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JOINT RESEARCH CENTRE

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JRC structure

Joint Research Centre

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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.

JRC Annual Report 2010

Joint Research Centre

European Commission

JRC
EUROPEAN COMMISSION

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Foreword from the Commissioner for Research, Innovation and Science

Máire Geoghegan-Quinn, Commissioner for Research, Innovation and Science.

> 'In my vision of EU science policies I want the JRC to be a fully fledged Directorate-General that places science right at the heart of policy making, backed up by its independence and integrity. In other words, I want the JRC to be the brain of the European Commission.'
>
> MÁIRE GEOGHEGAN-QUINN
> *Commissioner for Research, Innovation and Science*

Máire Geoghegan-Quinn visiting the Vehicle Emissions Laboratory (VELA) in Ispra, 15 October 2010.

Commissioner Geoghegan-Quinn visiting the JRC-Geel site, 25 February 2010.

The Innovation Union strategy which I launched in October 2010 is all about getting good ideas to the market and bridging the gap between discovery and delivery. Critically, the Innovation Union is key to making the European Union more competitive and speeding up recovery from the current economic down-turn. The European Commission's Joint Research Centre (JRC) has a key role to play in making the Innovation Union a reality.

Now more than ever, policy making must be based on the best possible advice available. Over the last 50 years the JRC has built an excellent reputation as a world-class provider of scientific and technical support to European policy makers and legislators. Policy makers need to be presented with options based upon the best scientific evidence that is integrated across all relevant disciplines, from natural science and engineering to socio-economics. In an ever more complex world driven by rapid technological developments, we need a trusted and truly independent voice advising us on what is on the horizon in order to take timely policy decisions. It is reassuring to know that the European Commission can count on the scientific expertise of the Joint Research Centre during the policy-making process.

In this 2010 annual report, you will see solid examples of how the JRC has deployed its scientific and technical expertise to support all stages of the EU policy-making process — from policy anticipation to evaluation.

The JRC has implemented a European-wide electricity grid model and supported the 'Seveso III' Directive on the control of major accident hazards. For the first time, in-use emission testing is introduced in European emissions control legislation, thanks to the JRC's contribution to the drafting of the new Euro VI Regulation. The JRC provided detailed nuclear forensic analysis to the Member States as well as excellent crisis response work to natural disasters in Haiti and Pakistan. In terms of health and consumer protection, the JRC worked from developing analytical methods to measuring the levels of mycotoxins in infant food, to the challenges and perspectives of Bisphenol-A in baby bottles. The JRC also published two soil atlases — the first of their kind. These are just some of the examples that you can read about in this report.

The JRC's work creates tremendous benefit not only for the European Institutions, but also directly for European citizens. I intend to bring the JRC right to the heart of European science-based policy making — it is essential that the JRC provides sound, independent and relevant advice in order to make our lives safer, healthier and more sustainable.

To conclude, I wish to acknowledge the work of my predecessor, Janez Potočnik, to thank Roland Schenkel who retired as Director-General of the JRC and to welcome Dominique Ristori in his place. Finally, I wish to thank and acknowledge the staff of the JRC, on whom I depend for their support, commitment and engagement.

MÁIRE GEOGHEGAN-QUINN

Message from the Director-General

The year 2010 has been an important year for the JRC with the finalisation of its Corporate Strategy 2010–20. The JRC has re-oriented itself into a pivotal position to support the Europe 2020 strategy and its seven flagship initiatives, as endorsed by the European Council.

Dominique Ristori, Director-General, JRC.

European decision makers are increasingly faced with policy dilemmas requiring solid scientific evidence, in areas such as genetically modified organisms, nanotechnologies, biofuels and dangerous chemicals. Although final decisions remain political, it is important to ensure that scientific evidence is fully taken into account. The JRC, with its seven scientific institutes in five Member States, is a valuable source of in-house Commission scientific expertise.

In line with Commissioner Geoghegan-Quinn's high ambitions for the JRC, the main objective of the JRC will be to provide maximum scientific support to the Europe 2020 policy priorities, which address the major challenges facing Europe in terms of competitiveness, sustainability and grand societal issues, such as health, safety and security. This requires a substantial change in the way the JRC approaches its scientific and technical support to European policies.

The JRC will become much more proactive, e.g. through building up a capacity for scientific foresight and policy anticipation, identifying emerging issues and future trends. At the same time the JRC will enhance its interactions with all the European Institutions as well as with the Member States, stakeholders and with international partners. The year 2010 has already seen many examples of this, as you will be able to appreciate in the present annual report.

Part of the support to policy makers is the capacity of the JRC to act quickly in crisis situations. The devastating earthquake in Haiti in January 2010, but also the volcanic ash crisis that grounded planes across Europe for a week, have shown how instrumental the JRC can be in providing ad hoc advice. On a more day-to-day level, legislative decisions about the food we eat, the air we breathe, and the energy we use, continue to demand the scientific-technical support of an independent European body: the JRC.

All the above would not be possible without staff who are highly skilled and motivated. I therefore wish to thank everybody for the excellent work in 2010 and am confident that we can continue to count more than ever on your commitment to making Europe the most thriving place on Earth.

DOMINIQUE RISTORI

Dominique Ristori visiting the JRC-Ispra site.

Observations from the Board of Governors

Killian Halpin, Chairman of the Board.

In 2010, the Board of Governors continued to be actively involved in advising the JRC in matters relating to the strategic management and technical and scientific work of the JRC. The Board met in February, June and November to discuss issues such as the development of the JRC Corporate Strategy 2010–20, the JRC Multi-annual Recruitment Competition Planning, the interim evaluation of the nuclear activities of the JRC under the 7th Euratom Framework Programme (2007–11), and the role of the JRC in the development of the European Research Area (ERA). The Board was particularly pleased to welcome Máire Geoghegan-Quinn to the February meeting and to have had the opportunity for an exchange of views with her so soon after her appointment as Commissioner for Research, Innovation and Science.

The Board welcomes the new vision and Corporate Strategy for the JRC. It shows the commitment of the JRC to identify new goals and objectives which are challenging yet achievable to support the EU in meeting the goals of Europe 2020, thereby contributing to realising the European Research Area (ERA). The Board is convinced that the JRC is now well positioned to contribute to those goals.

The new strategy aims to generate the pronounced change recommended by Sir David King and the panel of experts, who carried out the Ex-post evaluation of the JRC Direct Actions in the 6th Framework Programme, in order to make the JRC even more relevant for policy making in the European Union. The Board also welcomes that the JRC has fully completed its follow-up actions in eight of the 10 recommendations in the Panel's report and intends to complete the remainder in 2011.

The JRC makes a noticeable contribution to the mobility and the flow of knowledge in the European Research Area (ERA) through the training of roughly 600 researchers annually, and by making its research facilities available. Its role in harmonising measurement methods and data across different fields, and in bringing together practitioners from across the EU to promote best practices are further examples of the JRC's important role in the ERA. Nevertheless, the Board wishes to reiterate the need to strengthen the role of the JRC in EU policy making through the establishment of even closer links between the JRC and similar national and international organisations that provide science-based policy advice in the Member States and Associated Countries.

In 2010 the Board was continuously, and in various ways, involved in strengthening the links between the JRC and Member States and Associated Countries. This included making the activities of the JRC better known in individual countries in order to foster increased cooperation as well as to ensure that Member States' priorities are appropriately reflected in the work of the JRC. The Board believes that these efforts need further attention.

Throughout the year the JRC provided input to the EU policy cycle. The JRC published the 'European atlas of soil biodiversity' and supported the Marine Strategy Framework Directive with its work on biodiversity and alien species, chemicals in the environment, marine litter, eutrophication, and the health of exploited fish and shellfish stocks. The JRC released 24 new reference materials and developed analytical methods to determine the levels of mycotoxins in infant food. It also published a review study to clarify uncertainties about exposure from polycarbonate baby bottles and the adverse health effects of Bisphenol-A at low doses. In terms of nuclear security, the JRC provided nuclear forensics support to the EU Member States in four cases. In consultation with Member States, the JRC carried out a feasibility study for establishing a nuclear security training centre and, as a consequence, the JRC was tasked by the Home Affairs DG to implement a European Nuclear Security Training Centre (EUSECTRA).

The Board commends the JRC management and staff on the progress made in 2010 in fulfilling the JRC mission.

For energy efficiency and a low carbon society, the JRC published the ninth edition of the annual 'Photovoltaic Status Report', which provides policy makers and industry with an overview of the current activities regarding research, manufacturing and market implementation. Based on a guidance document developed by the JRC, a new methodology for estimating changes in greenhouse gas emissions from soil and above- and below-ground biomass resulting from global land use changes was developed. The JRC also made significant contributions to the drafting of the new Euro VI Regulation which aims to limit emissions from heavy duty vehicles.

In cooperation with researchers from the Internal Market and Services DG (Directorate-General) and experts from academia, the JRC developed the statistical model SYMBOL (Systemic Model of Banking Originated Losses), which estimates the probability and the magnitude of any new potential crisis hitting the banking system.

The above are just a few examples of how the JRC is carrying out very 'down to earth' activities relevant and important to the different directorates within the Commission but which also have significant relevance to the development of policies in Member States and Associated Countries.

Successful EU policy making needs to be based on sound technical advice and solid scientific research. In fulfilling its role as an important contributor to EU policy making, the JRC needs a wide range of professional competences. It is therefore essential for the JRC to retain flexibility in its recruitment process. The Board welcomes the progress made in the development of a multiannual recruitment plan.

Finally, the Board wishes to record its appreciation for Roland Schenkel as Director-General of the JRC, who had a very positive and recognised impact both in affirming the role of the JRC as a provider of scientific and technical support to the EU policy-making process, and in promoting cooperation with relevant international partners. Roland Schenkel retired in November 2010, having led the JRC for six years. We would also like to express our warm appreciation for the work and the dedication of Peter Kind, the JRC Director, who retired in April 2010, and to Robert-Jan Smits for his work as Deputy Director-General from April to June 2010.

The Board welcomes the appointment of Dominique Ristori as the new Director-General of the JRC and wishes him every success in his new and challenging role.

The Board endorses the present annual report and expresses its gratification to the JRC management and staff for the progress in 2010 in fulfilling the JRC mission.

KILLIAN HALPIN
Chairman of the Board

JRC 2010-2020

The Joint Research Centre (JRC) has undertaken the challenge of reinvigorating the organisation by creating a new vision and strategy for 2010–20. This was necessary to address grand societal challenges on a European scale, as well as globally, for which scientific and technological support requires more integrated, pro-active and cross-policy action.

This has led to the definition of a new profile for the JRC with a dynamic vision for 2010–20, the major driving force behind the strategy:

'The vision of the JRC 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 new strategy firmly positions the JRC alongside the 'Europe 2020' strategy, the Innovation Union, the European Research Area, and the European Commission's research priorities for years to come. The JRC aims to pay increased attention to the grand challenges by providing assessments of policy options to key customers rather than solely focusing on sectoral policy support and analysis. The strategy recognises the need for European research to be more issue-driven, capable of providing sustainable solutions in broad areas of EU interest, and promoting growth and investment.

Without a doubt, this strategy represents significant changes for the JRC. It identifies new goals and objectives, and implies a number of strategic developments to allow the JRC to deliver policy support and policy options at the European and global level.

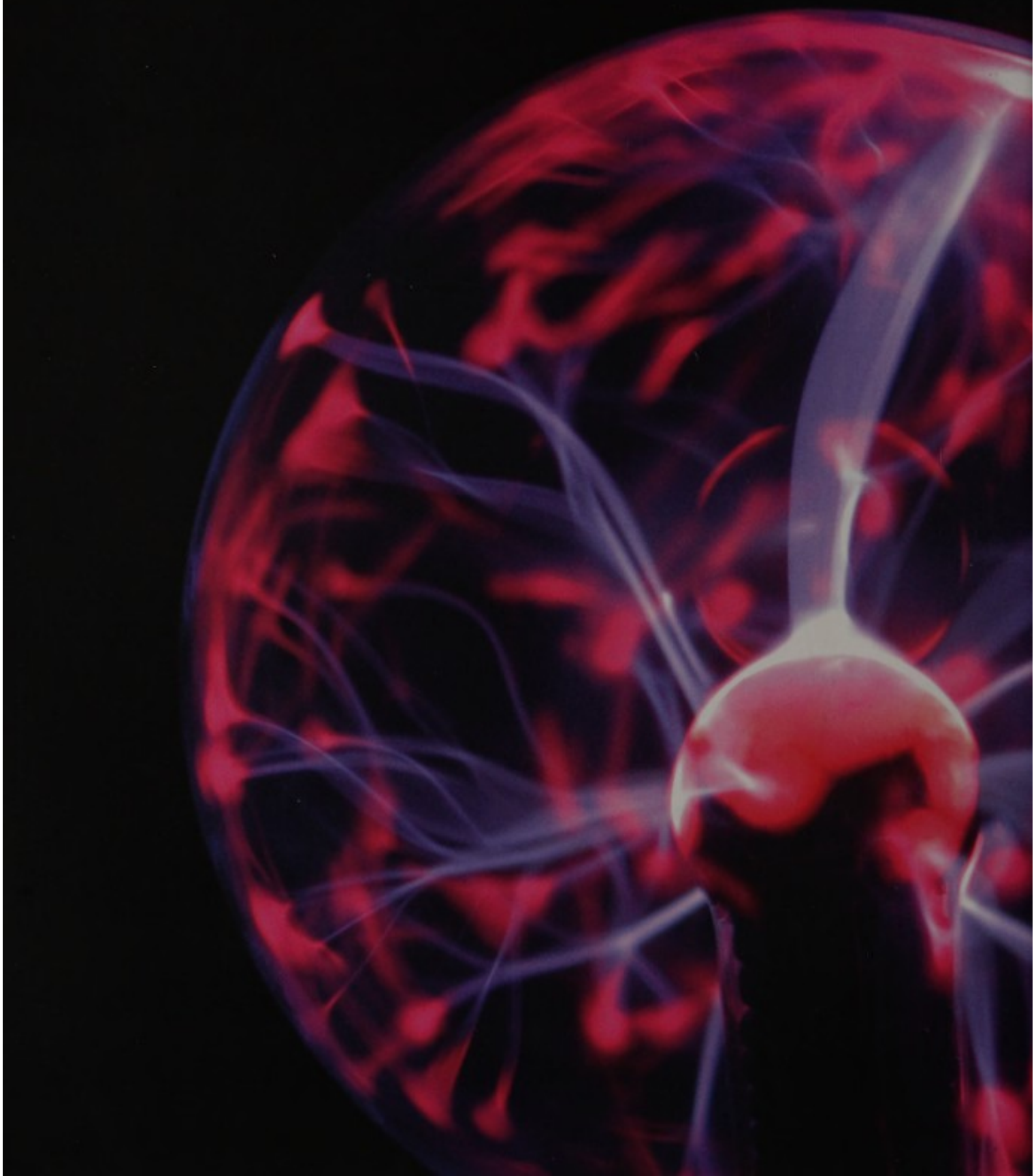
- Competences in economic and socio-economic research will be expanded and integrated with natural science and engineering-based approaches.
- Complex and long-term challenges will be addressed by multi-disciplinary research teams integrated across the JRC via seven thematic areas and the application of modelling platforms.
- Policy analysis and related impact assessments will receive increased emphasis.
- A new programme-oriented management approach will be introduced.
- The JRC will strengthen the interface at a higher strategic level with its customers and stakeholders such as the European Parliament, the European Council and Member State ministries and research centres.
- The JRC will develop its capacity to anticipate future areas of policy making by initiating a corporate capacity to provide horizon scanning and anticipation intelligence while pro-actively complementing the customer-driven approach.

The seven thematic areas are:

- Towards an open and competitive economy;
- Development of a low carbon society;
- Sustainable management of natural resources;
- Safety of food and consumer products;
- Nuclear safety and security;
- Security and crisis management;
- Reference materials and measurements.

This new approach requires the JRC to strengthen its interactions and broaden the interface with policy Directorates-General (DGs) and, importantly, groups of DGs addressing inter-linked policy issues. In developing these thematic areas, the JRC will follow a programme-oriented approach, with a management structure that fosters over-arching objective setting, a multi-disciplinary collaboration and integrated solutions to deliver high quality scientific support to EU policy and development of policy options. The JRC will prioritise its resources to achieve its strategic objectives, and especially enhance its role in economic and policy analysis across the thematic areas as a service to its customers. The JRC will also engage in new and emerging areas of research driven by scientific and technological advances, the emergence of societal issues or new policy developments whose selection will also be based on horizon scanning activities carried out in close collaboration with customers.

SUPPORTING
EU POLICIES



QUOTATIONS

JRC Geel (28 June 2010)

'It was a real pleasure having been here! I was impressed by the quality and dedication of the staff and although I leave the JRC in the next days, realise that you have an ambassador for life!'

ROBERT-JAN SMITS, *Director-General for Research and Innovation*
(after having worked as Deputy Director-General in the JRC)

JRC Geel (23 November 2010)

'What you are doing is very important for Europe, Belgium and Flanders. Good luck!'

KRIS PEETERS, *Flemish Minister-President*

JRC Ispra (18 March 2010)

'On behalf of the American Association for the Advancement of Science: Many thanks for hosting me and providing such an interesting day of discussions. The JRC Ispra undertakes so many useful projects and the AAAS looks forward to a long, fruitful and mutually beneficial relationship. Looking forward to our collaboration.'

BENN TANNENBAUM, *Program Director,*
Center for Science, Technology and Security Policy – AAAS

JRC Ispra (19 March 2010)

'I was dazzled by what I have seen during my visit to the Ispra site and I had never dreamed that we were doing such things in the Commission. I was impressed by the motivation, enthusiasm and professional approach of the staff and management. I will be very happy to support, with all my effort, the JRC in the HR domain.'

IRENE SOUKA, *Director-General for Human Resources and Security*

Response to crises in 2010

JRC staff collecting GPS-tagged field photographs in downtown Port-au-Prince to assist in the validation of damage figures derived from satellite imagery and aerial photography. The deployment to Haiti in February and March 2010 was part of the European Commission contribution to the post-disaster needs assessment jointly organised with the United Nations and the World Bank.

Haiti earthquake — assessing damage in support to relief and reconstruction efforts

In the aftermath of the earthquake in Haiti on 12 January 2010, the JRC supported the Commission's external relations services in coordinating a response from the EU by issuing early-warning alerts and delivering updated situation maps throughout the critical emergency phase. Eighteen minutes after the first shock on 12 January 2010, the Global Disaster Alert and Coordination System (GDACS)[1] issued a red alert to 8 500 users — mainly aid and first response organisations. This mobilised the interventions of the EU's Civil Protection Mechanism, as well as those of the United Nations emergency relief and humanitarian agencies such as the Office for the Coordination of Humanitarian Affairs and the World Food Programme.

Within days of the earthquake, the JRC produced a preliminary damage estimate for south-western Haiti, including Port-au-Prince, based on the analysis of high resolution satellite data from before and after the earthquake. This first analysis allowed a prioritisation of the most affected areas. The preliminary damage analysis found that more than 4 000 physical structures were destroyed or damaged in Haiti's densely populated capital Port-au-Prince. About 2 000 residential buildings were identified as partially or totally collapsed and the same number of buildings showed severe damage. The analysis also showed that a number of critical infrastructures, such as government buildings, educational structures and hospitals, had collapsed or were severely damaged.

These damage figures were subsequently revised by the JRC in collaboration with its key international partners, the World Bank and the United Nations Operational Satellite Applications Programme (UNOSAT), with in-depth analyses of images with even higher resolution. The revised assessments indicated that the damages visible in these new, better-resolution datasets were higher by a factor ranging between 5 and 10 compared with the first satellite-based rapid damage assessment. This reassessment, complemented by field-based damage surveys for the housing and infrastructure sector, constituted an important input to the post-disaster needs assessment and recovery framework that was carried out jointly by the government of Haiti, the World Bank, the United Nations, the European Commission (including experts from the JRC) and the EU represented by experts from its Member States.

The result of this process was a comprehensive damage and loss assessment of the impact of the Haiti earthquake and related recovery and reconstruction needs, which was presented at the International Donors' Conference that was held in New York in March 2010.

A sheet from the damage atlas produced jointly by UNOSAT, the World Bank/Global Facility for Disaster Reduction and Recovery (GFDRR) and the JRC for a downtown area in Port-au-Prince. The damage locations found during image interpretation are plotted on the 0.15 m aerial photograph background. Colours identify the damage grade. The atlas was particularly useful for survey planning and to support teams.

1 GDACS (http://www.gdacs.org/) is a web-based platform developed by the JRC and the United Nations. It provides near real-time alerts about natural disasters around the world and tools to facilitate response coordination.

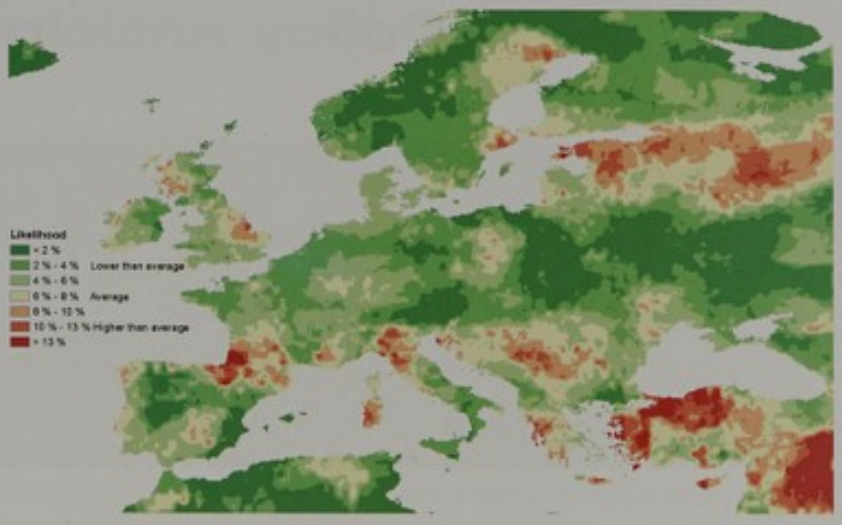
Supporting EU and international efforts to help Pakistan

The severe Pakistan floods in 2010 killed almost 2 000 people, affected about 20 million people and caused extensive damage to agricultural lands, property and infrastructure.

In close cooperation with the EU Member States and the international community, the European Commission assisted the Pakistani authorities and the population by providing expert humanitarian relief and rescue support and by contributing to the post-disaster needs assessment under the lead of the United Nations and the World Bank/Asian Development Bank. Representing the European Commission, the JRC contributed to the process by helping with the organisation of the analytical work of the Pakistani Space and Upper Atmosphere Research Commission (SUPARCO) and assisted in product quality assessment. This facilitated the delivery of robust damage analyses and statistics into the post-disaster needs assessment plan for recovery and reconstruction that was presented at the ensuing International Donors' Conference. The JRC also provided geospatial information support to the European Commission's Monitoring and Information Centre, providing an insight into the most affected districts and the extent of affected societal functions (e.g. population, infrastructure and agricultural land). The support was based on openly available data from the Pakistani authorities, as well as in-house flood extent analysis and other analyses provided by JRC partners, based on satellite data.

Guido Lemoine

'International coordination of post-disaster needs assessment has gained urgency in 2010, following the Haiti earthquake and Pakistan floods. The JRC is leading in the use of remote sensing imagery to support disaster impact mapping.'



This graph shows the likelihood of a severe meteorological drought from 1989 to 2008, expressed as the percentage of months with a Standardized Precipitation Index (SPI-12) less than minus 1.5. Since the long-term statistical expectation for such an event is about 7 %, regions with red colours showed an increased likelihood, while regions with green colours showed a reduced likelihood for severe meteorological drought over this period.

Water scarcity and droughts — a major concern for many areas in Europe and worldwide

JRC work on developing the European Drought Observatory (EDO)[1] aroused interest among specialist communities on a European and world scale. The EU Member States' Water Scarcity and Drought Expert Network, established under the Water Framework Directive, decided to support the further development and maintenance of the system*. At a meeting on natural hazards' databases at the European Environment Agency in Copenhagen, the potential of EDO was explained, and interest in a database of historical droughts discussed. Later in 2010, the JRC's EDO experts were invited to participate in a consultation meeting on the proposed global 'Integrated Drought Management Programme', organised by the World Meteorological Organization (WMO) and the Global Water Partnership in Geneva. There, the JRC's EDO was presented to participants from various UN organisations, as well as institutions and ministries from North America, Africa and Australia. Drought-related experiences (e.g. monitoring, assessment, forecasting and management) were exchanged, drought impacts discussed, and a first concept paper on the 'Integrated Drought Management Programme' elaborated. The JRC is now part of a core group revising and extending this note, to be presented to the WMO Council for approval. Together with the US National Drought Mitigation Centre and Australian initiatives, EDO has further been recognised by the Global Earth Observation System of Systems (GEOSS) community as a cornerstone for the development of a global drought monitoring initiative and the JRC's EDO team is involved in related developments.

* COM(2007) 414 final: Addressing the challenge of water scarcity and droughts in the European Union.

Post-disaster needs assessment after the Pakistan floods in July and August 2010 was supported by satellite imagery from different sensors (MODIS, SPOT and various very high-resolution sensors).

1 http://edo.jrc.ec.europa.eu/

Policy anticipation

Cereals are one of the main EU agricultural markets.

Desertification — the JRC was nominated UNCCD Regional Reference Centre

In 2010, the United Nations Convention to Combat Desertification (UNCCD) established 15 reference centres worldwide on the basis of their recognised experience in desertification and land degradation issues. These reference centres support the UNCCD* to implement country reporting guidelines and participate in the development activities of new indicator-based monitoring and assessment of desertification at regional, sub-regional and national levels. The JRC was nominated as one of these reference centres. It provides assistance to the countries of the UNCCD's regional annexes for the Mediterranean, central and eastern Europe and other affected parties (e.g. Canada, Israel, Russia and the United States), covering the largest constituency worldwide. The JRC gave two training sessions in Brussels in June 2010: one, on the new indicator-based reporting system, was attended by 48 participants representing UNCCD national focal points from 21 countries; the other training session had 25 participants from 11 donor countries, representatives of the Global Mechanism and the coordinator of the Performance Review and Assessment of Implementation System (PRAIS) project [1]. PRAIS coordinates activities of all reference centres on behalf of the UNCCD Secretariat.

* Ten-year strategic plan and framework to enhance the implementation of the Convention (2008–18), Document ICCD/COP(8)/10/Add.2, 9 July 2007.

** COM(2010) 672 final: 'The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future'.

Robert M' Barek

'Projections never match reality. However, policy making needs a robust reference for medium-term market and ex-ante policy analysis.'

Outlook for agricultural markets

Each year, the European Commission publishes medium-term projections for the main EU agricultural markets (cereals, oilseeds, meat, eggs and dairy as well as biofuels) and income.

The 2010–20 market outlook constitutes the main reference scenario (baseline) for further ex-ante evaluations of policy impacts and feeds into the ongoing Common Agriculture Policy post-2013 impact assessment process**. The projections are based on market statistics, results of economic models, and market expert judgements, all being subject to specific assumptions regarding further development of macro-economic conditions, agricultural and trade policy environment, the path of technological change and the functioning of international markets.

The publication of the market outlook involved joint efforts by the JRC and the Agriculture and Rural Development DG. The JRC worked in particular on the modelling background and baseline projections as well as quantification of main areas of uncertainty, such as yields, oil price and GDP growth.

The complete report 'Prospects for agricultural markets and income 2010–2020' can be found at http://ec.europa.eu/agriculture/publi/caprep/prospects2010/index_en.htm

Training on UNCCD-PRAIS indicator reporting of national focal points by the JRC Reference Centre (June, 2010).

1 http://www.unccd.int/prais/

Energy security — smarter power grids needed

Developing and remodelling electricity grids is an essential step in the pursuit of the EU's competitiveness, sustainability and security of energy supply objectives for 2020 and beyond. Power grids need to become more interconnected and smarter by seamlessly integrating a wide range of users, including renewable energy sources, storage technologies and electric vehicles. The JRC has identified and analysed the vulnerabilities of Member States' electricity transmission systems, in line with the Directive on European critical infrastructures*. Based on this, the JRC has implemented a European-wide electricity grid model. The model includes more than 10 000 elements (nodes and lines) of Europe's transmission grid and can be used to run static and dynamic analyses via advanced power simulation tools based on MATLAB and NEPLAN platforms and associated models.

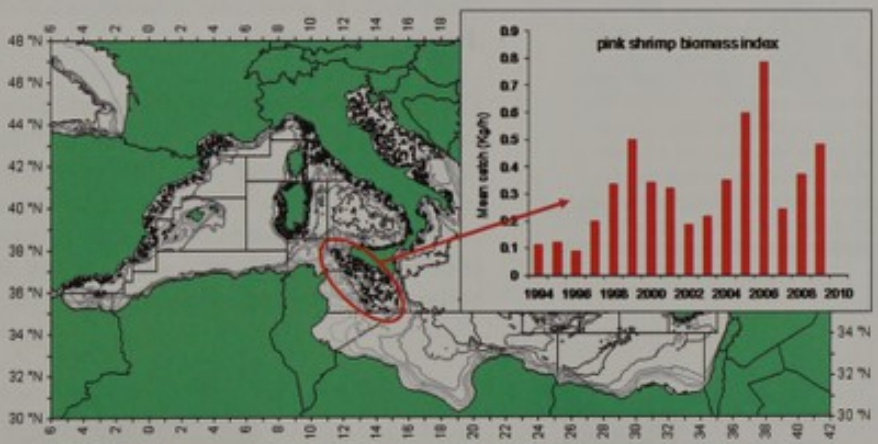
Developing the EU's electricity grids is critical for our energy security.

Working towards more sustainable fisheries in the Mediterranean

The Mediterranean Regulation** aims to ensure the sustainable exploitation of fisheries resources and requires Member States to implement fisheries management plans on the basis of scientific advice. In 2010, the European Commission's Scientific, Technical and Economic Committee for Fisheries (STECF) concluded that about 85 % of the exploited fish and shellfish stocks assessed in the Mediterranean were overexploited and thus unable to produce high yields in a long-term perspective. Thanks to more reliable and complete data sets assembled by the JRC on fish stocks, fishing effort and landings, as well as JRC expert contributions to the STECF, the previous estimate of the state of overexploitation of resources was revised upwards from a less critical status (54 % overfished) to an aggravated status (85 % overfished). Following this scientific advice, the Commission decided to take a tougher stance towards Member States involved in these fisheries[1]. In addition, thanks largely to the JRC's contributions, both the number and the reliability of analytical assessments for Mediterranean fish stocks have significantly increased[2] and are now available to support sound scientific advice.

* Council Directive 2008/114/EC on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection.

** Council Regulation (EC) No 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, amending Regulation (EEC) No 2847/93 and repealing Regulation (EC) No 1626/94.



Geographical positions of 15 809 scientific survey catches (black spots) in the Mediterranean Sea and estimated stock biomass trend of pink shrimp Parapenaeus longirostris (Lucas, 1846), south of Sicily, Italy, 1994–09.

'Smart grids are all about integration — not simply connection — of power and information technologies.'

'The JRC is committed to supporting sustainable fisheries management in the Mediterranean Sea.'

1 Press release 'Mediterranean Fisheries: sustainable fishing practices cannot be postponed', IP/10/703 of 8.6.2010.
2 Scientific, Technical and Economic Committee for Fisheries (STECF), *Assessment of Mediterranean Stocks — Part I* (edited by: Cardinale, M., Cheilari, A. and Rätz, H.-J.), EUR 24637, Publications Office of the European Union, Luxembourg, 2010, p. 1 077.

Inauguration of the new scientific-technical facility to develop measurement standards.

Policy formulation

The JRC supports the Euro-VI heavy duty Directive

The JRC made significant contributions to the drafting of the new Euro VI Regulation which aims to limit emissions from heavy duty vehicles. This Regulation implements and amends EC Regulation No 595/2009**. The work performed in 2010 enabled the adoption of the draft regulation by the Technical Committee for Motor Vehicles, established by the Enterprise and Industry DG, thus moving the new Euro VI emission standards one step closer to final approval. The JRC's independent role was essential: since 2004, JRC scientists developed, in collaboration with industry and the Member States, the technical aspects of the procedure to check the in-use emissions of heavy duty vehicles using portable emission measurement systems. The JRC's results are now laid down in Annex II 'Conformity of in-service engines or vehicles'. For the first time, in-use emission testing is introduced in European emissions control legislation, which represents a major breakthrough.

New reference material production facility at the JRC site in Geel, Belgium

A new scientific and technical facility to develop measurement standards* was officially inaugurated at the JRC in Geel, Belgium, on 23 November 2010. The Minister-President of the Belgian Region Flanders, Kris Peeters, and the European Commission's Director-General for Enterprise and Industry, Heinz Zourek, performed the ceremonial ribbon cutting.

The reference materials developed and produced in the new facility will provide laboratories around the world with benchmarks to deliver accurate and traceable measurement results, notably in emerging areas such as molecular biosciences and personalised medicine.

The building features a flexible production hall and special laboratories which bring together processing and measurement equipment in an innovative set-up. It also provides the European Commission with an in-house laboratory for the safe handling of pathogenic biomaterials (see also page 56).

* Directive 98/79/EC of the European Parliament and of the Council on *in vitro* diagnostic medical devices;

Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy;

Commission Regulation (EC) No 1881/2006 setting maximum levels for certain contaminants in foodstuffs.

** 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.

Truck equipped with portable emissions measurement systems on a long-distance test between Ispra and Barcelona.

'In-use testing with portable equipment is becoming one of the most important elements of the emissions standards, which shall ensure the environmental friendliness of trucks, off-road machines and potentially passenger cars. Since 2004, the JRC has played a central role to develop technical elements for EU legislation.'

'The new reference material production building places the JRC's infrastructure at the forefront of the development and production of reference materials, and allows us to meet the measurement challenges of the 21st century.'

A global INSPIREd information society

With INSPIRE (Infrastructure for Spatial Information in Europe, http://inspire.ec.europa.eu) the European Union has embarked on the largest data harmonisation effort worldwide in the area of environmental information. The JRC is the technical and scientific coordinator of INSPIRE and has taken the lead in establishing interoperability between data and services of the 27 Member States, by developing and testing technical specifications and organising consensus-building with the stakeholder communities. With the adoption of Regulations (1088/2010 and 1089/2010), the JRC and its customer Environment DG reached a major milestone in the access to, and harmonisation of, data required for environmental policy making and assessment. In 2010, Member States implemented the INSPIRE Metadata Regulation*, by making available the metadata of thousands of geospatial resources — thus enabling them to be discovered and evaluated by data users. The JRC has played a major role in drafting all above-mentioned legal acts, written after intensive networking and stakeholder contributions.

The contribution of INSPIRE to global efforts in sharing environmental information has been recognised by Commission's Vice-President AntonioTajani at the 2010 Group on Earth Observations Ministerial Summit. In his words[1]: 'The principle of free data sharing and the establishment of norms and standards allowing easier access and exchange are of paramount importance. The European Commission already actively supports this development through its INSPIRE Directive.'

Alessandro Annoni

'INSPIRE is a major breakthrough in policy making by an open, participatory approach to conception, development and implementation. I am proud to see this model "inspiring" on a global scale.'

Indirect land use change from biofuels

Within the JRC's thematic programme on biofuels, a topical report was published in August 2010[2]. It uses a new methodology to estimate changes in global greenhouse gas (GHG) emissions from soil and biomass as a result of land being converted to biofuels production.

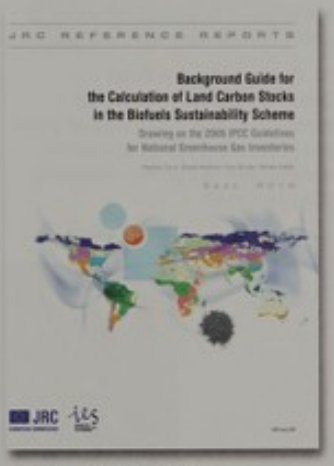
The report was discussed at a stakeholders' conference held in Brussels in October 2010, attended by farmers' associations, industry and political as well as environmental groups from all over the world. It received wide press coverage and had notable political impact by underpinning the Commission report of December 2010 on indirect land use change from biofuels and bioliquids**.

This achievement was possible, in part due to a JRC scientific Reference Report 'Background Guide for the Calculation of Land Carbon Stocks in the Biofuels Sustainability Scheme', published in early 2010, which defined the background guidelines for the calculation of land carbon stocks in the biofuels sustainability scheme.

Roland Hiederer

'Our work on greenhouse gas emissions due to indirect land use changes provided answers for a highly complex and political issue. Our integrated team approach has been both scientifically stimulating and very rewarding.'

JRC Scientific and Technical Report.



JRC Reference Report.

* Commission Regulation (EC) No 1205/2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata.

** Report from the Commission on indirect land use change from biofuels and bioliquids, COM(2010) 811 final of 22.12.2010.

1 Vice-President Antonio Tajani's full speech at: http://earthobservations.org/documents/ministerial/beijing/statements/bms_European%20Commission_statement_english.pdf

2 Hiederer, R. et al., *Biofuels: a New Methodology to Estimate GHG Emissions Due to Global Land Use Change — A methodology involving spatial allocation of agricultural land demand and estimation of CO_2 and N_2O emissions*, EUR 24483, Publications Office of the European Union, Luxembourg, 2010. Available for download at http://re.jrc.ec.europa.eu/bf-tp/html/documents_main.htm

The JRC has been testing plastic infant baby bottles from all over the EU.

Bisphenol-A and baby bottles — challenges and perspectives

The JRC's work on plastics used for infant feeding bottles was initiated to support the Health and Consumers DG in devising appropriate measures to respond to the growing concern regarding the potential health hazards caused by exposure of babies to Bisphenol-A (BPA) via leaching from polycarbonate bottles.

In 2010, the JRC published a review study to clarify uncertainties about exposure from polycarbonate baby bottles and the adverse health effects of BPA at low doses. The report provided the European Food Safety Authority (EFSA) and the Health and Consumers DG with an overview of the scientific issues, summarising the risk assessment activities and latest scientific information carried out so far.

In parallel, the JRC investigated the influence of test conditions on release of BPA from polycarbonates, using a method validated at EU level by the JRC-hosted European Reference Laboratory for Food Contact Materials. The Commission recently amended the Directive* on plastics for food contact materials to prohibit the manufacture of infant feeding bottles with BPA from 1 March 2011. A complete substitution towards BPA-free polycarbonate substitutes will ensue. The results of an EU monitoring study on release from other plastics, carried out by the JRC, will be therefore highly instrumental for a full risk assessment of these materials, helping both EFSA and the Health and Consumers DG to safeguard consumer protection.

'The JRC's work on baby bottles is a perfect example of the need for evidence-based data for policy decisions to ensure consumer protection.'

* Commission Directive 2002/72/EC relating to plastic materials and articles intended to come into contact with foodstuffs.

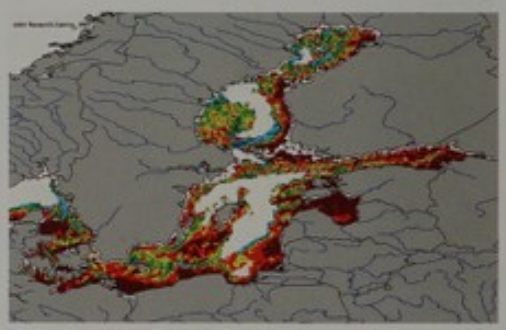
** Commission Decision 2010/477/EU on criteria and methodological standards on good environmental status of marine waters (notified under Document C(2010) 5956).

JRC support to the Marine Strategy Framework Directive — good environmental status for the European seas

The JRC supports the development of the EU integrated maritime policy. One key area of its work in 2009 and 2010 was related to the Marine Strategy Framework Directive that aims to achieve good environmental status of the EU marine waters by 2020 and to protect the resource base upon which maritime-related economic and social activities depend.

The JRC has provided scientific support for defining environmental objectives and developed, in collaboration with the International Council for the Exploration of the Sea (ICES), methodologies to monitor them. The work included the overall coordination of the process, co-chairing and scientific-technical support to several marine strategy task groups of independent experts.

The JRC contributed to the work on biodiversity and alien species, chemicals in the environment, marine litter, eutrophication, and the health of exploited fish and shellfish stocks. In the framework of this project, 11 reports were published in 2010. The work has ultimately fed into the Commission Decision** where direct reference to the work of the JRC is made.



Climatology of oxygen depletion risk index in the Baltic Sea for the month of June. The data scaled from 0 (low probability of bottom anoxia) to 1 (high probability of bottom anoxia) are estimated from the combination of satellite data and hydrodynamic model outputs. Source: http://emis.jrc.ec.europa.eu/

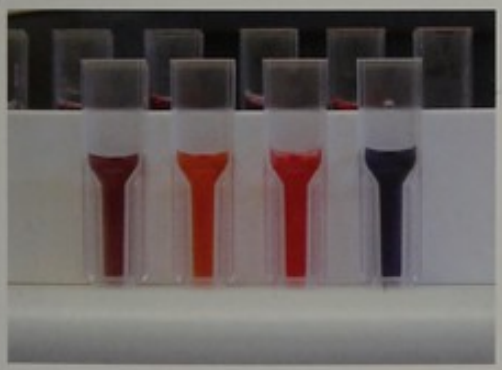
Size matters — definition of nanomaterials for regulatory purposes

Despite the growing use of engineered nanomaterials in consumer products and innovative technological applications, there is at present no widely accepted definition of the term 'nanomaterial' that is suitable as a basis for legislation on their safe use.

The European Parliament requested the introduction of a definition of nanomaterials into EU legislation and called on the Commission to promote the adoption of a harmonised definition at the international level*. In July 2010, the JRC published a Reference Report entitled 'Considerations on a definition of nanomaterial for regulatory purposes'[1], which provides guidance on the preparation and contents of such a definition.

The report discusses possible elements of a comprehensive, science-based definition aiming at reducing ambiguity and confusion for regulators, industry and the general public. It recommends that the specific term 'particulate nanomaterial' should be employed in legislation to avoid inconsistencies with other definitions and that size should be used as the only defining property.

The report has attracted considerable attention in the debate on nanomaterial Regulation among stakeholders such as industrial associations and policy makers, and in particular in the context of the public consultation launched in October 2010 on a definition drafted by the European Commission.



Gold nanoparticles change colour depending on the size of nanoparticles (2-3 nm on the left, to over 30 nm on the right).

Centrifugal liquid sedimentation instrument to measure the size distribution of nanoparticles in a suspension.

Validation of methods to characterise nanoparticles

Nanomaterials are increasingly discussed in the European regulatory arena*. This is due to concerns about potential effects of nanomaterials, in particular nanoparticles, on human health and the environment. The only property currently used to classify particles as nanoparticles is their size. A variety of techniques exist to analyse the size and size distribution of nanoparticles. However, there is a general lack of full validation reports and suitable reference materials with properly assigned values traceable to the International System of Units.

The JRC performed an in-house validation study of two standard particle-sizing methods to assess their suitability for use with nanoparticles suspended in an aqueous solution: Dynamic Light Scattering (DLS) and Centrifugal Liquid Sedimentation (CLS). Performance characteristics were assessed using a non-certified reference material (IRMM-304) produced by the JRC. Both the DLS and the CLS methods were proved to be robust and suitable for measuring the size of dilute suspensions of monodisperse silica nanoparticles in the particle size range of about 25 nm to 75 nm, and the corresponding measurement uncertainties were estimated.

Particle sizing techniques were also investigated in an interlaboratory comparison organised by the JRC. Overall, 38 laboratories from four different continents participated with different methods. CLS, DLS, small-angle X-ray scattering (SAXS) and electron microscopy provided sufficiently reproducible particle size results to proceed with reference material certification studies.

* COM(2008) 366 final and European Parliament resolution (2008/2208(INI)) on regulatory aspects of nanomaterials;

Regulation (EC) No 1223/2009 of the European Parliament and of the Council on cosmetic products.

Andrée Lamberty

'Correct nanoparticle sizing is crucial for the identification of nanomaterials and we have carefully evaluated laboratories' competences in this area.'

Hubert Rauscher

'Our JRC Reference Report (also refer to page 59) provides the scientific elements for an informed decision on the definition of nanomaterials.'

1 Lövestam, G. et al., *Considerations on a Definition of Nanomaterial for Regulatory Purposes*, EUR 24403, Publications Office of the European Union, Luxembourg, 2010.
Available at: http://ec.europa.eu/dgs/jrc/downloads/jrc_reference_report_201007_nanomaterials.pdf

Swimming pool tiles are made of glass — and are indeed recyclable!

End of waste

Five years of scientific support from the JRC to the Environment DG have now led to the formulation of a first Commission Regulation on end-of-waste criteria. The criteria define the requirements that iron/steel and aluminium scrap have to fulfil in order to cease to be waste, a new policy mechanism introduced by the Waste Framework Directive*. The objective of end-of-waste criteria is to remove the administrative burdens of waste legislation for safe and high-quality waste materials.

The JRC has developed the scope and methodological approach of end-of-waste criteria, and in the last two years it has brought this methodological effort into life with practical applications to recycled materials such as metals, glass and paper. The studies prepared by the JRC are the result of intense consultation rounds with experts, and consist of thorough techno-economic-environmental assessments that help verify when a recyclable waste material is safe for the environment, is of high quality and so merits to be released from the waste regime.

* Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain directives.

** Commission staff working document SEC(2010) 627: Europe's Digital Competitiveness report;

Commission staff working document SEC(2010) 1276 final: European competitiveness report 2010, accompanying document to the COM(2010) 614: An integrated industrial policy for the globalisation era putting competitiveness and sustainability at front stage.

Alejandro Villanueva

'We are very satisfied that JRC research has had such a central role in the formulation of a piece of secondary EU legislation.'

Marc Bogdanowicz

'The JRC's studies on ICT innovation contribute to a better understanding of the opportunities and help better shape market conditions (financial, labour and product markets) to support the "Smart growth" priority of the Europe 2020 strategy.'

Analysing the future competitiveness of the EU ICT sector in emerging technologies

The JRC and the Enterprise and Industry DG launched a series of studies to analyse the prospects for success of European Information and Communication Technology (ICT) industries in the face of technological and market innovation**.

These studies explored areas where it is particularly important for the EU ICT industry to be competitive: online and mobile video games software, Web 2.0, displays (organic light emitting diodes — OLEDs, and e-paper), radio frequency identification, robotics, and embedded software in the automotive sector.

Each of the studies illustrates that European companies are actively present in emerging and disruptive ICTs and are supplying the market with relevant products and services. Nevertheless, the studies also show that the creation and growth of high-tech companies is still very complex and difficult in Europe, and too many innovative economic opportunities seem to escape European initiatives and ownership.

More information at: http://is.jrc.ec.europa.eu/pages/ISG/COMPLETE.html

European companies are actively present in emerging and disruptive ICT technologies.

Contributing to the 'Innovation Union'

October 2010 saw the publication of the Commission Communication entitled 'Innovation Union: Transforming Europe through research and innovation'*. This announced the launch of a flagship initiative to stimulate jobs and growth via policies aimed at overcoming obstacles which prevent innovative ideas from reaching the market. Focusing in particular on the resolution of major societal challenges, the 'Innovation Union' initiative contains a broad range of policy proposals designed to optimise the governance and performance of research and innovation systems in the EU, underpinning the overall targets of the Europe 2020 strategy.

A JRC expert was on the task force responsible for preparing the 'Innovation Union' communication and the JRC also had overall responsibility for coordinating and preparing 'A rationale for action', the accompanying Commission staff working document that presented the evidence for the proposed policy options.

The JRC was represented on the Task Force responsible for preparing this EU flagship initiative.

The new legislation will contribute to a better prepared banking sector in order to absorb financial shocks (© Jakub Krechowicz).

Helping achieve a more resilient banking sector

In response to the financial crisis, in the summer of 2010, the Basel Committee on Banking Supervision approved a revision of the banks' capital Regulation, known as Basel III, with the goal of promoting a more resilient banking sector, a prompter to absorb financial shocks.

In cooperation with researchers from the Internal Market and Services DG and experts from academia, the JRC developed the statistical model SYMBOL (Systemic Model of Banking Originated Losses), which estimates the probability and the magnitude of any new potential crisis hitting the banking system.

SYMBOL has been used to assess the macroeconomic impact of Basel III via a cost-benefit analysis.

Results of the analysis will be used to formulate the new EU Directive on capital requirements ('CRD IV')** which is aimed at transposing Basel III to the EU Member States.

* COM(2010) 546 final: 'Europe 2020 flagship initiative — Innovation Union', SEC(2010) 1161.

** Capital requirements Directive ('CRD IV'), comprising Directive 2006/48/EC of the European Parliament and of the Council relating to the taking up and pursuit of the business of credit institutions, and Directive 2006/49/EC of the European Parliament and of the Council on the capital adequacy of investment firms and credit institutions.

Ken Guy

'Research and innovation have a critical role to play in the creation of economic prosperity and the resolution of major societal problems.'

Francesca Campolongo

'Better banking regulation is essential to ensure future financial stability.'

Policy adoption

The JRC supported the implementation, harmonisation and further development of the European standards for construction (Eurocodes) during the period 2005–11.

Towards the second generation of the Eurocodes

The adoption of common European standards for construction (Eurocodes) has approached the final stage of national implementation as Member States are moving from their national construction codes to the Eurocodes. From 2010, all new public buildings and other civil engineering structures in the EU should be constructed with similar levels of structural safety.

The pre-normative research performed at the JRC's European Laboratory for Structural Assessment (ELSA) has significantly contributed to the development of the Eurocodes to their present stage, especially Eurocode 8, which covers the design of all civil engineering structures in seismic zones.

The JRC provides support* to the implementation of the Eurocodes by developing informatics tools and producing policy support documents, fostering training and promotion of the Eurocodes within and outside Europe and by facilitating further harmonisation. The JRC is also involved in extending the Eurocodes to additional fields of structural design, such as glass structures, and incorporating in construction standards the emerging demands of modern societies, such as sustainability. Based on the work of the Mandate Working Group coordinated by the JRC, in 2010 the European Commission issued a new mandate to the European Committee for Standardisation (CEN) for the second generation of Eurocodes which will further facilitate implementation at national level and support market developments, innovation and research in the European construction sector.

* Council Directive 89/106/EEC on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products.

** COM(2010) 781 final: Proposal for a Directive of the European Parliament and of the Council on control of major-accident hazards involving dangerous substances.

Supporting the 'Seveso III' Directive on the control of major accident hazards

On 21 December 2010, the Commission adopted a new proposal for a Directive on the control of major accident hazards, the so-called 'Seveso III' Directive**. The JRC developed, together with Member States' experts and in coordination with the Environment DG, the methodology and scientifically sound options to align Seveso categories with the new classification of dangerous substances; it also analysed the safety impact of these options. For the first time, the scope of the Directive, i.e. the obligations of the industrial installations, is based on the hazard potential of the dangerous substances and activities, as analysed in the JRC report[1]. Furthermore, a number of new requirements are based on the JRC's work, such as the requirement to address natural hazards as causes of accidents and the requirement to formally include a review of past accidents in the assessment — e.g. from eMARS[2] — with the same substances or processes and to explicitly evaluate specific measures to prevent similar accidents.

Buncefield (UK) in 2005. Accidental explosion and fire in an oil storage tank – 60 people injured – complete destruction of the site – cost GBP 1 billion. Such accidents are reported and analysed in the JRC eMARS system (http://emars.jrc.ec.europa.eu). Henceforth, with the new 'Seveso III' Directive, consultations of past accidents will become obligatory (© Courtesy of UK Royal Chiltern Air Support Unit).

Artur Pinto

'The Eurocodes will replace the differing structural design rules in the various Member States, improving the functioning of the Single Market for construction products and services and boosting the competitiveness of the European construction industry.'

Michail Christou

'In a sustainably growing society the petrochemical industry needs not only to be safe but also to be perceived to be safe. Research can provide the analytical means to ensure that risks are properly regulated and managed.'

1 Gyenes, Z., *Application of GHS substances classification criteria for the identification of Seveso establishments*, EUR 24734, Publications Office of the European Union, Luxembourg, 2010, available at: http://mahb.jrc.ec.europa.eu/fileadmin/MAHB/downloads/guidance/id-34/Technical_report_Seveso_and_GHS.pdf

2 The Major Accident Reporting System eMARS is a database of 'major accidents' reported under the Seveso Directive, hosted by the Organisation for Economic Co-operation and Development (OECD) and the United Nations Economic Commis-

Policy implementation

International standards to measure mycotoxins in infant food

Two analytical methods developed by the JRC to determine the levels of mycotoxins in infant food were adopted by the European Committee for Standardization (CEN) in 2010.

Mycotoxins are toxic contaminants produced by fungi. These toxins can enter the food chain as a result of crops infected by fungi, either by being directly consumed by humans, or by being used as feed for animals.

Infants and young children are more vulnerable than adults to many toxic substances, due to the fact that they have a relatively high intake of certain foodstuffs compared to their body weight. For this reason, European legislation* has set lower maximum limits for toxins in certain foods intended for infants and young children.

The analytical methods developed by the JRC are for measuring zearalenone and aflatoxin B1 in cereal products for infants and young children (EN 15850 and EN 15851 respectively).

Measuring heavy metals in seafood

A study[1] by the JRC benchmarked the abilities of laboratories around the world to determine heavy metals (arsenic, cadmium, lead, mercury, methylmercury and inorganic arsenic) in seafood. The outcome of the exercise was generally positive, with 80 % to 96 % of laboratories reporting satisfactory measurement results, depending on the heavy metal considered.

In contrast to the results of a previous study of arsenic in rice, the values reported for inorganic arsenic showed a large spread, indicating that the composition of the sample (in this case, seafood) has a major influence on the analytical determination of inorganic arsenic. This is a crucial consideration for legislators, when specifying a maximum level of inorganic arsenic in seafood*.

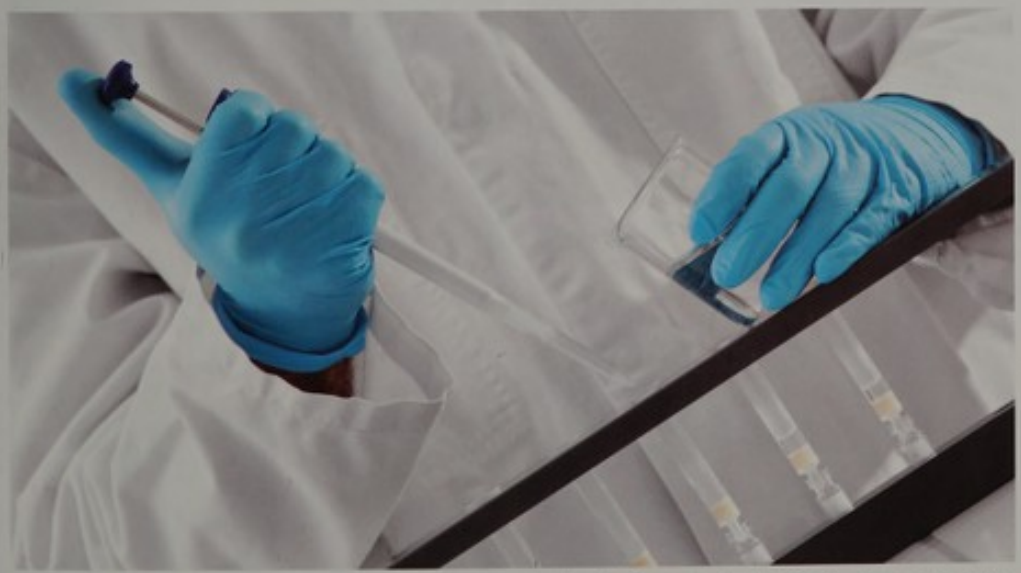
The study was organised in support of the European Cooperation for Accreditation (EA), the Asia Pacific Laboratory Accreditation Cooperation (APLAC) and the national reference laboratories associated with the EU Reference Laboratory for Heavy Metals in Feed and Food.

In Europe, maximum levels for lead, cadmium and total mercury in food are laid down in legislation, varying from 0.5 to 1.0 mg per kg for different seafood (© Microstock Photography via stoch.xchg).

* Commission Regulation (EC) No 1881/2006 setting maximum levels for certain contaminants in foodstuffs.

Jörg Stroka

'Standardisation is the key for the generation of meaningful data within a community. Without standardisation on how data are generated, figures that appear poles apart may in fact be equivalent, and vice versa.'



Two analytical methods developed by the JRC to measure the levels of mycotoxins in infant food were adopted by the European Committee for Standardisation (CEN) in 2010.

Beatriz de la Calle

'When considering the introduction of maximum limits for metal species in legislation, it must be kept in mind that different matrices may require different methods of analysis.'

1 Baer, I. et al., *IMEP-30: Total arsenic, cadmium, lead, and mercury, as well as methylmercury and inorganic arsenic in seafood - Interlaboratory Comparison Report*, EUR 24604, Publications Office of the European Union, Luxembourg, 2010.

JRC scientist Paolo Bertoldi presenting one of the prizes at the 2010 GreenLight/GreenBuilding Awards Ceremony.

Initiatives for reducing energy consumption in buildings

'GreenLight' and 'GreenBuilding' are two voluntary programmes managed by the JRC that invite private and public organisations to reduce their energy consumption*. The GreenLight programme, started in 2000, has recruited 644 European partners. By replacing old-fashioned lighting with modern, low-energy lamps, and by controlling the use of lighting, they have in total reduced their energy consumption by 241 GWh/year. The GreenBuilding programme, started in 2005, promotes improved energy efficiency in buildings through measures such as thermal insulation, efficient heating and cooling, intelligent control systems, and PV panels. GreenBuilding has gathered over 280 partners with 360 buildings which save an estimated 304 GWh/year in primary energy (e.g. electricity, natural gas and heating oil), which corresponds to an average saving of 41 %. The JRC monitors and assesses the programmes' participants and publishes regular reports on the energy savings achieved and energy technologies used.

EU leading the way in newly installed solar cells

The ninth edition of the annual 'Photovoltaic status report' provides policy makers and industry with an overview of the current activities regarding research, manufacturing and market implementation.

The report highlights Europe's continued leading position for newly installed photovoltaic cells, and accounts for three quarters of new solar systems worldwide, with a peak capacity of 5.8 GW. The production of photovoltaic cells increased worldwide to 11.5 GW in 2009 (56 % up from 2008). In the EU, it remained at 2 GW (1.9 GW in 2008). A special feature is a shift in the market from a supply-driven to a demand-driven logic.

The resulting over-capacity has caused a dramatic price reduction of almost 50 % over two years. This has resulted in an average selling price of modules of less than EUR 1.5 per Watt. The report, based on a survey of more than 300 companies, is a key reference document and was cited more than 1 000 times in Alpha Galileo, the science news service for the EU. The information provided in the report supports the European Directive on the promotion of the use of energy from renewable sources**.

Assessing photovoltaic systems at the European Solar Test Installation at the JRC-Ispra site.

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

'The GreenLight and GreenBuilding programmes are win-win solutions: companies and organisations save large amounts of energy in their buildings, while the JRC gets access to real data and performances of efficient buildings in order to assess different solutions, technologies and innovation potential.'

'It is an incredibly complex process to analyse data from more than 300 sources, and cross check it. Therefore, I am very pleased that this report has developed into one of the Reference Reports for the photovoltaic sector.'

Biofuels sustainability — JRC methodology for calculating greenhouse gas emissions from land use changes

Increased EU demand for biofuels could have an impact on land use in both EU and non-EU countries, leading to significant changes in carbon stocks in soils and biomass, and subsequent changes in greenhouse gas emissions. This issue is widely discussed, in particular due to the high uncertainties in the calculations of the overall impact of these emissions.

In support of this debate, the JRC first developed a guidance document* for assessing carbon stock changes in soils and biomass due to the cultivation of biofuel crops. Following this guidance, a new methodology for estimating changes in greenhouse gas emissions from soil and above- and below-ground biomass resulting from global land use changes was developed and referred to in COM(2010) 811**. The Renewable Energy Directive*** sets an ambitious target of 10 % share of renewable energy in the transport sector.

Biofuels sustainability is a complex issue requiring the evaluation of many process variables.

Commissioner Janez Potočnik at the launch of the ILCD handbook stated[2]: 'This handbook will provide a much needed reference to support decision making and ensure better environmental choices when designing goods and services. A scientifically robust and reliable approach is essential to support the requirements of business and policy makers in a coherent and efficient manner.'

Life cycle assessment — Methodological guidelines launched

The main set of documents of the International Life Cycle Data (ILCD) handbook was officially launched[1] on 12 March 2010 in the Berlaymont building in Brussels. This handbook provides detailed guidelines on how to conduct a Life Cycle Assessment (LCA):

- general guide for LCA: 'detailed guidance', 'provisions and action steps' and 'review schemes';
- specific guide for life cycle inventory 'data sets' and their 'reviewer qualification';
- framework and requirements for life cycle impact assessment models and indicators;
- analysis of existing environmental impact assessment methodologies for use in LCA.

LCA helps quantify the emissions, resources consumed and the pressures on the environment and human health that can be attributed to a product****. The handbook, developed by the JRC in cooperation with the Environment DG, is in line with international standards and was established through a series of extensive public and stakeholder consultations.

'Biofuels are subject to global discussions at the moment. To be part of a team trying to quantify the uncertainties, with one foot in the science arena and the other in policy making, is a real challenge but incredibly interesting.'

* Commission Decision 2010/335/EU on guidelines for the calculation of land carbon stocks for the purpose of Annex V to Directive 2009/28/EC.

** COM(2010) 811 final: Report from the Commission on indirect land-use change related to biofuels and bioliquids.

*** Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

****COM(2008) 397 final on the sustainable consumption and production and sustainable industrial policy action plan.

1 Available online at http://lct.jrc.ec.europa.eu/assessment/

2 http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/273&format=HTML&aged=0&language=EN&guiLanguage=en

SETIS supports the implementation of the European energy technology policy by assessing the developments and potential of each technology on a neutral and objective basis.

Implementing Europe's energy technology policy — the role of SETIS

The JRC coordinates and operates the Commission's Strategic Energy Technology Information System (SETIS), which supports the implementation of the European Strategic Energy Technology Plan (SET-Plan)*.

SETIS enabled the kick-off of the European Industrial Initiatives for the development of low-carbon energy technologies by developing the associated implementation plans. This was achieved in collaboration with public and private stakeholders, identifying the priorities and the necessary activities to be undertaken for the rapid implementation of SET-Plan.

Furthermore, SETIS established a protocol for monitoring and reviewing the progress of the SET-Plan, and proposed key performance indicators and analytical procedures for their calculation. SETIS initiated the mapping of European projects with SET-Plan relevance, essential for joint programming between the Member States and the Commission for implementing the SET-Plan. The SETIS website was further developed and offers online tools for the assessment of energy technologies.

Nuclear safety (Clearinghouse) — learning from others

For Nuclear Power Plants (NPPs), a worldwide collective experience of more than 14 000 operating reactor-years has been accumulated to-date. Enhancing the use of this collective experience in the EU to improve nuclear safety** is the objective of the 'European Clearinghouse on Operational Experience for NPPs'.

Members of the European Clearinghouse include nuclear safety authorities from all the 14 EU Member States having NPPs, Switzerland, and several EU technical support organisations and representatives from the nuclear industry and international organisations.

The Clearinghouse's activities in 2010 focused on lessons learned from nuclear fuel related events in NPPs, maintenance issues and electrical transients. In answer to the nuclear renaissance, a topical report[1] on events caused by anomalies during the construction and commissioning of new NPPs has been issued. This report led to recommendations in various fields: management of temporary devices, quality assurance, welding, labelling, task interfaces, and management of non-conformances.

* COM(2007) 723 final: 'A European Strategic Energy Technology Plan (SET-PLAN) — Towards a low carbon future'.

** Council Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations.

'SETIS ensures the review of progress of the European Strategic Energy Technology Plan (SET-Plan) through agreed monitoring and appraisal methodologies in a transparent and objective way.'

'2010 has marked a turning point, with a breakthrough in terms of participation of the EU Member States in the Clearinghouse.'

Analysis of fuel-related events by JRC experts.

1 Zerger, B., *Summary Report on Nuclear Power Plants Construction, Commissioning and Manufacturing Events*, EUR 24674 EN, Publications Office of the European Union, Luxembourg, 2011.

Nuclear forensic support to Member States

The JRC's work in nuclear forensics plays a very important role in nuclear security in Europe*. In 2010, nuclear forensics support to EU Member States was provided in four cases. Each of the cases consisted of multiple items of scrap metal contaminated with uranium. Three incidents occurred in the Netherlands and one in Finland. The scrap metal shipments were coming both from inside and outside the EU.

The detailed nuclear forensic analysis included isotopic composition analysis of uranium, impurity measurements, production date determination and microstructure analysis. In these four cases, the uranium found in the scrap metal proved to be a mixture of components of different enrichment including natural uranium, low enriched uranium and highly enriched uranium. The complex analytical data, together with information about the incidents themselves, allowed in most of the cases the origin of the material to be traced, which is of paramount importance for stopping further dumping of radioactively contaminated scrap metal from the nuclear facilities in question.

Control of collected samples from scrap metal objects upon receipt.

Joint JRC/DG Energy celebration of the 10th on-site laboratories' anniversary at Schloss Karlsruhe.

Euratom on-site laboratories at Sellafield and La Hague — 10 years of operation

To account for nuclear material in the reprocessing plants of Sellafield (UK) and La Hague (France), the European Commission, represented by the Energy DG, has installed two on-site laboratories**. Both laboratories are operated by the JRC and they offer the Euratom safeguards inspectors an independent analytical capacity of the highest quality and provide sample results within a short time.

The JRC and the Energy DG celebrated the 10th anniversary of the laboratories on 15 June 2010 with a symposium at Schloss Karlsruhe, Germany. The on-site laboratory in Sellafield went into operation in October 1999, the on-site laboratory in La Hague in June 2000. Presentations provided an overview of the history and evolution of the on-site laboratories and of the role of safeguards in Europe. The laboratories have become a key factor for the accurate accountancy verification of nuclear materials with 1 044 samples processed in 2010 and a total throughput of over 9 000 samples since going into operation. The concept of an on-site laboratory, which is based on the operational experience of these two European laboratories, was also adopted by the International Atomic Energy Agency (IAEA), Vienna, and the Japanese safeguards authority for the Rokkasho reprocessing plant in Japan.

* Council Decision 2010/212/CFSP relating to the position of the European Union for the 2010 Review Conference of the Parties to the Treaty on the non-proliferation of nuclear weapons.

** Commission Communication to the European Parliament and to the Council concerning a Commission Decision on the implementation of on-site laboratories for verification analysis of safeguards samples at reprocessing plants (SEC(92) 515 final).

Maria Wallenius

'The JRC analyses seized nuclear material as support to EU Member States and combats illicit nuclear trafficking.'

Karin Casteleyn

'The JRC makes a significant contribution to the high profile of European nuclear safeguards.'

Detection portic installed at the European nuclear security training centre for training custom officers.

* COM(2009) 273 final on strengthening chemical, biological, radiological and nuclear security in the European Union — an EU CBRN action plan.

** COM(2009) 143 final on nuclear non-proliferation.

'Adequate training and education in the nuclear field provided through EUSECTRA shall aim to reduce the nuclear risk in the EU and consequently to assure international peace and security.'

'The analysis of environmental samples is a measure (under the additional protocol between Member States and the International Atomic Energy Agency) to assure the absence of undeclared nuclear material and activities.'

Towards a European nuclear security training centre

The Nuclear Security Summit in April 2010 highlighted the threat of nuclear terrorism and emphasised the need for preventive measures. Next to appropriate technical equipment, trained personnel are of key importance for increasing nuclear security. The EU CBRN action plan to strengthen chemical, biological, radiological and nuclear security,* which was approved by the Council on 30 November 2009, acknowledges the need for specific training in nuclear security, in particular for law enforcement officers. The JRC, in consultation with Member States, carried out a feasibility study for establishing a nuclear security training centre which clearly identified the added value of practical training involving nuclear material. As a consequence, the JRC was tasked by the Home Affairs DG to implement a European nuclear security training centre (EUSECTRA).

The overarching goal of EUSECTRA is to improve Member States' capabilities to address the threats associated with illicit incidents involving nuclear or other radioactive materials. The training centre will complement national training efforts by providing hands-on training to front-line officers and their management as well as national trainers and other experts in the field, using real nuclear materials. EUSECTRA will thus be playing a major role in the fight against illicit trafficking of nuclear and radioactive materials in the EU.

Determining the source of plutonium contamination

A JRC paper[1] published in February 2010 documented a significant advancement in the 'fingerprinting' of plutonium contamination, giving nuclear safeguards authorities more information on how nuclear material was produced and helping to identify sources of environmental contamination.

Using a technique known as Thermal Ionisation Mass Spectrometry (TIMS), the researchers measured the ratio of plutonium isotopes with unprecedented accuracy in reference samples obtained from the International Atomic Energy Agency (IAEA) and the US National Institute of Standards and Technology (NIST, USA), and also in soil and moss samples collected from the site of the Chernobyl accident.

The researchers published data with considerably low uncertainties not only for the isotope ratio of $^{240}Pu/^{239}Pu$, but also — for the first time — for the ratios of $^{241}Pu/^{239}Pu$ and $^{242}Pu/^{239}Pu$. The results confirmed the suitability of the measurement technique, and the researchers could identify with confidence whether the environmental contamination originated from reactor-grade or weapons-grade plutonium.

The published work represents a further advance in environmental sample analysis to strengthen the effectiveness of nuclear safeguards in line with global nuclear non-proliferation objectives**.

Nuclear mass spectrometry: by measuring isotope ratios, scientists can determine whether environmental plutonium contamination is of civil, military or illicit origin.

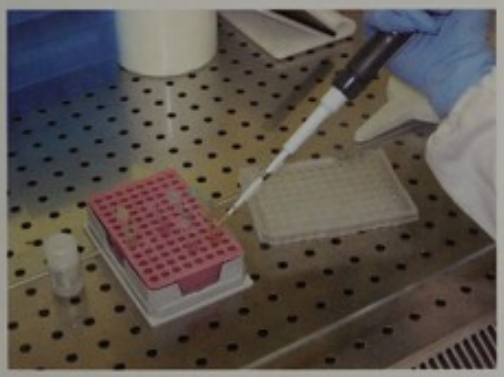
1 Jakopič, R. et al., 'Determination of $^{241}Pu/^{239}Pu$, $^{242}Pu/^{239}Pu$ and $^{242}Pu/^{239}Pu$ isotope ratios in environmental reference materials and samples from Chernobyl by Thermal Ionisation Mass Spectrometry (TIMS) and filament carburisation', *Journal of Analytical Atomic Spectrometry (© The Royal Society of Chemistry 2010)*, 2010, 25, pp. 815–821.

Robust methods for GMO detection — ready at hand

The 'Compendium of reference methods for GMO analysis', a Reference Report published by the JRC in 2010, lists 79 GMO detection methods which were validated according to international standards. This compendium, developed jointly by the JRC's EU Reference Laboratory for Genetically Modified Food and Feed and the European Network of GMO Laboratories (ENGL), presents the technical state-of-the-art in GMO detection methods.

This work supports the implementation of the Regulation on official food and feed controls*, which foresees that the European reference laboratories are responsible for providing national reference laboratories with details of analytical methods, including reference methods.

Each method is described in a user-friendly way, facilitating the implementation of GMO legislation by official control bodies in the Member States and therefore ensuring effective control of food and feed in Europe.



Preparation of wells containing maize samples for the GMO analysis.

Feed additives: the JRC checks the appropriateness of methods to analyse additives in animal feed.

Safety of the feed-food chain — a priority for European consumers

More than 1 000 feed additives are currently authorised in Europe but according to European legislation** they need to be re-evaluated. It is the task of the JRC's EU Reference Laboratory for Feed Additives to check the appropriateness of analytical methods which are required to monitor the correct use of these substances. The deadline for submitting applications for the re-evaluation of additives currently on the market was November 2010. The EU Reference Laboratory for Feed Additives was tasked with checking the documentation submitted by the applicants. In total, about 440 applications need to be evaluated, a task which will take several years. The completion of this evaluation, which is carried out in close cooperation with other Commission services and the European Food Safety Authority, will be a further milestone in safeguarding the safety of the feed-food chain in Europe.

* Regulation (EC) No 882/2004 of the European Parliament and of the Council on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules.

** Regulation (EC) No 1831/2003 of the European Parliament and of the Council on additives for use in animal nutrition.

Damien Plan

'This JRC Reference Report (also refer to page 59) reflects more than 10 years of expertise in GMO analysis. I really believe it is a big asset for GMO control laboratories.'

Christoph Von Holst

'The JRC's contribution to setting high standards for analytical methods plays a key role in ensuring high quality and safety of food.'

In vitro cell-based testing.

* Directive 2010/63/EU of the European Parliament and of the Council on the protection of animals used for scientific purposes.

Alternative methods to animal testing

The year 2010 was a landmark in the history of the European Centre for the Validation of Alternative Methods (ECVAM). The revised Directive for the protection of animals used for scientific purposes* established ECVAM as EU Reference Laboratory for the validation of alternative methods to animal testing.

The assessment of the robustness, reliability and predictive capacity of the alternative methods includes independent peer review of validation study reports. In 2010, ECVAM re-modelled its advisory structure, appointing 15 external experts to serve as a standing independent peer review body, complemented by separate networks of stakeholders and regulators.

ECVAM also carried out, on request of the Health and Consumers DG, a review of the current status of alternative non-animal methods for the safety testing of cosmetics for human use, in view of the upcoming 2013 marketing ban of cosmetics tested on animals. The report 'Alternative (non-animal) methods for cosmetics testing: Current status and future prospects — 2010' was prepared in cooperation with scientists proposed by Member State competent authorities, animal welfare organisations and the cosmetics industry, and it included a public consultation phase.

Automated high throughput screening of chemical toxicity.

'The new Directive strengthens the "3Rs" principle of replacing, reducing and refining animal testing. The creation of the new EU Reference Laboratory will provide a great opportunity to work more closely with Member States on the validation of new methods.'

Policy evaluation

Supporting regional cohesion in Europe

Cohesion policy* has had a proven effect in helping the European Union's regions to develop, but it will face some new challenges in years ahead. Those are the findings in the European Commission's latest report on economic and social cohesion, published every three years. This fifth cohesion report uses some of the first results of simulations performed by the JRC with the prototype system of regional models (RHOMOLO) to illustrate the possible impact of EU support.

The Commission's fifth report on economic, social and territorial cohesion — 'Investing in Europe's future' — recognises the need to use models in line with empirical evidence for examining the effects of cohesion policy.

The results and prospects are positive and a new arrangement between the JRC and the Regional Policy DG was signed in December 2010. The objective is for the JRC to take over the validation of the model, develop it further and use it to evaluate the impact of various scenarios in support of the cohesion policy.

JRC research contributed to the fifth Commission report on economic, social and territorial cohesion in Europe.

The Digital Observatory for Protected Areas (DOPA) presentation at Nagoya

The 10th Conference of the Parties (COP10) of the UN Convention for Biological Diversity (CBD)**[1] held in Japan in October 2010, led to the adoption of the Nagoya Protocol, binding 193 parties[2], once ratified. It established targets to prevent biodiversity loss through 20 specific goals, including a call for increasing protected areas from 10 % of the world's terrestrial areas and inland water areas to 17 %, and from 1 % of coastal and marine areas as biodiversity protection zones to 10 %.

One example of the support to biodiversity policy was that JRC scientists organised a side event in Nagoya about their Digital Observatory for Protected Areas (DOPA — http://dopa.jrc.ec.europa.eu/) in collaboration with the United Nations Environment Programme — World Conservation Monitoring Centre, the Global Biodiversity Information Facility, BirdLife International and the Royal Society for the Protection of Birds.

DOPA is designed to assess the state of and pressure on protected areas on a global scale. It aims to become the backbone information system of the European Commission on the matter and will help to prioritise protected areas in developing countries according to their biodiversity and the pressures to which they are exposed. This supports decision making and fund allocation processes. The side event was one of few that was webcast by the organisers and reported about in the CBD's newsletter.

Chairing a side session on protected areas at the UN Biodiversity Conference in Nagoya. From left: Gregoire Dubois and Stephen Peedell, JRC, and Charles Besançon of the United Nations Environment Programme — World Conservation Monitoring Centre, (© International Institute for Sustainable Development).

* SEC(2010) 1348 final: Conclusions of the fifth report on economic, social and territorial cohesion: the future of cohesion policy;

COM(2011) 17 final: 'Regional policy contributing to sustainable growth in Europe 2020'.

** UNEP/CBD/COP/10/27: report of the tenth meeting of the Conference of the Parties to the Convention on Biological Diversity.

'The Commission is seeking a strong empirical underpinning of EU cohesion policy.'

'DOPA is designed to answer the call of the European Parliament to support the ambitious CBD mission for 2020: to halt the loss of biodiversity and to share the values and benefits of biodiversity and ecosystem services equitably.'

1 http://www.cbd.int/cop10/;http://www.iisd.ca/biodiv/cop10/enbots/29octe.html; http://webcast.cop10.go.jp/player.asp?id=2918&type=ondemand

2 All Nagoya resolutions adopted are under: http://www.cbd.int/cop10/doc/

HIGHLIGHTS FROM THE JRC's THEMATIC AREAS 2010

JRC Ispra (21 May 2010)

'With the JRC, the Commission has at its disposal a formidable scientific resource, which it must utilise more for taking decisions and political initiatives. In my new role at BEPA I will take up the challenge to make this happen. Thank you again. I very much appreciate your enthusiasm and commitment.'

JEAN-CLAUDE THÉBAULT, *Director-General of the Bureau of European Policy Advisers (BEPA)*

QUOTATIONS

JRC Ispra (27 September 2010)

'After many years, it was a privilege to come back to Ispra and see the increase of influence and quality of this European Institution. Future is by definition challenging, but JRC is well equipped to deal with this mission. I am confident JRC will be more and more a significant actor of Europe's contribution to innovation! With best wishes.'

VISCOUNT ETIENNE DAVIGNON, *former Vice President of the European Commission and Commissioner for Industry, Research and Energy (1981–84)*

JRC Ispra (11 October 2010)

'Thank you very much for the excellent preparation of my first visit to Ispra. I was very impressed by the quality of research we do here. Europe plays here a real world league. We need to spread this quality everywhere in Europe!'

MAROŠ ŠEFČOVIČ, *EC Vice President for Interinstitutional Relations and Administration*

JRC Ispra (15 October 2010)

'Ba mhór an anóir agam cuairt a thabhairt ar Ispra inniú. D'fhoghlaim mé go leor.'

'It was a great honour for me to make it to Ispra today. I learnt a lot. Thank you for your dedication and commitment and your hospitality today.'

MÁIRE GEOGHEGAN-QUINN, *Commissioner for Research, Innovation and Science*

Contributing to the goals of the Europe 2020 strategy by providing integrated socio-economic and policy support to macro- and micro-economic policies, the structural reform agenda, employment, the education and skills agenda, the Digital Agenda and the Innovation Union.

Towards an open and competitive economy

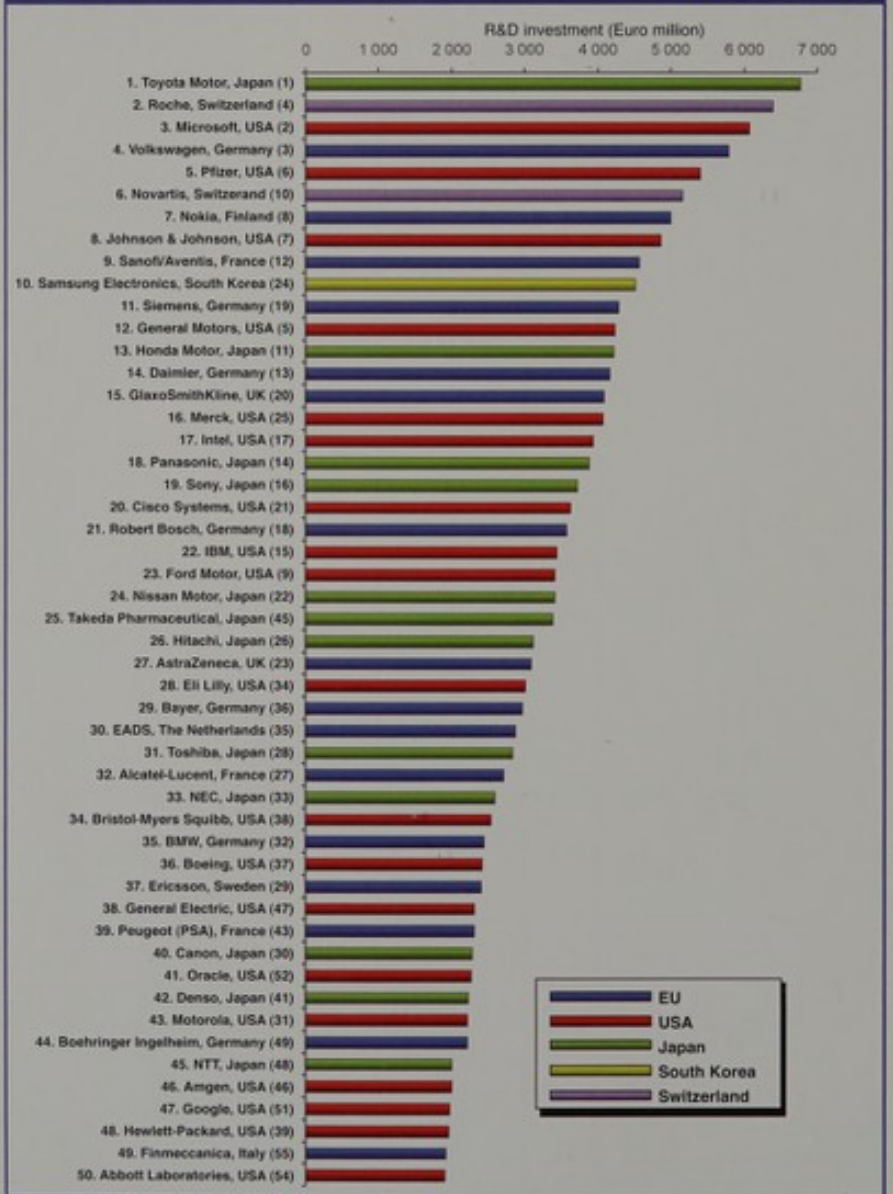
The EU Industrial R&D Investment Scoreboard

The 2010 EU Industrial R&D Investment Scoreboard presents information on the top 1 000 EU companies and 1 000 non-EU companies investing in R&D in their latest reporting year. The scoreboard includes data on R&D investment along with other economic and financial indicators taken from the companies' latest published accounts, i.e. the 2009 fiscal year accounts. The global economic and financial crisis that started in 2008 and hit companies worldwide is fully reflected in the company accounts used for the 2010 scoreboard.

The report examines the performance of individual companies among the top R&D investors, and analyses the main indicators of the company data aggregated by industrial sectors and world regions respectively, with comparisons between the EU companies and their main competitors. It also includes a supplementary analysis of the characterisation of the scoreboard companies according to their age of foundation and how it correlates with their R&D.

The European Commission's 2010 'EU Industrial R&D Investment Scoreboard' shows that R&D investment by top EU companies fell by 2.6 % in 2009, even though sales and profits fell much more, by 10.1 % and 21.0 % respectively. The fall in R&D investment by leading players in the US, at 5.1 %, was twice as sharp as in the EU, but the worldwide reduction was lower, at 1.9 %. Japanese firms maintained their level of investment.

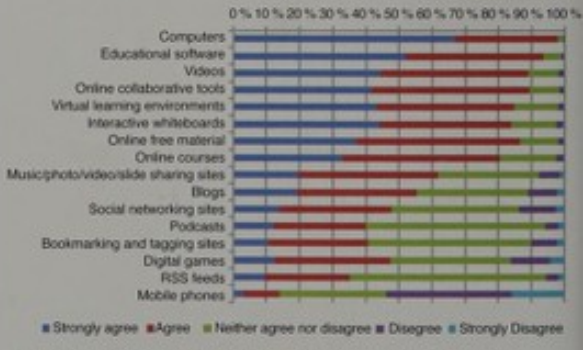
Ranking of the world's top 50 R&D companies by their total R&D investment in the 2010 scoreboard



Note: the number in brackets after the names of the companies indicates the rankings in the past scoreboard.
Source: the 2010 EU Industiral R&D Investment Scoreboard, European Commision, JRC/Research and Innovation DG.

Creativity in schools — a survey of teachers in Europe

Understanding teachers' perception of creativity and their current teaching practices is essential for developing policies on creativity and innovation for education in Europe. A JRC study [1] examines how teachers perceive, understand and foster creativity through their teaching and through the use of Information and Communication Technology (ICT). This analysis is part of a bigger study on 'Creativity and innovation in education and training in the EU-27'.



Summary of the appreciation of different ICT tools by European teachers (7 659 responses).

1 http://is.jrc.ec.europa.eu/pages/EAP/iceac.html

Teachers' opinions were collected through an online survey, gathering data from 32 countries and at distinct school levels. Although not representative, teachers' positive opinions on creativity in education are much stronger than their practices. While teachers claim to foster many skills that are connected to creativity, traditional teaching and assessment methods, and resources, are still predominant.

Teachers also agree that ICT has improved their teaching and that it could be used to enhance creativity, but usage of ICT remains largely related to more traditional technologies.

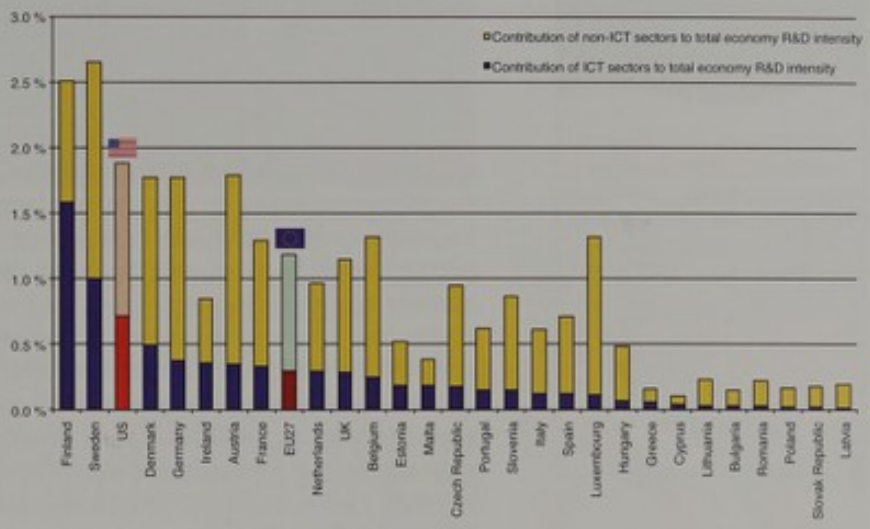
The state of the electronic identity market (eID) — technologies, stakeholders, infrastructure, services and policies

Empowering citizens to be active and confident in the new digital society, which must deliver sustainable economic and social benefits, is of prime importance to Europe. Therefore the creation of an e-authentication scheme that is encompassing, interoperable and based on open standards is crucial — one that reduces EU business and public sector costs and barriers to the provision and take-up of identity-based services, and one that empowers citizens to take and expect responsibility in the digital domain.

The study 'The state of the electronic identity market (eID): technologies, infrastructure, services and policies' asserts that the market for eID products and services is fragmented, far from efficient and lacks viable business models. Services based on mobile authentication and identity management have not yet realised their huge potential value. This study[1] provides exploratory evidence of the potential of eID for the single digital market. A clear understanding of this market is crucial for Digital Agenda policies on identification and authentication, e-signature and interoperability.

Prospective insights on R&D in ICT (PREDICT)

The PREDICT project[2] analyses R&D investments in the EU Information and Communication Technology (ICT) sector. Results are presented in annual reports jointly published by the JRC and the Information Society and Media DG.



Contribution of the ICT/non-ICT sectors to total private R&D intensity by EU Member States, 2007 (based on data from Eurostat, OECD, EU level analysis of capital, labour, energy, materials and service inputs (EU KLEMS), and national statistics.)

PREDICT supports directly the ICT R&D and innovation policy of the European Commission and has become a unique source of information on ICT R&D investments in the EU and its main global competitors.

PREDICT relies on the latest available official statistics delivered by Member States, Eurostat and the Organisation for Economic Co-operation and Development (OECD). It combines, in a unique way, three complementary perspectives: national statistics (covering both private and public R&D expenditures), company data, and technology-based indicators such as patents. Each annual report also includes a specific thematic analysis. In 2010, it focused on the internationalisation of ICT R&D.

According to the latest PREDICT report Europe's Information and Communication Technologies (ICT) sector, accounting for just 4.8 % of GDP, leads the way in private research and development (R&D) in the EU, with 25 % of total investment and 32 % of researchers working in the private sector in 2007.

Target markets for primary electronic identity stakeholders.

'As it emerges from the crisis, the EU economy will continue to go through a major process of adjustment and restructuring. This is the time to think in depth about the strategy we need to achieve the welfare and the employment generation we want for the future. Scientific research and analysis have a fundamental role to play in guiding our reflections about the areas in which we want to concentrate our efforts.'

JOHN BENSTED-SMITH, *JRC Director*

1 Study accessible at: http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=3739
2 http://is.jrc.ec.europa.eu/pages/ISG/PREDICT.html

Addressing energy, transport, clean production technologies and consumption patterns, issues that will be pivotal to the progressive transition of the EU towards a low carbon society.

Development of a low carbon society

The ever-increasing demand for policy support in this area has been demonstrated by many success stories in 2010. These include the JRC methodology for calculating greenhouse gas emissions from land use changes (which has made a key contribution to the biofuels sustainability debate). Other successes were energy efficiency initiatives such as 'GreenLight' and 'GreenBuilding', and the continued principal role of the energy information system SETIS in the implementation of Europe's energy technology policy (refer to 'Supporting EU policies' section for more details).

Large-scale deployment of CCS will require the construction of a trans-European CO_2 pipeline and shipping network between today and 2050.

Heinz Ossenbrink is Chairman-elect of the Technical Committee on Photovoltaic Solar Energy of the International Electrotechnical Commission (IEC).

Photovoltaic standards

Standards for emerging technologies such as photovoltaic cells are crucial to cementing the gains of innovation and to ensure an open and transparent market. The JRC's European Solar Test Installation (ESTI) continues to be a leading force in the development of international standards in this area, and is also chairing the International Electro-Technical Commission's (IEC) Technical Committee 82. The new IEC-60904-4 standard sets requirements for ensuring calibration traceability to the International System of Units (SI) and contains methods developed at ESTI and previously published in scientific journals. December 2010 saw the final approval of IEC-61853-part 1, which sets a basis for implementing energy rating methods for photovoltaic modules. ESTI staff provided significant input, in particular simplification of the testing matrix, to ensure the standard is relevant for industrial applications. The development of an energy rating system that can provide an indication of power output in operation, as opposed to peak power under idealised conditions, is a long-awaited development of particular interest to end-users.

A tool for pan-European optimisation of a CO_2 capture and storage infrastructure

Fossil fuels will, in the short- to medium-term, remain the main source for electricity generation in Europe, despite the significant ongoing efforts to promote renewable energy technologies. CO_2 Capture and Storage (CCS) is considered one of the most promising technological options for reducing CO_2 emissions. It offers a bridge from the fossil-fuel-dependent economy towards a carbon-free future. Large-scale deployment of CCS in Europe will require the development of a new infrastructure most likely consisting of a network of pipelines and — to a lesser extent — shipping routes.

The JRC has developed a tool — *InfraCCS* — that can describe the likely extent and cost of such a network on a European scale for the period 2015–50. The tool contains a number of methodological innovations which allow it to compute the optimal minimum-cost network when investments are coordinated at a European level.

The *InfraCCS* tool has been used to provide input for the Commission Communication 'Energy infrastructure priorities for 2020 and beyond: A blueprint for an integrated European energy network' (COM(2010) 677). In the scenario used for this purpose, the size of the optimal network grows steadily until 2030, to 8 800 km, requiring around EUR 9 billion of cumulative investment, followed by a step change towards 2050, leading to a total investment of around EUR 29 billion.

Commissioner Neelie Kroes surrounded by representatives of ICT companies at the 'Codes of Conduct' signature event.

Major ICT companies join JRC 'Codes of Conduct' initiative to reduce electricity consumption

The JRC manages voluntary codes of conduct for ICT companies to reduce energy consumption in both their premises and products. On 28 September 2010 in Brussels at the 'ICT 2010 — Digitally Driven' event, another 16 large ICT firms agreed to reduce electricity consumption of their broadband equipment and data centres by joining the codes of conduct. This should reduce their electricity consumption, in many cases by 50 %. In total, 36 of Europe's biggest ICT companies already apply the codes of conduct.

Assessing indirect land use emissions

JRC biofuels experts have continued to play a key role in the global biofuels sustainability discussion. They provided reports on the assessment of Indirect Land Use (ILUC) which were required by both the European Parliament and the Council for the implementation of the renewable energy Directive. The reports are a major contribution to the debate on how to estimate emissions from ILUC, when food crops are diverted to biofuels or bioenergy. The studies show that ILUC is a critical component in assessing the impact of biofuels production on the release of greenhouse gas. They demonstrate the need to calculate both direct and indirect land use change to determine if there is a net gain (in terms of greenhouse gas emission reduction) in diverting food crops, or the land that produces them, to biocrops.

Ensuring Europe's energy supply

The identification and characterisation of gas transmission system vulnerabilities required from Member States for the implementation of the Directive on critical European infrastructures is an essential input to addressing the security of energy supply for Europe. The JRC has developed the GEMFLOW and SynerGEE models which can be used to model gas flows in the event of a major gas supply disruption.

Emission legislation for alternative fuels

The JRC is actively involved with all main stakeholders in developing the future Euro VI emission standards for passenger cars. The JRC is addressing one of the main concerns related to the introduction of bioethanol blended with petrol as fuel, namely the impact of ethanol on evaporative emissions. The work conducted by the JRC, based on a multiannual study conducted in the Vehicle Emissions Laboratory (VELA) has shown that evaporative emissions from European passenger cars will increase due to several reasons, the main ones being:

- the increased vapour pressure of the fuel caused by ethanol addition;
- the increased difficulty in purging ethanol rather than normal hydrocarbons from the carbon canister trapping the vapours generated in the tank;
- the increased fuel permeation through the fuel system (tank and fuel line) which is made from plastic material.

Issues and possible solutions related to the work were presented in November 2010 at a workshop 'Future approach on emission legislation', organised by the Enterprise and Industry DG. The JRC also suggested possible modifications to the current legislative certification procedure for evaporative emissions. Following up on the proposal, the Enterprise and Industry DG has set up an ad hoc working group (within the Motor Vehicle Emission Group) which will be coordinated by the JRC to conduct a cost/benefit analysis of the new measures suggested and to develop a revised certification procedure for Euro VI.

The GEMFLOW gas model simulates the exchange of gas between Member States in the event of a gas disruption, taking into account demand, production, Liquefied Natural Gas (LNG) as well as storage measures.

One of the JRC's vehicle emissions testing laboratories.

'The EU is a European and global partner in the move towards a low carbon society and the JRC has a pivotal role to play.'
Giovanni De Santi, *JRC Director*

Addressing issues related to the sustainable management and use of strategic resources such as food, water, air, minerals, energy and land.

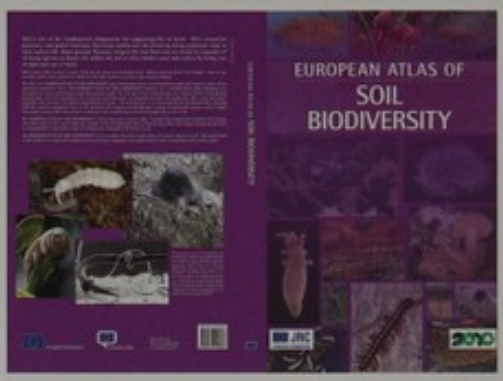
Sustainable management of natural resources

Quality assurance for land parcel identification systems

With 'direct aid' payments of nearly EUR 44 billion in 2010 for managing agricultural land, the EU's Common Agricultural Policy (CAP) is a very significant policy instrument. The JRC supported it by, inter alia, standardising the quality assessment on the data collected on farmers' fields, i.e. the Land Parcel Identification Systems (LPIS) of Member States. Member States use such geographical information systems to administer and control direct aids, aiming at unique location of land and accurate, up-to-date quantification of its agricultural area. Today the 45 LPIS across the EU hold more than 135 million detailed land parcels, annually declared by some 8 million farmers in the EU. Inaccurate records result in proportional errors in payments to farmers.

The Agriculture and Rural Development DG audits had revealed weaknesses, e.g. inclusion of land not eligible for aid. The JRC elaborated the quality elements essential for LPIS to perform its role[1] (e.g. total eligible area recorded, extent of incorrect records, effects of Member State procedures, etc.). As a direct outcome of the JRC's research and proposals on the LPIS quality assurance strategy, a new methodology was included in the CAP regulations (20 January 2010[2]). The JRC controls the sampling, applying industry-standard sampling plans in order to collect objective data, whilst Member States inspect the sample. LPIS quality is now assured using enhanced and harmonised procedures, based on remote sensing data also provided by the Commission. The JRC actively supported Member States during 2010, the first year of implementation, byoffering detailed documentation, technology and know-how transfer, access to satellite imagery and providing sampling instructions.

A harmonised inspection method, as developed by the JRC, applying photo-interpretation to detect and identify non-agricultural area within the LPIS reference parcel.



The new European atlas of soil biodiversity.

European atlas of soil biodiversity

The biodiversity within our soils plays a vital role in agriculture and in the water and carbon cycle. The JRC produced the first European atlas of soil biodiversity[3], a publication of 128 pages, using striking photographs, informative texts and maps to explain and illustrate the great diversity of life in the soils across Europe. It also highlights areas within Europe where soil biodiversity is most at risk of decline — notably parts of the UK, the Benelux countries and northern France, although there are areas of high risk also in several other Member States. For this map, potential threats to soil biodiversity were selected and ranked in an expert evaluation organised by the Soil Biodiversity Working Group, established by the JRC. Multiple pressure factors were included in the calculation of this new indicator map of potential threats, including land use change, habitat disruption, intensive human exploitation, invasive species, soil compaction, erosion and pollution. The atlas provides a comprehensive source of information for researchers, policy makers and teachers, attracting 4 000 downloads from the JRC soil website. It was launched at the conference 'Soil, climate change and biodiversity — Where do we stand?' on 23–24 September 2010 and at a press conference in Brussels[4].

1 Official technical guidance by the JRC is on: http://marswiki.jrc.ec.europa.eu/wikicap/index.php/GAMMA_o

2 Art. 6.2 in Commission Regulation 2009R1122: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2009R1122:20100303:EN:PDF, mostly based on Technical Note JRC59479, April 2010: 'LPIS quality inspection, EU requirements and methodology'

3 Download from http://eusoils.jrc.ec.europa.eu/library/maps/biodiversity_atlas/index.html

4 Press release: http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/1165&format=HTML&aged=0&language=EN&guiLanguage=en

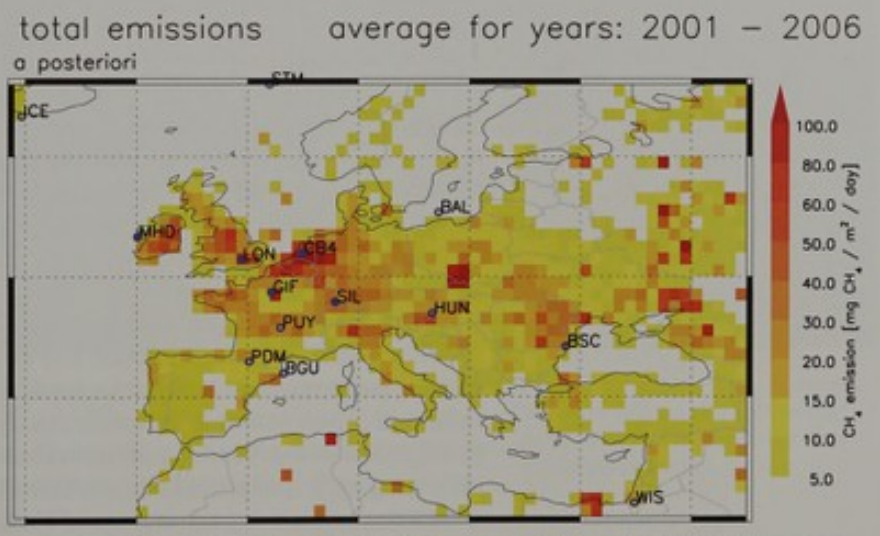
Getting the most out of space-borne data — the JRC chairs new Climate Working Group

The Committee on Earth Observation Satellites (CEOS), established in 1984 by the (then) G7, deals with activities required for proper international coordination of civilian Earth observation programmes and the optimum use of their data. Currently, 50 members and associate members, delegated by space agencies, national and international organisations, participate. The 24th CEOS Plenary, held on 12–13 October 2010, accepted the proposal for the full establishment of a dedicated CEOS Working Group on Climate (WGClimate). JRC scientist Mark Dowell was nominated as the chair of this group with John Bates (The National Oceanic and Atmospheric Administration) as vice-chair. WGClimate is set to ensure improved coordination among CEOS agencies in the production of fundamental climate data records and essential climate variables in response to the needs of the Global Climate Observing System (GCOS), and ultimately the United Nations Framework Convention on Climate Change (UNFCCC). It thus contributes to the review of compliance of satellite missions and products with the GCOS climate monitoring principles and with the 'Guideline for the generation of datasets and products meeting GCOS requirements'.

CEOS climate ad hoc group meeting at ESA Harwell Centre, United Kingdom, on 22 July 2010. This meeting preceded and prepared the official establishment of the CEOS WGClimate. © European Space Agency (ESA).

Verification of European methane emissions based on atmospheric monitoring and inverse modelling

Atmospheric methane (CH_4) is the second most important anthropogenic greenhouse gas (GHG) after CO_2. Atmospheric concentrations of CH_4 are about 2.5 times higher than preindustrial levels. Man-made CH_4 emissions come mainly from agriculture (ruminants, rice cultivation) and landfills, but also coal mining, and oil and gas production. The most important natural source of CH_4 are wetlands. The estimations of the CH_4 emissions that are based on statistical data have large uncertainties, notably in relation to the emission factors. For instance, CH_4 emissions from wetlands show very large variability in space and time, which make estimates of total emissions very uncertain. Nevertheless the so-called bottom-up methods, based on statistics using activity data and emission factors are commonly used. However, emissions can also be estimated top-down, using atmospheric concentration measurements combined with inverse models. These can trace back the observed atmospheric GHG concentrations to the origin of the emissions. The JRC developed a sophisticated inverse modelling system for atmospheric CH_4 and N_2O, based on a global three-dimensional atmospheric transport model and advanced optimisation techniques. In 2010, it has been applied to estimate the European CH_4 emissions over the period 2001–06, using atmospheric observations from European and global surface monitoring stations. For global inverse modelling, also satellite data are used, such as the SCIAMACHY[1] instrument onboard the European environment research satellite ENVISAT. To further improve the top-down emission estimates, long-term high-quality atmospheric measurements are indispensable. An integrated European monitoring network is currently prepared by the new European research infrastructure project ICOS (Integrated Carbon Observations System), involving also the JRC.



European methane emissions derived by the JRC inverse modelling system[2]. Filled circles represent stations which take continuous measurements, open circles represent sites with weekly ones.

'In 2010, a series of integrated products were defined such as sustainable agriculture, prospects on water, adaptation to climate change and Digital Earth. They are the next steps towards a science-based sustainable management of natural resources, both in Europe and globally.'

LEEN HORDIJK, *JRC Director*

1 SCIAMACHY = Scanning Imaging Absorption Spectrometer for Atmospheric Chartography.

2 Bergamaschi, P. et al., 'Inverse modeling of European CH_4 emissions 2001–2006', *Journal of Geophysical Research*, Vol. 115 (2010), D22309, doi:10.1029/2010JD014180.

Contributing to the development of European legislation on safety of food and feed, and on other new consumer products.

Safety of food and consumer products

This work serves a wide range of policy areas such as food and feed safety and quality including Genetically Modified Organisms (GMOs), safety of chemicals used in consumer products including nanomaterials, health and environmental aspects, and nutrition. The work focus is on the provision of appropriate evidence-based quality assurance tools to support standardisation across Europe and worldwide. This comprises the provision of validated methodology for chemical, molecular biological and toxicological analysis of food, chemicals and consumer products.

The year 2010 was successful in terms of consolidating our expertise in present and emerging areas and we initiated new co-operations with our national and international partners.

Scientific policy support — the example of nanotechnology

EU legislation provides European citizens with a high degree of assurance concerning the safety of food and consumer products available on the European market. Legislation, however, requires periodic revision to take into account the uptake of new technologies and the results from new scientific findings. Potential safety concerns regarding manufactured nanomaterials provide one contemporary example where existing legislation may need revising.

Nanostructured materials offer a range of benefits over traditional materials and enable the development of innovative applications and products. For European industry to capitalise in the best sense from nanotechnologies, it is essential that the EU has a well-considered regulatory framework. Important issues relate to the safe practices in the manufacturing process, health of consumers, and protection of the environment.

In 2010, activities continued to lay the groundwork for a harmonised and evidence-based risk assessment in nanotechnology. One major milestone which attracted the attention of many stakeholders was the publication of a JRC Reference Report setting out the basis for discussion on a definition of nanomaterials (refer to page 19 and 59 for more details).

The JRC's recently-opened European repository of nanomaterials contains more than 25 types of nanomaterials most commonly used in consumer products.

A further output has been the establishment of the first European repository of nanomaterials with a representative range of 25 different types of reference nanomaterials containing thousands of samples for each type. By making these samples widely available, the JRC enables the accurate comparison of harmonised data obtained in different test laboratories worldwide. Such data are of critical importance to regulatory bodies.

JRC Director Elke Anklam and the President of the Chinese Academy of Inspection and Quarantine, Huailin Li, signing a Memorandum of Understanding in Shanghai.

Enhanced international collaboration

With today's globalisation of markets, food safety and consumer protection are no longer domestic issues, but need to be addressed in an international context. 2010 was also a year of enhanced international cooperation in this area.

In June 2010, the JRC launched an EU–China partnership with the Chinese Academy of Inspection and Quarantine. The partnership will support risk management measures as well as improve consumer protection through integrated approaches in the areas of nanotechnology and alternative methods to animal testing.

In October 2010, the JRC signed a collaboration agreement with the National Centre for Computational Toxicology (NCCT) of the US Environmental Protection Agency (EPA). The collaboration will facilitate the exchange of research materials and results useful for the development of integrated methods for predicting chemical toxicity. The NCCT, through its involvement in the US ToxCast programme, is generating toxicological profiles of hundreds of reference chemicals using a comprehensive array of automated high-throughput screening assays. This endeavour fits well with the expertise available in the JRC and with its efforts to focus on the design and evaluation of integrated testing strategies for predicting chemical toxicity and thereby reducing the number of animal studies.

Towards new horizons — computational toxicology, endocrine disruptors and nutrition

In 2010, strong focus was given to the development and harmonisation of integrated testing strategies which use a growing number of complementary scientific disciplines (e.g. computational chemistry, *in-vitro* toxicology, biophysical modelling, metabonomics, and systems biology), to provide more quantitative and robust tools for risk assessment.

In this regard, the JRC successfully completed a computational toxicology study in support of the European Food Safety Authority (EFSA) on pesticides by estimating whether the metabolites of the pesticides left on crops might be more toxic than the pesticide itself. Predictions were based on structural relationships thereby avoiding further animal testing than that which was already required for the associated plant protection products themselves.

Pesticides and/or substances derived from their degradation are investigated as having potential endocrine disrupting properties.

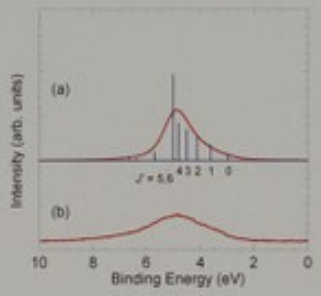
In 2010, the JRC also began consolidating its activities in the area of nutrition science and launched a bimonthly newsletter 'Nutrition Research Highlights'. The newsletter, which features recent nutrition research highlights with relevance to current societal debates and policies, is published on the JRC website.

'For new and innovative products to succeed on the market, it is essential that consumers consider them safe. The JRC provides methods and expertise supporting harmonised risk analysis on which health assessments are based. This infrastructure is indispensable for enabling the responsible exploitation of innovative technologies.'

ELKE ANKLAM, *JRC Director*

Nuclear safety and security

Providing independent and reliable scientific and technological assessment on nuclear safety of present and future generations of nuclear reactors, on the safety of the nuclear fuel cycle, and nuclear safeguards, non-proliferation and nuclear security issues.



(a) Calculated line intensities and broadened spectra for Cm 5f photoemission.
(b) Experimental valence photoemission after background correction measured with He II radiation.

Inhibited nuclear fuel corrosion in a final repository

The worldwide scientific consensus is that deep geological repositories provide the most promising solution for effective long-term isolation of spent fuel and that safe geological disposal is feasible. However, there are still open questions in the understanding of processes and the systems' performance that need to be addressed in order to reduce uncertainties. In this context, the JRC is studying the stability of spent fuel under repository conditions. Experiments carried out at the JRC have demonstrated that hydrogen (H_2) produced by anaerobic corrosion of the cast iron in deep underground repositories of Europe's most advanced nuclear waste repository concepts developed in Sweden and in Finland greatly enhances the stability of the spent fuel matrix against oxidation caused by radiolysis and, as a consequence, drastically reduces the mobility of radionuclides. This result has a major impact on the performance assessment of a waste repository for spent nuclear fuel.

Electronic structure of elemental curium studied by photoemission

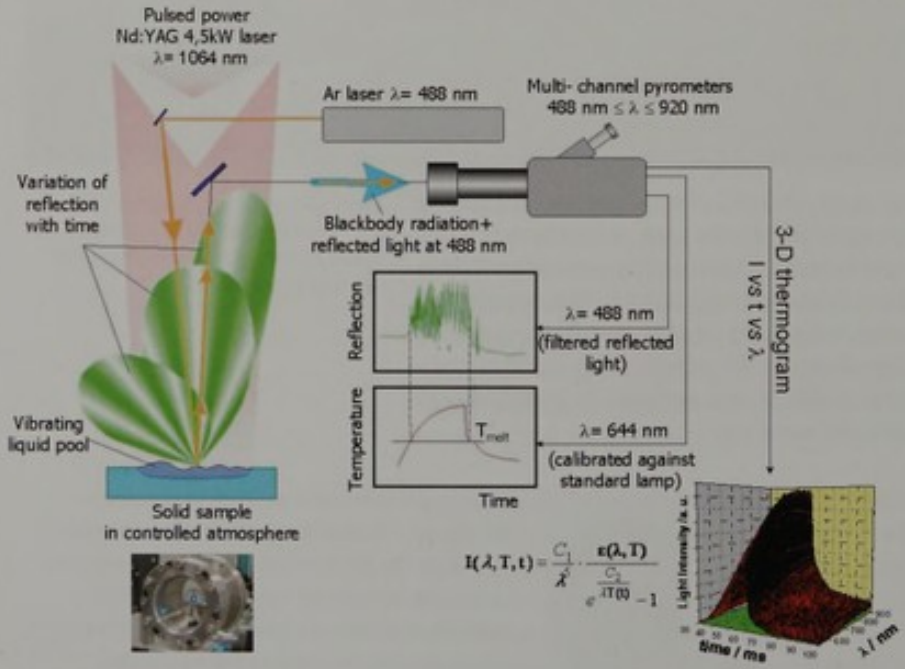
Understanding the electronic structure of actinides is the backbone of nuclear energy technological applications. Curium (Cm), sitting in the middle of the actinide series, is a key element on which to test the predictions of advanced theoretical models. The electronic structure of curium metal has been investigated by valence-band and *4f* core-level photoemission spectroscopy using a high purity ^{248}Cm sample prepared at Oak Ridge National Laboratory, USA. The results obtained are in good agreement with atomic multi-electronic calculations and complete the study of the electronic structure of the actinide elements providing the basis for the global understanding of their relevant properties.

New assessment of the melting behaviour of plutonium dioxide (PuO_2)

The melting temperature of PuO_2 is a fundamental material property highly relevant for nuclear fuel technology. It is likely that the accepted melting temperature of PuO_2 is underestimated significantly due to the limitations of traditional measurement methods. The JRC has developed a new experimental approach: fast laser heating combined with containerless (self crucible) conditions and controlled atmosphere. As published in *Materials Today* in 2010 (13-11 (2010), pp. 52–55), the JRC scientists have now convincingly demonstrated that the true melting temperature of pure uncontaminated PuO_2 is 3017 ± 28 K, exceeding the generally accepted value by about 350 degrees. The study shows the high potential of the new experimental approach, which is now applied to the analysis of the melting behaviour of the UO_2-PuO_2 system, a research subject of great relevance to the safety analysis of nuclear plants.

Experimental demonstration of a closed nuclear fuel cycle

Long-term waste management solutions and closing the nuclear fuel cycle are key technology challenges to maintain and improve the safety level and competitiveness of advanced/sustainable (Generation IV) reactor concepts and related fuel cycles. The METAPHIX programme, devoted to the study of fast reactor metal fuel containing minor actinides and conducted at the JRC in collaboration with the *Commissariat à l' Energie Atomique et aux Energies Alternatives* — CEA (France) and Central Research Institute of Electric Power Industry — CRIEPI

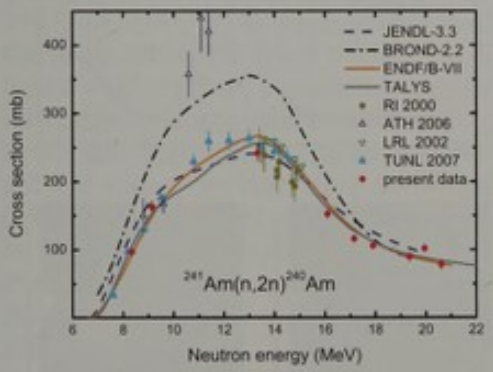


The laser heating technique is a continuous wave laser heating source, employed in short pulses (a few milliseconds), in order to reduce undesired side-effects (reduction, vaporisation) by minimising the experiment duration.

(Japan), is currently the only project worldwide providing an experimental demonstration of all the steps of a closed fuel cycle. A uranium-plutonium-zirconium (U-Pu-Zr) alloy fuel containing minor actinides (MA) and rare earth reproducing the possible output of pyrometallurgical reprocessing of light water reactor spent fuel were fabricated in JRC, irradiated in the PHÉNIX reactor (with burnup levels of ~2.5, ~7.0, and ~10.0 at. %) and transported back to JRC for post-irradiation examination and pyrometallurgical reprocessing performed. All investigations on the low and medium burnup confirm that the presence of minor actinides in the fuel did not cause significant anomalies in terms of fuel behaviour during irradiation compared with conventional U-Pu-Zr fuels, marking a milestone towards achieving the goals for the development of Generation IV reactors.

High-resolution measurements of the americium – ^{241}Am(n,2n) – reaction cross-section

$^{241}AmO_2$ samples were irradiated at the 7-MV Van de Graaff accelerator at the JRC site in Geel, Belgium, to investigate the ^{241}Am(n,2n) reaction cross-section[1]. Below 15 MeV, the present results are in agreement with data obtained earlier, whereas measurements above 15 MeV allowed experimental investigation to be performed for the first time. The data are required to reliably predict the behaviour of reactor cores in both present and future fission reactors and to investigate the possible transmutation of long-lived radioactive waste. The present data were disseminated through the EXFOR database and are included in the latest release of the European (JEFF-3.1.1) and US evaluated data files (ENDF/B-VII.1).



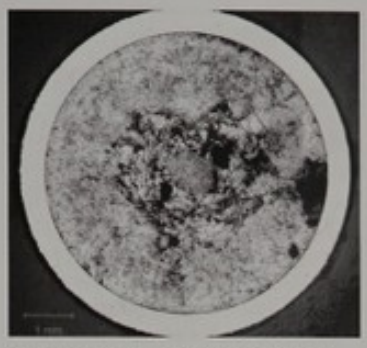
The JRC data (red) for the ^{241}Am(n,2n) ^{240}Am reaction compared with data from earlier work, the new model calculation by CEA Bruyères-le-Châtel (TALYS) and earlier model calculations (JENDL-3.3, BROND-2.2, ENDF/B-VII).

Improved decay data for lutetium – ^{177}Lu

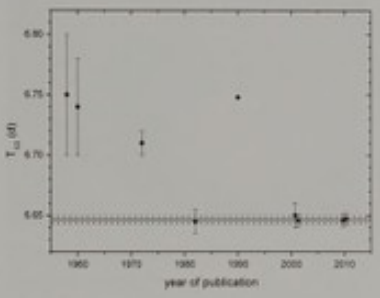
An accurate knowledge of selected nuclear decay data is critical to a wide range of fields such as radiopharmaceutical production, radiotherapy and diagnostics, safeguards investigations, environmental monitoring, theoretical physics and radioactive waste disposal. In 2010, the JRC published measurement results for the half-life of ^{177}Lu, which is an emerging radionuclide for medical therapy. The physical half-life of the radionuclide is an important feature, because it should match with the rates of biological uptake and clearance of the radiopharmaceutical to maximise the dose delivered to target tissue and minimise the burden on normal tissue. It was shown that four out of seven data published in literature were systematically too high and should be discarded.

R&D support for the implementation of the European Sustainable Nuclear Industrial Initiative — safety assessment of innovative reactor systems

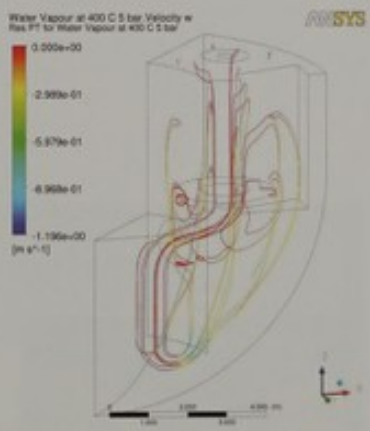
The JRC plays a leading role in the R&D needed for the safety assessment of next generation nuclear fission (Generation IV) energy systems. In 2010, the JRC contributed to the adaptation and interpretation of the International Atomic Energy Agency's nuclear safety standards in view of needs identified for fast neutron reactors and high temperature gas cooled reactors. Using state-of-the-art computational tools in the fields of Monte Carlo neutronics, thermal hydraulics, fluid dynamics, as well as safety assessment, the JRC carried out performance assessment, optimisation of core characteristics and accident analyses. This was done in the framework of the European collaborative project on the 'Sodium-cooled fast reactor' (CP-ESFR) and analyses of steam-generator tube leakages in the framework of the 'European lead-cooled fast reactor' project (ELSY LFR).



Optical microscopy cross section of a U-Pu-Zr fuel containing 5 % minor actinides and 5 % rare earth irradiated in the framework of the METAPHIX project.



Overview of measured values of the ^{177}Lu half-life as a function of their year of publication. The 2010 data were generated using an ionisation chamber and liquid scintillation counting.



Trajectories of hypothetical steam bubbles in the Pb (lead) flow of the primary pool of the lead-cooled fast reactor. Analysis was performed using the computational fluid dynamics code CFX, in order to investigate how sufficiently small steam bubbles would be entrained in the Pb flow. Colours of trajectories indicate velocities in z-direction.

'Nuclear energy is providing an important contribution to reach the EU's 2020 targets. This can only be achieved while ensuring highest safety and security standards which is the main objective of the JRC thematic area "Nuclear safety and security".'

THOMAS FANGHÄNEL, *JRC Director*

1 Sage, C. et al., 'High resolution measurements of the ^{241}Am(n,2n) reaction cross section', *Physical Review C (© 2010 The American Physical Society)*, Vol. 81, 064604, (2010).

Contributing to the development of new technological approaches to enhance the security of the citizen, including support to crisis management.

Security and crisis management

Global early alerting and reporting platform for chemical, biological, radiological, nuclear and pandemic influenza threats

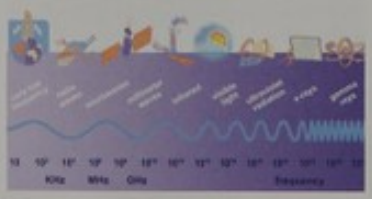
The global Early Alerting and Reporting (EAR) platform for health security threats was released by the JRC in 2010 for intensive testing by the project partners.

The EAR platform builds upon the existing early threats' detection and crisis information management systems, such as the JRC's Medical Information System (MedISys) and the Health Emergency and Diseases Information System (HEDIS)[1]. These establish a common web-based platform that serves to enhance global situation awareness, common threat assessment and alerting, and information sharing in order to improve the early identification of intentional and unintentional threats to public health, thus in turn improving early action measures.

This initiative was established within the framework of the international partnership between the Ministries of Health of the G7 countries and Mexico, the European Commission and the World Health Organization under the Global Health Security Initiative (GHSI).

Radio frequencies for new and faster wireless services

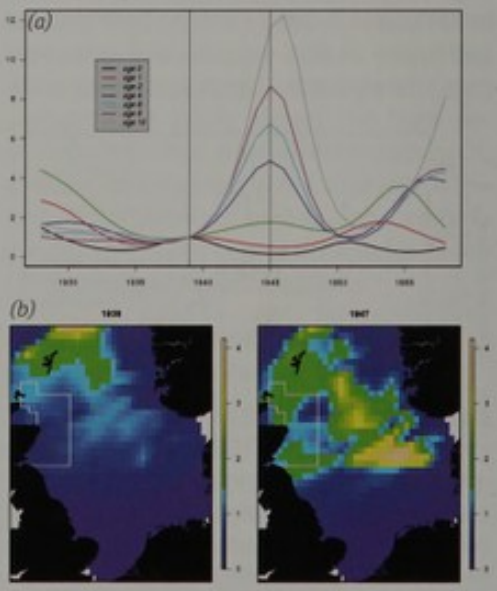
The EU's first radio spectrum policy programme 2011–15[2] recognises the strategic role of the JRC in the standardisation process through laboratory-based measurements. The proposal includes steps towards efficient spectrum management and availability of adequate spectrum for wireless broadband as a key action in the Digital Agenda for Europe. Access to the radio spectrum is essential for a huge range of activities from telephony to transport applications. As a limited natural resource, the radio spectrum needs to be used efficiently while avoiding harmful interference using new techniques such as cognitive radio. The JRC scientists carried out experimental measurements on radio frequency interference in the European Microwave Signature Laboratory to validate simulation results proposed by Member States at the European Conference of Postal and Telecommunications Administrations.



The 'digital dividend' of the radio spectrum policy will create new information and communication technology services for the citizens.

North Sea fish population: fishing pause during WWII provides unique insights

JRC scientists led an international study[3] examining the collateral effects of the six-year closure of the North Sea during World War II on migratory fish species. Understanding how commercial fishing pressures, management regimes and environmental changes interact with the ecology of fish populations, is a key question for fisheries science. The question becomes more difficult to answer using recent time-series data since fishing pressure has been ubiquitous over recent decades. Results of the study showed that fish responded rapidly and positively to the sharp reductions in harvesting rates between 1939 and 1946, and the numbers of older fish in the population reacted earlier, and in much greater proportion, than their younger counterparts in a kind of age-dependent wave. The authors conclude that protected areas are useful in the conservation of migratory species in temperate areas, that older fish benefit fastest and in greater proportion, and also that increases in the spawning stock may not lead immediately to enhanced numbers of younger fish.



(a) The age dependent wave: haddock trawl survey abundance index for ages 0, 1, 2, 4, 6, 8 and 10 between 1928 and 1958 estimated from scientific trawl survey data (NB: each series has been scaled to equal one in 1939).
(b) Landings per hour fishing of haddock in 1937 and 1947 estimated using data derived from commercial fisheries.

1 http://medusa.jrc.it/

2 COM(2010) 471 final: Proposal for a Decision of the European Parliament and of the Council establishing the first radio spectrum policy programme.

3 Beare, D., Hölker, F., Engelhard, G. H., McKenzie, E. and Reid, D. G., 'An unintended experiment in fisheries science: a marine area protected by war results in Mexican waves in fish numbers-at-age', *Naturwissenschaften*, 2010, Vol. 97, Number 9, pp. 797–808.

Cyber Europe 2010: The JRC supports the first pan-European cyber security exercise

Europe's cyber security experts put their skills to the test in the first-ever pan-European exercise held in November 2010. At Cyber Europe 2010, experts tried to counter simulated attempts by hackers to paralyse critical online services in several EU Member States. The event was organised by EU Member States with support from the European Network Security Agency (ENISA) and the JRC, which provided scientific and technical support including the communication and coordination tools that made the exchange of hundreds of simulated events possible. Cyber Europe 2010 enhanced Member States' understanding of how cyber incidents are handled and it tested communication links and procedures.

Completion of the conformity tests on first generation electronic passports

In June 2009, the new EU legislation on the electronic passport came into force[1]. Interoperability of passports and reading systems worldwide is based on the fact that the same technical specifications, issued by the International Civil Aviation Association (ICAO), are used. It was therefore necessary first to assess through testing and validation that passports conform to the specifications, and secondly that they can interoperate with different reading devices. The JRC's Identification and Biometrics Testing Laboratory played a fundamental role in testing prototype passports and readers during the phase that preceded the entry into force of the regulation. Following that, the Home Affairs DG asked the laboratory to test a set of official passports issued by EU Member States to verify their conformity to the specifications. In addition to standard test suites, the laboratory developed in-house a specific test suite and executed, for each passport, over 400 individual tests. The final report and the tests results were delivered to the Home Affairs DG in July 2010.

'Transparent aid': a global view on development and humanitarian projects

With the creation of the European External Action Service (EEAS), the Lisbon Treaty reinforces coordination in the area of external relations. The 'Transparent aid' project (TR-AID) is supporting the mandate of the Union and the Member States to coordinate their development policies and underpin the aid effectiveness agenda by specifically making data on development and humanitarian aid available from a single platform.

The new advanced search facilities implemented in TR-AID in 2010 allow users to view data, textually and graphically, on development and humanitarian projects financed by the Organisation for Economic Co-operation and Development (OECD), the United Nations Office for Coordination of Humanitarian Affairs (OCHA), selected Member States and the European Commission.

Analysing robustness of universities' rankings

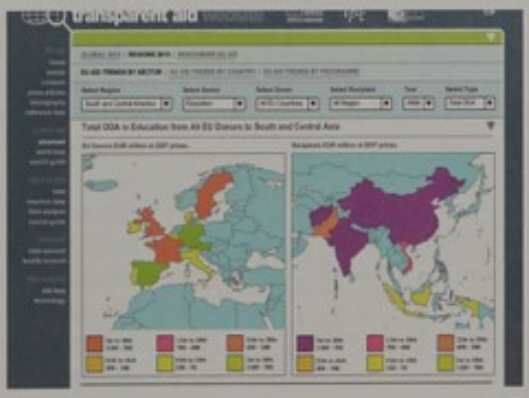
A paper[2] published by the JRC calls into the question the use made by media and social actors of popular world university rankings such as the Academic Ranking of World Universities (ARWU) of Shanghai Jiao Tong University and the UK's Times Higher Education Supplement (THES).

These rankings are routinely taken at face value, and thus are politically influential. Still, they are sensitive to both the conceptual framework and the modelling choices made in their construction. A robustness analysis tested what inference can be drawn based on these measures.

The JRC concludes that, while university-level and country-level statistical inferences are very fragile, the inference on macro-regions is more robust. In other words, these rankings are good to ring the alarm on the poor performances of continental Europe versus the United States, and to identify the excellence of the best British universities, but cannot be used to pick winners among individual countries in continental Europe.

Cyber Europe 2010 enhanced Member States' understanding of how cyber incidents are handled.

Reading a biometrics passport's machine readable zone and chip.



Visualising aid in TR-AID, a web-based system that makes data on development and humanitarian aid available from a single platform.

'In a globalised world, intelligent systems and interconnected solutions are key to enhance citizens' security and support crisis management.'
STEPHAN LECHNER, *JRC Director*

1 Council Regulation (EC) No 2252/2004 of 13 December 2004 on standards for security features and biometrics in passports and travel documents issued by Member States.
2 Saisana, M., D'Hombres, B. and Saltelli, A., 'Rickety numbers: Volatility of university rankings and policy implications', *Research Policy*, 2011, Vol. 40 No. 1, pp. 165–177.

Developing globally accepted measurement standards and providing expertise to EU policy makers from the cutting edge of measurement science.

Reference materials and measurements

Twenty-four new reference materials

A total of 24 new reference materials were released by the JRC during 2010, in areas such as food safety and quality (including genetically modified organisms), environmental monitoring, engineered materials and clinical testing.

In the field of environmental monitoring, three new certified reference materials are now available for water quality testing. These materials serve as a tailored, quality control tool for laboratories involved in the mandatory monitoring of the priority substances set out in the water framework Directive (2000/60/EC), and in response to the groundwater daughter Directive adopted in 2006 (2006/118/EC) for the assessment of the chemical balance in groundwater. Furthermore, reference materials for the testing of grass and soil for trace elements and for a fish oil for environmental monitoring of the levels of polychlorinated biphenyls (PCBs) were released.

A total of 24 new reference materials were released during 2010.

In addition, two new Certified Reference Materials (CRMs) for the quality control of measurements of fine dust in ambient air were finalised. The monitoring of air quality is required by the European air quality Directives (2008/50/EC and 2004/107/EC). The new CRMs were developed to match the requirements of European legislation, in particular regarding the type of matrix (including the particle size) and the type and content of certified analytes.

In the area of clinical chemistry, the JRC released a reference material certified for cystatin C (ERM-DA471/IFCC). Cystatin C in human plasma is used as a marker of the proper functioning of kidneys, and can be used for testing children, the elderly, patients with low muscle mass, and persons in the early stages of kidney problems. Cystatin C is also used as a marker for cardiovascular risk and pre-eclampsia.

In the field of food safety and quality, three materials for food composition were added to the CRM catalogue. These materials help to ensure the correctness of the nutritional information on food labels. Other new materials include a material for testing aflatoxins (very potent liver carcinogens) in feedstuff and one for chloramphenicol — an antibiotic used illegally as a growth promoter in pork muscle. These materials help to keep food sold in the European Union free from those substances. Furthermore, one set of materials for quality control of measurements for genetically modified cotton was issued.

In the field of engineered materials, a series of reference materials for the quality control of instruments for testing the impact toughness of steel was released. The use of these materials is mandatory under European legislation that makes direct reference to the international standard ISO-148 (e.g. construction products Directive (89/106/EEC) for the stability of buildings and the pressure equipment Directive (97/23/EC) for the stability of pressure vessels).

Certified reference materials are required for the calibration and quality control of GMO measurements carried out by the European GMO control laboratories.

Genetically Modified Organisms (GMOs)

Legislation in the European Union requires food and feed products containing more than 0.9 % GMOs to be labelled, provided that the GMO has been approved for the European market.

In 2010, the JRC released a new series of GMO reference materials for the event T304-40 cotton (ERM-BF429) consisting of three different mass fraction levels of T304-40 cotton seeds powder with a nominal value of 0.10 and 100 g/kg.

The genetically modified (GM) cotton *(Gossypium hirsutum)* event T304-40 is designed to control lepidopteran pests of cotton. The material was prepared according to ISO Guide 34 by gravimetrically mixing GM and non-GM cotton seed powders. The resulting GM ratios were confirmed by real-time polymerase chain reaction (qPCR) analysis after DNA extraction from the powder mixtures.

The JRC provided 140 certified reference materials (CRMs) containing various concentrations of 98140 maize, T304-40 and GHB 119 cotton and RoundupReady soya to its EU Reference Laboratory for Genetically Modified Food and Feed (EURL-GMFF). The CRMs are needed to maintain the ISO/IEC 17025 accreditation of this EU Reference Laboratory.

New developments in nanotechnology

In 2010, important steps forward were made in the field of metrology at the nanoscale. The JRC has achieved ISO/IEC 17025 accreditation for the measurement of the size of nanoparticles by dynamic light scattering and centrifugal liquid sedimentation.

The accreditation by the Belgian accreditation body BELAC confirms the proficiency to measure sizes of nanoparticles. This external recognition for these measurements is the first in the JRC and among the first globally. It will make results obtained at JRC accepted globally, and is invaluable for the further research activities in the field of nanotechnology.

The JRC also contributed to an important ISO technical specification defining key terms in the field (ISO/TS 80004-1:2010). This specification subdivides the term 'nanomaterials' into 'nano-objects' and 'nanostructured materials', and defines 'nanoscale' (size range from approximately 1 nm to 100 nm), nanotechnology, nanoscience and other terms. The publication of this ISO document is intended to facilitate communication between stakeholders in the field.

International conference 'The future of reference materials — Science and innovation'

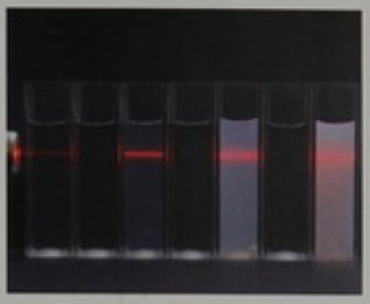
Following the official inauguration of a new reference material production building (see pp. 16 and 56), an international scientific conference entitled 'The future of reference materials — Science and innovation' took place on 23–25 November 2010. The conference was held under the auspices of the Belgian Presidency of the Council of the European Union, and in the framework of the 50th anniversary of the JRC-Geel site.

Over 130 participants from 26 countries around the world participated in the conference, which mapped out the current and upcoming measurement and testing needs for which challenging demands on reference materials are envisaged. Forward-looking contributions addressing the scientific and technological demands for the design, preparation and certification of such measurement standards were presented. The symposium covered a broad range of emerging scientific areas, from the 'omics' to functional materials as well as nanotechnology.

Training and knowledge transfer

The project 'Europe and metrology in Turkey' (EMIT) entered its implementation phase on 1 January 2010. The main purpose of the project — which was set up between the EU Delegation in Ankara and JRC — is to enhance institutional and measurement capacity in chemical and ionising radiation metrology for the main beneficiaries, TÜBITAK-UME (National Metrology Institute of Turkey) and TAEK (Turkish Atomic Energy Authority). The aim is to ensure that Turkish laboratories are able to produce traceable and comparable measurement results, leading to improvements in quality of life, and facilitating the adoption of the body of European laws known as the *acquis communautaire* related to the free movement of goods.

During the course of 2010, experts at the JRC arranged and provided short-term training of Turkish scientists. Ten long-term trainees (from the beneficiary institutes) were hosted for 12-month traineeships, four of whom have recently returned and are transferring their knowledge to their home institutes.



The JRC has achieved ISO/IEC 17025 accreditation for the measurement of the size of nanoparticles by dynamic light scattering and centrifugal liquid sedimentation.

The JRC Director Krzysztof Maruszewski welcomes the participants of the conference 'The future of reference materials', which was held under the auspices of the Belgian Presidency of the EU Council.

'Standardisation of measurements accelerates innovation, brings products to the market and enables sound regulation of new technologies.'
KRZYSZTOF MARUSZEWSKI, *JRC Director*

CROSS-CUTTING **ACTIVITIES**

JRC Ispra (16 November 2010)

'One of the better investments that I had the pleasure of performing in my capacity at the Environment DG! A wealth of knowledge and very open friendly discussions! An experience that will be repeated!'

KARL FALKENBERG, *Director-General for the Environment*

JRC Karlsruhe (15 January 2010)

'To the whole team of the ITU — very high-tech facilities and excellent hospitality!'

CHRISTOPHE BÉHAR, *Director of Nuclear Energy, CEA*

JRC Petten (28 September 2010)

'Implementing these two codes of conduct will significantly reduce the EU's electricity consumption and could save EUR 4.5 billion per year. I welcome this work towards a more sustainable future.'

NEELIE KROES, *EC Vice President for Digital Agenda*

JRC Karlsruhe (13 October 2010)

'With the highest respect for, and in high recognition of, the excellent scientific work — I wish you luck and success for the future.'

MONIKA HOHLMEIER, *Member of the European Parliament*

QUOTATIONS

Intellectual property and technology transfer

'Speed dating' event during the ESOF conference in Turin, Italy, in July 2010.

SESAMONET equipment.

'Intellectual property rights are our most valuable assets in the transition towards a knowledge society.'

Since 2001, the JRC has been responsible for managing the Intellectual Property Rights (IPRs) of the European Union, a task which includes the protection and exploitation of Commission-related IPRs. Throughout 2010, the JRC provided IPR assistance to many Commission services, focusing on training and awareness-raising on the importance of protecting IPRs. In addition, the JRC filed 20 new patent applications, 28 trademarks and concluded 15 exploitation agreements.

IPR support to Commission services expanded in 2010, in particular to include new initiatives in the field of research and development, such as the development of framework conditions for joint programming for the aspects of IPR and dissemination of results, the ITER nuclear fusion programme and the International Science and Technology Center (ISTC) in Russia, the Science and Technology Centre (STCU) in Ukraine and selected joint technology initiatives.

Of particular relevance was the support that the JRC has continued to give to the European global navigation satellite programmes managed by the Enterprise and Industry DG. In preparation for the Galileo open-signal service planned for 2014, the JRC contributed to successful negotiations with European and US industry and drafted the IPR licence agreement. It has also contributed to the Global Navigation Satellite Systems (GNSS) procurement service contract, the regulation of use for the European Geostationary Navigation Overlay Service (EGNOS) and the co-existence agreement with the European Space Agency (ESA).

As a contribution to the implementation of the 'Innovation Union', the JRC, together with the Research and Innovation DG, organised a stakeholder seminar in the field of knowledge transfer in Varese and Ispra under the aegis of the Belgian Presidency of the EU. Suggestions for practical follow-ups of the 'Innovation Union' communication as well as interesting new ideas for discussion came up during the highly interactive debates at the various technical sessions.

In 2010, the JRC launched an 'Innovative projects' competition which attracted considerable interest. Twenty-two applications were received, among which 12 projects were selected for funding. The winning projects came from five JRC institutes and two of the selected projects are related to nuclear activities. Moreover, the JRC organised the 'Speed dating' event at the ESOF2010 conference in cooperation with the Torino Chamber of Commerce and the Piemonte Regional Chamber of Commerce in the framework of the Enterprise Europe Network, of which the JRC is a partner. The goal of the meeting was to foster collaborative research between science and industry. Around 240 people, of which around 140 representatives were from European private companies, participated in the event.

An example of a recent JRC licence is the patented SESAMONET (Secure and Safe Mobility Network) technology for the Italian association of the visually impaired[1]. This technology uses RFID (Radio Frequency Identification) microchips embedded in the ground to guide a visually impaired person through a predefined area. A testing path was installed and validated in the Polyclinic Gemelli in Rome (Italy) in September and the JRC is negotiating with interested organisations from other EU countries.

Group picture for the knowledge transfer seminar in Varese and Ispra, Italy, in November 2010.

1 ONLUS: http://www.uiciechi.it/

Press and media relations

- Number of press clippings: 3 179 (2 854 in 2009)
- Coverage was retrieved in 74 countries including all 27 EU Member States
- 61 audiovisual broadcasts (radio, TV and online videos) were recorded

With 3 179 articles and media broadcasts retrieved, 2010 media coverage on the JRC's work was the highest ever since media monitoring and clippings' recording started.

This was achieved thanks to careful planning of press actions and efforts to identify every potential opportunity for a press release or press trip. All JRC sites and institutes hosted media events, ranging from topical press trips, press conferences and briefings to individual journalists' visits and interviews. Some 30 press events involving more than one visitor were organised and new studies, reports, products or events were announced to the media through more than 30 press releases.

Furthermore, JRC participation in major scientific events like the annual meeting of the American Association for the Advancement of Science (AAAS) and the EuroScience Open Forum (ESOF) helped to increase awareness within the science media community of the JRC as a reliable source for scientific news and expertise.

Increased geographical spread

JRC visibility was secured in all 27 EU Member States, and in all Candidate and Associated Countries, such as Norway, Switzerland and Turkey.

The total number of countries where coverage was reported has increased to 74 with the share of non-EU countries going up to 46 from 41 in 2009.

With regard to the number of articles per country, Italy remained on top (676), Spain is new in second position (371), while Germany is now in third place (202).

Fluctuating coverage numbers have been observed over the years for all countries and can be explained to a large extent by events in the country or participation by media from certain countries in JRC events. For example, Spain hosted several high-level scientific events during the Presidency which resulted in excellent coverage for the JRC. In Ireland, coverage numbers more than doubled as a result of the new Commissioner and a press trip for Irish media.

Notable increases from the average coverage retrieved during the previous three years can also be reported for Bulgaria, Greece, Hungary, Latvia, Poland, Portugal and Slovakia.

Combined efforts and top topics in the media

The number of press releases on topics of broad interest issued through the Commission's press room almost doubled in 2010 compared with 2009 and represented nearly half of the total news releases (15 out of 31). For issues of a more technical nature the JRC continued to publish news releases and distributed them to its growing mailing list of science journalists all over the world.

In addition to topical press events and interviews, country specific press trips for the Irish and Slovenian media and a press trip in collaboration with the European Union of Science Journalists Associations (EUSJA) were organised and presented an ideal occasion for journalists to discover the JRC.

The topics which generated the highest visibility for the JRC in the media were renewable energy and energy savings, followed closely by cyber security, the R&D Industrial Investment Scoreboard and soil research including two new atlases on the biodiversity of European soils and northern circumpolar soils. Also food-related issues — crop yield forecast and genetically modified organisms — received a strong echo in the media.

EXAMPLES OF ARTICLES

Chasa (BG): *'Лаборатория подобрява качеството на живот в ЕС' (new facility at the JRC-Geel site) — 08.12.2010*
De Standaard (BE): *'Schade op Haiti tien keer groter dan eerst werd geschat' (Haiti damage assessment) — 18.3.2010*
Der Spiegel (DE): *'Erneuerbare Energien legen kräftig zu' (renewables snapshot) — 6.7.2010*
Die Welt (DE): *'Europas Industrieforschung kriselt' (R&D Industrial Scoreboard) — 29.10.2010*
Dnevnik (SI): *'Bistra glava siri dober glas o nas (The European Centre for the Validation of Alternative Methods) — 28.4.2010*
El Pais (ES): *'Europa planea enterrar la basura nuclear a 400 metros bajo tierra' (nuclear waste) — 23.2.2010*
Il Sole 24 Ore (IT): *'Gli studenti al microscopio col JRC di Ispra' (Schools Day) — 3.3.2010*
Irish Times (IE): *'Before the flood, a warning' (European Flood Alert System) — 14.10.2010*
Le Monde (FR): *'European atlas of soil biodiversity' — 26.9.2010*
Lidove Noviny (CZ): *'V Belgii vyrabejí pravdu v lahvi' (New facility at the JRC-Geel site) — 21.12.2010*
Nature (UK): *'Soil map digs under the tundra' (Northern circumpolar soil atlas) — 2.9.2010*
Népszabadsag (HU): *'Katasztrofaelorejelzes es foldrengesvedelem' (post-ESOF press trip report) — 2.8.2010*
Neue Zürcher Zeitung (CH): *'Stetiger Strom aus böigem Wind' (ESOF electricity grid session) — 14.7.2010*
New Scientist (UK): *'Chemistry helps to trap the trappist imitators' (food quality and safety) — 21.12.2010*
The Economist (UK): *'War dividend' (maritime affairs) — 21.8.2010*
The New York Times (US): *'Data centers tighten energy belts' (energy savings) — 3.11.2010*
The Sun (UK): *'Aid delays hit devastated Haiti' (Haiti damage assessment) — 15.1.2010*

EXAMPLES OF BROADCASTS

Euronews: *TV report about the European Laboratory for Structural Assessment — 14.1.2010*
La7 (IT): *TV documentary about protected areas including report about the Africa Observatory — 1.6.2010*
Rai3 (IT): *TV report about signing of contract for new buildings Ispra — 4.3.2010*
RTÉ (IE): *Two-minute TV news report about research at JRC Ispra — 8.10.2010*
Deutschlandfunk (DE): *Radio report: 'Der schwierige Kampf gegen den Nuklearschmuggel' (nuclear forensics) — 11.4.2010*
CNN: *'Connect the World': TV report about oil spill clean up technologies — 27.7.2010*
BBC World Service: *Radio interview on the European Floods Alert System — 9.8.2010*
TVE1 (ES): *TV interview about R&D Industrial Scoreboard — 19.11.2010*
ETV (EE): *TV report about Euromaster ceremony at the JRC-Geel site — 27.10.2010*

American Association for the Advancement of Science and Euroscience Open Forum

One of 9 JRC exhibitions in downtown Turin, July 2010.

The JRC at the annual meeting of the American Association for the Advancement of Science (AAAS)

AAAS is the world's largest general scientific society, and publisher of the journal *Science*. Its annual meeting is the most prestigious science and communication event in the United States.

The annual meeting of AAAS in 2010 was held in San Diego on 18–22 February. Under the theme 'Bridging science and society', the event brought together a diverse array of leading scientists, engineers, educators and policy makers from all over the world. The JRC was very well represented in the scientific programme through nine sessions:

1. Working together for the public: challenges for verification of nuclear activities
2. Smart and secure transmission grids to realise US and EU renewable energy potentials
3. Scientific rationality and policy making: making their marriage work
4. Food allergies: the enemy within
5. Nuclear waste management: from public perception to industrial reality
6. Applying biogenomics to ecology: from the molecular to the ecosystem level
7. Privacy in a new global context: trapped between culture, laws and technology
8. Protecting the consumer: can 'omics' keep the promise?
9. Progress in the use of earth observation for fighting hunger

All sessions were very well perceived by the public, and contributed to raise the JRC's visibility and its research work beyond EU boundaries. The two nuclear sessions were also integrated in the official AAAS press programme, which resulted in large media coverage of JRC activities in this field.

From left to the right, speakers in the 'Biogenomics' session: Mark Hildebrank (University of California), Ari Patrinos (Synthetic Genomics Inc), Teresa Lettieri (JRC), Nancy Denslow (University of Florida) and Kevin Chipman (University of Birmingham).

Passion for science — JRC @ ESOF

Under the theme 'Passion for science', the biggest scientific gathering in Europe during 2010 was the biennial Euroscience Open Forum (ESOF), which took place in Turin, Italy, on 2–7 July 2010. With 14 sessions in the scientific programme, the JRC was a prime player and attracted an average attendance of 99 participants per session. Each conference was evaluated by the organisers and the JRC session 'Evidence-based policy versus policy-biased evidence: EU/US perspectives' was ranked in the top five of the conference.

In downtown Turin the streets came to life with over 100 spectacular science and technology exhibitions in temperatures which soared above 40°C. The JRC was present with no less than nine activities. As well as actively participating in the 'All night long' exhibition, the JRC also participated in the 'Career Programme' (career openings for young researchers) and organised the 'Speed dating' (fostering collaborative research and technological transfer between science and industry) event. To conclude, the ESOF2010 Champion, Enrico Predazzi, said the JRC's collaboration and participation were key factors for the success of ESOF2010.

Facts and figures from ESOF2010

- 4 400 participants attended the scientific programme with 200 conferences and 700 speakers.
- 75 000 participated in the 'downtown' 'Science in the city' programme.
- There were participants from 42 countries — 48 % were female.
- More than 50 % of the participants were under 35 years old.
- 5 Nobel Prize winners participated.

Nature Workshop and Annual Lecture

Back row, from left: David Adam (Nature), Samantha Packer (KPMG), Peter Höppe (Corporate Climate Centre, Munich Re), Chester J. Koblinsky (National US Oceanographic and Atmospheric Administration), Frank Raes (JRC), Michael A. White (Nature), Leen Hordijk (JRC), Yvo de Boer (KPMG), Roland Schenkel (JRC). Front row, from left: Aidan Gilligan (JRC), Sir John Beddington (UK Government Chief Scientific Adviser), Joanna Thorpe (Support to the UK Government's Chief Scientific Adviser), Olive Heffernan (Nature), Saleemul Huq (International Institute for Environment and Development), Jos Delbeke (EC's Climate Action DG), Julia Slingo (UK Met Office), Philip Campbell (Nature).

Nature Workshop

The JRC and the *Nature Publishing Group* organised a joint workshop entitled 'Climate services: fit for purpose?' at the latter's central offices in London on 25 October 2010. The initiative brought together some of the world's leading influencers (see photo) on climate science support to policy making, taking place shortly before the JRC's Annual Lecture on the same topic, given by participant Yvo de Boer.

High-level participants from Germany, the UK and the United States explained their recent decisions to create or develop a national climate service. Further participants were actively involved in the World Meteorological Organization's decision to establish a 'global framework for climate services', with the aim of providing climate data and information to nations worldwide.

During the workshop it became clear that the information most urgently needed by decision makers and resource managers is how the climate will change in the decades ahead and on regional scales. Much of the new science that will be presented in the next report of the Intergovernmental Panel on Climate Change, due out in 2013–14, will be focused on this type of decision-relevant science. The workshop's overriding aim was to look at the vision for, and the limitations of, climate services while asking whether the science can ever meet the expectations of end-users.

JRC Annual Lecture

The keynote speech at the JRC Annual Lecture was delivered by Yvo de Boer, Special Global Adviser, Climate Change and Sustainability at KPMG and former Executive Secretary of the United Nations Framework Convention on Climate Change (UNFCCC). In his speech he talked about 'Climate services: fit for purpose?'. He discussed the importance of such services to be put in the context of people's regional relevance — even if this means extrapolating data at regional level — and stated that the dissemination frequency of information has to be much higher. Only then will they be able to provide their crucial role of supporting the policy-making process, bringing business on board and contributing to the creation of public awareness and understanding.

JRC Annual Lecture, 27 October 2010. Yvo de Boer, keynote speaker.

Addressing a selected audience of about 350 people, including Members of the European Parliament, Yvo de Boer stated that '*...the urge to build climate-resilient nations naturally brings with it a desire for more detailed knowledge of the changes that lie ahead. In response to this demand, the idea of "climate services" has emerged whereby detailed climate information will be tailored to the needs of specific end-users and delivered on demand*'.

Geraldine Barry

'The JRC is committed to communicating science whether through flagship events such as its Annual Lecture, Open Days at its sites or participating in key international conferences such as ESOF and AAAS, while developing new web and publicity products that paint a clear picture of the JRC today and where it is going.'

Stakeholder events

The JRC stand at the European Parliament 'Science meets policy' exhibition, 4–6 May 2010.

Support to the European Parliament

'Science meets policy', the JRC at the European Parliament, 4–6 May 2010

Following the taking up of posts by the newly elected Members of the European Parliament (MEPs) in 2009, the JRC organised an exhibition at the European Parliament (4–6 May 2010) in order to raise awareness on how it supports the decision-making process. This was the third initiative of its kind, following successful events in 2000 and 2005.

JRC Directors and EP President, Jerzy Buzek, at the European Parliament 'Science meets policy' exhibition, 4 May 2010.

'JRC proactively increases its support and involvement in EU Presidencies in order to strengthen relations with the Member States.'

The exhibition took place under the title 'Science meets policy' and demonstrated the special skills and unique tools that the JRC has developed to use science for providing and assessing policy options. More than 500 visitors, including about 100 MEPs, had the opportunity to see examples of the JRC's work through demonstrations on matters such as early warning systems for tsunamis, nanotechnologies, the amounts of bio-products needed to produce the same quantity of fuel, and how different energy sources can contribute to our future energy mix.

The exhibition was inaugurated by the Commissioner for Research, Innovation and Science, Máire Geoghegan-Quinn, and the Vice-President of the European Parliament, Diana Wallis. During the opening ceremony, the Commissioner launched the 'Soil atlas of the northern circumpolar region', the result of a three-year collaborative project led by the JRC. The President of the European Parliament, Jerzy Buzek, also attended.

Commissioner Máire Geoghegan-Quinn and Vice-President of the EP, Diana Wallis, launching the 'Soil atlas of the northern circumpolar region' at the opening of the European Parliament 'Science meets policy' exhibition, 4 May 2010.

In 2010, the JRC strengthened relations with the JRC-EP Interface Working Group (IWG), in the framework of which the JRC strategy 2010–20 was communicated to some of the main JRC stakeholders in the European Parliament, including the Committee on Industry, Research and Energy (ITRE). Additionally, MEPs from the IWG visited the JRC Karlsruhe and Ispra sites.

In order to discuss the future direction of mutual collaboration, a JRC-STOA (Scientific and Technological Policy Options Unit of the European Parliament) meeting took place, involving all JRC Directors and STOA Bureau members.

Support to EU Presidencies

During the last couple of years, the JRC has been actively seeking collaboration with the countries holding the Presidency of the Council of the European Union by contributing to relevant research events and their conclusions.

Supporting EU enlargement and integration

Support to Spanish Presidency of the Council of the EU in the first half of 2010

The JRC, together with the European Union Satellite Centre (Torrejón), hosted an Information Exchange Day with Spanish stakeholders in Madrid on 2 June. More than 100 high-level participants from government, research organisations and industry had the opportunity to listen to presentations by JRC speakers and partners emphasising the application of technology to address grand challenges facing society today in the areas of climate change, nanotechnology, remote sensing and applications such as the European forest fire and drought information systems, agriculture and fisheries.

Support to Belgian Presidency of the Council of the EU in the first half of 2010

The Belgian Presidency of the Council of the European Union together with the JRC and the Research and Innovation DG held the third edition of the Knowledge Transfer Forum which, in 2010, focused on implementing the 'Innovation Union' and in particular on discussing the next steps to improve knowledge transfer in Europe.

The JRC Geel site hosted a conference under the auspices of the Belgian Presidency of the EU aimed at mapping the current and upcoming measurement and testing needs for which challenging demands on reference materials are envisaged.

The Belgian Nuclear Society, in association with the Belgian Nuclear Research Centre (SCK•CEN), the Institute for Radioelements (IRE), and the JRC, organised a conference on nuclear sciences in physics and medical applications under the umbrella of the Belgian Presidency.

Workshop on foresight in Moldova, 9 November 2010.

The JRC is playing an important role in providing scientific and technological support for the EU enlargement and integration process by fostering collaboration with target countries' governmental organisations, which will have an institutional role in the implementation of policies.

The Enlargement and Integration Action (E&I Action) targets in 2010 were the new Member States[1], the EU Candidate and Potential Candidate Countries[2] and possibilities are gradually opening for the partner countries of the European Neighbourhood Policy[3]. In promotion of cooperation with non-EU countries which are associated to the 7th Research Framework Programme, the JRC E&I Action is also open to Iceland, Israel, Liechtenstein, Norway and Switzerland. E&I Action activities in 2010:

- 44 workshops and training courses on specific scientific and technological aspects of EU legislation, involving about 2 500 experts;
- 28 new positions for seconded national experts and grant-holders at the JRC for nationals of the E&I Action target countries;
- a Memorandum of Understanding between the JRC and Serbia was concluded;
- the JRC held an Information Exchange event in the former Yugoslav Republic of Macedonia; the Research and Innovation DG also participated;
- the second meeting of the Steering Committee between the JRC and TÜBITAK (Scientific and Technological Research Council of Turkey) took place;
- a high-level delegation from Egyptian research centres visited the JRC-Ispra site;
- in Moldova, the JRC held an Information Exchange event followed by a workshop on foresight.

Roland Schenkel (JRC) and Bozidar Delic, Deputy Prime Minister for EU Integration and Minister for Science and Technological Development, signing the Memorandum of Understanding between the JRC and Serbia.

1 Bulgaria and Romania.
2 EU Candidate Countries: Croatia, the former Yugoslav Republic of Macedonia and Turkey. EU Potential Candidate Countries: Albania, Bosnia and Herzegovina, Montenegro, Serbia and Kosovo.
3 Algeria, Armenia, Azerbaijan, Belarus, Egypt, Georgia, Israel, Jordan, Lebanon, Libya, Moldova, Morocco, occupied Palestinian territory, Syria, Tunisia and Ukraine.

Investment plan, nuclear decommissioning and waste management

Laying the foundation stone for the new Science Zone, 15 October 2010.

Investment plan

New Science Zone (Ispra)

At the JRC-Ispra site, the new Science Zone is taking shape with the signing of the contract for the construction of two new research facilities, on 2 March 2010. The project, which represents a global investment of EUR 44 million, will accommodate some 400 staff working in the area of life sciences and the environment. Works started in June and are well underway and completion of this ambitious project is expected for the end of 2012. Commissioner Máire Geoghegan-Quinn laid the foundation stone at a ceremony on 15 October 2010. These projects are rooted in the strategic Ispra site development plan, which foresees the concentration of most scientific activities and staff at the centre of the site.

In addition to these new constructions, regular refurbishments and upgrades of the existing buildings, technical installations and utility plants proceeded throughout the year. These aimed at assuring that JRC-Ispra meets new and emerging safety and environmental standards while improving the working conditions of the staff in offices and laboratories.

Works on the foundation of the new research facilities at the JRC-Ispra site.

New facility for developing and producing reference materials (Geel)

On 23 November 2010, a new scientific facility to develop measurement standards in challenging areas such as life sciences was inaugurated at the JRC site in Geel.

The new facility is a multifunctional building which will be mainly used to develop and produce reference materials in a new pilot laboratory, a unique asset and unparalleled amongst facilities of other major reference material producers in the world. The building also houses some 14 laboratories of different sizes for various measurement tasks, including biosafety laboratories which equip the European Commission with in-house laboratory facilities for the safe handling of the more potent human pathogens (bacteria and viruses) — refer to page 16 for more details.

Refurbishment of linear accelerator flight path cabins (Geel)

The 150 MeV electron linear accelerator, GELINA, is used to produce high-precision data on the interaction of neutrons with material for various applications, such as the safe operation of nuclear power plants and the management of nuclear waste.

In 2010, the first 4 of 23 measuring stations of the linear accelerator were completely refurbished. These stations are located in a vast outside area and date back almost 50 years. The new measurement stations are state-of-the-art experimental facilities, enabling a better control of experimental parameters as well as offering improved safety in terms of nuclear and conventional hazards.

External view of one of the refurbished GELINA measurement stations at the JRC-Geel site.

The refurbishment will improve the quality of neutron-interaction data in terms of accuracy and reliability, thus reinforcing the JRC's position as a world-class producer of nuclear data.

Full renovation of hot cell 107: Replacement of the sample preparation caisson (Karlsruhe)

The study of fuel behaviour during irradiation in a nuclear power plant contributes to the improvement of the safety of the nuclear fuel cycle. The JRC investigates the performance of high burn-up nuclear fuels through post-irradiation examination. This is mainly performed by remote handling in hot cell facilities. Surface examination and analysis of composition, morphology, structure and phases are key aspects of these characterisations.

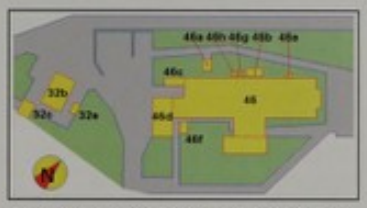
Replacing a 40 year old sample preparation caisson which operated on highly active materials for decades was an extremely challenging task that required design efforts and a carefully planned and executed series of tasks to empty out the old caisson, remove it and then install the new caisson.

View of the inside of the new caisson after its installation at the JRC-Karlsruhe site.

In this process, significant innovation was introduced and the whole configuration of the caisson was redesigned to improve efficiency, minimise consumption of material and waste production, and ensure full flexibility of operation. The indications from the first operation of the new installation are positive and in line with the expected improvements.

Nuclear decommissioning and waste management (Ispra)

The execution of the decommissioning of the Ispra-1 reactor was transferred to the Italian government following the signature of the Settlement Agreement to compensate for the Italian liabilities stemming from past Italian nuclear activities on the Ispra site.



Map of released infrastructures following decommissioning of the ex-radiochemistry lab.

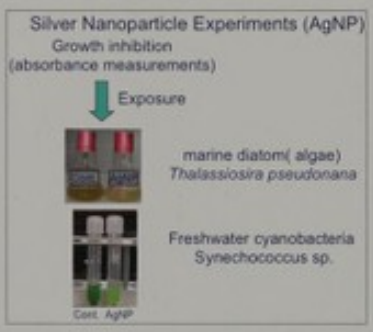
The retrieval, characterisation and treatment of waste proceeded with several hundreds of waste containers (drums) being recorded, measured and characterised. One of the shut-down nuclear facilities in Ispra, the ex-radiochemistry laboratory, was completely released from radiological control and can now be used for conventional purposes (possibly following refurbishment). Start of construction of an interim waste storage facility is scheduled for 2011 following successful tendering in 2009. Issue of the construction licence took place at the end of 2010.

To mark the 10th anniversary of successful decommissioning and waste management, a brochure 'Nuclear decommissioning programme at the Joint Research Centre — 10 years of progress' was published.

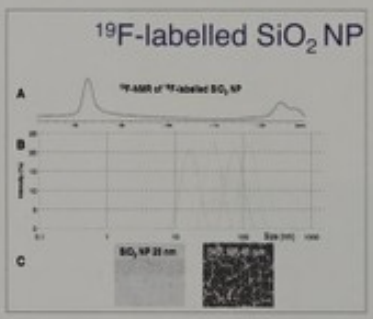
Exploratory research

A vial of ERM-DA472/IFCC, a serum reference material certified for its content of C-reactive protein.

CO_2 sources (red) and potential CO_2 storage sites (blue and green) to be connected by CO_2 transport infrastructure.



Analysis of growth inhibition upon exposure to silver nanoparticles.



(A) ^{19}F-NMR spectrum of ^{19}F-labelled SiO_2 nanoparticles. The signal coming from the nanoparticles will allow their tracking by using NMR.
(B) particle size distribution of well defined SiO_2 nanoparticles of around 20, 40, 70, 120 nm.
(C) Electron microscopy images of SiO_2 nanoparticles of 20 and 40 nm showing very homogeneous nanoparticles.

The JRC exploratory research programme is an important instrument for building competences and preparing to meet the future challenges. Exploratory research projects are selected each year on the basis of proposals submitted by JRC researchers. The JRC invests about 6 % of its annual specific credits in these projects, which have an average duration of one to two years.

Examples of exploratory research projects carried out in 2010

1. Protein isoform profile and immunoassay response

Malgorzata Rzychon, Guy Auclair, Heinz Schimmel, Ingrid Zegers
The team investigated the link between different forms of an important health status marker protein and immunoassay results with the aim to enable reference material development and thus improve reliability and standardisation of clinical tests.

2. Nano-objects of actinide compounds: synthesis and physicochemical properties

Damien Hudry, Christos Apostolidis, Thomas Gouder (JRC), Daniel Meyer (Institut de Chimie Séparative de Marcoule ICSM, France)
Whereas much research is ongoing on nanomaterials made of stable elements, little is known about the properties and resulting effects and potential applications of actinide nanomaterials. This group, in collaboration with the ICSM, developed a method to prepare uranium-oxide nanoparticles without organic stabilising agents. Their physicochemical properties will be analysed, opening up new areas of investigations for nuclear fuels.

3. The benefits of interconnected European CO_2 transport infrastructure: the JRC *InfraCCS* tool

Joris Morbee, Joana Serpa, Evangelos Tzimas
The team developed an innovative modelling approach to study the optimisation of a large-scale, pan-European CO_2 transport infrastructure, in terms of development and deployment. Such an infrastructure will help reduce CO_2 emissions via carbon capture and storage (CCS).

4. In-cell tool for remote operation on spent nuclear material

Jordi Cornellà Medrano, Emilio Ruiz Morales (JRC) and Paolo Fiorini, Davide Zerbato, Luca Giona (University of Verona, Italy)
The remediation of storage sites for spent nuclear fuel can sometimes cause safety and environmental concerns if a site is poorly maintained. The aim of the project was to develop a new tele-operated system for carrying out inspection and manipulation tasks on spent nuclear fuels in dry storage units. The project resulted in a patent application.

5. Nano-ecotoxicology: environmental toxicity and fate of nanoparticles

Teresa Lettieri, Alina Burchardt, Raquel Carvalho, Gerard Tanet, Valerio Pedroni, Rosanna Passarella, Douglas Gilliland, François Rossi and Jessica Ponti
The team developed a method for testing the toxicity of nanoparticles towards aquatic organisms. The aim was to support the life-cycle and environmental assessment of nanoparticles and products.

6. ^{29}Si and ^{19}F Nuclear Magnetic Resonance (NMR)-based methods and probes for highly specific tracing and detection of nanoparticles in biological systems

Luigi Calzolai, François Rossi, Douglas Gilliland, Claude Guillou, Fabiano Reniero, Ana Frangolho
The health risk assessment of nanoparticles is a topic that receives a lot of attention due to the increasing use of nanoparticles in manufacturing. The group developed an approach to trace nanoparticles of non-radioactive isotopes in cells and to characterise their interaction with proteins in complex biological fluids. This work will help to understand and predict any toxic potential of nanoparticles.

7. The economic geography of spatial sorting

Andries Brandsma, D' Artis Kancs
Against the background of striking economic and social disparities between countries and regions in the EU, this team developed a general framework to investigate the factors that determine differences in productivity and thus wages across regions. The resulting quantitative estimate of the significance of different factors can be used to guide cohesion and regional policy.

JRC Reference Reports

JRC Reference Reports establish the current state of scientific knowledge in specific areas of research and aim to serve as a reference for scientists and policy makers alike. Although aimed at academics, civil servants, 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 2010, the JRC published five Reference Reports:

Considerations on a definition of nanomaterial for regulatory purposes

Nanomaterials are now used in many innovative technological applications and products, including a wide range of consumer goods. Yet, a widely accepted definition on which to base legislation is missing. Therefore, this work aims to discuss issues related to a definition of the term 'nanomaterial'. It recommends that the specific term 'particulate nanomaterial' should be employed in EU legislation and that size should be used as the only defining property. The report also emphasises that the adoption of a definition will entail policy choices and political decisions, and it will have to be broadly applicable in EU legislation, be clear and unambiguous and in line with other approaches worldwide.

Compendium of reference methods for GMO analysis

This report lists 79 reference methods for GMO analysis which have been validated according to international standards. The compendium, developed jointly by the European Union Reference Laboratory for Genetically Modified Food and Feed and the European Network of GMO Laboratories (ENGL), presents the technical state-of-the-art in DNA-based GMO detection methods. Each method is described in a user-friendly way, facilitating the implementation of GMO legislation by official control bodies. They will be used by EU Member States to organise official controls on GMOs.

Regulating air emissions from ships — the state-of-the-art on methodologies, technologies and policy options

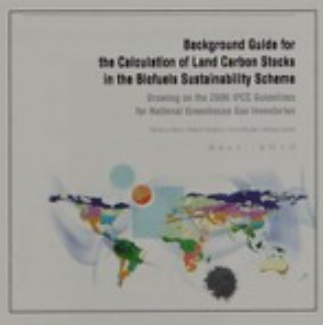
Maritime transport causes about 4 % of global manmade CO_2 emissions, affecting air quality and contributing to climate change and human health problems. Although shipping is the most environmentally-friendly mode of transport with regard to greenhouse gas emissions it is estimated that (if no action is taken) these emissions will increase by 150–200 % by 2050. This report provides the first comprehensive overview of methodologies for estimating air emissions from shipping, describes technological solutions and proposes policy options for reducing carbon emissions and air pollution in this sector. Analytical tools for an environmental strategy to regulate air emissions from ships integrated into an international framework are provided, taking into account all the pillars relating to the sustainable development of transport.

Background guide for the calculation of land carbon stocks in the biofuels sustainability scheme

Renewable energy from biofuels should come from sustainable sources and deliver high greenhouse gas (GHG) savings. Land use changes for biofuel production can lead to changes in carbon stocks in soils and biomass and consequent changes in GHG emissions. This guide covers the calculation of land carbon stock changes and above- and below-ground vegetation due to land conversion for biofuel production in support of Directive 2009/28/EC. Economic operators are also supported to calculate the impact of land conversion on GHG emissions by using actual values for the carbon stocks associated with the reference land use and the land use after conversion. Therefore, this report contributes to ensure that European biofuels come from sustainable sources and meet the highest environmental standards.

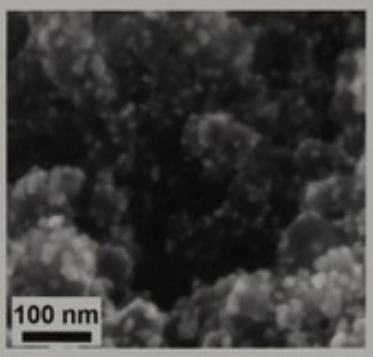
Impacts of the EU biofuel target on agricultural markets and land use: a comparative modelling assessment

The renewable energy Directive (2009/28/EC) requires that 20 % of the EU's energy needs should be provided from renewable sources by 2020, and includes a target for the transport sector of 10 % from biofuels. This report analyses and discusses the agro-economic impacts of EU biofuel policies on agricultural production, trade and land use within and outside the EU up to 2020. Three agro-economic models, AGLINK-COSIMO, ESIM and CAPRI, are used in this study. They are able to identify policy impacts on supply and demand, trade flows, domestic and world markets, and give a consistent global picture of indirect land use change impacts triggered by price signals transmitted via market interactions.



JRC Excellence Awards

Best young scientist



Scanning electron micrograph of carbon-supported PEM fuel cell catalyst particles.

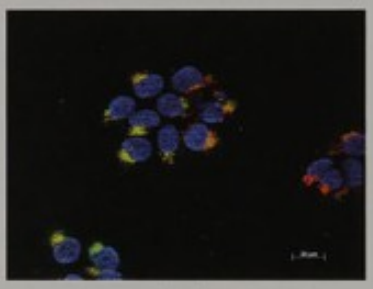
Andreas Pfrang

Micro- and nanostructure analysis of polymer electrolyte membrane fuel cells

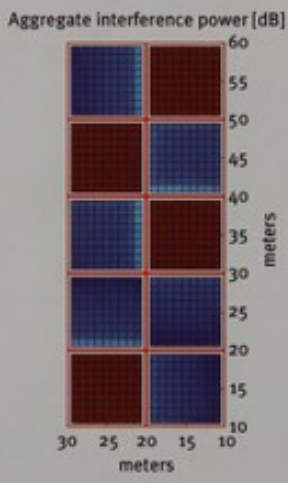
Fuel cells are expected to play a major role in the future energy supply and in this context, Polymer Electrolyte Membrane (PEM) fuel cells are promising candidates in the automotive sector as well as in other sectors.

Under real-world conditions and especially using lower noble metal loadings for the catalyst layer, fuel cell degradation is still an important issue. This degradation was investigated by directly imaging the catalyst particles using scanning and transmission electron microscopy. This allowed for an assessment of the impact of carbon monoxide (CO) poisoning on degradation and thereby of the acceptable CO concentration in hydrogen fuel.

Additionally, x-ray computed tomography was applied to acquire quantitative 3D microstructural data of fuel cell components. The direct insight into the complex multi-scale structure and physical properties of fuel cell components were calculated numerically based on these 3D datasets helping to improve our understanding of the relationship between fuel cell design and performance.



Human immortalised keratinocytes (HaCaT) exposed for 24 hours to fluorescently labelled silicon oxide nanoparticles. Cells were stained to investigate the cellular uptake and fate of nanoparticles and their possible distribution within cellular organelles. SiO_2-NPs (red); Nuclei (blue); Lysosomal compartment (green); SiO_2 nanoparticles inside the lysosomes (yellow).



Aggregate interference power calculated by the statistical tool in an apartment building scenario when secondary users are placed in different areas of a building (red areas) with a density of one device per 100 m².

Jessica Ponti

***In vitro* nanotoxicology research at the JRC**

Nanotoxicology is a discipline that aims at understanding the potential risk for human health and environment of new nanomaterials used in different fields of applications such as biomedical (drug delivery, imaging), consumer goods, food and cosmetics. Thanks to their very particular physicochemical characteristics, they allow for the production of goods with dramatically improved properties with a large socio-economic impact. It is already observed that nanotechnology pervades virtually all sectors of industrial production and considering that nanotechnology-based products could be ultimately available in all natural compartments such as water and soil, their potential hazards must be taken into account.

The *in vitro* nanotoxicology research area was established and an interesting and very innovative approach combining different *in vitro* methods was developed. This was an alternative to the use of animals, to assess cytotoxicity, genotoxicity and carcinogenic potential of nanomaterials, coupled to cell interaction and uptake studies. The collaboration with a large number of people from different scientific backgrounds such as chemistry, biochemistry, materials science and physics allowed to produce excellent results, which places the JRC among the most active teams in the field of nanotoxicology.

Alberto Rabbachin

Statistical modelling of network interference

New allocation policies exploring the possibility of using Opportunistic Spectrum Access (OSA) for reusing licensed radio spectrum by secondary networks have been recently considered by regulatory bodies in order to increase the radio spectrum usage. In this context, the problem of coexistence between multiple networks arises.

The project addressed the networks' coexistence problem in the context of OSA by using stochastic geometry tools. A statistical characterisation of the aggregate interference generated by multiple sources has been derived taking into account not only locations and spatial densities of primary and secondary users, but also spectrum sensing procedures, channel fading, shadowing, and other uncertain environment-dependent conditions. This statistical model replaces long simulation campaigns and therefore is a very powerful tool for both regulatory bodies and standardisation consortia to address the problem of network coexistence.

Best peer-reviewed scientific paper

Christos Apostolidis

$[An(H_2O)_9](CF_3SO_3)_3$(An=U–Cm, Cf)*: Exploring their stability, structural chemistry, and magnetic behaviour by experiment and theory

Christos Apostolidis, Nicola Magnani, Alfred Morgenstern, Eric Colineau, Roberto Caciuffo, Jean Rebizant, Frank Bruchertseifer, Thomas Fanghänel

In: *Angewandte Chemie International Edition 2010*, 49(36), pp. 6343–7.

The understanding of the behaviour of actinides in groundwater systems near a nuclear waste repository and the development of methods for the separation of actinides are important aspects of the safety of the nuclear fuel cycle. Detailed knowledge of the coordination chemistry of actinide ions in aqueous systems is fundamental to address these questions. This paper has combined synthesis, spectroscopy and computational modelling to characterise for the first time a series of complexes in which actinide ions are coordinated directly by water molecules, revealing new details of aqueous actinide chemistry.

From a synthetic point of view, the development of a route for the synthesis of the highly oxidation sensitive hydrated U(III), Np(III) and Pu(III) compounds is an important achievement, in particular considering that the compound $[U(H_2O)_9](CF_3SO_3)_3$ had previously been regarded as being too unstable to exist. The series of compounds has been characterised in detail by single crystal x-ray diffraction, infrared and absorption spectroscopy. Structural findings are supported by density functional theory calculations and experimentally determined magnetic susceptibilities could be reproduced by ligand field calculations. The importance of this study has been reviewed in *Nature*, 2010;465:704–5.

A theoretical framework for predicting the oxidative stress potential of oxide nanoparticles

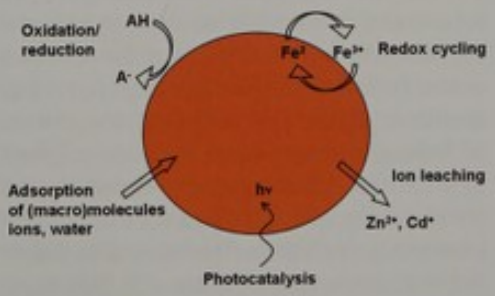
Enrico Burello, Andrew Worth

In: *Nanotoxicology*, 2010, (doi:10.3109/17435390.2010.502980).

A comprehensive evaluation of the biological and toxicological effects of nanomaterials is necessary for designing safe and efficacious products. Toxicological tests, however, are time-consuming and resource-intensive, calling for the development of fast computational models that can predict the behaviour of nanomaterials.

In this study, a theoretical framework is proposed for predicting the oxidative stress potential of oxide nanoparticles. The model calculates the available electronic energy levels in the nanoparticle structure, and matches them up with the redox potentials of intracellular reactions. Where these two values overlap, it means that the nanoparticles can accept electrons and cause oxidative stress in cells — either by removing antioxidants or generating reactive oxygen species like hydrogen peroxide or superoxide ions.

The research, which aims at detecting early intracellular effects that may lead to adverse health effects, is continuing, and the team is now trying to build in other factors such as ions leaching from the particles and interactions with proteins and lipid membranes. The model should enable regulators to streamline and prioritise nanotoxicology testing as well as provide a useful practical guide to help protect people handling nanoparticles.



Potential mechanisms of toxicity that can occur at the surface of a metal oxide nanoparticle. Inorganic nanoparticles like metal oxides can act as electron acceptors/donors or catalysts and oxidise or reduce molecules and components of the cell, eventually eliciting oxidative stress.

Representation of the structure of $[An(H_2O)_9](CF_3SO_3)_3$ (An=U–Cm, Cf) and aqueous solutions of uranium and neptunium triflates in various oxidation states.*

* Actinide Triflate Complex

Knowledge transfer

The beauty of marine ecosystems — school of striped red mullet Mullus surmuletus L. (© J. Guillen).

Support to EU policy

Good environmental status for European seas

Ana Cristina Cardoso, Georg Hanke, Nicolas Hoepffner, Henna Piha, Wouter van de Bund, Nikolaos Zampoukas, Hendrik Doerner, Hans-Joachim Rätz, Robert Scott

An interdisciplinary team of JRC scientists have collaborated together with the International Council for the Exploration of the Sea (ICES) to coordinate and facilitate the establishment of the scientific basis of the 'criteria and methodological standards' necessary to define the 'Good Environmental Status' (GES) for the EU regional seas (the Baltic Sea, the north-east Atlantic Ocean, the Mediterranean Sea and the Black Sea). This work was done together with the Environment DG, the Maritime Affairs and Fisheries DG and the Health and Consumers DG. The role of JRC scientists was to ensure robust and defendable science with resulting scientific advice. The major deliverables were a Commission Decision (2010/477/EU) and 11 scientific and technical documents with detailed information for 10 descriptors of GES and a Management Group report summarising and linking up the information from each descriptor. The work also led to publications in scientific journals. Details on the policy-support work are described under 'JRC support to the Marine Strategy Framework Directive' on page 18 of this report.

Arwyn Jones, Luca Montanarella

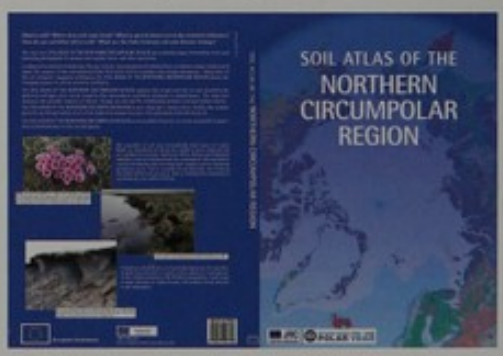
Soil atlas of the northern circumpolar region

Arwyn Jones, Luca Montanarella

While the Arctic is recognised as a sensitive barometer of global change, limited attention has been given to permafrost-affected soils, which store up to half of the Earth's terrestrial carbon or about twice the amount in the atmosphere. Increased temperatures in the Arctic are causing these soils to thaw, a process that could potentially release significant quantities of greenhouse gases and accelerate the processes driving climate change.

To highlight such issues, JRC scientists collaborated with researchers from Europe, Russia and North America as part of the International Polar Year to produce the 'Soil atlas of the northern circumpolar region'. For the first time, the distribution of soil types above a latitude of 500 N can be visualised in a comprehensible manner making users aware of the unique characteristics, environmental importance and global significance of northern soil.

During 2010, the atlas was the focus of the JRC's exhibition at the European Parliament and was presented at a number of scientific meetings. More than 3 000 copies have been distributed throughout the world, with a particular emphasis on schools in the EU. The atlas is an excellent example of how scientific information and data can be reinterpreted in a manner that is understandable to society at large.



This atlas (price EUR 25.00) can be ordered from the EU Bookshop website at http://bookshop.europa.eu/

Technical support/assistance

John McGinley, Andrea Cambriani

Generation IV material joining electromagnetic pulse technology

John McGinley, Sven Pfirrmann, Marie Lanaud, Andrea Cambriani

Generation IV nuclear reactors, which will operate at substantially higher temperatures than present designs, will require reactor materials with higher strength and creep resistance, as well as innovative means of joining them.

The JRC, with its long-established competence in fuel pin fabrication, is preparing for these new challenges and since 2008 has been investigating the use of Electromagnetic Pulse Technology (EMPT) to join these materials. EMPT is a solid-state joining process that circumvents many of the problems encountered in conventional, fusion-based processes.

In 2010, important milestones were reached, such as the first examples of joining P91 ferritic-martensitic steel, one of the candidate materials. This is now routinely achieved with helium-leak tightness of fuel pin standard, capable of withstanding 800 bar pressure without damage.

110 KJ EMPT device.

Device to test radiation detectors used to combat illicit trafficking of nuclear material

Jan Paepen, Raf Van Ammel, Leopoldo Silva Pestana, Mauro Caviglia, Luc Dechamp

The JRC organised an extensive testing campaign to assess the performance and capabilities of detection equipment used by law enforcement bodies to intercept the illicit trafficking of nuclear and radiological material. This work was carried out for the Home Affairs DG under the ITRAP+10 project (Illicit Trafficking Radiation Detection Assessment Programme), in the framework of the EU CBRN action plan on countering chemical, biological, radiological and nuclear threats.

Jan Paepen, Luc Dechamp

Assessing the performance of radiation-detection equipment requires a large number of tests, in which the response of the detection equipment is observed when it is exposed to radiation from various gamma and neutron-emitting sources. The JRC developed a device that can expose detection equipment to a radioactive source in a reproducible way. This device facilitates the execution of a large number of accurately timed tests in a short time, while being safe to operate and flexible to accommodate the requirements of the different test procedures.

Device to test radiation detectors used to combat illicit trafficking of nuclear material.

Communication/ administrative and site support

Delivery and services at the JRC Ispra site

Mike Thompson, Marie Oskarsson, Marco Mirabella, Roberto Miglini, Carmine Laudone, Antonello Violetti, Massimo Tonan, Eleonora Beverina, Antonio Fittipaldi, Ilario Santangelo, Alessio Balducci

In 2010, the delivery and services at the Ispra site were improved. The group's achievement is a good example for the management of change: key customer-oriented processes were optimised, resulting in faster delivery times (from 72 hours to 24 hours, on average), and effective tracking and monitoring of the turnaround was introduced (13 000 items per year are delivered throughout the Ispra site, which covers 160 ha). A major organisational change has also been the integration of the document management office. This has allowed the centralisation of all invoice registrations within one building, thereby improving the daily registration, and allowing the distribution of all invoices on a daily basis. By continually dealing with the work in a professional manner, the quality of the work during this time of change has not deteriorated.

Marco Mirabella, Massimo Tonan

Reception and shipment of goods.

Figures on staff, budget and publications

Core staff

The core staff of the JRC (i.e. staff with permanent positions) is composed of the following categories:

Core staff (M: male, F: female) (end-of-year situation) 2010	M	F	Total
Officials (permanent)	1231	514	**1745**
Temporary agents on renewable / non-renewable contracts	40	18	**58**
Total	1271	532	**1803**

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 2009 (94 staff) to 2010 (58 staff) by 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 a strong visiting staff population including contract agents, seconded national experts, trainees and grant-holders. Opportunities exist for Member State and non-Member State nationals to participate in the various schemes. Visiting staff bring advanced skills, knowledge and expertise to help resolve current and future scientific challenges, while benefiting from the multidisciplinary research domains, extensive research networks and cultural diversity at the JRC. The number of visiting staff is steady (compared with 2009) at around 36 % of the total number of JRC staff.

Visiting staff (end-of-year situation) 2010	M	F	Total
Contractual agents	164	224	**388**
Seconded national experts	36	11	**47**
Trainees	25	38	**63**
Postgraduate grant-holders	290	201	**491**
Senior scientists	25	5	**30**
Total	540	479	**1019**

Total staff

The total number of staff (core and visiting) in the JRC reached 2822, which is comparable with that of 2009 (2732). Of the 2822 total, 76.61 % are working on scientific projects, 21.22 % are doing administrative or support work and 2.16 % are working in nuclear decommissioning and waste management. The distribution throughout the JRC institutes and directorates is as follows:

Staff distribution (core and visiting; end-of-year situation) 2010	M	F	Total
Institute for Reference Materials and Measurements	169	117	**286**
Institute for Transuranium Elements	206	87	**293**
Institute for Energy	211	84	**295**
Institute for the Protection and Security of the Citizen	320	144	**464**
Institute for Environment and Sustainability	282	146	**428**
Institute for Health and Consumer Protection	148	142	**290**
Institute for Prospective Technological Studies	131	82	**213**
Corporate Services	344	209	**553**
Director-General's Office	*10*	*8*	***18***
Directorate for Programmes and Stakeholder Relations	*35*	*38*	***73***
Directorate for Resource Management	*66*	*62*	***128***
Ispra Site Management Directorate	*233*	*101*	***334***
Total	1811	1011	**2822**

Equal opportunities

Driven by the commitment to make the JRC a better place to work and the Commission's new strategy for equal opportunities 2010–14, a new action plan focusing on talent management, on attracting, recruiting, retaining and developing a balanced workforce and on ensuring a respectful environment at the JRC was prepared. Supported by the JRC Equal Opportunities Group, a number of actions have been initiated:

- gender balance indicator monitoring;
- survey of career choices of women in the administrative (AD) category;
- promotion of specific training for the advancement of the career of women;
- awareness raising through specific training;
- promotion of outreach activities.

The JRC Women and Science Network (W&SN) organised its 10-year celebration in the form of an Open Forum for Gender Equality and Scientific Careers discussions, broadcasted via video link to all JRC sites.

The W&SN carried out its mission by monitoring gender-sensitive indicators, facilitating, via recommendations, the development of a fair and effective environment for women scientists in the JRC, and promoting tools for a better work–life balance. It disseminated information within the JRC, and advertised the JRC competitions in dedicated conferences.

Budget (budget and expenses — institutional activities)

The credits available 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).

The table below shows the sums that were committed from the institutional budget (meaning available in commitment appropriations, EFTA is not included).

In million Euro	2010
Staff expenses	238.70
Means of execution	77.75
Operational appropriations	39.97
Total (rounded)	356.42

In addition, EUR 26.9 million was made available to finance the programme to decommission the JRC nuclear installations, and to manage the waste activities related to the EURATOM Treaty.

Additional credits of EUR 20.26 million came from the contributions of countries associated to the Framework Programme.

JRC earned income

The table on the right shows the value of contracts signed and inscribed in the accounts during 2010. The quantity cashed amounted to EUR 62.5 million.

A portion of the JRC's income comes from its participation in FP7 collaborative projects (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.

Contracts signed (in million Euro)	2010
Indirect actions of the Framework Programme (FP)	13.0
Support to Commission Services	49.5
Third-party work	9.3
Total (rounded up)	71.8

JRC publications 2010

Research publications produced by the JRC are available for download through the Publications Repository (http://publications.jrc.ec.europa.eu/repository/) and from the EU Bookshop website (http://bookshop.europa.eu/).

Key publications in 2010:

	1		2	3	4	Total
	1.1	1.2				
JRC-IRMM	9	83	59	40	3	**194**
JRC-ITU	10	74	9	19	1	**113**
JRC-IE	23	84	43	54	0	**204**
JRC-IPSC	71	82	170	121	4	**448**
JRC-IES	76	138	70	66	3	**353**
JRC-IHCP	15	90	33	8	1	**147**
JRC-IPTS	48	34	31	11	1	**125**
	252	585	415	319	13	**1584**

excluding the following categories:
- JRC technical notes (214 publications)
- Poster presentation (134 publications)
- JRC public information documents (49 publications)

Category 1.

Monographs and articles
1.1 Books, monographs with JRC editorship, article contribution to a monograph, article contribution to other periodicals.
1.2 Article contribution to a periodical listed in the ISI science/social science citation index.

Category 2.

JRC reports and notes
(JRC Reference Reports, 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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* On 1 March 2011, Dan Claudiu Chirondojan was appointed as the Director for Ispra Site Management.

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Abstract
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