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JRC

JOINT RESEARCH CENTRE
European Commission

JRC Annual Report 2003 JRC Annual Report 2003

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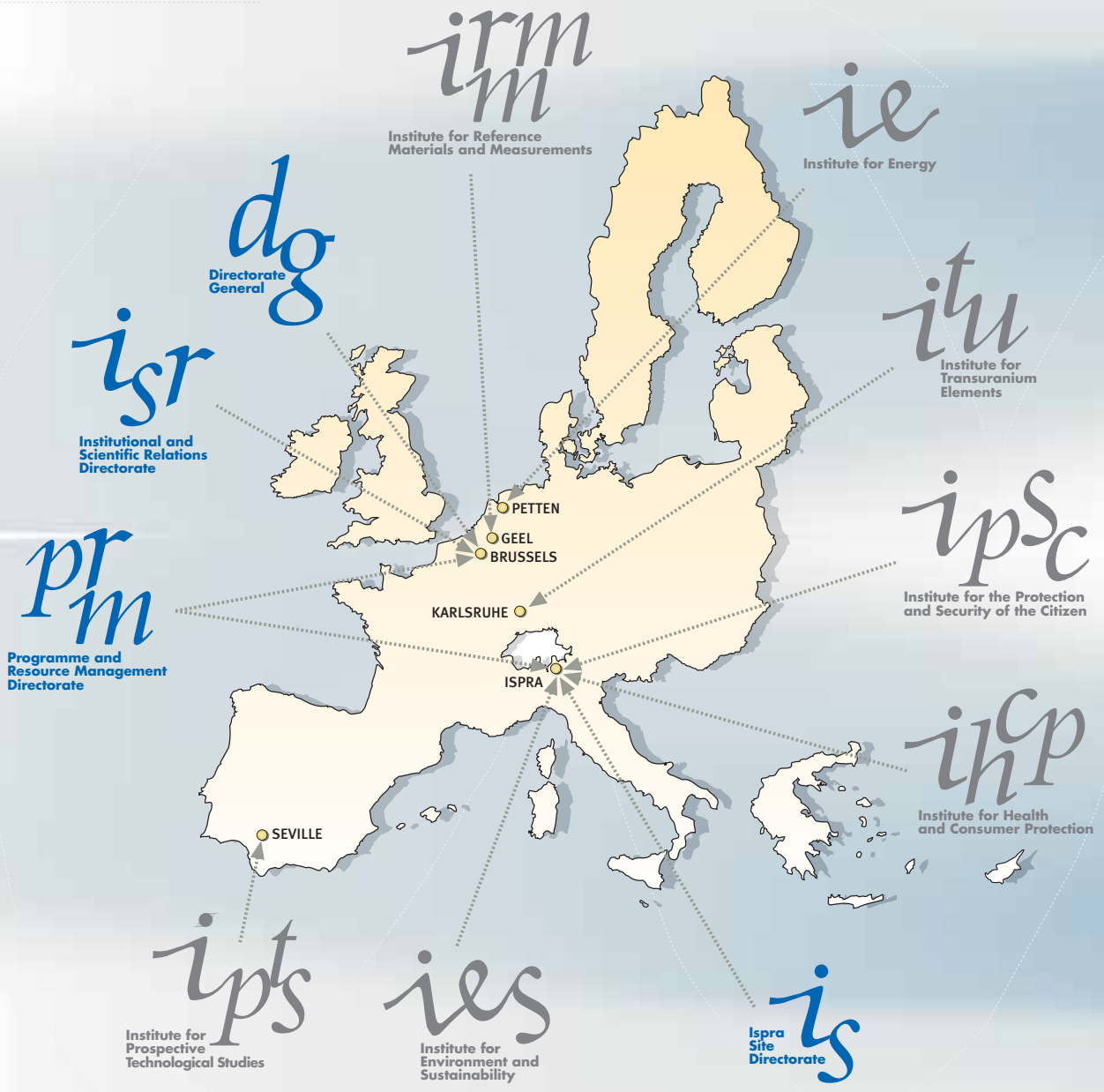
The **Joint Research Centre**
Structure



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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 JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

Foreword from the **Commissioner for Research**

The Joint Research Centre (JRC) has made many important contributions to supporting EU policies in 2003, the first year of the Sixth Framework Programme (FP6). Among the examples described in this report is the support provided to the new chemicals policy, particularly with reference to the registration, evaluation, authorisation and restrictions of chemicals.

The nomination of the JRC as the Community Reference Laboratory for support to genetically modified organism (GMO) food and feed legislation is a concrete example of how the JRC is contributing to the development of scientific and reference systems to support policy makers. This is one of the building blocks of the European Research Area (ERA) and a key component in the JRC's ERA Action Plan. Such support is not provided solely by the JRC but rather through the European Network of GMO Laboratories (ENGL), managed by the JRC.

Other key elements in the JRC ERA Action Plan include networking, enlargement, training and mobility, and increasing access to specialised facilities. The signing of a collaboration agreement between the Research DG and the JRC Institute for Prospective Technological Studies (IPTS), and the creation of a dedicated ERA unit are welcome developments and highlight the importance I attach to the European Research Area.

Making a success of Enlargement is the major challenge for 2004 and the coming years. One of the issues facing the new Member States is the need to comply with the body of EU legislation, the "acquis communautaire". Through a comprehensive programme of hosting scientists, organising technical workshops and training courses, and actively involving national laboratories from the new Member States in its work programme, the JRC has continued to contribute significantly to accelerating compliance with the scientific and technical aspects of the acquis.

I am confident that, in 2004, the JRC will continue to play its unique and valued role as the Commission's in-house research-based policy support organisation.

Phillippe Busquin

Commissioner Busquin visiting the JRC Institute for Transuranium Elements

Observations from the **Board of Governors**

In 2003, the JRC's new work programme emphasised the delivery of scientific and technical support to major Community policy areas such as chemicals, food safety, health, environment, nuclear security and enlargement. The relevance of the JRC's work to policies was demonstrated to the Board by interaction with the JRC's High Level User Group during the year.

The Board noted JRC compliance with the requirements of the Commission's administrative reform: the Strategic Planning and Programming (SPP) cycle and the Activity-Based Management (ABM) system. These systems were established to improve transparency, accountability and efficiency through better planning, implementation and monitoring of objectives and measurement indicators at every level throughout the organisation.

The Board endorsed a restructuring of Directorates in Autumn 2003. This reorganisation has the advantage of bringing the management of resources and the work programme together into one Directorate. A separate Directorate was created to cover institutional and scientific relations. All aspects associated with Ispra site management and logistics were consolidated into one dedicated Directorate to improve the efficiency and effectiveness of such operations.

Main issues in 2003

The Board has followed the JRC Specific Programmes as carried out under JRC obligations to the EU Research Framework Programme. One such requirement is an external expert evaluation; the Five-Year Assessment of the JRC covering the period 1999 to 2003. The Board was actively involved in defining and approving the terms of reference and in the selection of the panel of experts. A presentation by the panel chairman, made to the Board during the closing stages of the panel visits, provided the Board with first-hand information on the initial conclusions of the assessment.

The Board closely followed progress made by the JRC in contributing to the aims of the European Research Area and the targets set in the accompanying implementation plan.

Board Members and Participants expressed a positive opinion on actions conducted by the JRC towards Enlargement. Technical support to complying with EU legislation, partnership in research projects of the Framework Programme, training and opening up of JRC-led networks of competence were strongly acknowledged, as were JRC information days, dedicated workshops, the network of JRC contact points and specific targeted projects.

The Board noted the contributions made by the JRC during various crises, including forecasting forest fires and estimating the effects of drought on crop forecasts. The Board also acknowledged the development of a JRC crisis response mechanism to ensure a coordinated and professional in-house response on request.

The Board appreciated the evaluation and granting of excellence awards for JRC young scientists and welcomed this year's inclusion of a technical assistance prize.

JRC Board of Governors

The JRC strategy for the continued management and exploitation of the Community's intellectual property portfolio was endorsed by the Board, which continues to follow progress and results in this area. The Board emphasised the need to communicate science and its results effectively, and a revised JRC strategy on public relations was produced in response to this request.

The Board closely followed JRC nuclear decommissioning activities and endorsed the transfer of the High Flux Reactor licence operation to the Dutch Nuclear Research and Consultancy Group. Finally the Board acknowledged the major contribution that the JRC Director General and JRC staff played in ensuring the quality and relevance of its work.

Fernando Aldana
Chairman

Message from the **Director General**

In 2003, the JRC made good progress in consolidating its reputation as a research-based policy support organisation, adept at providing support to a range of Commission policies while maintaining a strong science base. The new JRC Multi-Annual Work Programme for the Sixth Framework Programme, adopted in March 2003, reflects the emphasis placed on our customers and users, whilst also allowing the development of new scientific competence in order to meet emerging needs.

Examples of such JRC support are cited throughout this report, but I should like to highlight the input provided by the JRC to the new chemicals policy, jointly led by the Commission's Environment and Enterprise DGs. The designation of the JRC as the Community Reference Laboratory for GMOs recognises our efforts over a number of years in establishing and leading the European Network of GMO Laboratories (ENGL). The JRC has played the role of catalyst in developing a new large-scale collaborative project on envirogenomics, examining links between environmental effects and individual susceptibility in childhood asthma.

These are examples of the long-term nature of JRC support. However, the JRC also demonstrated its ability to respond rapidly and professionally to a number of crises. This included support provided to France and Portugal during the summer 2003 forest fires.

Barry Mc Sweeney welcoming the Environment Commissioner, Margot Wallström, to the JRC in Ispra, Italy

Much of the work performed by the JRC ultimately supports the Member States, the Council and European Parliament, and is carried out in close collaboration with some 2000 scientific partners throughout Europe and beyond. In acknowledgement of this, a new Directorate was created in late 2003 to focus on the JRC's external stakeholders.

Measuring the relevance of JRC work to its users is important, and for this reason, the JRC conducted its first corporate user satisfaction survey in 2003. This survey targeted both internal (Commission) and external (ministries, national authorities, etc.) users and a high degree of satisfaction with the JRC was expressed overall. The Five-Year Assessment (1999 to 2003), a formal appraisal of JRC scientific and technical output, was also performed by an external expert panel and the results will be available in 2004.

In carrying out its work programme, the JRC continued to contribute to the European Research Area, the major EU research policy initiative in recent years. The signing of a collaboration agreement between the Research DG and the JRC Institute for Prospective Technological Studies (IPTS) underlined the need for additional support to this policy.

The JRC is an ideal place to carry out research where scientists can see the relevance and use or implementation of their work in EU legislation. The JRC stresses the importance of research training, and a significant number of our scientists are at the early stages of their careers. To highlight this, a section of this report has been dedicated to young scientists' awards and recognition of technical achievement has also been introduced.

I acknowledge the efforts of all JRC staff, which, combined with the support of the JRC Board of Governors and Commissioner Busquin, have contributed greatly to our achievements in 2003, and we now look forward to the challenges of 2004.

Barry Mc Sweeney

Support to **Community Policies**

Examples of support to EU Legislation

In 2003, the JRC provided scientific and technical support to over 80 pieces of EU legislation. The following table describes some examples, mainly from the areas of "Food, Chemical Products and Health" and "Environment and Sustainability".

As support for Regulations **(EC) No 1829/2003** and **(EC) No 1830/2003**, the JRC was appointed Community Reference Laboratory (CRL) for GM food and feed legislation with the mandate to evaluate the fitness of methods for the purpose of regulatory compliance.

Commission Recommendation **C2003/556/EC** on guidelines for the coexistence of GM and non-GM crops was largely based on JRC work.

As support for Council Decision **2000/766/EC** and Regulation **1774/2002 EC** imposing a total ban on meat and bone meal as feed ingredients, the JRC coordinated an inter-comparison study with about 50 laboratories.

To amend Regulation **(EEC) No 3508/92** and support the new Regulation for the identification and registration of ovine and caprine animals (sheep and goats), the JRC coordinated a large-scale field test.

In formulating Commission Proposal **COM(2003) 644 final** (for the Registration, Evaluation and Authorisation and Restrictions of Chemicals–REACH), the JRC played a key role–more details on pages 6 and 28.

As support for Directive **93/67/EEC** on risk assessment for new notified substances, Regulation **(EC) No 1488/94** on risk assessment for existing substances and Directive **98/8/EC** of the European Parliament and of the Council concerning the placing of biocidal products on the market, the JRC finalised and published the "Technical Guidance Document of risk assessment".

Revisions of the Seveso II Directive **96/82/EC** for the prevention of major-accident hazards involving dangerous substances were substantially guided by the results of focused expert workshops organised by the JRC.

The JRC supported Directive **2003/42/EC** related to the European Coordination Centre for Aviation Incident Reporting Systems on occurrence reporting in civil aviation.

As support to Commission Decision **1999/847/EC** (Community Action Programme on Civil Protection), the JRC's European Flood Alert System provided successful flood warnings for the Ebro (Spain), Iskar (Bulgaria), Upper Oder and Vistula basins (Poland and Czech Republic), Siret River (Romania) and Sicily.

As support to Commission Proposal **COM(2002) 404** for a new Regulation on the "monitoring of forests and environmental interactions in the community", the JRC has been appointed to the Scientific Coordination Body.

Commission Communication **COM(2003) 354 final** entitled "On the Road to Sustainable Production Progress in implementing Council Directive 96/61/EC concerning integrated Pollution Prevention and Control", refers to the JRC work as "a key driver for improved environmental performance".

To prepare for the Commission Communication **COM(2003) 250**, the JRC provided data in the area of energy recovery from waste to the Environment DG, published with a view towards the possible revision of the Waste Framework Directive 75/442/EEC.

As support for the Water Framework Directive **COM(1997) 49**, the JRC jointly led the Common Implementation Strategy Working Group on "Ecological Status and Inter-calibration".

In signing the US-led international charter **COM(2003) 1911/1** on "Carbon Sequestration Leadership Forum (CSLF)", the JRC supported the formulation of the Commission's position.

The JRC supported Commission Communications **COM(2002) 179** and **COM (2002) 539** on the "Thematic Strategies on Soil Protection and on the Marine Environment" by participating in the respective working groups.

The JRC supported the Commission Communication **COM(2003) 17** on the emerging European Space Policy, building on its contributions to the Global Monitoring for Environment and Security (GMES) Initiative.

As support for Commission Communication **COM(2001) 245** entitled the "Clean Air for Europe initiative", the JRC organised and implemented a model inter-comparison study and provided forecasts of ozone and particulate matter concentrations for 2010 in various European cities.

For Directive Proposal **COM(2003) 453** on establishing a framework for the setting of Eco-Design requirements for Energy-Using Products, the JRC provided input data for the assessment of the potential energy and carbon savings resulting from the efficiency requirements in different types of end-use devices.

For Directive Proposal **COM(2003) 739** on Energy End-Use Efficiency and Energy Services, the JRC explored the present market and policy situation for Energy Service Companies and provided input to other measures proposed in the directive such as: energy efficiency certificates; demand response; advanced meters; and informative billing.

As support to Commission Communication **COM(2002) 263** on the eEurope 2005 Action Plan, the JRC presented the draft pilot exercise on the "composite indicator of e-business readiness" at a meeting between Eurostat, and the Enterprise and Information Society DGs.

Commission Communication **COM(2003) 265 final** was the first report based on the implementation of the data protection Directive 95/46/EC and refers to the JRC report entitled "future bottlenecks in the information society".

Commission Communication **COM (2003) 301** entitled "Towards a thematic strategy on the prevention and recycling of waste", specifically referred to the JRC "Pay as you Throw" project.

As support for the implementation of Directive **96/61/EC** on "Integrated Pollution Prevention and Control", the JRC provided data for waste incineration and reviewed the draft document. The JRC handles the definition of the best available techniques (BAT), through drafting the "BAT Reference Documents (BREFs)".

Safety of **Chemical Products**

In October, 2003, the European Commission proposed new legislation for the Registration, Evaluation and Authorisation of CHemicals (REACH) to enhance health and environmental protection, while promoting innovation and competitiveness of the European chemicals industry. The JRC has coordinated the EU notification scheme and risk assessment for new chemical substances and, with its expertise in data collection, priority setting and risk assessment, will help develop the guidance documents, software tools and infrastructure for REACH.

Dilution of samples for a cytotoxicity assay

The JRC European Chemicals Bureau (ECB) is the focal point for collecting information on new and existing chemicals. In 2003, 350 new substances were classified, 30 risk assessment reports on existing substances were produced and 5 testing methods were developed. The ECB also established the European Chemical Substances Information System, which now publicly offers a single search tool on chemicals and associated legislation.

According to REACH, about 20 000 substances will be tested. Sole reliance on traditional risk assessment methods to obtain chemicals data would involve testing several million laboratory animals. At the JRC's European Centre for the Validation of Alternative Methods (ECVAM), methods are being validated to reduce the need for animal testing and yet increase the number of tests while reducing costs. Likewise, the implementation of the Seventh Amendment to the Cosmetics Directive calls for the validation of methods replacing animal testing for cosmetic ingredients. Responding to these needs, ECVAM has focused on key areas targeting those animal tests that need to be replaced. A JRC report, produced in 2003, estimates that the direct testing costs of implementing REACH can be reduced by more than €900 million if quantitative structure-activity relationships ((Q)SARS) are used. These are theoretical models able to predict the physicochemical and biological (e.g. toxicological) properties of molecules from knowledge of their chemical structure. In light of this, ECVAM has started to validate, together with the Organisation for Economic Co-operation and Development (OECD), the most promising of some 3 000 computer models and programs.

Human exposure data is essential for implementing REACH and is scarcely available at present. In order to assess the total human exposure to substances emitted from products and articles, the JRC has completed a range of experiments using its unique "Indoortron" facility. Experiments were carried out to identify additives and pesticides in tobacco products, and further studies indicated that changes in the ventilation rate during tobacco smoking do not significantly influence the air concentration levels of smoke constituents such as CO, NOx and aromatic compounds.

Food Safety

The JRC provides scientific and technical support for the establishment and implementation of EU food and feed legislation. It does this by developing, harmonising and validating analytical methods to monitor various chemical, physical and biological parameters. It includes the production and certification of certified reference materials (CRMs) and proficiency testing materials to support EU food and feed legislation–e.g. maximum levels for contaminants, withdrawals of authorisations concerning various additives, food labelling (nutritional properties) and antifraud measures (food authenticity). Some selected highlights from 2003 include:

Acrylamide

The presence of acrylamide, formed by heating carbohydrate-rich food (e.g. potato chips), and classified as a probable human carcinogen, has led to worldwide surveillance of this compound in various food products. To support the standardisation of acrylamide measurements, the JRC validates methods, produces certified reference materials and maintains an acrylamide monitoring database. A first inter-laboratory test on the determination of acrylamide in crisp bread and in butter biscuits was organised in 2003 to check laboratories' performance and identify potential problems associated with the methods applied.

The Community Reference Laboratory for feed additives

The new Regulation (EC) 1831/2003 on additives for use in animal nutrition requires that all such additives be authorised according to a new procedure. Whilst the European Food Safety Authority handles this process, the JRC, in its capacity as Community Reference Laboratory, will assume responsibility for storing the reference samples and the analytical methods proposed by the applicants from November, 2004.

Transmissible spongiform encephalopathies (TSE)

As support to the Health and Consumer Protection DG for the implementation of EU legislation on TSE, the evaluation of newly developed post-mortem TSE tests, the quality assurance of rapid TSE tests and performance testing have all been actively continued in 2003. As the ban on meat and bone meal (MBM) in food/feed is important to TSE, the JRC conducted a proficiency test that revealed that the ban can be enforced only by using microscopy–all other methods showed very poor results. This JRC study also showed, in order to fine-tune the MBM ban, that there is a strong need for methods that allow for animal-specific detection.

Mercury in tuna fish

A species-specific methyl-mercury (CH_3-Hg) spike isotopic reference material was produced: IRMM-670, with an isotopic enrichment of about 98% in mercury-202 (^{202}Hg). A measurement procedure was developed, extensive stability tests were performed and the new spike was used to certify the content of methyl-mercury in a tuna fish sample.

Peanut allergens in cookies can be detected using an ELISA test

Rapid Reaction to **Emergencies**

Forest Fires

The summer of 2003 was one of the hottest summers in Europe. Temperatures exceeding 40°C contributed to some of the worst forest fires ever witnessed. In Portugal, the government declared a state of national emergency as some 20 people lost their lives and vast areas of forest were destroyed by fire.

Figures derived from satellite observations by the JRC indicate that some 355 976 ha. of land had been burnt in Portugal by 20 August, 2003. By 15 September, 2003, this figure had increased to 379 038 ha. These figures illustrate that almost 6% of the forest area in Portugal was damaged. This is equivalent to the total annual burnt area of all five EU Mediterranean countries in recent years.

Until recently, fire risk calculations were performed at a local level but now, a coherent forest fire information system exists for Europe, thanks to the European Forest Fire Information System (EFFIS). This was established by the Environment DG and the JRC. All fire risk forecast maps computed by EFFIS are distributed every morning via internet to the civil protection and forest fire services in the Member States, as well as to the civil protection services of the Environment DG.

The JRC will continue supporting the Environment DG, Member State experts and national authorities, to develop and apply appropriate terrestrial and satellite data-collection and visualisation tools, as well as modelling systems for prevention, damage assessment and post-crisis analysis.

Forest fire devastation

Forecasting the effects of drought on EU crops

In parallel to the record temperatures, 2003 also suffered the worst drought in Europe for more than a quarter of a century. The JRC used its advanced crop yield forecasting system to predict the effects of the unrelenting drought on the year's EU harvest–a useful prerequisite for agricultural planning and decision making. JRC crop-yield forecasting combines agro-meteorological models and satellite indicators, supporting the needs of the Agriculture DG for detailed information on Europe's planted areas, crop yields and production volumes.

The JRC provides quantitative forecasts, producing objective, well-timed and accurate crop-yield assessments.

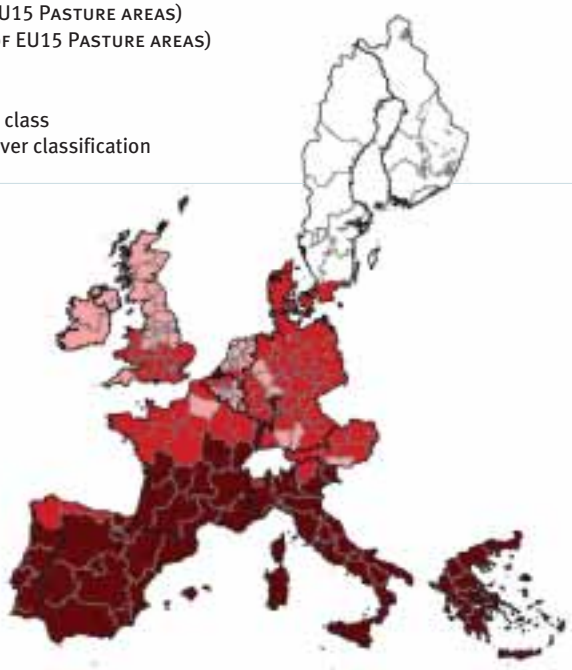
Yields are calculated bi-monthly and figures for the main cereals (wheat, barley, maize); oil seeds (rapeseed, sunflower); and sugar beet and potato are published for the entire European continent, North Africa and Turkey.

The expected drop in EU main crop yields ranged from about 6% for potatoes to 25% for sunflowers. The loss in wheat production was approximately 10 million tonnes compared with the previous agricultural campaign (the UK's wheat yield was predicted as being reduced by 10%) with a drop of about four million tonnes for grain maize.

Regions where pastures have been affected by dry and hot conditions

- Extremely High impact (17% of EU15 Pasture areas)
- High impact (46% of EU15 Pasture areas)
- Moderate impact (37% of EU15 Pasture areas)
- Low or Absent impact (3% of EU15 Pasture areas) or Pasture not present

* The percentage of area per class is based on Corine Land Cover classification



Production date: 14 Aug. 2003

Safety of **Hydrogen** as a **Transport Fuel**

Reduction of greenhouse gas emissions and improvement in the security of energy supply have motivated considerable interest in alternative fuels for road transport in the EU. The most recent Commission initiative to promote hydrogen as a future energy carrier is the European Hydrogen Technology Platform, which aims to accelerate the development and deployment of hydrogen and fuel cell technologies in Europe. Although hydrogen is one of the most promising alternative fuels, significant research and development is still needed before it can be exploited in the same way as petrol, diesel or hydrocarbon gases. Hydrogen performance, end-use efficiency and safety must all be assured before mass use becomes possible. The JRC is engaged in this Platform initiative, and part of its hydrogen-related activities focus on safety, risk evaluation and performance assessment of hydrogen storage and transportation systems.

In 2003, the JRC issued a comprehensive report on safe technologies for hydrogen storage and organised a dedicated workshop for Acceding Countries on the "Safety, efficiency and performance of innovative hydrogen storage technologies for road transport". Specific test facilities for hydrogen storage are currently being installed, including full-scale vehicle tank testing to assess hydrogen high-pressure cycling and permeation (for gas storage studies), and a set of complementary test facilities to assess the storage efficiency of hydrides and carbon structures (for solid-state storage studies). In this field, the JRC collaborates in the "Safety of Hydrogen as an Energy Carrier" and the "Hydrogen Systems for Automotive Applications networks" and through partnership with the International Energy Agency (IEA).

JRC efforts focus on harmonising test methods and providing technical and scientific support for the development of safety standards, and best practices guidelines for industry-wide standardisation. Experimental efforts are complemented by simulation techniques to study the consequences of hydrogen explosions following a severe accident and to define effective countermeasures. The Commission Communication on alternative fuels of November, 2001 suggests a hydrogen development scenario of 2 % road transport fuel market share in 2015 and 5 % in 2020. This JRC work contributes to enabling the implementation of these policy goals.

Typical road transport scenes

Safety of
Eastern Nuclear Reactors

In the Commonwealth of Independent States (CIS) and the Central and Eastern European Countries (CEEC), 61 nuclear power reactors of Soviet design are presently operating with a capacity of 47 electric gigawatts. However, by 2007, 75% of current Soviet-designed nuclear power plants will be more than 20 years old. Thus, supporting their continuous monitoring, surveillance and research is vital to ensure that safety standards are maintained.

With over 40 years experience in this field, the JRC is engaged in plant management studies of ageing nuclear installations and in improving safety assessment methods for critical damage mechanisms. Topics covered apply to both Eastern and Western reactor designs. JRC networks are operated within a JRC project called SAFELIFE, and address subjects ranging from the assessment of reactor pressure vessels, studying residual stress fields on welds, risk-informed inspection procedures and thermal fatigue, to advanced irradiation studies and optimisation of maintenance procedures.

In 2003, extended analysis of all available pressurised water reactor vessel surveillance data was continued and research into the provision of new materials (e.g. model steels) has been carried out. A reference base metal was characterised with the International Atomic Energy Agency (IAEA), corrosion studies of reactor core irradiated internals commenced, and the Safety of Eastern European Nuclear Facilities network steering committee arranged the signing of a collaboration agreement by nine organisations, seven of which are from CEEC and CIS.

The JRC has also launched a new TACIS (Technical Assistance to the Commonwealth of Independent States) project that aims to provide Russian and Ukrainian nuclear power operators with conclusions on demonstrated safety margins and remaining expected lifetimes. The JRC analyses the thermal and mechanical behaviour of Soviet-designed pressurised water reactor fuel rods. Through the JRC Enlargement action, training workshops were organised on neutron embrittlement and nuclear safety.

The JRC provides technical and scientific expertise in all areas of the PHARE and TACIS nuclear safety programmes devoted to the improvement of nuclear facility safety in CEEC and CIS. This work contributes to one of the key challenges for an enlarged Europe–the establishment of an affordable, sufficient and safe energy supply for European citizens.

Paks MTC, training on main cooling pump

Nano-biotechnology

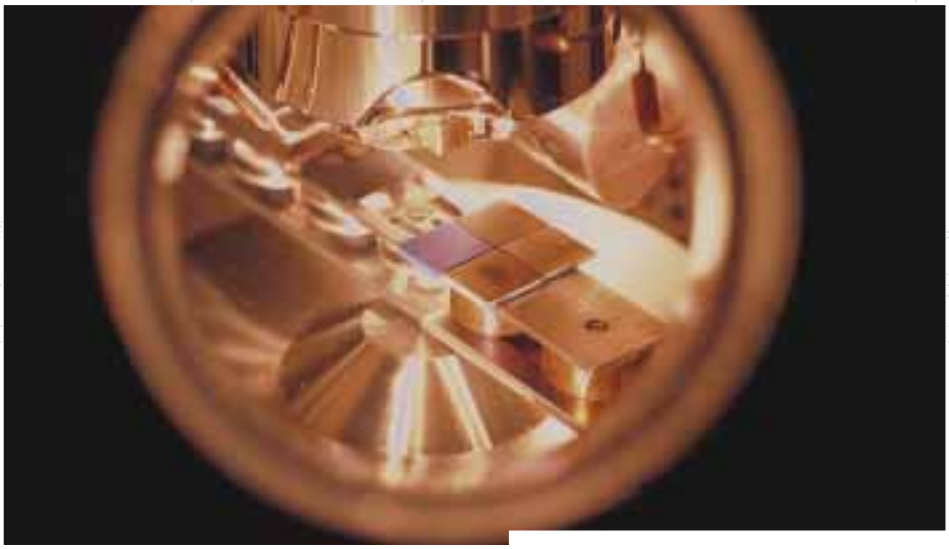
JRC exploratory research helps to anticipate science and technology needs, and to chart new paths for undertaking projects designed to support complex future policy issues. Some 6% of the JRC's budget is devoted to exploratory research.

Nano-biotechnology is an emerging area of scientific and technological opportunity that integrates nano/microfabrication and biosystems. Major applications in the field of health are related to biosensors, protein chips, "cell-on-a-chip", and *in vivo* monitoring. For example, medical devices such as heart pacemakers, artificial joints, scaffolds for tissue engineering and stents used to dilate clogged blood vessels can provoke a variety of biological effects such as irritation, inflammation, blood clotting and encapsulation. The JRC is working to alleviate these problems by developing functional surfaces at micro and nano scale that interact with biological systems to trigger responses such as increasing user comfort, healing and safety.

The JRC is currently developing interfaces between biological and non-biological systems, with specific activity allowing controlled biological responses. Such precisely engineered surfaces must be designed and constructed at the nano or molecular level.

It is hoped that this research will lead to the development of a new generation of biosensors and biochips to be used, for instance, in health and environmental monitoring, food analysis and/or toxicology studies. The production of polymer surfaces with a controlled level of chemical functional groups (e.g. amine, carboxyl or thiol) with micro and nano patterns helps study the effect of morphological and chemical patterning on protein adsorption and activity. At the same time, protein adsorption studies on antibodies, enzymes or peptides, for example, are made in conjunction with optical and electrical endpoint detection, in order to apply these developments to biosensors.

Networking forms an integral part of JRC research and, although nano-biotechnology is in its infancy, the JRC is involved with over 80 partners from both EU and Acceding Countries, keeping pace with current developments, evolving technologies and future perspectives in this area.



XPS Chambers, detail of sample mounting

JRC **Excellence Awards**

The JRC Excellence Awards were initiated in 2002 to recognise the achievements and contributions of JRC staff, especially those of young scientists. In addition to the three young scientists described on the following pages, awards were also given for the best scientific publication and technical assistance.




Dolores studied biology at the **University of Maryland**, doing undergraduate research at the **National Cancer Institute** (NCI-NIH), USA. She obtained a PhD in **genetics** from the Universidad Complutense de Madrid, Spain. The experimental research work was carried out at the **Centro de Investigaciones Biológicas** (CIB-CSIC), also in Madrid. As a postdoctoral fellow, she worked at **Georgetown University Medical Centre** in the USA, focusing on the molecular pathology of Alzheimer's disease. In 1999, she moved from laboratory- to desk-based research, focusing on analysis of the impacts of new biotechnologies on the human health sector.

Young Scientist of the Year

Dolores Ibarreta

Genetic testing is used to identify DNA sequence alterations that correlate with disease or possible disease development. As such, it can predict the future onset of (severe) disorders, not only for the patient but also for the patient's relatives. The DNA sequence information obtained from genetic tests remains constant, so that genetic testing results can have far-reaching consequences for both individuals and society. These facts alone render the quality assurance of genetic testing services an issue of utmost importance.

As part of its prospective role, the JRC had already identified, back in 1999, that genetic testing would require a quality assurance service. Dolores and her colleagues started working on the issue, collaborating with the Research DG in carrying out a prospective study on genetic testing services in Europe. This JRC study, which aimed to provide support for Europe-wide consistency in quality, safety and efficacy standards of genetic testing for common and rare diseases, was completed in 2003.

The study showed the poor state of quality assessment practices in the EU, despite Europe's renowned expertise in this area. It identifies shortcomings and proposes measures to ensure the highest quality of such services, providing a good foundation for further research. In fact, the JRC coordinated an expression of interest in June, 2002, bringing together the main stakeholders in the field. The positive evaluation of this action caused its transformation into a priority line for a genetic testing reference system for the second call in the Sixth Framework Programme (FP6). The proposal, now coordinated by one of the main centres promoting the quality of genetic testing in Europe, was presented in November, 2003. The presentation was attended by top scientific experts in the EU.

Furthermore, Dolores's study served as the main background discussion material in a European Commission/OECD joint colloquium with several international bodies–World Health Organisation (WHO), Council of Europe, etc.–aiming to create an international exchange platform to help form a common framework guaranteeing the quality of increasingly used genetic diagnostic services.*

* The study is available via the publication reference: D. Ibarreta, A.K. Bock, E. Rodríguez-Cerezo: *Towards quality assurance and harmonisation of genetic testing services in EU*, ESTO Report, Joint Research Centre, European Commission, EUR 20977 EN, 2003.

JRC Excellence Awards

Young Scientist Prize for Scientific Innovation

Nicole Erdmann

Nicole graduated in 1994 from the **University of Mainz** with a degree in physics and went on to complete her **PhD** at the university's **Institute of Nuclear Chemistry** in 1998. She worked at the JRC as both a grant holder and research scientist until 2003, and is now working at the University of Mainz as a **research scientist**.

International governmental organisations for the control of nuclear material have implemented new and more stringent safeguards programmes to strengthen and improve compliance checks of nuclear facilities and detection checks of undeclared nuclear activities.

A release of radioactive material often results in the formation of small particles consisting of uranium oxide matrices containing trace amounts of plutonium and americium. Analysis of such single particles enables deduction of the origin, age and history of the material. However, the standard technique for analysing such particles, secondary ion mass spectrometry (SIMS), suffers from isobaric interferences; uranium-238/plutonium-238 ($^{238}U/^{238}Pu$) and americium-241/plutonium-241 ($^{241}Am/^{241}Pu$). For example, measurements of ^{238}Pu are affected by the presence of ^{238}U and vice versa.

For this reason, resonance ionisation mass spectroscopy (RIMS) in combination with ion gun sputtering was suggested to overcome the problem. A RIMS feasibility study was performed in collaboration with the universities of Münster, Mainz (Germany) and Leuven (Belgium), and the results* demonstrated an increase in detection efficiency of two orders of magnitude for uranium particles as well as enhanced selectivity and sensitivity. Today the construction of a RIMS facility is planned at the University of Mainz, in collaboration with the JRC.

Young Scientist Prize for Major Scientific Contribution to Food Research

Hubert Chassaigne

Hubert graduated in analytical chemistry from the **University of Bordeaux** (France) in 1996, completed his **PhD** in 1999 and joined the JRC as a research fellow from 2001 to 2003. Since September, 2003, Hubert has been working as a **research scientist** at the JRC.

Selenium (Se) is an essential, yet toxic, element. On average, a human requires an intake of between 50 and 200 micrograms per day. This narrow concentration range demands an in-depth understanding of this element's speciation.

Selenised yeast is used as a food supplement to help regulate selenium intake, with several producers now supplying this product to the European market. However, little or no information is given concerning the chemical forms of the minerals likely to be present in such supplements.

Therefore, the JRC is now developing a methodological approach to feasibility studies for selenium speciation in a yeast material. In 2003, a sequential extraction procedure was set up to assess the solubility of dietary Se in yeast material. An analytical approach for low-molecular weight Se species was chosen and a novel integrated approach was proposed for the analysis of intact proteins. This consisted of three components:

1. Two-dimensional gel electrophoresis for proteins;
2. Laser ablation-based technique for Se detection; and
3. Protein characterisation by mass spectrometry.

These results** will help develop the speciation of selenium and selenium-containing proteins in a yeast candidate reference material.

* N. Erdmann, M. Betti, F. Kollmer, A. Benninghoven, C. Grüning, V. Philipsen, P. Lievens, R.E. Silverans, E. Vandeweert: "Resonant and non-resonant laser ionization of sputtered uranium atoms from thin films and single micro-particles: Evaluation of a combined system for trace and particle analysis", *Anal. Chem.*, 75(13) (2003), 3175-3181.

** H. Chassaigne, C.C. Chery, G. Bordin, A.R. Rodríguez: "2-Dimensional gel electrophoresis technique for yeast selenium-containing proteins–Sample preparation and MS approaches for processing 2-D gel protein spots", *Journal of Analytical Atomic Spectrometry*, 19(1) (2004), 85-95.

Scientific Publication Prize

Yannis Drossinos

Recent interest in aerosol particles derives partly from increasing evidence of their adverse effects on human health and influence on the earth's climate. A process called homogeneous nucleation governs the formation of nanoparticles in engine emissions, thereby contributing to the high concentration of ultrafine particles emitted by modern low-mass emission engines. By comparison, ice nucleation in supercooled water droplets is the controlling mechanism for the formation of high clouds in the upper troposphere.

Classical nucleation theory is the most frequently used theory to calculate nucleation rates. However one limitation is the implicit assumption of a stationary nucleating droplet, which leads to the so-called "translation-rotation" paradox. The publication* addresses this inconsistency and proposes a resolution of the paradox by deriving a consistent correction to the classical theory. The correction is shown to be a consequence of translational invariance of the nucleating droplet and the approach adopted is based on an application of quantum mechanical considerations developed in studies of Bose-Einstein condensation.

The resulting modified classical nucleation theory has applications in modelling nanoparticle emissions from modern car engines, an area of considerable concern regarding potential environmental and health impacts, and in urban air quality models. Environmental applications include using it to describe the formation of cloud condensation nuclei in the atmosphere–an essential ingredient when estimating the indirect aerosol effect on climate.

Yannis graduated from **Yale University**, obtained a Masters degree in mathematics from **Columbia University**, completed his **PhD** in **chemical physics** at **Harvard University** and joined the JRC in 1990.

Technical Assistance Prize

Heinz Stutz and Joachim Küst

The JRC, in focusing on the safety of nuclear fuel, performs microstructural level research on the mechanical and chemical interactions of the fuel at various stages. This requires the characterisation of irradiated fuels and a new programme for characterising lattice structure variations of high burn-up fuel has recently begun.

For such analyses, fine X-ray beam is the preferred tool and, to date, the X-ray beam concentrator has applied a lead-glass capillary. The 2003 JRC technical prize has been awarded to H.-M. Stutz and J. Küst for their contribution to developing a new type of X-ray beam concentrator called the "metallic iris capillary". The new device was conceived, fabricated and tested at the JRC. It has significant advantages over the conventional lead-glass capillary, as it can be used for high-resolution X-ray techniques, such as micro-diffraction, spectroscopy and small-angle X-ray scattering.

The metallic iris capillary, currently being patented, will have potential applications in the fields of lithography, synchrotron radiation, metal purification and even medical procedures. Two prototypes have already been specially designed for use at the Belgian Nuclear Centre and, with this new and innovative system, the structural characterisation of different nuclear and non-nuclear thin interface materials will also be possible.

Heinz joined the JRC in 1974, has a strong background in the development of equipment and glove boxes for laboratories and hot cells and is **head of one of the JRC technical workshops**.

Joachim with a background in craftsmanship and mechanical engineering, joined the JRC in February 2002 and is workshop **deputy head**.

* Yannis Drossinos and Panayotis G. Kevrekidis**: "Classical nucleation theory revisited", *Physical Review*, E 67, 026127 (2003).

** Panayotis G. Kevrekidis is Professor at the Department of Mathematics and Statistics, University of Massachusetts, Amherst, Massachusetts.

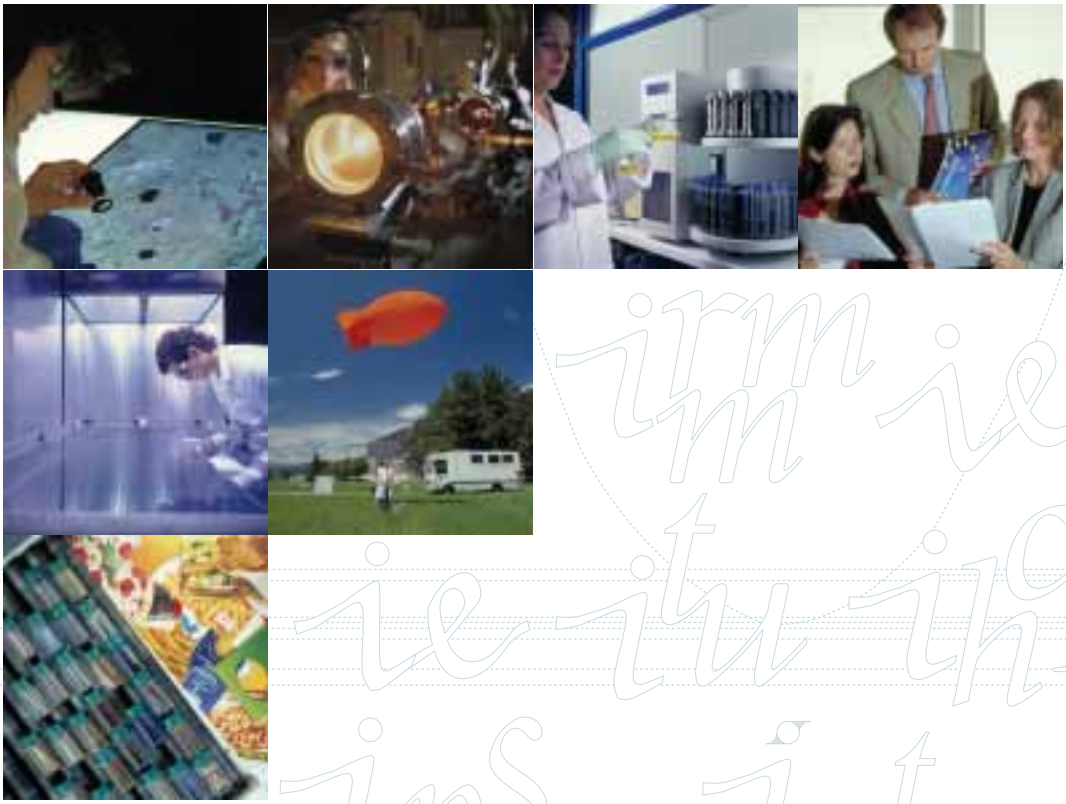
Structure of the multiannual work programme

The JRC Multi-Annual Work Programme (2003-2006), adopted on 20 March, 2003 (Commission Decision C(2003) 819), consists of four core areas, namely:

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

The activities within these core areas, selected to represent the best match between policy needs and JRC competencies, are categorised according to Integrated Scientific Areas (ISAs). The ISA structure was developed for the Sixth Framework Programme (FP6) so that activities are shared between the Institutes, thereby enhancing the cohesion and focus of the JRC. The ISA breakdown per Institute is shown on the next page.

This chapter contains a brief overview of the activities of the seven JRC Institutes in 2003. Selected extracts reveal breakthroughs ranging from the determination of natural toxins (patulin), to the transmutation of radioactive iodine-129 (^{129}I). The latest progress on fishing vessel detection is documented and an insight on nuclear reactor safety support is given. The JRC's role in areas ranging from vehicle emissions and genetically modified organisms (GMOs) to prospective technological studies is also featured in the following pages.



Integrated Scientific Areas	JRC Institutes
1. Food, Chemical Products and Health	
Safety and quality of food and feed	irmm
Food chain: from agriculture to consumer protection	ipsc ipts
GMOs in food, feed, seeds and the environment	ihcp irmm ipts
Assessment of Chemicals and Exposure	ihcp
Alternative methods to animal testing	ihcp
Technologies for Biomedical Applications	ie irmm ihcp itu ipts
Health and Environment: addressing exposure via human envirogenomics	ihcp
2. Environment and Sustainability	
Air quality and environmental radioactivity	ies irmm
Water quality and aquatic ecosystems	ies irmm
Soils and waste management	ies irmm
Land resources	ies
Integration of sustainability into other policy areas	ipts ies
Climate change: the Kyoto protocol and beyond	ies ipts
Monitoring and assessing ecosystem sustainability	ies
The Sustainable Energy Technologies Reference & Information System	ie ies ipts
Renewable energies and advanced energy conversion technologies	ie ies
3. Nuclear Safety and Security (EURATOM Programme)	
Management of spent fuel and of radioactive waste	itu ie
Nuclear Security (safeguards and non proliferation)	itu irmm ipsc
Reactor and Nuclear fuel Safety	ie itu
Radiation Monitoring	itu irmm
Basic Actinide Research	itu
4. Horizontal Activities	
Technology Foresight in other JRC priorities	ipts
Cross-cutting techno-economic foresight	ipts
Statistical methods for analysis of economic indicators	ipsc ipts
Reference materials and methods in other JRC priorities	irmm
BCR and industrial certified reference materials	irmm ihcp
Metrology in Chemistry and Radionuclide Metrology	irmm
Metrology in Physics: Neutron Data Measurements	irmm
Antifraud and monitoring compliance with EU regulations in selected policies	ipsc ihcp
Support to cybersecurity	ipsc ipts
Technological and natural risks	ipsc ies ie
Contribution to Commission objectives in humanitarian aid and assistance	ipsc
Promotion of innovation, technology transfer and management of intellectual property rights	

Note. The designation of institutes above is strictly according to the actions laid down in the multi-annual workprogramme 2003-2006.

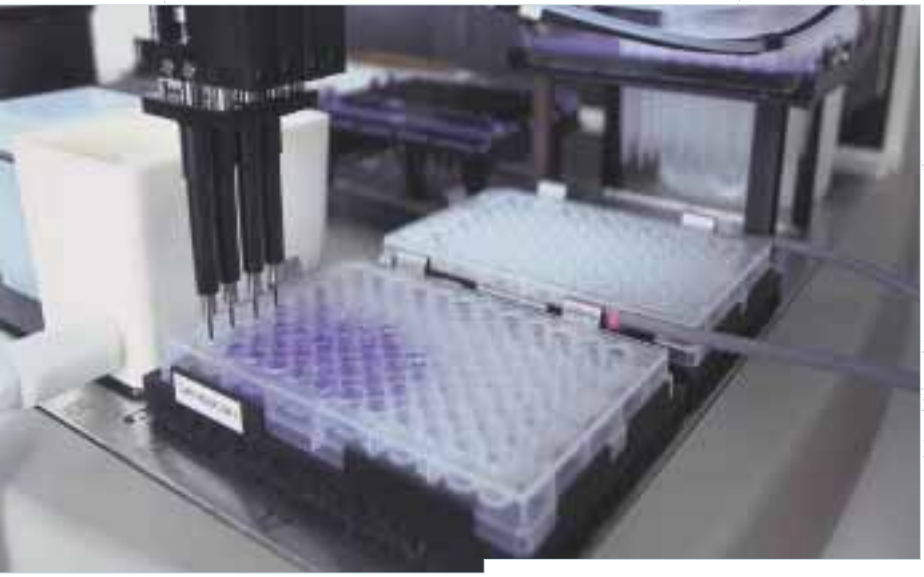
Institute for **Reference Materials and Measurements**

In recent years, the Institute for Reference Materials and Measurements (IRMM) has actively focused its research on supporting EU policies. Prioritising its activities has resulted in the consolidation of five research areas:

1. Food and feed quality and safety
2. Reference materials, with special emphasis on matrix reference materials and bio-analysis
3. Chemical reference measurements
4. Radionuclide metrology, and
5. Neutron physics.

In 2003, IRMM was designated as the JRC Centre for Food and Feed related research activities. To take charge of this new function, the Institute's analytical chemists and food scientists were brought together in a new unit. Synergy was also increased in the field of reference measurements by merging Institute metrology activities into one single unit focusing on premium quality reference measurements of stable and radioactive isotopes.

The following is a cross section of IRMM activities in 2003:



Automatic protein digestion and sample preparation for mass spectrometry

Determination of natural toxins

IRMM organised a collaborative trial to provide evidence that patulin, a toxin often found in apple products, can be reliably determined at levels lower than 10.0 g/kg in clear apple juice and fruit puree. These results now make it possible to set the maximum limit for patulin, in products intended for infant consumption, at a lower value than previously possible (draft amending Regulation (EC) No 466/2001).

Third generation of reference materials for genetically modified organisms

Genetically-modified maize powder reference materials for the detection of Bt-11 and Bt-176 maize have been certified and released for distribution in order to implement and control the current labelling Regulation (Regulation (EC) No 49/2000) for GMOs in foodstuffs. These were produced by a new dry-mixing technique developed at IRMM that helps avoid degradation of DNA in the production process.

From the Bureau Communautaire de Référence (BCR) to the European Reference Materials Initiative (ERM®)

IRMM is one of the world's largest producers of certified reference materials (CRMs) and is managing the production and distribution of both BCR and IRMM reference materials since 2003. In October, 2003, an ERM initiative that brings together the largest reference materials producers in Europe was launched in conjunction with the German Federal Institute for Materials Research and Testing (BAM, DE) and LGC (UK). The new ERM® trademark will be a guarantee of high quality and will only be granted to reference materials that have successfully passed a peer evaluation and have been produced according to the principles described in ISO Guides 34 and 35.

Focusing metrology applications in support of EU policies

IRMM organised a measurement evaluation programme for EU national reference laboratories measuring the lead and mercury content in fish (Directive 2001/22/EC). This inter-laboratory comparison enabled them to demonstrate their measurement capabilities, which comply with ISO/IEC 17025 – the standard for testing and calibration laboratories.

Ultra-low level radioactivity measurements

In its underground laboratory at the Belgian Nuclear Centre in Mol, IRMM measured the activity of cobalt-60 (^{60}Co) in steel plates taken from roofs of buildings directly exposed to neutrons from the atomic bomb explosion in Hiroshima. Current knowledge of the effects of ionising radiation on human beings is, to a large extent, based on the follow-up of Hiroshima and Nagasaki victims. There are, however, discrepancies between the model calculations and ^{60}Co activity measurements. The data set produced by IRMM is the first that fully supports the most recent model – the Dosimetry System 2002.

New knowledge and data in neutron physics

Measurements at the Institute's Van de Graaff laboratory have improved the understanding of how ^{60}Co is produced by irradiating nickel in stainless steel with high-energy neutrons. This data is crucial for radiation damage calculations for the structural parts of accelerator driven systems, fusion reactors and spallation neutron sources.

Furthermore, experimental data on decay properties above the shape-isomeric ground state in uranium-239 (^{239}U) via the ^{238}U(n, g) reaction was measured for the first time ever and the data were entered in the international reference database.

Members of the mass spectrometry team working in the sample preparation laboratory

Institute for Transuranium Elements

In October, 2003, the Institute for Transuranium Elements (ITU) celebrated its 40th anniversary with a scientific agenda that involved numerous invited speakers, including Commissioner Busquin. This occasion gave ITU the chance to look back over 40 years of technical development in the nuclear field – ITU's speciality. Although ITU has remained loyal to its original nuclear mandate, it has also diversified over the four decades. Some early core programmes remain, such as fabricating nuclear fuel and examining irradiated fuel in hot cells – a capability in considerable demand by the nuclear industry. Major thrusts include the characterisation of spent fuel and attempts to understand the complex processes resulting from the release of nuclides from long-term repositories. ITU is also working on both separation and possible transmutation scenarios to reduce the long-term radiotoxicity of spent fuel. Particularly good progress was made this year in both liquid-liquid and molten-salt separation technologies.

Safeguards

In terms of more recent activities, considerable progress in "Safeguards R&D", aimed at building technologies and methodologies to prevent the misuse or diversion of nuclear materials has been achieved. Closely allied to this has been the continued progress in the relatively new field of "nuclear forensics", which tracks the origins and possible intended use of nuclear material smuggled out of facilities. The study of radioactivity in the environment continued, focusing on particles and the analyses of their content and possible origin. For the first time, plutonium-containing particles have been separated in sediment samples and detected via their characteristic X-rays, using the synchrotron source (ANKA) at the Forschungszentrum Research Centre (FZK) in Karlsruhe.

Actinide research and waste transmutation

In basic research, important progress was made in understanding the superconductivity of americium metal and the new ternary systems, such as the plutonium-based alloy $PuCoGa_5$. ITU hosted the second summer training school in June 2003, with some 70 participants, including 30 from the Acceding Countries. The Actinide User Laboratory entered its second year of full operation and, in addition to hosting many visitors, four workshops on topics of interest to the community were held.

Laser transmutation studies continued this year with the transmutation of the important fission product iodine-129 (^{129}I) by an intense laser pulse. This was successfully demonstrated at both the University of Jena (DE) and Rutherford Appleton Laboratory (UK).

Medical applications

The alpha-immunotherapy programme using the isotope bismuth-213 (^{213}Bi) is another example of ITU diversification. Important new work was started in this area, trying to understand the exact processes by which radiation, such as alpha particles, destroys malignant cells. Collaboration between the University Hospital Düsseldorf, the German Cancer Research Centre and ITU entered into stage I clinical trials for alpha-particle treatment of blood-borne cancer.

Nuclear forensics-sample examination

Working towards enlargement

Enlargement and providing services to scientific organisations in the Acceding and Candidate Countries was an important theme in 2003. ITU accepted this challenge with enthusiasm and held a large number of successful workshops. For example, two workshops were held on nuclides training, two on radioactivity in the environment, and a TRANSURANUS user meeting was convened. The TRANSURANUS code system describes and combines interacting phenomena by accounting for all relevant thermal, mechanical and isotopic properties of nuclear fuel–most of which change during reactor operation or long-term storage. The code is supported by a comprehensive verification database. Finally, ITU staff made many trips to the Acceding Countries, and vice-versa, emphasising the importance of this link for the future of the enlarging Union.

Second Summer School at ITU, June 2003

Institute for **Energy**

In 2003, the Institute for Energy (IE) promoted increased interaction with European Commission customer services, and continued to establish partnerships with world leaders in the energy field. Through its experience in coordinating and participating in networks, IE demonstrated that energy research activities are successful if developed in symbiosis between industrial efficiency and sustainable development.

In addition to progress documented in the sections "Safety of Eastern Nuclear Reactors" and "Safety of Hydrogen as a Transport Fuel", some additional highlights are described below.

Ageing of materials under the effect of load and irradiation-assisted stress-corrosion cracking

Stress corrosion cracking, possibly enhanced by neutron irradiation mechanisms affecting light water reactor (LWR) core internals, is still not properly understood, despite large international programmes based mainly on post-irradiation tests.

Artistic impression of the fuel cell test facility currently under construction

In 2003, IE acquired a new rig consisting of an autoclave with fracture toughness testing equipment and a water chemistry preparation loop. The autoclave is equipped with a pneumatic loading device for bending tests of mini and standard toughness specimens, and its compact dimensions also make it suitable for future special applications in a High Flux Reactor irradiation capsule.

If successful, it would be the only rig in the world able to perform such fracture toughness tests on small specimens, complementing results obtained using other rigs designed to carry out tensile, fatigue or fracture toughness tests on larger specimens.

Safety of new reactor systems

IE, with a clear focus on safety, supports R&D efforts related to new reactor concepts and started the assembly of two fuel irradiation facilities and the associated instrumentation in the area of high temperature reactors (HTR). An additional irradiation set-up was adapted to the needs of a Generation IV reactor system. Experiments will start in 2004. The facilities for material tests were prepared and made operational, and the HTR fuel database was updated, maintained and equipped with a user interface.

First exploratory research results on HTR fuel reprocessing were obtained and will be patented. IE also participated in defining projects for new systems. The safety of a lead-bismuth (Pb-Bi) and gas-cooled accelerator-driven systems (ADS) and gas-cooled fast reactors were analysed. IE also contributed extensively to the organisation of international conferences via networking.

Fuel cell systems performance testing and standardisation

The main goal of the Fuel Cell Testing & Standardisation (FCTEST) Action is to initiate a Commission Reference System in the sector, through the creation of a testing facility and the operation of the FCTEST Network, geared towards integrating European research activities. Furthermore, work on mathematical modelling of the physical laws pertinent to fuel cells and providing numerical simulation tools to support future testing activities was carried out.

Sustainable energy technologies

IE's Sustainable Energy Technologies Reference and Information System (SETRIS) programme provided a techno-economic study entitled "Controlling Carbon Emissions: the option of Carbon Sequestration", which substantially contributed to the EU common position paper on carbon sequestration. This study served as a scientific and technical platform to support the Commission in defining its position for the Carbon Sequestration Leadership Forum partnership, which is a US-led initiative.

Loading samples in the special autoclave designed to test stress corrosion cracking

Institute for the **Protection and Security of the Citizen**

In addition to the highlights on crop forecasting, the Institute for the Protection and the Security of the Citizen (IPSC) successes for 2003 include: the rapidly expanding use of the Europe Media Monitor (EMM); contributions to the amendment of the Seveso II directives; the installation of the design information verification system at the Rokkasho Reprocessing Plant in Japan; and, finally, the demonstration of near real-time tracking of fishing vessels in the Baltic sea.

Europe Media Monitor (EMM)

The primary objective of EMM is to provide Commission services with targeted intelligence culled from the Internet and other electronic sources. The Press and Communication DG has based its future media monitoring strategy for the enlarged EU on EMM, while the Health and Consumer Protection DG has commissioned a Medical Information System derived from it. The External Relations DG and the Humanitarian Aid Office have both requested news services covering each country of the world. Most services have established policy-specific alerts and receive corresponding SMS text messages. EMM is coupled with JRC research into new semantic processing of web pages and new statistical trend analysis. The alert system exploits a JRC-developed parallel state algorithm for identifying keywords across multilingual texts. It can process the full text of any article against 8000 keywords from 350 subjects in just 100 msec. No other system achieves the same real time performance. In tests, EMM outperforms Google, Yahoo and Lexis Nexis, detecting new stories up to three hours before the others.

An impression of information collection

Revision of the Seveso II Directive

On 10 September, 2003, an agreement was reached in conciliation on the first revision of the Seveso II Directive 96/82/EC on the control of hazardous substances. The results of focused expert workshops held by the IPSC Major Accident Hazards Bureau (MAHB) substantially guided the coverage of chemical and thermal processing operations in mining and operational tailings management facilities, the tightened scope with regard to explosive and pyrotechnic substances and ammonium nitrate following the Enschede and Toulouse accidents, and reinforced land-use planning provisions. The amendment's provisions on land-use planning include a mandate for the Commission to develop a European database for assessing the compatibility between Seveso establishments and sensitive areas–an IPSC-led activity.

Design Information Verification System

A Design Information Verification System was developed for the IAEA and installed at the Rokkasho Reprocessing Plant (RRP) as part of IPSC's non-proliferation and nuclear safeguards work. The system consists of a laser range scanner with JRC software for the acquisition, processing and analysis of the 3D data. Successful demonstration, training and field testing were accomplished, and fifty RRP hot cells, prior to closure, were scanned, with reference models being built for further use.

Automatic supply of vessel detection results

On 16 June, 2003, the Fishing Vessel Detection Systems (VDS) project achieved the first fully automatic supply of vessel detection results. This was based upon an algorithm developed by IPSC using near real-time synthetic aperture radar (SAR) data. Results were e-mailed to fishing monitoring centres, 39 minutes after the RADARSAT ScanSar acquisition. Such efficient image transfer and processing enables collaboration between space-based observation and local coast-guards so that, for example, illegal fishing vessels may be intercepted.

Other notable achievements include the impact analysis of the Israeli wall on Palestinian settlements and the approval of the Council regulation on electronic labelling of caprine and ovine (goat and sheep) species, which was based upon JRC work. Full-size testing of a road bridge beam-deck made of advanced composite materials was performed for the Spanish ministry for industry and infrastructure at the European Laboratory for Structural Assessment (ELSA). Other successes include the conclusion of the CTOSE (Cyber Tools for Online search for Evidence) project on collecting and securing electronic evidence that is reliable and admissible in international contexts. The IAEA received support on the improvement of technical measures to detect and respond to the illicit trafficking of nuclear material and other radioactive materials. And workshops were convened with the Economic and Financial Affairs DG, the European Central Bank and the OECD on business cycle analysis and econometric tools for short-term analysis.

Fishermen want efficient regulations with equal treatment throughout the Community

Vessels detected in RADARSAT images in North-East Atlantic Fisheries Convention Waters

Institute for **Environment and Sustainability**

The Institute for Environment and Sustainability (IES) offers a blend of expertise and competence ranging from the environmental sciences to the field of Earth observation. IES is at the forefront of providing scientific and technological support to the Commission Directorates and Services (e.g. the Environment and the Energy and Transport DGs) dealing with environmental issues. IES activities combine short-term technical projects with longer-term strategic research in a work programme which supports more than 30 EU regulations, strategies (including the EU thematic strategies) and communications in the fields of global change emissions; air quality and health; water; terrestrial and natural resources; and renewable energies.

The Institute provides scientific support by networking with the best partners in Europe, including Acceding States and Candidate Countries. IES has established highly acclaimed experimental facilities and laboratories–including the European Reference Laboratory for Air Pollution (ERLAP) and the European Solar Testing Installation (ESTI), and produces European and global reference data sets (e.g. Global Land Cover and the European Soil database).

Supporting the European Marine Strategy

The oceans play a vital role in the ecological and climatic balance of our planet and policies are needed to manage the conflicting needs of protecting the marine environment and exploiting its natural resources. JRC work supporting the European Marine Strategy includes the application of integrated environmental observation systems, both at sea and from space. IES-developed remote sensing techniques provide key information on bio-geo-chemical marine processes, such as those related to coastal eutrophication.

Optical space observations, duly calibrated by ground measurements, are used to assess the distribution and abundance of marine biomass and primary productivity in European seas and the world's oceans. This contributes to a better understanding of ecological relations in the oceans, eutrophication of coastal waters and enclosed seas, as well as of the oceans' role in absorbing atmospheric CO_2 and thus in regulating the Earth's climate.

Motorcycle emissions testing, VELA

Support to the Kyoto Protocol

The European Commission is at the forefront of international efforts to mitigate climate change and aims to continually improve the monitoring and reporting of greenhouse gas emissions in Europe. In 2003, a pilot study with six Member States on how to harmonise methodologies for carbon sink estimates was completed, and investments were made in new methods to measure the carbon sink.

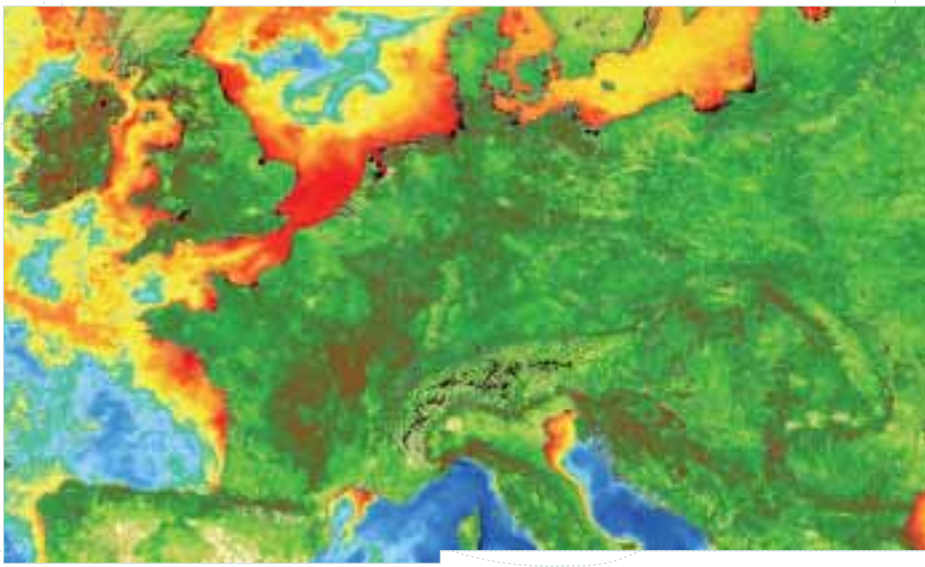
Given the trend to global warming, it was discovered how a carbon sink might become an unwanted source. EU-wide methodologies were developed to estimate emissions of methane based on atmospheric measurements and EUROSTAT statistics. Furthermore, improving the understanding of regional and global pollution by ozone and particulate matter enhanced the ability of IES to evaluate alternative post-Kyoto climate change mitigation policies.

Vehicle emissions–EURO-V and EURO-III

The JRC is acknowledged as a scientific reference centre for the development and harmonisation of vehicle and engine emission standards. In 2003, several hundred tests with cars and motorbikes were performed in the JRC Vehicle Emission Laboratories (VELA), as support to policymaking. The JRC was invited to act as scientific coordinator of a laboratory inter-comparison exercise to test new measurement methods for particle emissions from passenger cars and light duty vehicles (EURO V) on the initiative of the coordinator of the Particle Measurement Programme (UK Ministry of Transport). The highlight event of 2003 was the International Conference on Future Worldwide Emission Requirements for Passenger Cars and Light Duty Vehicles and EURO V that was organised by the JRC and supported by the Environment and the Energy and Transport DGs.

Support to EU strategy for soil protection

In 2003, concern over European soil quality and the depletion of soil resources led the Commission to outline the first steps in a strategy to protect our soils. The goal is to place soil protection on a par with cleaning up our water and air. To support the Soil Protection Strategy, the JRC, through collaboration with the European Soil Bureau Network and other partners, has developed an improved and harmonised knowledge base on soil properties. This database was expanded (up to 1.1 million) to include data for Acceding and Candidate Countries, the Russian Federation, Ukraine and Belarus, with the aim of developing a coherent information system for reporting on the conditions of European soils.



Chlorophyll-like pigment concentration (mg m^{-3}) in European seas coupled with a terrestrial vegetation index (TVI). Monthly mean for May (from SeaWiFS data)

Implementation of the EU policy on GMOs

During 2003, the European Commission strengthened its framework for GMO legislation by issuing two new regulations, one dealing with GM food and feed and the other with traceability and labelling.

The Institute for Health and Consumer Protection (IHCP) Biotechnology and GMO unit (established in November, 2002) attained increased responsibility in its work supporting the implementation of EU policy on GMOs. In relation to the GM food and feed legislation, it has been appointed Community Reference Laboratory (CRL), with the mandate to evaluate if methods are fit for the purpose of regulatory compliance. The European Network of GMO Laboratories (ENGL) will assist in the execution of this demanding task. ENGL is managed and chaired by IHCP and consists of 46 official members from EU countries and observers from Accession Countries. This is the first ever nomination as CRL in the JRC, and its assignment to IHCP recognises its key role in GMO testing.

The IHCP is also responsible for collecting all summary notifications of deliberate field crop trials (SNIF) in the EU, and summaries and risk assessment files of dossiers submitted for marketing approval. This information is made publicly available and allows comments to be submitted. As an extension of this work, the Unit has also been nominated EU focal point for the Biosafety Clearing House as part of the Cartagena protocol, which entered into force in September, 2003.

Chemicals and REACH

The IHCP has responded to the needs set out by the REACH (Registration, Evaluation and Authorisation of CHemicals) system. The European Chemicals Bureau (ECB) contributed extensively to the drafting of the REACH legislation, specifically the technical annexes. The ECB also produced an important report on the testing needs under REACH and on the role of (Q)SARs (Quantitative Structure Activity Relationships). (Q)SARs can play an important role in reducing the testing needs (and costs) for industry under the future REACH legislation. An international workshop on the scientific aspects of REACH was organised in December, 2003 by IHCP.

The European Centre for the Validation of Alternative Methods (ECVAM) focused on the replacement of those animal experiments with the highest usage of laboratory animals. ECVAM successfully validated two methods on drugs/biologicals that have been introduced by the European Pharmacopoeia. Another benchmark for ECVAM was the completion of a validation study for six pyrogen tests, eliminating the need to use animals for such tests in the future. ECVAM also participated in a successful proposal for an integrated project on reproductive toxicology. This new project involves a consortium of 35 international research groups and a budget of €12 million.

Molecular biology research at the Biotechnology and GMOs Unit

The Physical and Chemical Exposure (PCE) unit focused on exposure data to allow for a more accurate evaluation of the overall risk for European citizens when exposed to chemicals from various sources via different routes (ingestion, inhalation, skin contact). A series of studies to identify and quantify chemical substances emitted from products and articles was performed using the Indoortron facility–a large-scale environmental chamber–and a list of indoor-originated chemical substances was established. A pan-European R&D platform and Information/Reference System on "Risks from Chemicals in Products" and on the "Development/ Harmonisation of Testing Methods" was launched. The assessment of human exposure also includes toxicogenomic approaches.

Important research contributions were made to passive smoking (Environmental Tobacco Smoke) and to the health risks of tattoos.

Training and ERA research at the IHCP cyclotron

The IHCP runs a cyclotron to stimulate collaborative research to enhance patient access to nuclear medicine. It hosts the first radioisotope production facility that will sell radiopharmaceuticals in Italy, and fulfils the requirement to have a well-distributed radiopharmaceutical production network ensuring equal access for EU citizens to Positron Emission Tomography (PET) as a vital medical imaging technology. It also hosts a Marie Curie Training Site "Research Training in Biomaterials Testing Using Radiotracers", which aims to provide high-level interdisciplinary doctoral training in the testing of biomaterials using radiotracers.

Cyclotron

Institute for **Prospective Technological Studies**

The Institute for Prospective Technological Studies (IPTS) continued to support the European policy-making process in its competence areas by anticipating needs, providing techno-economic analysis, impact assessment and direct support to policy implementation. The Institute's achievements in 2003 spanned a broad range of policy areas, including industry, agriculture, health, environment, energy, transport and the information and communication sector.

Energy and environment

Prominent among IPTS achievements was the support given to the Commission's guidelines for Policy Impact Assessment and to the Environmental Technologies Action Plan (ETAP). IPTS work on environmental regulations and their impact on innovation provided background for support to the Commission's impact assessment on the EU chemicals policy.

Work in the area of energy and climate change supported the Commission's policy on emission trading and the United Nations Framework Convention on Climate Change negotiation rounds. A support agreement was signed between IPTS and the European Environment Agency (EEA) to provide long-term energy/emission scenarios for the forthcoming EEA State-of-the-Environment report. IPTS also provided input to the World Energy Technology Outlook (WETO) report presented by Commissioner Busquin in June.

The European Integrated Pollution, Prevention and Control Bureau (EIPPCB) at IPTS continued to play a key role in implementing the 1996 EU Directive on pollution control, by launching the last of a total of 32 best available technologies reference documents (BREFs). The two years of work invested in these internationally recognised reference documents brings together industrial experts, Member State representatives and environmental non-government organisations (NGOs). IPTS promotes contacts between services of the Commission in areas such as refineries, slaughterhouses, large combustion plants and waste management, each dealing with crucial aspects of regulations and structuring the daily lives of many European businesses.

GMOs and genetic testing

Substantial input was given to the development of the Commission's policy on the co-existence of conventional and GM plants, and to the Commission's Guidance document for the "Development of National Strategies and Best Practices in this area". In following up a long-term commitment on genetic testing, IPTS co-organised (with the Research DG and the OECD) a major workshop on policy options and challenges within this rapidly developing field.

Information society

The Foresight in Information Society Technologies in Europe (FISTE) action aimed to reconcile supply and demand aspects. Among its main achievements were studies on the development of the Information Society in Candidate Countries and support to the Information Society DG's high-level advisory groups.

Artistic impression representing information society technologies

Enlargement

IPTS enlargement activities concentrated on scenarios for potential future developments of certain structural indicators of the Lisbon process. Reports were delivered to the "Foresight in the Enlarged European Research and Innovation Area" conference in May in Ioannina, which was co-organised with the Research DG and the Hellenic Presidency of the EU, and to a conference co-organised with the European University Institute in Florence in November under the Italian Presidency.

Implementing the European Research Area

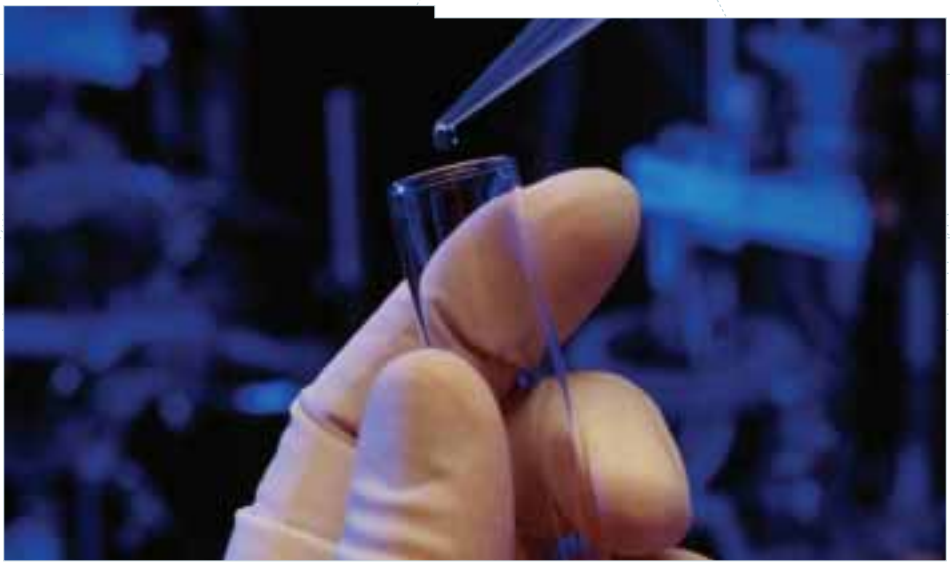
A major collaborative agreement between the Research DG and the JRC was signed in October for longer-term support to the construction of the European Research Area. The aim is to provide strategic intelligence services on science and technology policies to implement the action plan aimed at increasing investment in European R&D to 3% of gross domestic product (GDP) by 2010, and to establishing a European Area for Science and Technology Foresight.

Support to the European Parliament

IPTS continued to provide support on request of the European Parliament (EP). In March, Commissioner Busquin presented the IPTS study on employment impacts of technology innovation, and in July, the JRC delivered a report on "Security and Privacy for the Citizen in the Post-September 11 Digital Age: A Prospective Overview" to the EP Committee on Citizens' Freedoms and Rights, Justice and Home Affairs (LIBE). This study has augmented IPTS prospective work on cybersecurity, an area of joint endeavour with its sister JRC institute – IPSC.

European Science and Technology Observatory (ESTO)

IPTS managed close collaboration with more than 40 research institutions all over Europe within the ESTO Network, and a General Assembly was held in June. IPTS was particularly successful in competitive activities also, with 18 proposals funded out of the 22 submitted for the Sixth Framework Programme (an 82% success rate).



Genetic testing

Support to **Enlargement**

The 2003 JRC Enlargement action deals with the scientific and technical aspects underpinning EU legislation in the fields of environment, health, food, renewable energy, chemicals, agriculture and nuclear safety. The work has been aimed at accelerating the uptake of the "acquis communautaire", the body of EU legislation that the new Member States must adopt and implement. A network of JRC National Contact Points, scientific attachés and participants in the JRC Board of Governors from the 13 Acceding and Candidate Countries are providing direct input to the definition, monitoring and implementation of the JRC Enlargement Action. Highlights from 2003 include:

- Some 1000 experts from the Candidate Countries participated in 72 workshops and advanced training courses on S&T aspects of EU policies;
- JRC organised 15 information events in 10 Enlargement countries. Some 2500 mostly senior level representatives attended from academic, industrial and public administration domains;
- JRC invited 22 journalists from enlargement countries to a dedicated workshop in Ispra and 39 press articles on JRC-related topics were published;
- 112 researchers from the Enlargement countries worked at JRC Institutes under employment contracts as seconded national experts, visiting scientists or research fellows. A recruitment call for an additional 70 posts yielded 380 eligible applications;
- Of 230 FP6 proposals submitted by the JRC, 70% included one or more partners from enlargement countries;
- To nurture the development of future partnerships, a new facility for short-term contracts was introduced to encourage exchange visits between enlargement country research organisations and JRC Institutes; and
- The JRC has taken a pro-active approach to attracting young researchers from enlargement countries to train within its Institutes, and has sought stronger collaboration within the Marie Curie Actions by inviting the respective Marie-Curie National Contact Points to Ispra.

Seminar on encouraging S&T research through mobility

Contribution to the **European Research Area**

Overall strategy towards the European Research Area (ERA)

The JRC ERA Action Plan, published in 2003, sets out specific targets to measure the JRC's contribution to the European Research Area. This contribution is built around five major activities: common scientific reference systems; networking; training and mobility; research infrastructures; and enlargement. These activities are embedded in the JRC's own work programme.

In 2003, the JRC has strengthened its role in the development and operation of several reference systems on metrology, energy and cybersecurity. Work was carried out in preparation for Community Reference Laboratories on GMO Food and Feed Legislation, on Food Contact Materials and on Feed Additives.

Collaborations with partners

The Framework Programme is one of the main instruments for implementing ERA. In the first year of FP6, the JRC has, together with its partners, successfully prepared a number of major research projects and networks. Participation in these activities allows for important and lasting partnerships with major European research players. It also involves work around JRC facilities that results in increased access and use of specialised infrastructures and databases, and maximises the opportunities for training at JRC Institutes.

The new FP6 projects and networks cover a wide range of topics throughout the entire JRC work programme, such as: food safety; nano-biotechnology; photovoltaics; hydrogen; information society; vehicle safety; atmospheric change; actinides; nuclear accidents; and research policy.

Global Monitoring for Environment and Security (GMES)

The objective of the EU and European Space Agency (ESA) GMES initiative is to ensure European access to independent and reliable information, enabling decision makers to better manage our environment and security by anticipating or mitigating crisis situations and related issues.

The GMES "Initial Period Final Report and Communication" from the Commission to the European Parliament and the Council were both completed with full JRC participation in the drafting process. To this end, JRC in-house expertise in research and policy support played an important role. This work, detailed in a brochure, was widely distributed at the Fourth GMES Forum and at the First Earth Observation Summit at which 37 countries and 22 worldwide organisations participated.

This helped consolidate GMES priorities and has appreciably reaffirmed the JRC's international profile in this domain.

From 01 May, 2004 the EU will consist of 25 Member States

Decommissioning of JRC nuclear installations

The Commission is responsible for the management of nuclear installations, built for the purposes of the Euratom Treaty, until their decommissioning. In 1999, the JRC initiated the Decommissioning and Waste Management (D&WM) programme aimed at decommissioning its obsolete installations and the treatment of related waste. This programme is managed in each JRC establishment by a specialised team, with the advice of a group of experts, composed of external experts designated by the Member States.

The present status

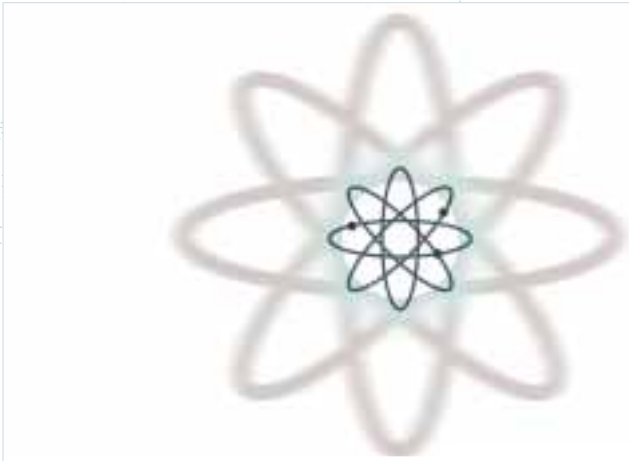
In 2003, the JRC entirely reassessed the programme. It was also reviewed by a consortium of experienced external organisations, to account for major technical and economic changes that have occurred since 1999, when the programme was first presented to the Council and the European Parliament.

A new Communication to the Council and the European Parliament has been prepared on the basis of the above, for approval in 2004.

Furthermore, the JRC established a permanent Steering Committee, chaired by its Deputy Director General, to review progress on an ongoing basis and to steer the achievements and objectives of the programme.

At the JRC Ispra site in Italy (the main site currently undergoing effective decommissioning), progress was made in the provision of waste management facilities, a prerequisite for decommissioning:

- The liquid effluent treatment plant was successfully commissioned and completed;
- The material clearance facility, which allows the declassification of non-radioactive material that originated from nuclear decommissioning activities, was equipped with a non-destructive assay system;
- The upgrading of the decontamination plant was pursued with the installation of an ultrasonic bath and a water-wash cabin is being installed; and
- Meetings were held with the Italian safety authorities in order to define waste acceptance criteria compatible with the future Italian final repository. There was also dialogue on the siting and management of the interim store to be built on the Ispra site.



High Flux Reactor (HFR)

The HFR is one of the most powerful research reactors of its kind and a key technological platform for fundamental, innovative, medical, thermonuclear fusion and reactor safety research.

As follow-up to the 2002 safety assessment, a new in-service inspection took place in the summer of 2003 and the structural assessment plan was successfully completed in November. It concluded that the vessel may be operated until at least 2015. Furthermore, an IAEA action plan on safety culture improvement was completed by February, 2004.

A new licence request was launched in 2001 and submitted to the Dutch authorities in December 2003. The new licence should be granted to the Nuclear Research and Consultancy Group (NRG), the present operator of the HFR, by mid-2004. A new proposal for a Supplementary Programme covering the period 2004 to 2006 was adopted by the Commission in December, 2003 and by the Council in February, 2004.

View of the High Flux Reactor, Petten

Core staff

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

Core staff (end-of-year situation)	2002 M	2002 F	2002 Total	2003 M	2003 F	2003 Total
Officials	714	235	949	794	262	1056
Temporary agents on 5-year renewable contracts	458	154	612	344	123	467
Temporary agents on 3-year non-renewable contracts	64	17	81	39	10	49
TOTAL	**1236**	**406**	**1642**	**1177**	**395**	**1572**

Of the 1572 total, 1253 staff members can be considered as scientific staff. The number of scientists decreased temporarily in 2003 due to the change from the Fifth to the Sixth Framework Programme (FP6). It is anticipated that the numbers will increase significantly throughout FP6, particularly as a result of enlargement. Commission policy for staff financed on the research budget calls for the "integration of research staff into the mainstream of the Commission's personnel policy". A minimum target of 65% was set and the JRC attained 67% in 2003. On the other hand, a margin of flexibility of between 10 and 35% of permanent research posts must be maintained for the recruitment of specialised staff to cope with needs that are strictly time-limited.

Core staff distribution (end-of-year situation)	2002 M	2002 F	2002 Total	2003 M	2003 F	2003 Total
Institute for Reference Materials and Measurements	127	41	168	128	46	174
Institute for Transuranium Elements	175	40	215	168	40	208
Institute for Energy	130	24	154	127	20	147
Institute for Protection and Security of the Citizen	184	51	235	171	45	216
Institute for Environment and Sustainability	193	56	249	192	55	247
Institute for Health and Consumer Protection	100	58	158	87	54	141
Institute for Prospective Technological Studies	39	17	56	33	18	51
Directorate General, Programme and Resource Management and Institutional and Scientific Relations	288	119	407	271	117	388
TOTAL	**1236**	**406**	**1642**	**1177**	**395**	**1572**

Visiting staff

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

Visiting staff	2002 M	2002 F	2002 Total	2003 M	2003 F	2003 Total
Trainees	31	22	53	19	20	39
Postgraduate grant holders	53	51	104	42	36	78
Post-doctoral grant holders	60	29	89	48	22	70
Visiting scientists	19	5	24	21	10	31
Seconded national experts	18	6	24	29	9	38
Auxiliaries	141	156	297	211	227	438
TOTAL	**322**	**269**	**591**	**370**	**324**	**694**

Equal opportunities

The JRC takes a proactive stance with regard to promoting equal opportunities and, in particular, gender equality in its working environment. The JRC-wide network on "Women and Science", set up in 2000, continued monitoring gender equality in the organisation. In addition to monitoring progress on recruitment, promotions and managerial positions, the network undertook a comparative study on social working environment aspects and noted the successful implementation of the code of good practice concerning maternity leave replacement. Concerning visiting scientists, gender parity continued to improve with women up to 46.7% by the end of 2003.

Budget (budget and expenses –institutional activities)

The available credits to the JRC are subdivided into staff expenses, means of execution (maintenance of buildings and equipment, electricity, insurance, consumables, etc.) and specific credits (direct scientific procurements). The credits come from the institutional budget, made available directly from the European budget to the JRC for the Sixth Framework Programme. On the institutional budget, the following sums were committed:

In million euro (€ million)	2001	2002	2003
Staff expenses	160	163	168
Means of execution	49	49	53
Specific credits	40	38	35
TOTAL (rounded)	**249**	**250**	**256**

In addition, a total amount of €13 million was made available to finance an action programme to shut down and decommission nuclear installations and manage the waste-activities related to the EURATOM treaty.

Additional credits of €14.7 million came from contributions of countries associated to the framework programme and from competitive activities undertaken by the JRC.

JRC Competitive activities

The table below shows the values of contracts signed and inscribed into the 2001, 2002 and 2003 accounts.

Contracts Signed (€ million)	2001	2002	2003
Indirect Actions	14.1	2.3	4.1
Competitive activities outside FP	9.3	13.8	17.3
Third party work	11.4	5.2	4.5
TOTAL	34.8	21.3	25.9

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

In response to the first calls for proposals of 2003, the JRC enjoyed a success rate of almost 50% with 77 new proposals awarded. These include participation in 15 Networks of Excellence and 22 Integrated Projects, both new instruments of FP6. Examples of projects funded are:

- Sustainable introduction of GMOs into European agriculture
- A network on actinides research
- A network on nanotechnologies
- Sharing experience on risk management (health, safety and environment) to prepare future industrial systems
- Storage of hydrogen
- The future of identity in the Information Society.

Competitive activities outside the Framework Programme include additional paid work for Commission services that is not covered by the JRC's own work programme. 29 new contracts were signed in 2003 for a total amount of €17.3 million.

Institute	Monographs and EUR reports	Articles[1]	Conference Proceedings[2]	Conferences[3]	Special Publications[4]	Total
General Management	2		1	5	62	**70**
IRMM	27	71	42	95	7	**242**
ITU	1	78	48	80	8	**215**
IE	15	28	65	16	21	**145**
IPSC	30	33	91	74	48	**276**
IES	66	167	128	204	38	**603**
IHCP	26	57	34	122	24	**263**
IPTS	32	20	5	56	14	**127**
TOTAL	**199**	**454**	**414**	**652**	**222**	**1941**

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

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Abstract

Report on the activities, accomplishments and resources related to the JRC work carried out in 2003. An overview is given of the mission and its implementation, the scientfic activities and the relations with the outside world.

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JRC Annual Report 2003

JRC Annual Report 2003

The cover shows a new global land cover database for the year 2000 (GLC2000), completed in 2003 by a worldwide partnership of over 30 research organisations under the leadership of the JRC. This new map fills an important gap in our knowledge concerning the distribution of vegetation and other land cover on our planet.

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