, bringing the total number of approved projects to 17.

Also in 2009, a new collaboration agreement between JRC-EURATOM (The European Atomic Energy Community) and the 'Institut National de Physique Nucléaire et de Physique des Particules' was signed, covering common interests such as the improved understanding of neutron emission reactions and the fission process as well as developments in experimentation, sample fabrication and characterisation.



"Recent food scares and disputes over the import of genetically modified products have highlighted the importance of having a well-functioning measurement infrastructure in Europe and worldwide. The JRC-IRMM is providing the best tools for the job, from certified reference materials to internationally accepted measurement methods."

Krzysztof Maruszewski, Director JRC-IRMM



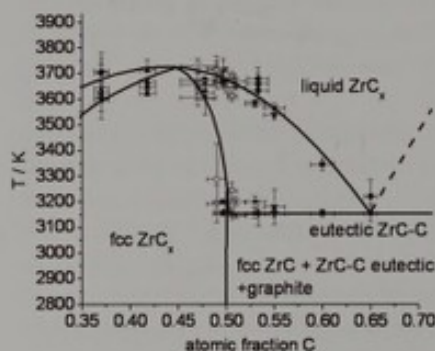
The JRC-IRMM is providing measurement expertise to laboratories and universities in Turkey, under the Instrument for Pre-Accession Assistance.

JRC Institute for Transuranium Elements (JRC-ITU)



High-temperature phase equilibria of zirconium carbides studied by laser heating

One of the challenges for the next generation of nuclear reactors, Generation IV, will be high-quality nuclear fuel. The high-temperature ($1500 \text{ K} \leq T \leq 4000 \text{ K}$) phase equilibria in the zirconium carbide system (ZrC) have been studied by laser heating. ZrC is a high-melting refractory material displaying high mechanical strength and good chemical stability up to high temperatures. Its very low permeability to CO_2 and to some fission products, as well as its low-neutron absorption cross section, makes this carbide a good candidate as a coating material for TRISO (tri-structural isotropic) nuclear fuel in high-temperature Generation IV reactors.



ZrC high-temperature phase diagram with the new data points measured in this work. Different symbols correspond to different heat treatments.



The new Küfa device, a furnace in which certain off-normal conditions can be simulated, installed in the JRC-ITU Hot Cells unit.

property of being inherently safe in certain hypothetical accident conditions due to its unique fuel packaging. To provide robust data for reactor design and licensing, the performance of VHTR fuel elements must be tested experimentally. In 2009, within the European 6th Framework Programme's (FP6) integrated project RAPHAEL (Reactor for Process Heat, Hydrogen and Electricity Generation), tests on a fuel pebble irradiated by the JRC-IE in Petten were carried out in the new Küfa (from German 'Kühlfingerapparatur') device. This furnace, in which certain off-normal conditions can be simulated, is a unique facility worldwide for accident testing of irradiated VHTR fuel elements. Several new tools for the characterisation of VHTR fuel are currently being developed at the JRC-ITU to further extend capabilities toward more extreme accident scenarios.

Training courses for new users of the TRANSURANUS Code

The TRANSURANUS fuel performance code, developed at the JRC-ITU, is a computer program for predicting and simulating the thermo-mechanical behaviour of nuclear fuel rods during their irradiation in a nuclear reactor. It is a key instrument for fuel performance modelling that is used by various research centres, universities, nuclear safety authorities and industrial partners in the EU. In 2009, the JRC-ITU organised two training courses for new users from German and Swedish industry as well as from safety authorities in the Ukraine, with finan-



TEM micrograph of a molten/refrozen $\text{ZrC}_{1.5}$ slice obtained by Fast Ion Beam (FIB), showing fcc ZrC grains and ZrC-C eutectic lamellae.

The study of phase equilibria at very high temperature shows the formation of an eutectic lamellar structure around 3200 K for compositions of $\text{C/Zr} > 1$. The outcome of this investigation provides fundamental information on refractory ceramics and allows determining the zirconium carbide characteristics in view of its possible applications under extreme conditions, such as nuclear fuel coating.

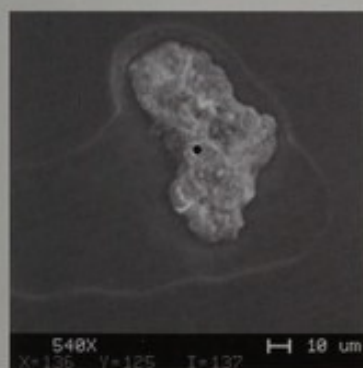
Development and application of tools for accident simulations of VHTR fuel

Euratom is engaged in an extensive R&D programme into novel nuclear reactors within the Generation IV International Forum (GIF). One of the six reactor types studied is the Very-High-Temperature Reactor (VHTR), which features the remarkable

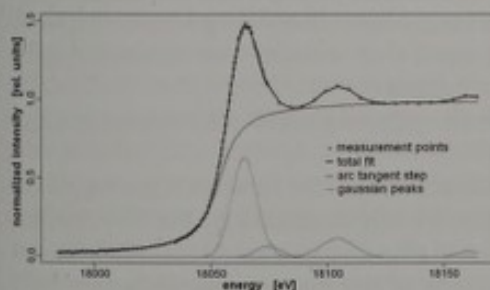
cial support from the International Atomic Energy Agency (IAEA). The main objectives of these courses were to enable the users to install the source code of the TRANSURANUS package on the appropriate platform, to create an input file and extract and visualise the main output parameters as well as to implement new model parameters in the source code, in order to fully and correctly use the potential of the code to verify the compliance with safety and design criteria provided by the IAEA.

Fast method for μ -XANES mapping of environmental particles

Radioactive particles are now understood to be more widespread in the environment than previously assumed, leading to new challenges in the fields of radioecology, risk assessment and dose assessment. Interactions of such particles with the environment are strongly influenced by their physical nature, composition and physico-chemical properties. The dose committed following the intake of a particle by a human being will depend on the *in vivo* dissolution behaviour determined by its chemical composition.



Hot particle from nuclear weapons tests.



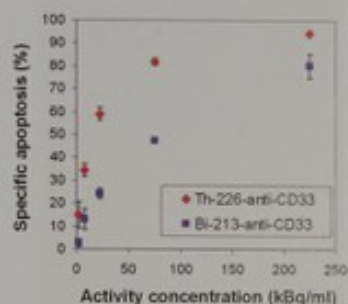
XANES spectrum obtained from a PuO_2 sample.

To determine this chemical behaviour, a method using X-ray Absorption Near Edge Structure (XANES) analysis with the synchrotron micro-beam at HASYLAB (Hamburg, Germany) was developed for fast mapping of the oxidation state of plutonium

in environmental particles on micrometer scale by applying an improved fit method for the Pu L_{III} absorption edge. This method was used to analyse a plutonium particle from the nuclear weapons tests site at the Marshall Islands and confirmed the presence of the less soluble +4 oxidation state of the particle.

Alpha-immunotherapy study receives EANM Eckert & Ziegler Award 2009

Two alpha emitters used for targeted alpha immunotherapy (^{226}Th - and ^{213}Bi -labelled radioconjugates) were compared by *in vitro* and *in vivo* experiments. The *in vitro* study showed that both alpha emitters can overcome resistance to beta- and gamma radiation and chemotherapy in leukemia cells. However, it was found that the novel alpha cascade emitter ^{226}Th was more efficient in cell kill than the single alpha emitter ^{213}Bi . In an animal model, the efficacy of ^{226}Th and ^{213}Bi for the treatment of bladder cancer was compared. The *in vivo* results also demonstrated a superior therapeutic efficacy of ^{226}Th . This work received the Eckert & Ziegler Award 2009 of the European Association of Nuclear Medicine (EANM) at its annual meeting in Barcelona.



Induction of apoptosis (programmed cell death) in leukemia cells after incubation with radiolabelled antibodies. At all activity concentrations, ^{226}Th induced cell death more efficiently than ^{213}Bi .

New Karlsruhe Nuclide 'Carpet' for International Year of Astronomy

A special giant version of the Karlsruhe Nuclide Chart, a sort of extended periodic table of the elements that displays all known atoms of any element and their radioactive data edited by the JRC-ITU, was designed to be displayed at the International Year of Astronomy 2009 exhibition in November in Paris. The 'floor chart' was presented to the public in an exhibition dedicated to astrophysics and nucleo-synthesis in the stars – 2009 being the International Year of Astronomy.



The Karlsruhe Nuclide 'Carpet' (approximate dimensions 1.3m x 8m) on display at the International Year of Astronomy 2009 exhibition in Paris.



"The JRC-ITU's primary focus is on nuclear safety and security research underpinned by basic science. Addressing key issues of 21st century nuclear energy systems is very challenging and inspiring."

Thomas Fanghänel, Director JRC-ITU

JRC Institute for Energy (JRC-IE)



2009 was a year in which the fruits of reorganisation and expansion to better meet customer demands for developing a sustainable European Energy policy were reaped. Several Memoranda of Understanding (MoUs) were signed with key Directorates-General, and there were many requests for support in both the nuclear and non-nuclear domains.

Examples include SETIS (Strategic Energy Technology Information System) activities where the JRC, in collaboration with all relevant stakeholders, estimated the financing gap which needs to be bridged in order to bring the SET-Plan prioritised low carbon energy technologies to market by 2020. Another example is the energy efficiency work which expanded to include support to the Covenant of Mayors initiatives (refer to page 20).

Other specific highlights from 2009 included:

The European Solar Test Installation (ESTI) – Testing demonstrates increased lifetime of solar panels

The European Solar Test Installation (ESTI) subjects photovoltaic (PV) panels to accelerated ageing through extremes of heat, cold and humidity and has been running long-term outdoor tests under natural conditions since the 1980s. Results published in 2009 confirm that more than 90% of existing solar photovoltaic panels last for 30 years, instead of the predicted 20 years, albeit with a slight drop in performance. Taking this into account effectively reduces the lifetime cost and helps bring photovoltaics closer to grid parity. As a European reference laboratory on the assessment of electrical performance for photovoltaic devices, ESTI promotes the development of a fair and transparent EU market for PV and is part of the system for assessing progress achievement towards the EU's 2020 targets for renewable energy. The laboratory has experience with a large variety of PV technologies and its R&D focuses on emerging techniques, in particular thin-film and multi-junction concentrator systems.



Solar panel testing at the European Solar Test Installation.



Annual Clearinghouse meeting, at the JRC-IE, Petten.

European Clearinghouse on Operational Experience Feedback for Nuclear Power Plants (NPP)

Nuclear Power Plant (NPP) operational experience has been used for many years to improve the safety of nuclear facilities throughout the world. To support EU activities on evaluation of NPP operational events, a centralised 'clearinghouse' on NPP operational experience feedback was established in 2008 in the JRC at the request of nuclear safety authorities of several Member States.

In 2009, the European Clearinghouse was recognised in international fora and three new member countries joined the clearinghouse network as observers (the Czech Republic, France and Spain). Furthermore, a close cooperation with the European Technical Support Organisations was initiated, in particular with the 'Institut de Radioprotection et de Sûreté Nucléaire' (IRSN) and 'Gesellschaft für Anlagen- und Reaktorsicherheit' (GRS). In-depth analyses of specific families of NPP operational events were performed, covering maintenance, fuel damage and events related to the construction and commissioning. In order to enhance communication and dissemination between the Clearinghouse members, a dedicated website and database were launched:

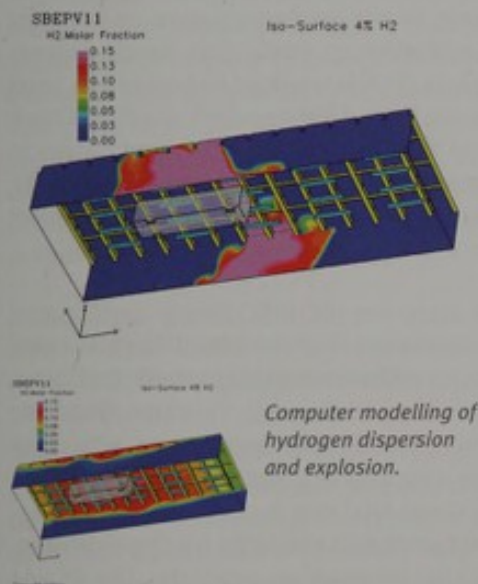
<https://clearinghouse-oef.jrc.ec.europa.eu/>

The activities of the European Clearinghouse are strongly supported by the Directorate-General for Energy and Transport (DG TREN)¹ as one of the means towards further harmonisation of nuclear safety practices in the European Union.

¹ From 17 February 2010, DG TREN has been split into DG Mobility and Transport (DG MOVE) and DG Energy (DG ENER).

Hydrogen and fuel cells

The year 2009 marked the effective start of the Joint Technology Initiative on Fuel Cells and Hydrogen (FCH-JTI), the first EU-level public-private partnership in the energy area, to which JRC contributes in three ways. Firstly, its institutional work programme on hydrogen and fuel cells contributes directly to that of the JTI. Secondly, JRC facilities will act as an independent reference laboratory for assessing technology performance improvements achieved within future JTI projects. Thirdly, the JRC contributes to JTI strategy formulation and implementation. In 2009 this included contributions to the Multiannual and 2009 Annual Implementation Plan and associated calls for projects, providing impartial S&T support to the JTI Governing Board and Scientific Committee, and advising on international programmes.



Computer modelling of hydrogen dispersion and explosion.

Within the institutional programme, the high pressure gas storage facility has been upgraded to allow fast filling of tanks up to 70 MPa. An auto-thermal reformer for hydrogen production has also been commissioned. Research on solid-state storage has identified new intermediate reaction products which enabled the provision of key information to explain different hydrogen uptake stages and kinetics. Two first-ever worldwide inter-laboratory exercises on solid-state storage were organised and evaluated by the JRC. A second global inter-laboratory programme on fuel-cell stack testing is ongoing. The draft ISO Standard for sensor response time testing was modified based on JRC experimental input. Basic R&D on fuel-cell catalysts identified ways to reduce catalyst loading and

therefore the cost of fuel cells. A number of numerical simulations on hydrogen dispersion and explosion were successfully benchmarked against experimental data.

Materials of performance assessment for innovative reactor systems

To focus JRC-IE's structural materials research towards next generation nuclear fission (Generation IV) applications, a new Materials Performance Assessment for Innovative Reactor Systems (MATTINO) project was set up in 2009. To this end, the materials testing laboratories have been adapted to the specific advanced testing needs such as extended temperature and pressure ranges and miniaturised environmental testing. This work will address the needs of Generation IV materials performance assessment. The research topics will be cross-cutting in nature, such as pre-normative R&D leading to harmonised testing procedures and materials data management in cooperation with standardisation bodies, or addressing system-specific issues, which depend on the new coolant environments of the various Generation IV systems. In 2009, materials-testing was performed for the European High Performance Light Water Reactor (HPLWR) and the High Temperature Reactor (HTR) and its envisaged heat applications process.

The work is linked to the Euratom contribution of the Generation IV International Forum, the Strategic Research Agenda of the European Sustainable Nuclear Energy Technology Platform, various International Atomic Energy Agency (IAEA) coordinated research projects as well as to the emerging Joint Programme on Structural Materials for Innovative Nuclear Systems of the European Energy Research Alliance.

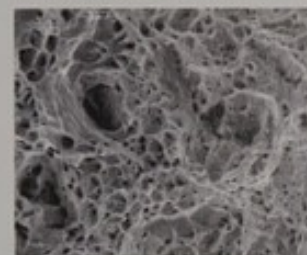


"As Director of the Institute for Energy I am proud to hear from key players in the energy sector that the JRC-IE has now established itself as an essential contributor to the energy policy process."

Giovanni De Santi, Director JRC-IE



Top: Transmission electron microscopy analysis of platinum nano-particles for use in fuel cells. Bottom: Hydrogen Sensor Testing facility.



Evidence of Stress-Corrosion Cracking (SCC) on the fracture surfaces of austenitic stainless steel (316L) samples which have been slow strain-rate tensile tested in supercritical water ($T = 550^{\circ}\text{C}$, $p = 250$ bar, 900 ppb oxygen content); top: ductile dimple fracture morphology after faster straining at $1 \mu\text{m}/\text{min}$, bottom: SCC morphology after straining at $0.15 \mu\text{m}/\text{min}$. SCC results in a significant loss in elongation to fracture.

JRC Institute for the Protection and Security of the Citizen (JRC-IPSC)



Ispra, Italy

The mission of the JRC-IPSC is to provide research results and to support EU policy makers in their effort towards global security and towards protection of European citizens from accidents, deliberate attacks, fraud and illegal actions against EU policies.



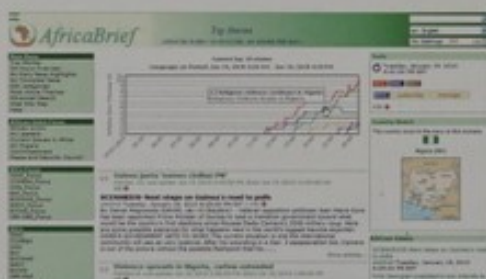
Satellite based flood extent mapping (left) allows the identification of the most affected communes (middle). In combination with population data (right), this allows the prioritisation of needs for recovery planning and reconstruction (map source Joint EC, UN and World Bank PDNA mission in collaboration with Government of Senegal, following heavy flooding during October - November 2009).

Implementation of the African Union's (AU) Continental Early Warning System (CEWS)

The aim of the African Union's (AU) Continental Early Warning System (CEWS) is to facilitate the anticipation and prevention of conflicts in Africa.

In the framework of the Africa-EU Joint Strategy, the JRC-IPSC, with the support of the Instrument for Stability, has been contributing to the operationalisation of the AU's CEWS since 2007 by means of:

- customisation of the JRC's open source information monitoring and analysis applications, its moderation system, and its crisis information management portal modules, in order to establish the Africa Media Monitor and the AU Crisis Management portal;
- capacity building and training of the AU Situation Room staff through short-term secondments and hands-on training in technical workshops.



Screenshot of the Africa-centred media monitoring application AfricaBrief, part of the AU Continental Early Warning System (CEWS), displaying the largest current news clusters published around the world, and their development over time (centre).

In 2009, the German 'Gesellschaft für Technische Zusammenarbeit' (GTZ) carried out a mapping and evaluation exercise to optimise the development of the AU's CEWS, to ensure continued and targeted funding, and to detect current strengths and weaknesses. The GTZ report concludes that the JRC-supported 'automated data collection and reporting' functionality is more advanced than any of the other components, and that it is in daily use at

the African Union (AU). The report stresses the need for continued partnership between the JRC-IPSC and the AU, beyond the current agreements ending in 2010.

Joint EC-UN-World Bank Framework for Post-Crises Needs Assessments (PCNAs)

The JRC-IPSC, with the support of the Instrument for Stability, is contributing in several ways to the implementation of the Joint Declaration on Post-Crisis Needs Assessments (PCNAs), signed in September 2008 by the United Nations (UN), the World Bank and the European Commission in order to establish a common framework for multi-stakeholder post-disaster and post-conflict recovery and reconstruction planning.

In 2009 the JRC-IPSC jointly participated with the UN and the World Bank in three major PCNAs missions in El Salvador, Namibia and Senegal. This contributed to the PCNAs findings and reports with satellite data and GIS (Geographic Information System) analyses for detailed damage assessment and statistics for thematic geo-spatial information products. The PCNAs results were presented to the governments of the three affected countries, donor and development partners, including the EC. Moreover, geo-spatial methodologies available at the institute for assessing the impact of disasters and conflicts were integrated in a joint guide aimed at supporting decision makers in the early stages of recovery planning and reconstruction.

Tools for nuclear trade analysis

As a result of the EC Support Task to the International Atomic Energy Agency (IAEA) 'Improving the Analysis of Covert Nuclear Trade', open source databases on world trade are proving to be useful in supporting a range of IAEA safeguards verification tasks. These tasks include the verification of the correctness and completeness of

Member States' declarations, as well as testing of hypotheses on possible undeclared activities by trade analysis.



Overview of the interface of the software demonstrator developed to support the IAEA's verification activities by means of trade analysis.

To further support nuclear trade analysis, a software demonstrator was developed by JRC scientists and installed at the IAEA to facilitate trade analysis by searching documents and handbooks for lists of controlled items (e.g. single or dual-use items) and providing correspondence tables between controlled items and Harmonised System codes, the latter being needed to retrieve data from open source trade databases. The demonstrator is used daily by trade analysts at the IAEA.

New method for measuring Electromagnetic Disturbance (EMD) emitted by electronic cards

The electronic passport, which is in force in the EU since 2006, contains an electronic component which consists of a contactless smartcard (also called a 'proximity card'). Information on the contactless smartcard is read by authorised readers by using a contactless protocol. The Electromagnetic Disturbance (EMD) emitted by contactless smartcards is an unwanted form of load modulation that degenerates the communication between the card and the reading device. The ISO Standard on contactless integrated circuit cards¹ specifies a limit for the EMD level that a proximity integrated circuit card (PICC) is allowed to emit during a time period before it transmits.

In 2009 the JRC-IPSC proposed a new method to measure the EMD level which is based on the use of a high resolution data acquisition system and dedicated analysis software. The JRC method proved to have better performances than a previous method based on a spectrum analyser which is currently pending approval by ISO. As a result,

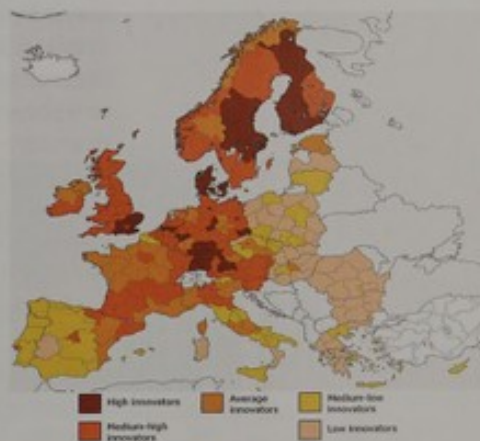
the method proposed by the JRC will be included in the normative EMD test method and the C programming code given as example in an informative annex. This result is a major step forward in developing an international standard for identification cards.

2009 Regional Innovation Scoreboard: diversity across Europe

In December 2009 the JRC-IPSC, together with the Commission's Directorate-General for Enterprise and Industry (DG ENTR) and Maastricht University (MERIT), published the 2009 Regional Innovation Scoreboard (RIS).

The 2009 RIS, based on the European Innovation Scoreboard (EIS) approach and methodology, assesses innovation performances across 201 regions in the EU and Norway. The report shows that the level of innovation in regions varies considerably across almost all EU countries. The Czech Republic, Italy and Spain are the most heterogeneous countries, where innovation performance varies from low to medium-high. The report also shows that the most innovative regions are typically in the most innovative countries, although some regions outperform their country level.

The 2009 RIS marks a significant step forward in measuring regional innovation performance although it also shows that more progress is needed on the availability and quality of innovation data at regional level. The results confirm the value of measuring innovation performance at regional level to complement the national level and emphasise the need for policies to reflect regional contexts.



2009 Regional Innovation Scoreboard: aggregate of indicators per region.



"The JRC-IPSC has strong scientific competences which are constantly deployed to help in shaping EU policies and to quickly react to crises arising at a global scale."

Stephan Lechner, Director JRC-IPSC



Electromagnetic Disturbance (EMD) measurement equipment of the JRC-IPSC ePassport testing lab.

¹ ISO/IEC 14443-2:2007 - Identification cards - Contactless integrated circuit(s) cards - Proximity cards - Part 2: Radio frequency power and signal interface.

JRC Institute for Environment and Sustainability (JRC-IES)

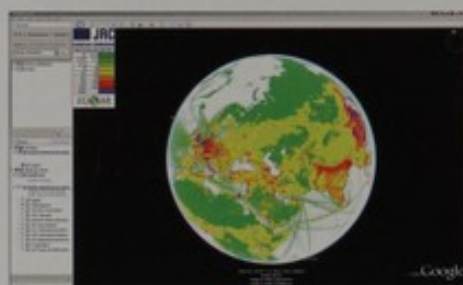


Ispra, Italy

The mission of the JRC-IES is to provide scientific-technical support to the European Union's policies for the protection and sustainable development of the European and global environment.

Greenhouse gases emitted in your area

JRC scientists have made it possible to cruise through and zoom into a map of the global distribution of Greenhouse Gas (GHG) emissions. They overlaid the Emissions Database for Global Research (EDGAR - <http://edgar.jrc.ec.europa.eu>) onto Google Earth®, thus bringing environmental information closer to the general public.



Scalable Digital view of man-made greenhouse gas emissions in Europe, Africa and Asia.

The grid size is 10 km squared and the system uses data from the 'EDGAR v4.0' dataset of the JRC-IES and the Netherlands Environmental Assessment Agency, released in May 2009. By inserting a city name, the system displays the amount of GHG released over that area since 1970. On a large scale, the system shows the evolution of global emissions over time and illustrates how emissions are unevenly distributed over the globe. In large parts of the world, manmade emissions per 100km² are less than 1 kton of CO₂ equivalents per year (e.g. Siberia), while in more densely populated and industrialised countries they are >250 kton per year (e.g. the Netherlands, Japan). EDGAR provides a unique 35-year (1970-2005) history of emissions by area and by sector, covering carbon dioxide (CO₂) and other GHGs such as methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆). The JRC-IES presented the systems at the EU pavilion during the United Nations Climate Change Conference (COP15) in Copenhagen.

How reliably can we measure particles from heavy-duty vehicles?

The goal of the Heavy Duty Inter-Laboratory Correlation Exercise was to demonstrate the practicality, repeatability and reproducibil-

ity of the particle emissions measurement technique proposed by the Particle Measurement Programme (PMP) conducted under the United Nations Economic Commission for Europe (UNECE). A reference engine equipped with a particulate filter was tested at five European laboratories, including the JRC-IES' Vehicle Emissions Laboratory (VELA), to assess inter-laboratory reproducibility. The exercise, completed in October 2009, was coordinated by the JRC-IES and the UK Department of Transport. The JRC-IES also carried out the bookend testing to check the stability of the engine throughout the exercise and was responsible for data collection and analysis.



Work for Particle Measurement Programme at VELA-5.

The PMP Working Group met in December 2009 to approve the final measurement procedure. It enables the introduction in the Euro VI European legislation of a new emission standard limiting the number of particles emitted by engines to a value of 6x10¹¹ particles/kWh (according to the World Harmonized Transient Test Cycle).

US Services adopt JRC's pattern recognition programme

As a result of transatlantic cooperation in the field of environmental mapping, a pattern recognition programme, developed by the JRC-IES, was adopted by US federal agencies. The programme detects geometric features and connectivity in digital images by following a customised sequence of image processing steps, called *Morphological Spatial Pattern Analysis (MSPA)*. The US Forest Service is using the software in the context of a collaboration agreement with the JRC and has documented national forest patterns on the *Eastern Forest Environmental Threat Assessment Center's* website¹. The US Environment Protection Agency applies MSPA for wetland habitat research.

¹ <http://www.forestthreats.org/tools/landcover-maps/mspa>



Analysis of a specific deforestation situation with the JRC's Morphological Spatial Pattern Analysis.

Moreover, MSPA has been deployed in US national protocols (Resources Planning Act²) to improve national forest assessments. The fruitful cooperation between these American institutions and the JRC-IES has resulted in several peer-reviewed scientific papers³. The exclusive use of geometric concepts to identify generic image structures makes MSPA suitable for a vast range of applications. Without manual interaction, the system can reliably detect connecting structures and 'holes' in any digital image. The technology could also be used to identify manufacturing defects, distinguish between healthy and clogged arteries in medical diagnostics, or potentially find impacted water systems in accident-related environmental crises. GoogleEarth[®] image overlays depicting the JRC-IES research results on European and global forest patterns are offered for download⁴.

High nature value farmland – biodiversity as 'public good'

Europe has habitats, generated by agricultural practices over a few millennia of land management, unique in their biodiversity. If these are lost, rehabilitation is – if ever possible – long and extremely difficult. The JRC-IES has been at the forefront in scientifically describing so-called High Nature Value (HNV) farmland, and published a joint study together with the European Environment Agency. It shows that approximately 30% of European farmland is of HNV type, thus favouring biodiversity. Certain types of farming are in fact major benefactors of the variety of life forms within a given ecosystem. Traditional and extensively farmed landscapes can constitute genuine biodiversity 'hotspots'. This is recognised by the EU's rural development policy which has set support for HNV farming and forestry systems as a specific objective. The JRC-IES' approach to map HNV farmland areas in EU-27 feeds into ongoing assessments of EU policies regarding the environment

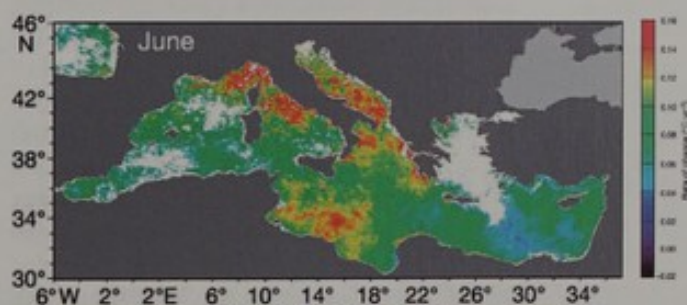
(e.g. biofuels) and the further definition of agri-environmental indicators. Given the relevance of biodiversity-rich grasslands in the HNV context, the JRC-IES work was published in a book ('Identification of high nature value farmland at the EU-27 level on the basis of land cover and biodiversity data'. In: Veen P., Jefferson R., de Smidt J., van der Straaten J. (eds.) *Grasslands in Europe of high nature value*. KNNV Publishing, Zeist, NL. 319 pp.) complemented by the foreword of the then EU Commissioner for Agriculture and Rural Development, Mariann Fischer Boel.



JRC's 2009 mapping of high nature value farmland in Europe.

20 years of sea surface temperature observed in the Mediterranean Sea

In 2009, a paper⁵ was authored which shows changes in the Mediterranean Sea surface temperature over two decades. The trend analysis was made for different periods of the year and different regions, showing a maximum rate of increase of 0.16 degree Kelvin per year during the month of June in the Tyrrhenian, Ligurian and Adriatic Seas, which correspond to a total increase of 3.5 degree Kelvin over the 22-year period of observations. The results have an impact on the understanding of the Mediterranean basin dynamics, facing climate change and climate variability.



Monthly sea surface temperature rate of change over the period of 1985-2006, measured during the months of June.



"In 2009, the JRC-IES took a step towards modelling key environmental issues, aiming at scenario-based analyses. When adding the socio-economic dimension, this will enable the JRC to take the next step: science-based and integrated assessments of policy options – for managing the Earth's resources sustainably."

Leen Hordijk, Director JRC-IES

² <http://www.fs.fed.us/research/rpa/>

³ For example: <http://dx.doi.org/10.1016/j.patrec.2008.10.015>

⁴ <http://forest.jrc.ec.europa.eu/biodiversity/GUIDOS>

⁵ Climate Research, Vol. 39: 11-17, 2009, free access under: http://www.int-res.com/articles/cr_oa/co39p011.pdf

JRC Institute for Health and Consumer Protection (JRC-IHCP)



Ispira, Italy

The mission of the JRC-IHCP is to protect the interests and health of the consumer in the framework of EU legislation on chemicals, food, and consumer products by providing scientific and technical support including risk-benefit assessment and analysis of traceability.

The year 2009 was an important one for the JRC-IHCP, marked by the restructuring of the institute around its core areas of scientific competence. The new structure allows for a more flexible response to changing policy needs via the implementation of horizontal policy support actions that draw on coordinated work between a number of different competences.

As well as its work at the European level, the institute continued to be active at the international level. In particular, the JRC-IHCP contributed to a number of international working groups, including OECD (Organisation for Economic Co-operation and Development) and WHO (World Health Organisation), and in April signed a collaboration agreement with other national alternative methods validation bodies (Canada, Japan and USA).

A major milestone was reached in December when the institute was awarded ISO 9001 certification.

The subheadings below provide a summary of the JRC-IHCP's work over the year in relation to the different policy areas served by the institute.



The Indoortron laboratory measures indoor pollution. In the 30m³ volume walk-in chamber which has controlled temperature, relative humidity, air quality and air exchange rate, the sources of indoor pollution by volatile organic compounds and their impact on our health and comfort are studied.

Health and environment

The JRC-IHCP supported the implementation of the Commission's European Environment and Health Strategy and Action Plan 2004-10 in identifying and quantifying some of the major risks to public health and the environment from exposure to chemicals and physical stressors. Moreover, the collaboration with other JRC institutes played an active role in the global harmonisation of practices and methodologies both to limit and to test the exposure to environmental factors which are harmful to health.

The review of the JRC-INDEX (Indoor Exposure limits in the EU) guidelines for indoor priority chemicals and the contribution to the development of the WHO's health-based indoor air quality guidelines have

been a major achievement in this regard, receiving endorsement from international expert committees.

In December 2009, the JRC-IHCP officially launched the web-based Generic Consumer Exposure Modelling Framework (GEX-FRAME). The modelling framework is an important first step towards harmonising exposure assessment procedures for consumer products applicable to multi-legislative mandates on a global scale. GEX-FRAME allows users of the tool to compare results of various exposure models with different exposure data sets relevant to specific exposure scenarios (e.g. via oral, dermal or respiratory routes).

The JRC-IHCP also published several guidance documents on risk assessment of biocides which are a major source of reference for industry and competent authorities.

Nanotechnology

The JRC-IHCP's current policy issues related to nanotechnology focus very much on safety concerns but also encompass wider issues such as products' quality and innovative use and applications of nanotechnologies. There is a strong need for appropriate testing methodologies and accurate data for risk and safety assessment. In 2009, test protocols for in vitro testing methods regarding endpoints for genotoxicity and carcinogenic potential have been optimised for safety testing of nanomaterials. This was complemented by new methods for studying the interaction of nanoparticles and proteins to gain a better understanding of toxicity mechanisms. The institute also developed a database and information platform on nanomaterials to address and host nano-specific



Nanomaterials from the JRC-IHCP repository.

information and methods. It currently hosts several hundred study entries and complements the repository of nanomaterials for test method development and assessment, containing six types of nanomaterials and several thousands of samples.

Genetically Modified Organisms (GMOs)

The JRC-IHCP's Community Reference Laboratory for Genetically Modified Food and Feed (CRL-GMFF) delivered 11 validated methods for GMO detection over the course of 2009. One of these methods concerned the flax GM event Triffid FP967, which is unauthorised in the EU. This GM event was im-

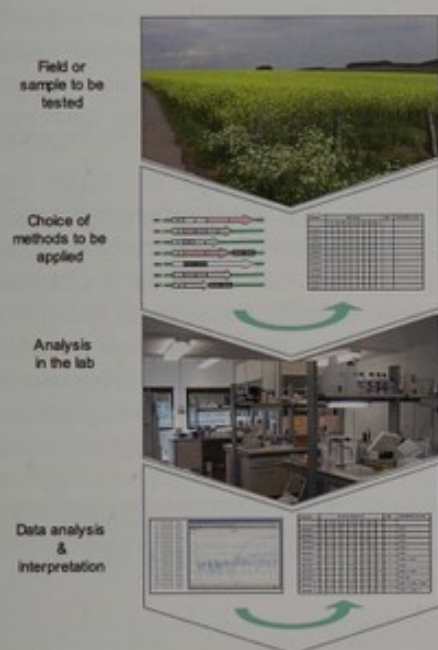
method of detection for the GM event and helped the Canadian authorities to define a sampling plan. CRL-GMFF also developed control samples for distribution to the relevant authorities of the EU Member States.

Consumer products and nutrition

The JRC-IHCP's Community Reference Laboratory for Food Contact Materials (CRL-FCM) issued new guidelines for the testing conditions and methods of food contact materials used for official controls, which have been fundamental towards ensuring proper enforcement of the EU legislation. The CRL also validated methods for the detection of diisononylphthalate in oil and bisphenol A in milk simulant, and performed studies on the presence of benzophenone from inks in paperboard for cakes. The JRC-IHCP's textiles laboratory concluded the characterisation of a new textile fibre, for which the establishment of a new generic name was requested to the European Commission by its manufacturer.

The institute contributed to the modification of the guidelines for the EU's rapid alert system for dangerous consumer products (RAPEX). The Consumer Products and Nutrition team completed two studies, one on exposure to chemicals from consumer goods such as furniture, carpets, textiles, office equipment, automotive interiors, toys, and air fresheners, and the other on innovative methods for safety assessment of cosmetics, laying the ground for novel approaches to consumer risk assessment.

Finally, the institute set up a team of nutritionists with the initial objective of identifying possible issues of concern in relation to the effects of diet on human health.



Sequence of activities in the application of GMO detection methods.

ported from Canada and distributed in the EU where it was used as an ingredient for bread and cereals. The CRL-GMFF worked with the Canadian authorities to verify a



Flax flower. Earlier in 2009 an unauthorised flax GM event entered the EU market. The JRC-IHCP's CRL-GMFF contributed to the verification of the detection method.



In order to evaluate the dermal exposure of consumers, the IHCP textile laboratory finalised EU surveys on the presence of carcinogenic and allergenic dyes in textiles and the chemical release of formaldehyde from leather products.



For 2009 highlights from the European Centre for the Validation of Alternative Methods, please refer to page 22.



"This year's integration of the JRC-IHCP activities has afforded a greater cross-disciplinary scientific approach to its policy support work."

Elke Anklam, Director JRC-IHCP

JRC Institute for Prospective Technological Studies (JRC-IPTS)



Seville, Spain

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

The impact of social computing or Web 2.0 on the EU economy and society

One of the main objectives of the EU 2020 Strategy is to empower people in inclusive societies. For this purpose the deployment of information and communication technologies (ICT) both in the public and the private sectors plays an important role.

In this context, the JRC-IPTS published in 2009 'The Impact of Social Computing (web 2.0) on the EU Information Society and Economy' that brings together multi-sector research findings and highlights the rapid growth of social computing. The report explores the relevance of this growth for policy makers and its policy-related implications in order to reap the benefits and also mitigate the possible risks. It shows that, if well managed, social computing can have an important positive impact on key policy areas such as industry, citizens, identity, social inclusion, education and training, health-care, public health, public governance and democratic participation.



Social Computing tags created with <http://wordle.net>.

In addition, a complementary work entitled 'Public Services 2.0: The Impact of Social Computing on Public Services', looks at the implications of social computing for an evolving public sector, and in relation to relevant government trends and normative policy visions within and across EU Member States on future public services. The report shows that social computing is leading to new forms of ICT-enabled participation, capable of enhancing users' social awareness and involvement.

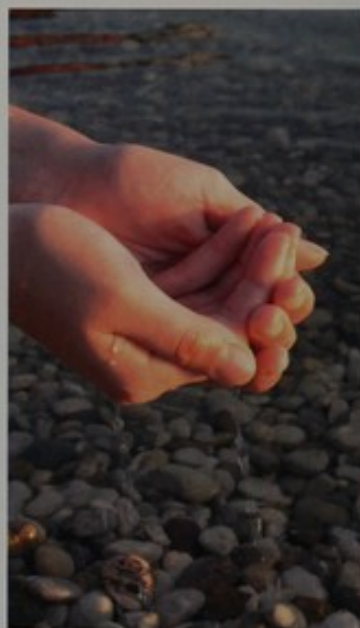
This research is a good example of how the JRC exploratory research activity can deliver results highly appreciated by policy makers. The two reports were presented at the

Ministerial Conference of Malmö in November 2009, where the Swedish Presidency and the European Commission presented a Ministerial Declaration setting out the path for the field of e-government up until 2015.

Facing the future: time for the EU to meet global challenges

What will the world look like in 2025? What are the possible future global challenges? And how can the EU position itself to take an active role in shaping a response to them? In order to achieve the objectives of the EU 2020 Strategy, it is necessary to anticipate future challenges and transform them into opportunities.

The final JRC-IPTS report of the project 'Facing the future: time for the EU to meet global challenges' was carried out for the Bureau of European Policy Advisors (BEPA) of the European Commission and gives possible answers to these questions, linking widely accepted quantified trends in 2025 and beyond with the opinions of experts and policy makers. The findings will support building a vision for the EU in 2020, as proposed by President Barroso in his political guidelines for the new Commission.



One of the main challenges facing both the EU and the world concerns the need to change the ways in which essential natural resources are used.

The study identified three challenges for the EU. The first is the need to implement more transparent and accountable governance structures and processes, capable of adapting to and anticipating the future. The second is to anticipate and adapt to political, cultural, demographic and economic transformations, such as how to provide equal access to healthcare and how to become a real knowledge society. The third challenge facing both the EU and the world concerns the need to change the ways in which essential natural resources are used. The main policy issues to be considered at EU level are alignment towards sustainability, social diversity and the use of ICT for citizen empowerment, and the anticipation of future challenges to transform them into new opportunities.

Competitiveness and CO₂ emissions

The EU has endorsed a commitment to unilaterally cutting GHG (greenhouse gas) emissions by at least 20% by 2020 (compared to 1990 levels). It has been argued that production from European factories could move to countries without carbon constraints in order to avoid the mitigation costs of EU Climate Policy. Such effect is called 'carbon leakage'.



The scenario analysis reveals that there is a significant carbon reduction potential in the pulp- and paper-making sector at global level up to 30-40%.

In order to nurture this debate and to address the potential evolution of global energy-intensive industrial sectors under alternative regulation schemes, a series of case studies has been endeavoured by the JRC-IPTS. During 2009, the pulp and paper sector has been addressed: a thorough review of the sector has been published and discussed with stakeholders and policy makers. The scenario analysis reveals that there is a significant carbon reduction potential in the pulp- and paper-making sector.

The EU regulation on carbon trading for the 2013-20 period considers the allocation of

emission permits free of charge ('grandfathering') to companies in sectors that could face such risk. The revised EU emission trading system regulating the emission allowance market organisation considers that if certain criteria are met for some industries, they will receive their allowances for free. The preliminary list of sectors has been determined in September 2009.

End-of-waste criteria

Under what conditions can 'waste' start to be considered as 'merchandise'? The Waste Framework Directive newly revised in November 2008 empowers the EU to clarify under which conditions waste could cease to be waste and could be regarded as a non-waste material to be freely traded as such on the open market.

In 2009, the JRC-IPTS has developed technical proposals for EU binding criteria specifying when waste aluminium and ferrous metals, that have undergone recovery operations, cease to be waste. Together with experts from the Member States and other stakeholders, the JRC applied a developed methodology to achieve this and several workshops ensued in Seville. For ferrous and aluminium scrap for example, the draft criteria describe that waste would have to be free of hazardous substances, radioactivity and visible oil in order to be reclassified as a product. For ferrous metals such as iron and steel, waste would have to contain less than 2% of non-metallic elements in order to qualify.

The JRC-IPTS is carrying out technical studies on similar criteria for waste copper, glass and paper. The technical proposals of the JRC-IPTS were used by the Directorate-General for the Environment (DG ENV) to prepare formal proposals of Commission Regulations.



For ferrous metals such as iron and steel, waste would have to contain less than 2% of non-metallic elements to qualify.



"The economic crisis has focused policy makers' minds on the vital importance of delivering policies to relaunch the EU's economy. The open fronts are many and closely interconnected. A cross-policy perspective is more and more necessary and the JRC-IPTS' experience in working across disciplines and jointly researching the economic, social and technological implications of EU policies will prove a critical asset."

Peter Kind, Director JRC-IPTS

SELECTED
HORIZONTAL
ACTIVITIES





"A wonderful opportunity to share experiences, goals and gain an understanding of your impressive JRC."

RICHARD BISSELL, *Head of Policy & Global Affairs, US National Academy of Sciences*



"Many thanks for this joint project and our excellent continuing partnership."

ALAN LESHNER, *Chief Executive Officer, AAAS; Executive Publisher, Science*

At the High-level Trans-Atlantic Science for Policy Workshop, JRC Ispra (27 October 2009)



"A session rich in colleagues and fascinating perspectives on very critical issues to the future of an increasingly complex world. I greatly appreciate having been included."

NORMAN NEUREITER, *Director, AAAS Center for Science, Technology and Security Policy*

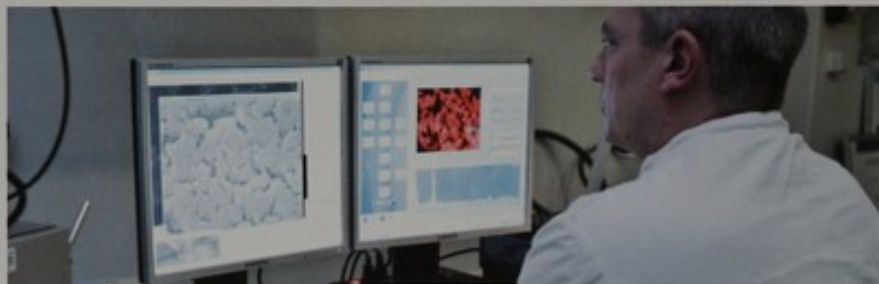


"Many thanks for an instructive session. I learnt a lot!"

HANS-OLAF HENKEL, *Formerly President of the Association of German Industry*

QUOTATIONS

Examples of training and entrepreneurship



Nuclear material analysed by scanning electron microscopy at JRC-ITU.



Representatives of the Shannon Airport police, Ireland, during the first training at the JRC Ispra site.



Pascal Dourès

"Successful fight against nuclear terrorism can only be achieved through coordinated international efforts."



Geraldine Barry

"Creating a spin-off poses many challenges. The pragmatic approach of the JRC's entrepreneurship programme helps to equip JRC researchers with the know-how to turn an interesting idea into a feasible business plan."

Training in nuclear security

Illicit trafficking of radioactive materials remains a reason for concern and a threat to international security. A recent survey on the radiological vulnerability in the EU identified the need for training at the European level in the area of detection of and response to nuclear security incidents. The JRC has been tasked by the Directorate-General for Justice, Freedom and Security (DG JLS) to work with Member States to enhance their capabilities and then to create a corresponding European Nuclear Security Training Centre (SeTraC). In a first phase, a series of workshops and training courses were held for customs officers (on detection of radioactive material), regulatory authorities and for measurement experts (on response and nuclear forensics) using JRC's expertise.

The pilot training courses and the related infrastructures were funded by the European Commission with the support of the US Department of Energy's (DOE) Second Line of Defence programme. The latter, and the International Atomic Energy Agency (IAEA), have stated their interest in using this new European facility for training purposes.

During 2009, the first pilot session for training in the area of prevention and detection in nuclear security, was hosted by the JRC-IPSC at the Ispra site (21-25 September). A second session dedicated to the response to nuclear security incidents was organised from 14-16 October at the JRC-ITU in Karlsruhe.

Entrepreneurship

The JRC runs an annual entrepreneurship programme targeting JRC scientists who may wish to take on the challenge of creating a new company. In spring 2009 a former 'best JRC young scientist' (2007) created Plasmore

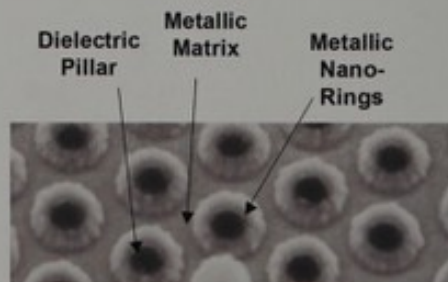
S.r.l, a spin-off company of the JRC, with the University of Pavia (Italy). The company uses a technology developed by the JRC-IHCP (nanobiosciences laboratory) and aims at developing a portable biosensor for the multiplexing analysis of complex biological samples. The target market for this product includes applications of point-of-care technologies (fast blood analysis, early diagnosis of diseases, etc.), homeland security, drug screening, food, environment and basic research in proteomics and genomics.



Prototype of the Multiplexing Nanoplasmonic Sensor developed by Plasmore. The prototype of the biochip is a glass disk consisting of a nanostructured surface and a protein microarray.

Plasmore has benefited from the support of JRC's Intellectual Property and Technology Transfer work throughout the whole development of the business idea. After having participated in the 2008 annual JRC entrepreneurship training, the JRC young scientist won a JRC Innovation grant to further develop the technology and the business concept. During spring 2009, a business plan was finalised with the support of the JRC. The technology was patented in summer 2009 prior to the signature of a licence agreement.

The first prototypes of the biosensor have been already developed and are now in the engineering stage. In the upcoming months the business will enter the field testing stage.



Scanning Electron Microscopy picture of the nanoplasmonic system enabling the development of the new generation of sensitive biosensors.

Supporting EU enlargement and integration

Building on its scientific and technical expertise in complex areas of the EU body of law, in 2009 the JRC continued its dedicated action to support enlargement and integration. This aimed not only at the new EU Member States (Bulgaria and Romania) but also at the EU Candidate Countries (Croatia, the former Yugoslav Republic of Macedonia and Turkey), Potential Candidate Countries (Albania, Bosnia-Herzegovina, Montenegro, Serbia and Kosovo), to the European Neighbourhood Policy Partner Countries as well as to other countries which are associated to the 7th Research Framework Programme (Iceland, Israel, Liechtenstein, Norway and Switzerland).

In compliance with the JRC mission, the Enlargement and Integration Action is focusing on scientific and technical aspects of EU legislation which are within the competence of the JRC in such fields as environment, food safety, chemical safety and nuclear safety. Emphasis is given to the JRC projects implementing EU directives such as monitoring agriculture with remote sensing, the Integrated Pollution and Prevention Bureau, identification and labelling of Genetically Modified Organisms (GMOs) and nuclear security.

The JRC Enlargement and Integration Action consists of different instruments that promote networking, mobility and integration of organisations, researchers and experts in the main activities of the JRC.

The JRC Enlargement and Integration Action included many activities in 2009:

- 48 workshops and training courses on specific scientific and technological aspects of EU legislation were organised. These were advertised on the web and involved experts from the target countries who were identified with the help of the Permanent Representations or Missions to the EU and the JRC National Contact Points.
- To increase awareness of the JRC activities to support EU policies and to promote collaboration between the JRC and the New Member States, Accessing Countries, Candidate Countries and Potential Candidate Countries, in 2009 the JRC organised several information/dissemination events.

Information Days, with Commissioner Potočnik present, were organised jointly with the Research DG (DG RTD) in Bosnia and Herzegovina (23 April 2009) and in Serbia (29 June 2009). The JRC partici-



Serbian Deputy Prime Minister Božidar Đelić and Research Commissioner Janez Potočnik at the Research Information Event in Belgrade, 29 July 2009.

pated in the Western Balkans Steering Platform on Research and Development and took part in very productive discussions in Liblice, Czech Republic (28-29 May 2009) and in Zagreb, Croatia (29 October 2009).

- As a follow-up to the Memorandum of Understanding with Turkey, signed in 2007, a joint call of the JRC and TÜBİTAK (The Scientific and Technological Research Council of Turkey) for grant-holders was implemented successfully and published in January 2009. A number of profiles for doctoral and post-doctoral students coming from Turkey were identified by the JRC institutes with agreement to be financed by the Turkish side but hosted by the JRC institutes working on research projects of mutual interest.
- As a support to the European Neighbourhood Policy, the JRC discussed opportunities for collaboration with Mediterranean countries in Portorož, Slovenia (9 June 2009) and Sousse, Algeria (24-25 November 2009). The JRC also participated in the S&T Subcommittees (External Relations DG - DG RELEX) for Morocco (19 January, 2009) and Egypt (10 November, 2009). Finally, the JRC contributed to the EU-Tunisia and EU-Morocco Scientific and Technological Cooperation Agreement Road Maps for 2009-10.



Research Information Event in Belgrade, 29 July 2009.



Research Information Event in Sarajevo, 23 April 2009.



Meeting of the JRC National Contact Points and Scientific Attachés in Ispra on 18-19 June 2009.



Giancarlo Coratti

"The JRC provides invaluable support to prospective EU candidate and neighbouring countries that envisage harmonising their legislation with the EU, by sharing knowledge and know-how on scientific and technical aspects of complex EU legislation."

JRC Open Day



Commissioner Potočnik sees for himself that the 'soil is alive'.

"I took so much pleasure in witnessing thousands of young people exploring the world of science and research at the latest Open Day of the JRC's research site in Ispra."

COMMISSIONER JANEZ POTOČNIK



Aerial view of entrance gates to the JRC Ispra site.

On Saturday 16 May in Ispra (Italy), the JRC hosted the biggest-ever event since its foundation back in 1957, namely the JRC Open Day. 2009 also marked the 50th anniversary of the JRC's Ispra site which gave extra zest and momentum to this special day.

No less than 8 128 visitors of 66 different nationalities (30% under 18) turned up despite a cloudy and overcast morning. The JRC on-site institutes opened up their laboratories, the non-Ispra based institutes presented interactive topics in the exhibition area with other EU organisations (e.g. the European Parliament, the Directorate-General for Research (DG RTD), the European Science Open Forum, Italian-based agencies, etc.) also represented and the Commissioner for Science and Research, Janez Potočnik, also attended.

During the day, laboratories, practical demonstrations, outdoor activities, exhibitions and conferences, games and quizzes were all used to illustrate the S&T research that goes behind EU policy making. More than 70 different scientific activities were put on show throughout the day.

In parallel the JRC, in collaboration with the Lombardy schools authorities and the Italian Ministry of Education, had organised an Italian schools' competition entitled 'Science and Creativity in the Classroom'. Some 214 schools from all over Italy had submitted innovative and interesting proposals and the winners were invited to the Open Day where Commissioner Potočnik presented their awards. Submissions for the competition were exhibited during the Open Day for all to see. The JRC has continuously promoted science in schools and the resonance of this particular project has led the organisers of the European Science Open Forum (ESOF) to run a similar competition for its 2010 ESOF event in Turin.

Large scale events like this Open Day require considerable investment in human and financial resources and the JRC is proud that over 300 staff volunteered to help. As well as that, several cost savings initiatives were instigated and implemented. To quote one example, an on-line registration system was developed in-house to handle the 12 000 registrations.

Furthermore, an event is only as good as the impact it creates. For this reason, the JRC performed an evaluation and 2 326 visitors voluntarily filled in the form before leaving the site. Interestingly, the gender balance was 50:50 and 94% of first-time visitors said they would attend another JRC Open Day in the future. 90% rated the organisational/logistical aspects of the event as either good or excellent and almost 90% said that their impression of the JRC and their knowledge of science and research improved as a result of the visit.



Kids get a feel for real bench experiments in ecology.



Seismic activity demonstrations at the European Laboratory for Structural Assessment (ELSA).



David Wilkinson

"The Open Day at the JRC Ispra site is a true success story in terms of communicating and promoting our research to the communities with which we coexist."

High-level Trans-Atlantic Science for Policy Workshop

The Trans-Atlantic Science for Policy Workshop held at the JRC in Ispra on 27 October 2009 brought together a unique group of 22 people with pertinent experiences of real-life scientific support to policy making. These individuals, ranging from science advisers and parliamentarians to heads of international organisations and NGOs (non-governmental organisations), represented all aspects of science-policy interaction from conception and development to implementation, monitoring and evaluation.

The workshop initiative succeeded in allowing this group to take a step back to debate with and to learn from each other and, most importantly, to identify best practices and pitfalls on both sides of the Atlantic when dealing with how science contributes to policy making in their nations – and how the influence could be sharpened. Participants appreciated the emphasis on looking at things from new and unexpected angles, while reaching firm conclusions about the challenge of 'evidence-based policy versus policy-based evidence'.

Though a summary report of the dialogue will be presented during a high-level panel discussion at the EuroScience Open Forum meeting in Turin (2010), the group settled on a series of main themes:

- in its relations with policy makers and the public, science must guarantee that it is guided by values of integrity and transparency, with its work underpinned by continuous peer challenge and evaluation;
- the public plays a critical role in affecting policy, especially by influencing the positions adopted by elected officials and policy makers. A key role of science leaders is to inform the public and policy makers and aid in their understanding of policy implications;
- as part of an ambitious effort to promote interaction between researchers and the public, science leaders should engage the public well in advance about potential ethical and societal issues that could arise from scientific advances;
- scientists must seek to provide a complete and accurate assessment of the potential risks in scientific research and policy. While assessments of risk and



Participants of the High-level Trans-Atlantic Science for Policy Workshop.



The JRC & American Association for the Advancement of Science (AAAS) planted a coast redwood tree during the workshop.

Celebrating the 50th anniversary of the inauguration of the JRC site in Ispra. From left: Roland Schenkel (Director-General, JRC); Vittorio Prodi (Member of the European Parliament); Alan Leshner (Chief Executive Officer, AAAS; Executive Publisher, Science).

uncertainty are inherently difficult and complex, science leaders should not create unnecessary angst as a means of motivating public support for particular science policies; and

- scientists should answer, in an accurate and timely way, to policy makers' requests for science information. At the same time, policy makers should encourage scientists to speak out even when their research or assessment may be unpopular.



Ulla Engelmann

"This High-level Trans-Atlantic Workshop was a new JRC initiative. It was most rewarding to see stakeholders from both sides brainstorming on how best to interface scientific support with policy making. We now need to keep the momentum going."

Stakeholder events



From left: Patrick Cunningham (Chief Scientific Adviser to the Irish Government), Pallab Ghosh (Science Editor, BBC), Roland Schenkel (Director-General JRC), Sir Fred Kavli (Kavli Foundation), Colin Challen (MP, UK Parliament, Chairman of the All Party Climate Change Group), Matthias Ruete (Director-General for Energy and Transport, European Commission).



Sir David King, Smith School of Enterprise & the Environment, University of Oxford.



Minister Ronchi visiting the European Laboratory for Structural Assessment.

"This visit confirms my belief in this extraordinary centre, which shows the perfect integration of minds, personalities and technical knowledge at the service of research and innovation. A real example of how to build on the European system."

ANDREA RONCHI,
ITALIAN MINISTER FOR
EUROPEAN AFFAIRS

6th World Congress of Science Journalists

The JRC played an active role in helping bring together more than 600 science journalists and other communicators in London to discuss the role of the science media in reporting on critical global issues, including energy and climate change. The conference is the flagship event for the World Federation of Science Journalists, which aims to strengthen the science journalism profession worldwide.

One of the many highlights of the conference on the opening day of the event was a workshop organised by the JRC with leading international speakers on the topic of 'Green Energy Technologies'. The session sought to answer two questions: 'Can technology save the world from climate change?' and 'Have the recent economic problems damaged the chances of bringing green tech to market (and should we be worried about it)?'

In addition to facilitating the participation of 25 science media from across Europe and hosting a stand, the JRC co-organised the 'International Dinner'. Held at the Royal Institution, this successful initiative brought together a select group of top journalists, scientists and decision-makers to discuss the 'Role of the media in energy and climate change policy'.

American Association for the Advancement of Science Annual Meeting, Chicago, 12 - 16 February 2009

Our planet and its life: Origins and futures
Building on previous involvements, the JRC and its partners organised four symposia and, for the first time, a high-level lecture at the 2009 Annual Meeting in Chicago.

For its part, the JRC delivered well-received symposia ranging from: 'Keeping the Lights on: The Revival of Nuclear Energy for Our Future' and 'Life Beneath Our Feet: Research Challenges in Soil Biodiversity'; to 'Preimplantation Genetic Diagnosis: Beyond Natural Selection?' and 'Nanofood for Healthier Living?'. Its topical lecture entitled: 'New Approaches to the Therapy of Infectious Diseases' focused on HIV and generated a lot of on-site interest.



From left: Roland Schenkel, Benn Tannenbaum (AAAS), Mujid Kazimi (MIT, Cambridge, MA), Jacques Bouchard (Commissariat à l'Énergie Atomique, France).

JRC staff were equally active in engaging with the many science-led civil society actors and network organisations present, ensuring representation at flagship events such as the International Reporters' Reception, the President's Dinner, the International Lunch and the full range of formal and informal side events.

Italian Minister for European Affairs visits JRC Ispra, 6 October 2009

Andrea Ronchi, Italian Minister for European Affairs, came to learn more about the JRC and the activities carried out at its site in Ispra.

The Director-General of the JRC presented an overview of the JRC and an open meeting ensued where points of common interest were discussed, including the situation of the European School in Varese, raising the visibility of the JRC in Italy's national press and the progress in the Ispra decommissioning plan.

He visited the three Ispra-based institutes and was especially impressed with the European Laboratory for Structural Assessment and JRC activities on renewable energies and vehicle emissions.

Press and media relations

Media actions in 2009 comprised press releases to announce new studies, reports, new methods or products, and collaboration agreements. Furthermore, thematic press briefings and conferences, media visits and workshops for journalists were organised in addition to information days and round tables in Member States and Candidate Countries, stands at exhibitions and conferences, open days at institutes, and interviews and meetings with senior management and scientists.

2009 results in brief

- Total hits: 2 854. Up by approximately 26% compared to 2008 (with 2 256 media hits)
- Coverage generated in 68 countries worldwide – the highest number of countries ever reached (67 in 2008)
- 103 audiovisual broadcasts (Radio, TV and online videos) were recorded which represents an increase of 51% on 2008 (68).

Geographical spread

JRC-related news was reported from all 27 EU Member States. With regard to the number of articles per country, Italy remained on top (617), with Germany in second place (259), followed by Spain (189). In the following EU Member States an increase compared to previous years was observed: the Czech Republic, Estonia, Finland, France, Ireland, Latvia, Lithuania, Luxembourg, the Netherlands, Portugal, Romania, Slovakia, Sweden and UK.

Trends over the last years and most covered topics

In 2009, the coverage numbers were back on a continuous upward trend, after a slight decrease in 2008, showing that the JRC concentrated on the right topics and actions. Overall, the coverage figures have quadrupled since reporting started in 2004 (710 pieces counted in that year). The main topics which generated the highest visibility comprised the European Forest Fire Information System (EFFIS), the PESETA study on climate change impacts and research on transport and environment. Other subjects included nuclear forensics and a new map of travel times (agglomeration index) which were also well covered.

EXAMPLES OF ARTICLES

De Standaard (B):

"Zonder kernenergie gaat het licht uit"
(energy research)

El País (E):

- "España, en la zona caliente"
(PESETA)
- "La UE paga los platos rotos de las promesas incumplidas en I+D"
(R&D investments)

Europolitics (pan-EU):

"Transatlantic research cooperation gets new boost"

Financial Times (UK):

"Genetic engineering conquers new ground" (GMO)

Frankfurter Allgemeine (D):

- "Spuren vom Spurengas"
(EDGAR/Google)
- "Eine Nase für strahlende Pulverchen"
(nuclear forensics)

Kathimerini (GR):

"Over 200 000 hectares of forest lost to fires" (EFFIS)

La Repubblica (I):

"La città dell'ambiente che sforna invenzioni per vivere meglio" (research at Ispra)

Le Monde (F):

- "Profession: détective nucléaire"
(nuclear forensics)
- "Incendies: forêts et maquis" (EFFIS)

Le Soir (B):

"Les sols européens souffrent de six maux" (soil research)

Lidove noviny (CZ):

"Jedy útoči doma i v kanceláři" (indoor air quality)

Nature (UK):

- "Dismal no more – Europe's Joint Research Centre should be empowered to stimulate other EU institutions"
- "Aerosols make methane more potent" (climate change)

Népszabadság (H):

"Tiramisu hasadóanyagból"
(nuclear forensics)

New Scientist (UK):

"Where's the remotest place on Earth"
(agglomeration index)

Science (USA):

"AAAS, Europe Build Engagement with S&T Policy, Cooperation Plans"

The Economist (UK):

- "Suffering for Science" (ECVAM)
- "Hey big spender" (R&D investments)

EXAMPLES OF BROADCASTS: RADIO

BBC (UK):

"The world today":
Interview about the travel times map

Radio France International:

Interview about EFFIS

Radio Netherlands Worldwide:

Interview about travel times map

Radio ORF (A):

Report about VELA-7

EXAMPLES OF BROADCASTS: TV

Euronews:

- Europe tackles nuclear safety issues
- Drive is on to make cheaper hydrogen cars

RAI (I):

- Rai3 TG Leonardo – report about the JRC in the special series – "I grandi luoghi della scienza"
- Rai3 TGR – report about Open Day Ispra
- Rai TG1 – "JRC polo di eccellenza" – report about Minister Ronchi's visit

TVR Romania:

Report about energy research at JRC

Nuclear decommissioning and infrastructure development

The Italian government takes over the dismantling of the Ispra-1 reactor at the JRC Ispra

A settlement agreement between the European Atomic Energy Community and the Italian government was signed on 27 November 2009. The agreement concerns the principles governing the responsibilities for the management of radioactive waste on the Ispra site.

The document establishes that the decommissioning of the Ispra-1 reactor will be taken in charge by the Italian government as a compensation for the costs resulting from the previous research activities for the Italian nuclear programme carried out at the JRC in Ispra. The JRC will be responsible for activities related to the characterisation, treatment and temporary storage of the low- and intermediate-level waste issued from the decommissioning until the Italian final repository will be available.



New transmission electron microscope, installed at the JRC-ITU for the analysis of radioactive materials.



Ispra-1 reactor.

As a consequence of the agreement, the Ispra-1 reactor licence will be transferred to an operator designated by the Italian government within one year from the agreement signature. The agreement has now to undergo ratification by the Italian parliament.

Infrastructure development

At the Ispra site, a new 1300 m² crèche building was finished in February 2009 and inaugurated by Commissioner Potočník on 13 March 2009. The new and highly energy-efficient facility can accommodate up to 86 babies and toddlers, up to 4 years of age. This facility is also intended to improve working conditions at the Ispra site and to help attract excellent scientists by making it one of the most attractive research campuses in Europe.

Also at the Ispra site, the tender for the construction of two modern buildings with offices and laboratories for up to 400 staff has been concluded. The construction yard will be opened in spring 2010. The two buildings which will be constructed simultaneously, are expected to be handed over to the JRC-IES and the JRC-IHCP, respectively, three years after the start of the works. A Life Cycle Assessment evaluating the environmental impact of the buildings from their construction to their demolition was completed and published.

The year 2009 marked the end of a series of improvements made over several years, which aimed at improving the quality and reliability of the Geel Electron Linear Accelerator facility (GELINA) at the JRC-IRMM. The facility is used to measure very accurate neutron data for nuclear energy applications (refer to page 27 for more details).

At the JRC-ITU, a new transmission electron microscope was installed. This device can perform high resolution micro-structural analyses and characterisation of radioactive materials as well as speciation work and chemical analyses. This versatile instrument will support basic studies on actinides, research on spent fuel and activities on the safety of conventional and new fuels.



New energy-efficient crèche facility.



Celso Osimani

"This agreement renews the fruitful collaboration between the European Atomic Energy Community and the Italian government, which started 50 years ago."

At the opening ceremony of the new crèche in Ispra (13 March 2009)

"Our children are our true legacy. The love and smart approach that transpires from this beautiful architectural infrastructure are exactly the improvements we need to let them grow up better. Well-done!"

VERONICA MANFREDI,
MEMBER OF CABINET OF COMMISSIONER KALLAS

"Sunny day for sunny future! You are doing a great job and I'm really happy that I can help you in doing that. Happy to be 'yours'!"

COMMISSIONER JANEZ POTOČNIK

Exploratory research

Exploratory research at the JRC has an important function in strengthening the scientific basis, developing new competences and approaching new areas of research. It is a valuable investment in the JRC's future. Usually about 6% of the annual institutes' budget is available for exploratory research projects.

Examples of exploratory research projects carried out in 2009 include:

1. Evaluation of neural networks coupled to Multi-well Micro-electrode Array (MEA) to test for addiction – Nicotine a model substance

Diana Rembges, Antonio Novellino, Camilla Bernasconi, Taina Palosaari (JRC-IHCP)
The group at the JRC-IHCP took the first steps towards the development of an alternative *in vitro* test method for studying the addictiveness of substances.

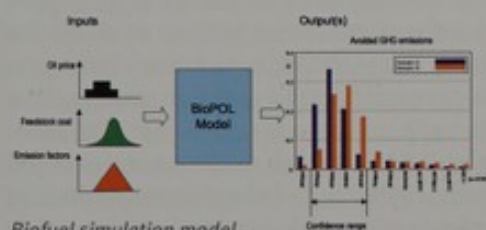
2. Application of metabolomics and metabonomics for the discrimination of organically and conventionally grown carrots

Alain Maquet, Lubomir Daško, Olivier de Rudder (JRC-IRMM), Matteo Politi, Claude Guillou (JRC-IHCP), Haïssam Jijakli (University of Liège, Belgium)
This project targeted the discrimination between organically and conventionally grown crops. Using carrots as a starting point, the team at the JRC-IRMM, in collaboration with the JRC-IHCP as well as the University of Liège, identified a distinguishing substance in the products from two farming approaches.

3. A systematic risk assessment applying the Monte-Carlo method illustrated for a biofuel simulation model

Burkhard Schade, Tobias Wiesenthal (JRC-IPTS)

The team at the JRC-IPTS investigated a way of making sure that modelling output allows the evaluation of different policy options with a sufficiently high degree of confidence – despite unavoidable uncertainties regarding the input variables.



Biofuel simulation model.

4. Multi-model ensemble modelling

Stefano Galmarini, Slawomir Potemski (JRC-IES)

Also this project deals with the increase of confidence in modelling results. The team at the JRC-IES investigated the conditions under which ensemble modelling fulfils the expectations of improving the final outcome, i.e. giving better results than the individual modelling systems. The scientists used atmospheric and air quality models as a starting point.

5. Modelling of the failure of the inter-layer of laminated glass loaded by air blast waves

Martin Larcher, Torbjorn Dyngeland (JRC-IPSC)
Laminated safety glass is widely used in building but also in transport. In the context of security research, the team of JRC-IPSC developed a numerical model to simulate the behaviour of laminated glass in case of a detonation.

6. Development and first test of a Radioactive Dispersion event Experimental Setup (RADES)

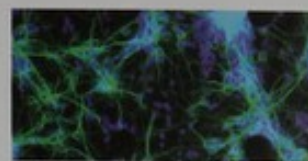
Jean-Yves Colle, Frederic Naisse, Rudy Konings, Joseph Magill (JRC-ITU)

Few experimental data have been available on the behaviour of irradiated fuel under high temperatures and oxidising conditions, as can happen in case of transport accidents and sabotage. The team of JRC-ITU developed an experimental facility to simulate radioactive dispersion events with irradiated fuel.

7. Qualification tests of irradiated EURO-FER 97 material in Super Critical Water (SCW) conditions by miniature-autoclave-bellows based system

Luigi Debarberis, Radek Novotny (JRC-IE)

This project dealt with the development of a prototype for mechanical and stress corrosion cracking tests of irradiated materials in super critical water conditions. This testing facility will now be used for research on supercritical water reactors.



Stained neuronal cells.



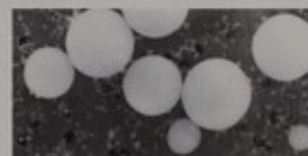
Carrot cultivation.



Cluster analysis.



Crack in laminated glass.



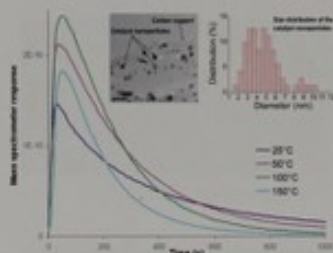
ZrO₂ simulation.



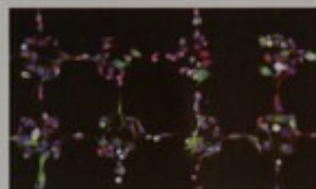
Miniature autoclave loading device.

JRC EXCELLENCE AWARDS

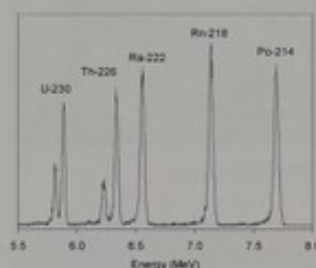
Best peer-reviewed scientific papers



Influence of the temperature on the ^{13}CO desorption rate measured by mass spectrometry; Inset: carbon-supported catalyst nanoparticles observed by transmission electron microscopy and their size distribution.



Cell microarrays (green: neuronal, red: astrocytes/stem cells, blue: nuclei).



Alpha spectrum of high purity uranium-230 and its alpha particle emitting daughter nuclides purified from sintered protactinium oxide after proton irradiation.



Aurelien Pitois (l.), Jon C. Davies, Alberto Pilenga (c.), Andreas Pfarr, Georgios Tzotridis (r.) (JRC-IE)

Kinetic study of CO desorption from PtRu/C PEM (proton exchange membrane) fuel cell anodes: Temperature dependence and associated microstructural transformations

In: *Journal of Catalysis*, 265 (2009) 199-208

The use of platinum-based nanocatalysts to obtain high current densities in proton exchange membrane fuel cells is a significant barrier to their market penetration because of the high cost and scarcity of platinum, and the fact that platinum is easily poisoned by carbon monoxide impurities. Therefore, a novel cheap and CO-tolerant alternative needs to be developed based on fundamental understanding of all the processes involved. Until now, the CO tolerance issue was almost exclusively studied through the CO electro-oxidation process. By considering in addition CO desorption, the authors have innovated the way to investigate CO tolerance. The temperature-dependent CO desorption rates measured for the first time in this work are high as compared to the rates of CO electro-oxidation, suggesting a need for revision of the kinetically predominant CO poisoning mechanism. This result will most likely change the strategies applied for the development of cheaper and more CO-tolerant nanocatalysts.



Ana Ruiz (l.), Leonora Buzanska (c.), Douglas Gilliland, Hubert Rauscher, Lucel Sirghi, Tomasz Sobanski, Laura Ceriotti, Frederic Bretagnol, Sandra Coecke, Pascal Colpo, François Rossi (r.), Marzena Zychowicz (JRC-IHCP)

Micro-stamped surfaces for the patterned growth of neural stem cells

In: *Biomaterials*, 29 (2008) 4766-4774

The development of *vitro* models based on stem cells is fundamental for toxicology studies because they represent a unique tool to predict or anticipate potential drug and chemical toxicity in humans. Neverthe-

less, the culture and control of stem cells fate is an issue because these cells are sensitive to many parameters, which would influence the *in vitro* test response. The main challenge resides in the ability to develop artificial platforms that mimic the 'natural environment' allowing the control of stem cells maintenance and differentiation. This paper describes a method for surface patterning by micro contact printing. The technique allows production of protein patterns of different sizes, shapes and composition which allows the control of stem cell maintenance and differentiation and opens new possibilities in *in vitro* toxicity assays.



Alfred Morgenstern (l.), Frank Bruchertseifer, John McGinley, Gert Rasmussen (c.), Barbara Zielinska, Christos Apostolidis (r.) (JRC-ITU)

Production of $^{230}\text{U}/^{226}\text{Th}$ for targeted alpha therapy via proton irradiation of ^{231}Pa

Cross-sections of the Reactions $\text{Pa-231}(p,n)\text{U-230}$ and $\text{Pa-231}(d,3n)\text{U-230}$ for Production of U-230 for Targeted Alpha Therapy

In: *Analytical Chemistry*, 2008;80(22):8763-70

Alpha-immunotherapy (AIT) is a promising strategy for cancer therapy. The treatment is based on the coupling of alpha-particle emitting radionuclides to specific carrier molecules that selectively bind to tumour cells. Due to the high energy and short range of alpha radiation in human tissue (<0.1 mm), AIT allows the delivery of a highly cytotoxic radiation dose to targeted cancer cells, while damage to surrounding healthy tissue is limited. Recently the radioisotope uranium-230 has been identified as a promising therapeutic alpha emitter, as its decay is generating a highly cytotoxic cascade of 5 alpha particles with a cumulative energy of 33.5 MeV. In order to make this isotope available for (pre-)clinical testing, a cyclotron-driven production route, based on the nuclear reaction $\text{Pa-231}(p,n)\text{U-230}$ was developed. The excitation function for this reaction was measured for the first time, and a large-scale production process utilising sintered protactinium oxide pellets as target material was developed. This new process allows the production of high purity uranium-230 in clinically relevant yields.

Support to EU policies



Valérie Zuang (l.), João Barroso (c.), Chandra Eskes, Claudius Benedict Griesinger, Juan Riego Sintes (r.) (JRC-IHCP)

Contributing to the feasibility of the Cosmetics Directive and REACH: validation and regulatory acceptance of alternative test methods for skin and eye irritation

Recent EU legislation, such as the Regulation on REACH – the Registration, Evaluation, Authorisation and Restriction of Chemical substances – and the Cosmetics Directive, have implemented strong legal means that discourage testing in animals (REACH) or ban such tests altogether (Cosmetics Directive) from March 2009 onwards. By validating seven alternative test methods in the field of skin and eye irritation in humans within the last three years, and securing their regulatory acceptance in 2009, the JRC-IHCP team has significantly contributed to the feasibility of both the Cosmetics Directive and REACH. In doing this, the JRC-IHCP has assured the regulatory acceptance and global usability of methods for skin and eye irritation with unprecedented speed.



Christoph von Holst (l.), Ana Boix (c.), Stefano Bellorini (r.), Federica Serano, Simona Androni (JRC-IRMM)

The safe use of animal by-products in animal nutrition: The marker concept based on Glyceroltriheptanoate (GTH)

In the EU, the meat industry produces more than 16 million tons of animal by-products each year. A lot of these nutritional products have to be disposed of at significant economic cost, because a fraction could potentially contain harmful substances. However, the work of the JRC has opened the door to the increased use of safe and beneficial animal by-products, while ensuring that potentially dangerous categories of animal by-products are permanently marked to avoid entering the feed and food chains.

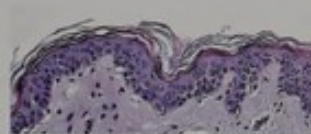
The JRC identified glyceroltriheptanoate as a suitable marker, and developed and validated an analytical method to enforce its correct use by the rendering industry. This means that only safe animal by-products can be used in animal nutrition, thus limiting the risk of diseases like BSE (Bovine Spongiform Encephalopathy) – which was largely due to the use of animal carcasses and material unfit for human consumption in the animal feed chain.



Antonio Soria (l.), Juan Carlos Ciscar (c.), Laszlo Szabo, Denise van Regemorter, Guillaume Leduc, Françoise Nemry, Catharina Bamps (JRC-IPTS), Luc Feyen (r.), Rutger Dankers, Katalin Bodis, Jose Barredo, Ad de Roo, Carlo Lavalle (JRC-IES)

Project on the impacts of climate change in Europe (PESETA)

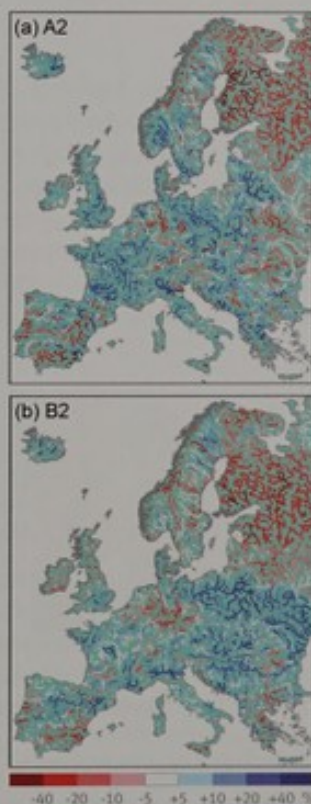
Europe has been lacking a regional and sector-specific economic assessment of the impacts of climate change, necessary to design and prioritise adaptation strategies. The PESETA (Projection of Economic impacts of climate change in Sectors of the European Union based on bottom-up Analysis) project integrates a set of coherent climate change projections and physical models into an economic modelling framework in order to quantify the potential impacts of climate change on vulnerable aspects of Europe: agriculture, riverbanks, coastal areas, tourism, and human health. The project's final report was published in December 2009, before the United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen. The project concludes that if the climate expected in the 2080s would occur today, the EU annual welfare loss would be in the range of 0.2% to 1%, with large variations across European regions: the British Isles, central Europe north and southern Europe appear most vulnerable to climatic change. Agriculture impacts, coastal impacts and river flooding are the dominant causes of welfare loss.



Epiderme in vivo represents a histological cross-section of normal human epidermis (© SkinEthic Laboratories, France).

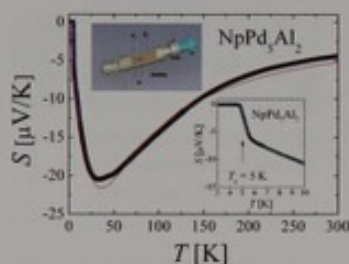


Processed animal proteins and animal fat: safe source of nutrients for farmed animals.

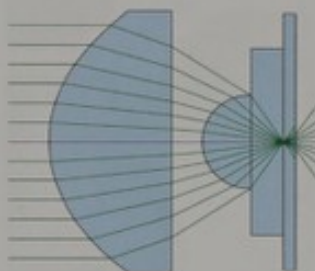


River floods: relative change in 100-year return level of river discharge between scenario (2071-2100) and control period (1961-1990) for the 3.9°C (top) and 2.5°C (bottom) scenarios.

Best Young Scientists



Thermoelectric power studies of actinide materials.



Ray tracer image of the core part of the aberration-free holographic lithography set-up designed to fabricate holographic optical elements.



Krzysztof Gofryk (JRC-ITU)

Thermoelectric power measurements of actinide materials

Transuranic intermetallics show a large variety of exotic physical phenomena including strongly correlated electronic behaviour and unconventional superconductivity. The understanding of these issues is one of the grand challenges condensed matter physics is facing today. Extensive studies of the magnetic, thermal and transport properties of new transuranic compounds were performed, in particular with regard to examining their electronic properties. A complete experimental setup for thermoelectric power measurements of actinide materials was designed and developed. This property (Seebeck effect) is well known in industrial applications, but its adaptation to low temperature studies of nuclear materials is innovative. By this technique, details of the electronic structure have been studied in several systems including the new superconductors NpPd_3Al_2 and PuCoGa_5 , and extremely rare actinide metals such as Pa, Am or Cm. All results obtained significantly extend our knowledge about the nature of the $5f$ -electrons and their interactions in actinide materials, and play a crucial role in understanding unconventional superconductivity and strong electronic correlations in general.



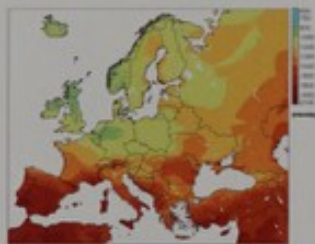
Peter Macko (JRC-IHCP)

Improvement of detection limits of biochip-based diagnostic systems

Biochip-based diagnostic systems are used for *in vitro* cell and tissue analysis for alternative test methods, for food safety monitoring, biomedical research and clinical diagnostics.

This work has successfully demonstrated that the detection limit of those systems can be increased by almost one order of magnitude by integrating a flat holographic element on the underside of the biochip. The holographic element increases the transmitted fluorescence intensity and also acts as a focusing element that eliminates the need for bulk imaging optics in biochip readers. The main challenge was the design and construction of an aberration-free holographic lithography optical setup that was used to fabricate the biochips with the integrated holographic elements. This work has made a significant contribution to the current state-of-the-art and is likely to change the way such biochips are designed by industry in the future.

Knowledge Transfer



Map of PV performance in Europe showing the energy output of a 1kW-peak system mounted on a single-axis tracking system with a vertical axis and modules mounted at the local optimum angle.



Thomas Huld (l.),
Ewan Dunlop (r.)
(JRC-IE)

Photovoltaic Geographical Information System (PVGIS) helps solar energy investors and installers by calculating the solar energy production online

In 2009, PVGIS contributed to an integrated project 'PERFORMANCE' by calculating the performance of various photovoltaic (PV) technologies under varying climatic conditions in Europe. This research has been published in the *Solar Energy* journal and

the results have been incorporated into the PVGIS online PV calculator to improve the estimates of PV performance.

Sun-tracking PV systems are becoming increasingly popular. PVGIS has now added the possibility to calculate the energy output of various single- and double-axis sun-tracking PV systems. The results will be published in the *Progress in Photovoltaics* journal.

Work has started on an improved solar radiation database for PVGIS based on satellite data. The increased time resolution and quality of the data will allow the expansion of PVGIS capabilities to include off-grid PV systems and concentrated PV systems.

Technical Support / Assistance



Valerio Pagliari (l.), David Roux (c.), Fulgencio Sanmartín (r.), Lorenzo Orlandini (JRC-IES)

Emission Database for Global Atmospheric Research (EDGAR)

EDGAR is an independent database of anthropogenic emissions in the atmosphere and serves as a reference for policy makers and scientists. In 2009 mapping features were implemented and are available on a web interface and users can make maps from the EDGAR database selecting pollutant, greenhouse gas, year or source category. Maps can be visualised from a map-server both as a flat image and as a rotating and 'zoomable' Google Earth[®] map (refer to page 34 for more details).



Remi Allanou, Chiara Macchi, Daniele Ghezzi (JRC-IHCP)

Effective technical and administrative support to the implementation of chemicals regulations – ESIS (Remi Allanou) – EDEXIM (Chiara Macchi, Daniele Ghezzi)

The European chemical Substances Information System (ESIS) provides information on chemicals within EU regulatory frameworks and in 2009 this was one of the world's most visited sites for chemical information, being frequented by more than 3 000 visitors per day. The information provided by ESIS has played a key support role for industry when submitting the pre-registration of REACH dossiers to the European Chemicals Agency.

The European Database on Export and Import of Dangerous Chemicals (EDEXIM) is the tool used by industry and Member State authorities to handle and follow up notifications concerning import and export of chemicals under Regulation 689/2008/EU. EDEXIM provides online information directly to relevant ministries in the importing countries warning them on the upcoming exports of banned or severely restricted chemicals.

Administrative / Site Support



Francesco D'Alberti, Stéphanie Lutique, Matteo Mazzuccato (JRC-ISM)

Successful transfer of hazardous material off the JRC Ispra site

Regarding the progressive elimination of the JRC Ispra nuclear liabilities, three relevant projects have been carried out successfully by the Nuclear Decommissioning team, meeting the objective to reduce the inventory of nuclear hazardous material, thus increasing the safety standards and reducing the related storage costs.

This involved the characterisation, repackaging and removal of depleted, natural, high- and low-enriched uranium, plutonium, mixed oxides and alkali metals.



Nuclear pins packaging at the JRC Ispra site.



Luigi Rogora, Rainer Schubert (JRC-IES)

European Soil Archive

During 2009 the JRC-IES received over 22 000 soil samples from all over Europe which will be stored within the newly created European Soil Archive. In recent years, the JRC produced the first ever soil atlas of Europe and in 2009 it compiled the data required to create a soil atlas of the northern circumpolar region which will help in present day climate change debates and discussions. Currently, the JRC is working on creating a soil database of planet Earth. For projects like these, the need for a robust archive of soil-related data is of paramount importance.

Communication



Patricia Lambert (JRC-PSR)

Core values: 'Our values. Our building blocks.'

An internal communication campaign centred on JRC values represented by four words – Competence, People, Responsibility, Service. These words serve as the building blocks to create a sense of belonging to the JRC, across sites, types of jobs, and backgrounds. Four words were used to challenge all colleagues to 'Give their face for our core values'.

The response was overwhelming with more than 800 people, approximately one out of three staff stepping forward, choosing the value they wanted to personify and having their picture taken by a professional team. Every participant received her/his picture and all were used to create posters featuring the colleagues 'sponsoring' their value. Overall, it was a successful internal communication campaign and an enriching human experience.

JRC Reference Reports

JRC Reference Reports represent the JRC-wide view on a specific subject matter. They provide a reference for specific audiences – academics, civil servants, interested political decision-shapers and decision-makers, and practitioners in public administrations and private businesses. They are also intended to be accessible to interested non-specialists and the media.

In 2009, the JRC published the following Reference Reports:

Future Fossil Fuel Electricity Generation in Europe, Options and Consequences

The report assesses the role that fossil fuel technologies will play in the future EU power system. It examines the technologies and fuel options necessary for the EU to achieve its energy and climate change goals, taking into account the probability that fossil fuels will continue to play an important role in European power generation in the short and medium term.

The report foresees a need of up to 635 GW for new fossil fuel power plant capacity, assuming that fossil fuel power generation will remain the backbone of the EU power system until at least 2030. It emphasises that the share of non-fossil fuel power generation needs to be increased and that the share of fossil fuel power generation will be compatible with the EU policy goals only if three factors converge: the commercialisation of carbon capture technology, optimal carbon credit prices in the EU Emissions Trading Scheme and higher global coal and gas prices.

Liquefied Natural Gas for Europe – Some Important Issues for Consideration

The report looks at the likely impact of increased reliance on Liquefied Natural Gas (LNG) for energy production and more shipments of LNG to the European Union. The report concludes that LNG may remain an expensive energy option for the foreseeable future, with both affordability and geo-political issues expected to remain key factors in this area of the energy sector. The report is intended as just one source of information in a number of elements to be taken into consideration in the development of the EU energy policy.

The sharp rise in energy prices and temporary cutbacks in pipeline gas imports from Russia in the recent past have raised concerns about the EU's gas supply. Delivering LNG by sea has been seen by many as a solution, and over the last decade LNG has become one of the world's fastest-growing sources of energy. The report examines the benefits and drawbacks of the EU's greater use of LNG shipments by 2020 in five areas, namely security and diversity of supply; affordability; energy efficiency and greenhouse gas emissions; quality and shipping issues.



http://ec.europa.eu/dgs/jrc/downloads/jrc_reference_report_200907_fossil_fuel_electricity.pdf



http://ec.europa.eu/dgs/jrc/downloads/jrc_reference_report_200907_liquefied_natural_gas.pdf

The report was established as part of the JRC's ongoing research in the assessment of energy technologies and systems, in liaison with the European Commission's Directorate-General for Energy and Transport (DG TREN)¹.

Risk Management and Agricultural Insurance Schemes in Europe

The report provides an overview of agricultural insurance schemes, risk management systems and public intervention in EU Member States, as well as in Turkey and Croatia. It also evaluates the potential of index insurance schemes for crop risk management. The report should serve as a basis for discussing the integration of risk management tools within the EU's Common Agricultural Policy (CAP).

The report features a collection of information, unpublished until now, on risk management tools and experiences in most EU

¹ From 17 February 2010, DG TREN has been split into DG Mobility and Transport (DG MOVE) and DG Energy (DG ENER).

Member States and Candidate Countries, including key technical details on reinsurance, triggers and deductibles. It suggests actions such as facilitating or subsidising the composition of databases at farm-level, the provision of public reinsurance, partial subsidisation of national risk management systems or the establishment of a common regulatory framework in order to encourage national insurance systems. However, it advises against a homogeneous 'common insurance system' given the diversity of risks and socioeconomic circumstances across the EU.



http://ec.europa.eu/dgs/jrc/downloads/jrc_reference_report_2009_09_agri_ins.pdf

Geological Disposal of Radioactive Waste: Moving Towards Implementation

This report provides an analysis of the scientific, technological and procedural aspects of waste disposal techniques in the nuclear energy sector. It identifies no major conceptual or research gaps concerning envisaged host rocks and repository systems (clays, hard rocks and salt), concluding that the technique is technically ripe for implementation.



http://ec.europa.eu/dgs/jrc/downloads/jrc_reference_report_2009_10_geol_disposal.pdf

The report points out that regulatory approval – requiring an adequate set of regulations, criteria for evaluation and the enabling of regulators – and public acceptance remain the critical factors in any future implementation in Europe.

R&D Investment in the Priority Technologies of the European Strategic Energy Technology Plan

This report shows that alone in 2007, EUR 3.3 billion was invested in EU Research and Development (R&D) on low-carbon technologies.

Of this, 56% came from industry, a figure that rises to 69% when taking only non-nuclear low-carbon energy technologies into account. The report also shows that both corporate and public R&D investment is largely concentrated in just a few EU Member States.



http://ec.europa.eu/dgs/jrc/downloads/jrc_reference_report_2009_10_investment_set_plan.pdf

This report is the result of research carried out by the JRC-IPTS and constitutes a snapshot of current industrial and public expenditure on R&D relating to the low-carbon energy technologies identified as a priority for the EU in the Strategic Energy Technology (SET) Plan. These technologies are: wind energy, photovoltaic energy, concentrating solar power, bioenergy, carbon dioxide capture and storage, smart grids, nuclear fission, hydrogen and fuel cells and nuclear fusion.

Figures on staff, budget and publications

Core staff

The core staff of the JRC is composed of the following categories:

Core staff (M: male, F: female) (end-of-year situation) 2009	M	F	Total
Officials (permanent)	1186	491	1677
Temporary agents on renewable / non-renewable contracts	65	29	94
Total	1251	520	1771

Of the 1771 total, 1107 staff members are working on scientific projects and 664 staff members are doing administrative or support work. Of the total, 15% are working in infrastructure, logistics and technical sup-

port and 2% are working in nuclear decommissioning and waste management.

The Commission policy for the "integration of research staff into the mainstream of the Commission's personnel policy" is reflected in an overall decrease in the number of temporary agents from 2008 (124 staff) to 2009 (94 staff) through converting temporary agents to permanent officials. Nevertheless, a margin of flexibility will be maintained for the recruitment of temporary specialised staff on permanent research posts to cope with short-term needs to ensure a healthy flux of ideas and competencies.

Visiting staff

In addition to its core staff, the JRC has an active policy of hosting grant holders, visiting scientists, seconded national experts, contract agents and trainees, primarily from the Member States and Candidate Countries. Visiting staff bring advanced skills, knowledge and expertise to help resolve current and future scientific challenges, while benefiting from the cultural diversity, multidisciplinary research domains and extensive research networks at the JRC. The number of visiting staff is steady (compared with 2008) at around 35 % of the total number of JRC staff.

Visiting staff (end-of-year situation) 2009	M	F	Total
Trainees	33	61	94
Postgraduate grant holders	183	139	322
Post-doctoral grant holders	16	9	25
Seconded national experts	38	15	53
Contractual agents	229	238	467
Total	499	462	961

Note: unpaid visiting scientists (4) are not included.

Total staff

The total number of staff (core and visiting) in the JRC at the end of 2009 reached 2732, which is comparable to that of 2008 (2683). The distribution throughout the JRC institutes and directorates is as follows:

Staff distribution (core and visiting; end-of-year situation) 2009	M	F	Total
Institute for Reference Materials and Measurements	167	119	286
Institute for Transuranium Elements	187	76	263
Institute for Energy	200	73	273
Institute for the Protection and Security of the Citizen	312	152	464
Institute for Environment and Sustainability	281	136	417
Institute for Health and Consumer Protection	151	145	296
Institute for Prospective Technological Studies	110	84	194
DG, PSR, RM and ISD	342	197	539
<i>Directorate General</i>	13	9	22
<i>(Directorate of) Programmes and Stakeholders Relations</i>	31	34	65
<i>(Directorate of) Resource Management</i>	35	55	90
<i>Ispra Site Directorate</i>	263	99	362
Total	1750	982	2732

Note: unpaid visiting scientists (4) are not included.

Equal opportunities

The JRC Equal Opportunities and Women & Science group (EO and W&S) was established in December 2005 with the mandate to implement the JRC Action Plan for Equal Opportunities, according to the Commission's 4th Action Programme for Equal Opportunities 2004-2008 (SEC (2004) 447/5). In 2009, the group met 4 times and continued its gender watch action on recruitment and career development. It worked towards preparing women for managerial posts through training, and raised awareness amongst all JRC staff. The group was represented in a number of conferences supporting gender equality and in other committees/panels within the JRC. It provided different opinions including one on the childcare services rules revision, and promoted initiatives aiming towards the reconciliation of life-work balance.

The JRC Women and Science Network (W&SN) was established in the year 2000 by the JRC Director-General to encourage women in science within the JRC. In 2009 the network met 5 times and carried out its mission through the monitoring of gender-sensitive indicators, and facilitated, through recommendations, the development of a fair and effective environment for women scientists in the JRC. It worked towards enhancing the visibility of women scientists inside and outside the JRC. It performed an internal W&SN visibility survey and participated in a number of conferences. It also took part in the Commission's Inter-service W&S Group and in the JRC Scientific Committee. The network also engaged with senior management in supporting the Ispra Site Directorate gender balance initiative with a number of recommendations and supported actions on the reconciliation of professional and private lives. The W&SN continued to promote communication among JRC women scientists across the JRC sites.

Budget (budget and expenses – institutional activities)

The available credits to the JRC are subdivided into staff expenses, means of execution (maintenance of buildings and equipment, electricity, insurance, consumables, etc.) and specific credits (direct scientific procurements).

On the institutional budget, the following sums were committed (meaning available in commitment appropriations; EFTA credits are not included):

In million Euro	2009
Staff expenses	231,79
Means of execution	68,25
Operational appropriations	38,20
Total (rounded)	338,24

In addition, EUR 32.6 million was made available to finance the programme to decommission obsolete nuclear installations, and to manage the relevant waste activities.

Additional credits of EUR 18.2 million (EUR 5.7 million EFTA and EUR 12.5 million PECO) came from contributions of countries associated to the Framework Programme.

JRC earned income

A portion of the JRC's income comes from its participation in FP7 indirect actions, performing additional work for Commission services, and contract work for third parties such as regional authorities or industry. These activities complement the tasks outlined in the JRC's work programme and are seen as an essential tool for acquiring and transferring expertise and know-how.

The table on the right shows the value of contracts signed and inscribed in the accounts during 2009. The total quantity cashed by the JRC for ongoing contracts in 2009 amounted to EUR 66.4 million, compared with EUR 48.3 million in 2008.

Some 41% of all contracts signed in 2009 were a result of requests from Commission services for additional S&T support.

Key publications in 2009

The trend over the last years shows that JRC publication figures are continuously increasing. In 2009 the JRC produced 1,4 publications per staff member working on scientific projects, compared to 1,3 in 2008.

Research publications produced by the JRC are available for download through the Publications Repository: <http://publications.jrc.ec.europa.eu/repository/>

Publications can be found by free-text searching or advanced searching based on bibliographic data. The publications can be browsed by JRC institute, publication year, author or title and cross-links are supplied to find all works of a particular author.

Key publications in 2009 compared to 2008:

	1		2				3		4		Total	
	2008		2008				2009		2008		2009	
	2008	2009	2.1	2.2	2.3	2.2	2008	2009	2008	2009	2008	2009
JRC-IRMM	65	81	0	47	0	45	61	24	6	3	179	153
JRC-ITU	97	70	0	18	0	17	30	43	5	5	150	135
JRC-IE	72	82	0	43	3	45	57	59	1	2	173	191
JRC-IPSC	129	148	0	136	1	150	86	122	3	5	354	426
JRC-IES	215	198	1	71	0	55	52	61	9	8	348	322
JRC-IHCP	108	71	1	40	0	27	20	19	3	3	172	120
JRC-IPTS	62	90	1	71	1	103	15	17	0	1	149	212
	748	740	3	426	5	442	321	345	27	27	1525	1559

Contracts signed (in million Euro)	2009
Indirect actions of the Framework Programme (FP)	19,3
Support to Commission Services	40,9
Third Party work	6,4
Total (rounded up)	66,6

Category 1.

Monographs and Articles

(Books, Monographs with JRC editorship, Article contribution to a monograph, Article contribution to a periodical listed in the ISI Science/Social Science Citation index, Article contribution to other periodicals).

Category 2.

JRC Reports and Notes

2.1 JRC Reference Reports;
2.2 JRC Scientific and Technical Reports.

Category 3.

Contributions published in Conference Proceedings (Article contribution to conference proceedings published in a periodical listed in the ISI Science/Social Science Citation index, Article contribution to conference proceedings published in other periodicals, Scientific paper presented at a conference and published in a book of conference proceedings (with editorship)).

Category 4.

Special Publications

(PhD theses, publications in a special format, including maps).

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Institute of Chemical Process Fundamentals
CZ – 165 02 Praha 6 – Czech Republic

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Laboratorio de Biología del Desarrollo Floral
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ES – 46022 Valencia – Spain

Mr. Philippe PRADEL
Directeur de l'énergie nucléaire
Commissariat à l'énergie atomique (CEA)
FR – 91190 Gif-sur-Yvette Cedex – France

As of September 2009:

Mr. Christophe BÉHAR
Directeur de la Direction de l'énergie nucléaire
Commissariat à l'énergie atomique (CEA)
FR – 91190 Gif-sur-Yvette – France

Dr. Paolo VENDITTI
Senior Counsellor of 'Consiglio Nazionale delle Ricerche' (CNR)
and 'Società di Gestione Impianti Nucleari' (SOGIN)
IT – 00184 Roma – Italy

Dr. Kalypso SEPOU
Research Promotion Foundation
CY – 1683 Nicosia – Cyprus

Prof. Andrejs SILIŅŠ
Vice President
Latvian Academy of Sciences
LV – 1524 Riga – Latvia

Dr. Giedrius VILIŪNAS
Head of the Research Policy Unit
Research Council of Lithuania
LT – 01103 Vilnius – Lithuania

Dr. Pierre DECKER
Conseiller de Gouvernement 1ère classe
Ministère de l'Enseignement supérieur et de la Recherche
LU – 2912 Luxembourg – Luxembourg

Prof. László KEVICZKY
Hungarian Academy of Sciences
HU – 1051 Budapest – Hungary

Dr. Jennifer HARPER
Policy Unit Director
Malta Council for Science and Technology
MT – Kalkara CSP 12 – Malta

Dr. Jan NIEUWENHUIS
Directeur Innovatiestructuur
Ministerie van Economische Zaken
NL – 2500 EC Den Haag – The Netherlands

Dr. Daniel WESELKA
Leiter d. Abteilung II/10
Bundesministerium für Wissenschaft und Forschung
AT – 1010 Wien – Austria

Prof. Tadeusz LUTY
Institute for Physical and Theoretical Chemistry
Wrocław University of Technology
PL – 50-370 Wrocław – Poland

Prof. José CARVALHO SOARES
Centro de Física Nuclear da Universidade de Lisboa
PT – 1649-003 Lisboa – Portugal

Prof. Ioan DUMITRACHE
President
Ministry of Education, Research and Innovation
National University Research Council
RO – 050025 Bucharest – Romania

Prof. Mikuláš ŠUPÍN
Director General
Ministry of Education - Science and Technology Division
SK – 813 30 Bratislava – Slovak Republic

Mr. Peter VOLASKO
Head of Department of International Cooperation and EU Affairs
Ministry of Higher Education, Science and Technology
SI – 1000 Ljubljana – Slovenia

As of December 2009:

Dr. Jana KOLAR
Director General of the Science Directorate
Ministry of Higher Education, Science and Technology
SI – 1000 Ljubljana – Slovenia

Prof. Erkki LEPPÄVUORI
Director General
VTT Technical Research Centre of Finland
FI – 02044 VTT – Finland

Ms. Kerstin ELIASSON
Director
Ministry of Education and Research
SE – 1032 33 Stockholm – Sweden

Prof. David FISK
BP/RAEng Prof. Engineering for Sustainable Development
Imperial College
UK – London SW7 – United Kingdom



Front row, from left: Viktor Nedović, David Wilkinson, Albena Vutsova, José Carvalho Soares, Kerstin Eliasson, Killian Halpin, Jennifer Harper, Janez Potočnik, Roland Schenkel, Alejandro Herrera, Megan Richards, Axel Björnsson, Elke Anklam, Walter Mönig, Kalypso Sepou, Pierre Decker.

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Back row, from left: Stephan Lechner, Giancarlo Caratti, David Fisk, Hans Peter Jensen, László Keviczky, Andrejs Šilgā, Ioannis Andreadis, Galip Veliji.

PARTICIPANTS

<p>Mr. Ammar MIRAŠČIJA Head of Department for Science Ministry of Civil Affairs BA – 71 000 Sarajevo – Bosnia and Herzegovina</p>	BOSNA I HERCEGOVINA	<p>Dr. Karin REFSNES Project Director, Division of Strategic Priorities The Research Council of Norway NO – 0131 Oslo – Norway</p>	NORGE
<p>Mrs. Slobodanka KOPRIVICA Deputy Minister for Higher Education and Science Ministry of Education and Science ME – 81 000 Podgorica – Montenegro <i>As of November 2009:</i></p>	CRNA GORA	<p>Dr. Galip VELIJI Tetovo State University MK – 1200 Tetovo – Former Yugoslav Republic of Macedonia <i>As of June 2009:</i></p>	PORANESNA JUGOSLOVENSKA REPUBLIKA MAKEDONIJA
<p>Prof. Igor RADUSINOVIĆ Deputy Minister for Science, Research and Technological Development Ministry of Education and Science ME – 81 000 Podgorica – Montenegro</p>		<p>Dr. Atanas KOCOV Dean of the Faculty of Mechanical Engineering MK – 1000 Skopje – Former Yugoslav Republic of Macedonia</p>	
<p>Dr. Radovan FUCHS Deputy Minister for International Cooperation Ministry of Science, Education and Sports HR – 10 000 Zagreb – Croatia <i>As of June 2009:</i></p>	HRVATSKA	<p>Mr. Gjergji GJINKO Director of Cabinet, Albanian Ministry of Education and Science AL – 1001 Tirana – Albania</p>	SHQIPERIA
<p>Dr. Zdenko FRANIĆ Research scientist; Member of Croatian Parliament Institute for Medical Research and Occupational Health HR – 10 001 Zagreb – Croatia</p>		<p>Mr. Bruno MOOR State Secretariat for Education and Research (SER) Head of the Multilateral Research Cooperation CH – 3003 Berne – Switzerland</p>	CONFEDERATIO HELVETICA
<p>Prof. Axel BJÖRNSSON Professor in Environmental Sciences University of Akureyri IS – 600 Akureyri – Iceland</p>	ISLAND	<p>Mr. Viktor NEDOVIĆ Assistant Minister, Ministry of Science Department for Int'l Scientific & Technological Cooperation SR – 11000 Belgrade – Serbia</p>	SRBIJA
<p>Dr. Shlomo WALD Chief Scientist Ministry of National Infrastructures IL – 91360 Jerusalem – Israel</p>	ISRAEL	<p>Prof. Nüket YETIS President Scientific and Technical Research Council (TÜBITAK) TR – Kavaklıdere, 06100 Ankara – Turkey <i>As of July 2009:</i></p>	TÜRKIYE
<p>Mr. Karl-Heinz OEHRI Amt für Volkswirtschaft LI – 9490 Vaduz – Liechtenstein</p>	FÜRSTENTUM LIECHTENSTEIN	<p>Mr. Hüseyin GÜLER Head of Science, Technology, Innovation Policies and Strategies Unit Scientific and Technical Research Council (TÜBITAK) TR – Kavaklıdere, 06100 Ankara – Turkey</p>	

Secretary of the Board of Governors:

Dr. Giancarlo CARATTI
European Commission JRC
SDME 10/44 – BE – 1049 Brussels
Tel: +32 2 296 15 16 Fax: +32 2 296 74 83
e-mail: giancarlo.caratti@ec.europa.eu

As of 1 January 2010:

Dr. Ulla ENGELMANN
European Commission JRC
SDME 10/44 – BE – 1049 Brussels
Tel: +32 2 295 76 24 Fax: +32 2 295 01 46
e-mail: ulla.engelmann@ec.europa.eu

The JRC Directors



JRC senior management meeting in October 2009 in Geel.

Back row, from left to right:
Director ISD, **David Wilkinson***
Director JRC-IES, **Leen Hordijk**
Director JRC-IPSC, **Stephan Lechner**
Director JRC-ITU, **Thomas Fanghänel**
Director JRC-RM, **Jean-Pierre Michel***
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Director JRC-IPTS, **Peter Kind**
Director JRC-IE, **Giovanni De Santi**

Front row, from left to right:
Director PSR, **Krzysztof Maruszewski***
Director JRC-IRMM, **Alejandro Herrero***
Director JRC-IHCP, **Elke Anklam**

* On 1 November 2009, D. Wilkinson became the Director of JRC-PSR and D. Van Hattem replaced him as acting Director of JRC-ISD. On the same day, A. Herrero retired and K. Maruszewski became the Director of JRC-IRMM.
On 1 January 2010, J-P. Michel replaced M. Richards who left the JRC on 31 March 2009.

European Commission

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Abstract

Report on the activities, accomplishments and resources related to the JRC's work carried out in 2009. An overview is given of the mission, its implementation, the scientific achievements and activities, and its external relations.

The mission of the Joint Research Centre is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies. As a service of the European Commission, the Joint Research Centre 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.

