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Joint Research Centre

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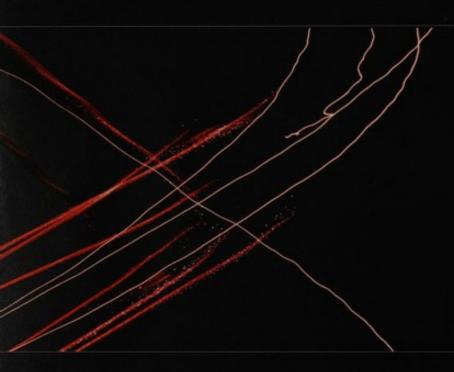
European Commission

Joint Research Centre (DG JRC)

Contact:

Mrs Lena Torell

Director of Programmes
Directorate-General JRC
Square de Meeûs 8 • 10/20
B-1050 Brussels
Tel. +32 2 296 72 16 / 296 88 91
Fax +32 2 296 18 35
E-mail: lena.torell@jrc.cec.be



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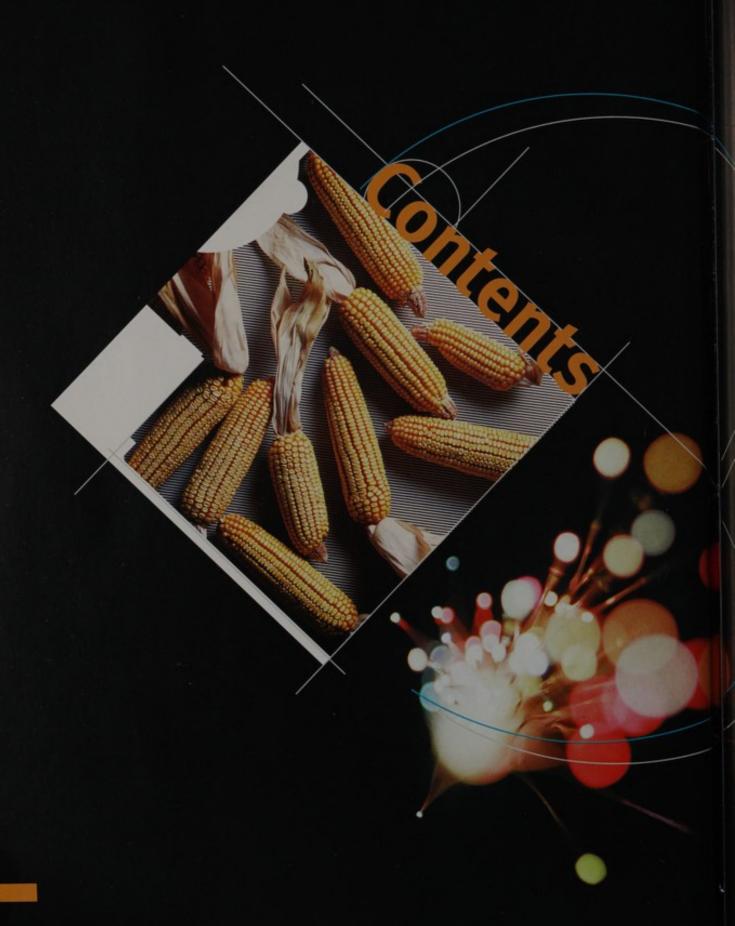


Joint Research Centre









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Introduction

The Joint Research Centre has undergone considerable change throughout 1998. With the appointment of Mr. Allgeier as Director-General, renewed emphasis has been placed on the JRC's role of supporting the European Union through the provision of an underpinning research that increases the validity and credibility of its policies. This has been reflected both at the strategic level, in the reformulated mission statement, and, on a practical level, in the creation of the Institute for Health and Consumer Protection (IHCP). This new institute consolidates the numerous contributions of the JRC to this increasingly important area.

Alongside this, much effort was devoted to the detailed preparation of the new Fifth Framework RTD programme. For the first time the JRC has its own separate work-programme, structured around European policies which focus on the concerns of the individual citizen, the alleviation of conflict between man and the environment, the promotion of sustainable development and the assurance of safe nuclear energy. Determining the priorities and refining the content has involved close contact with European policy-makers throughout much of the year.

The JRC places great importance on its role as a strategic partner to the scientific and industrial communities. Throughout 1998, it continued to actively participate in numerous networks and research collaborations involving economic and scientific actors from all over Europe. Such work also includes improv-

ing the availability of research results, facilities and installations to industry and other research centres. Technology transfer initiatives, started in 1998, aim to increase the exploitation of these results, thus supporting Community innovation policies.

Various achievements have helped to increase the visibility of the JRC to the research community and the general public. Important examples can be found in all the institutes:

- ► The opening of a new cancer treatment facility in Petten
- ▶ The validation of the first test to detect genetically modified organisms in food
- The ISO 9001 certification of the Institute for Transuranium elements
- ▶ The organisation of the conference on humanitarian demining in Ispra
- The launching and implementation of the "Futures" project
- The completion and official opening of the training centre in Obninsk (Russia).

The visibility of these achievements was aided by a proactive communications policy, which resulted in significant press and media coverage. The JRC looks forward to strengthening further its capacity to serve Community policies to create a better, prosperous, healthier and safer society in Europe.

Joint Research Centre











Geel

Kartsrune

Petter

Ispra

Seville

The Joint Research Centre

The JRC is the European Union's scientific and technical research laboratory, forming an integral part of the European Commission. It provides scientific advice underpinning EU policies. Over the years it has developed special skills and unique tools to provide independent and Europe-wide expertise to better understand the links between technology, the economy and society.

The JRC carries out Community research programmes decided by the Council and funded by the European Union budget with additional funding from associated countries. It also provides customer-driven research as scientific and technical support for other Community policies, such as those on the environment, agriculture or nuclear safety and is involved in competitive activities in order to validate its expertise and increase its know-how in its core competencies. Its guiding line is that of "adding value" where appropriate rather than competing directly with establishments in the Member States.

Five separate sites, located in Belgium, Germany, Italy, the Netherlands and Spain, house eight different institutes, each with its own focus of expertise.

The JRC headquarters is located in Brussels, with the Programmes Directorate serving as a link between the institutes and the policy makers. The Directorate coordinates the research performed by the eight institutes and helps to ensure its quality by interacting with the international scientific community and industry. An important role of the Directorate is to promote technology transfer of JRC's own research results both to create industrial added value and to support the Community's policies in Innovation.

The JRC employs about 2500 staff under different schemes and uses a budget of over 300 Mio ECU per year stemming from the European Research budget and from competitive income. Each of the eight institutes produces its own Annual Report, where readers will find more comprehensive information. The JRC also publishes numerous technical reports and contributes to scientific journals, presents papers frequently to conferences and organises workshops, seminars and conferences to disseminate its scientific output. Further information can also be found on the JRC website:

www.jrc.org



Observations of the



Board of Governors

The Joint Research Centre has undergone much change in the course of 1998.

First of all, the reorientation of the mission of the JRC: to provide customer-driven scientific and technical support for the conception, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union.

The Board acknowledges the efforts carried out by the new JRC management to adapt the scientific activities to the priorities of the European Union policies and to re-structure all JRC activities around its new mission.

The impact of the new mission is already demonstrated in the present 1998 Annual Report illustrating the JRC work during the last year of the 1995-1998 programme period under the 4th Framework Programme of Community Activities in Research and Technological Development. The report thus highlights several JRC achievements in the service of the European citizens and in support of a large spectrum of the EU policies.

The European Technology Transfer Initiative project represents an imaginative step towards optimising the use at European and world-wide level of JRC research and technological results. The Board, aware of the inherent challenge of a project of this nature, will continue to watch its viability in the coming year.

The Board notes the JRC's performance in competitive activities, notwithstanding the end of the Fourth Framework programme and consequently diminished opportunities for participation in the shared cost action programmes.

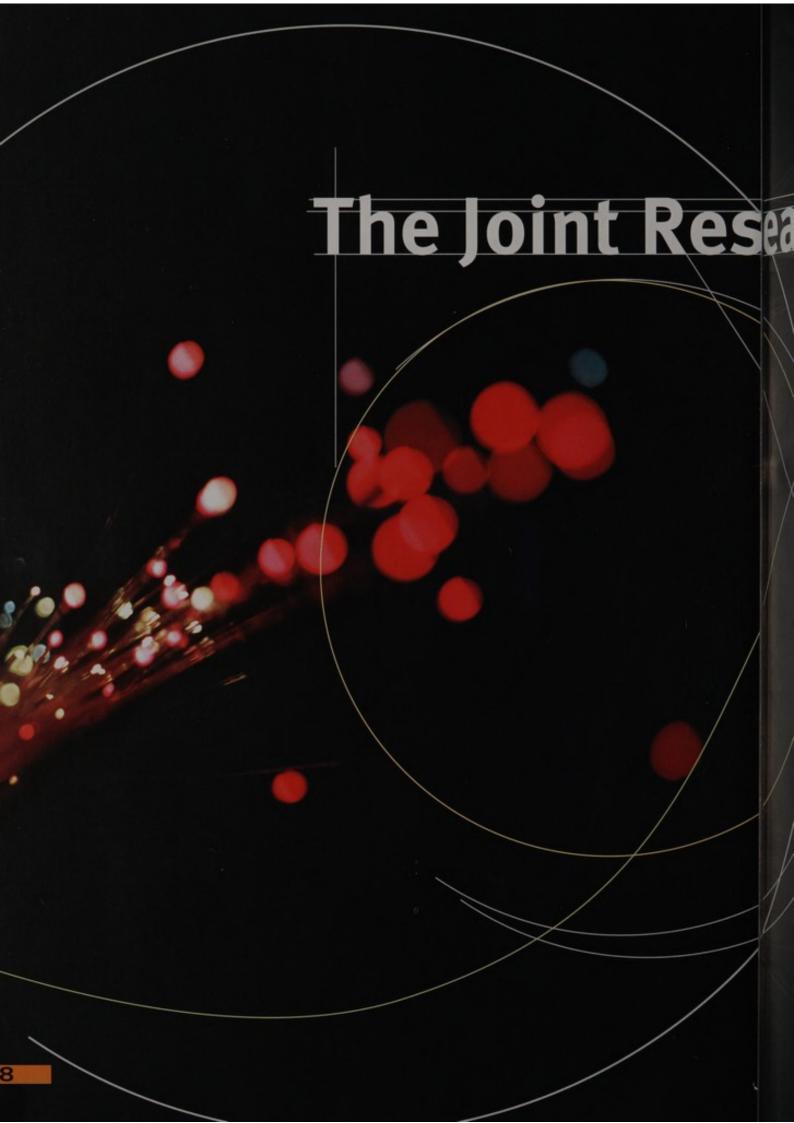
Such participation also leads to increased collaborations with national research and industry. The Annual Report testifies to the multitude and quantity of these collaborations. With regard to the HFR Supplementary Programme, operated by the JRC in Petten, the Board welcomes the inauguration by the Commissioner Cresson of the Boron Neutron Capture Therapy facility, and the promising results of this therapy for some brain cancers.

The JRC in 1998 devoted much effort to preparing the Fifth Framework Programme and the JRC specific programmes. The Board was closely involved in this demanding process which led to the endorsement by the Council and Parliament of the JRC's Specific Programmes as proposed by the Commission with the approval of the Board. The difficult compromise on the financial resources led to final figures lower than originally proposed implying the need for a further effort to reduce administrative and overhead costs and to rationalise the use of resources.

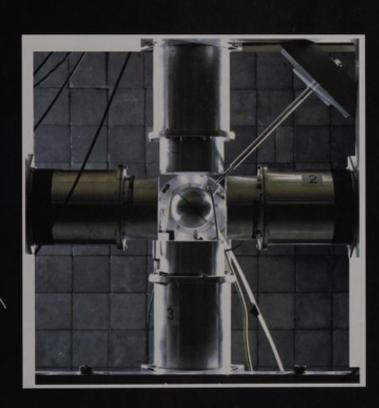
In line with the new mission, an internal reorganisation took place in 1998 with the setting up of the Institute for Health and Consumer Protection, the Administration Directorate and the Audit Unit as the most important. The Board welcomes Mr. Jean-Marie Cadiou as new Director of the IPTS in Seville, Mrs. Lena Torell as new Director of Programmes and Mr. Raoul Prado as Director of the new Administration Directorate.

The Board has said farewell to the former Chairman, Professor Flemming Woldbye. The Board expresses herewith its appreciation and warm recognition to him for the many years of service he has dedicated to the JRC Board of Governors.

The Board expresses its thanks to the Commissioner, Mrs. Edith Cresson for her unfailing support of the JRC. Finally the Board send its thanks and appreciation to the entire JRC staff for its hard work and dedication during the demanding year of 1998.



esearch Centre in 1998



Refocusing the mission

Scientific and technological developments increasingly impinge on our quality of life, working conditions, the environment and its effect on our health and climate. They also shape the decisions taken by our policy makers and by the important players in industry.

Such progress in technology, particularly in the life sciences and information technology is changing the way we live, the way we do business and the world we live in. The need to achieve fully sustainable development further adds to the complexities facing us. Many scientific or technological advances, such as the development of genetically modified organisms, spark fresh debate on their supposed advantages and inherent risks.

The challenge for public policy is to strike a balance between the desire of individuals to enhance quality of life, the need to protect the natural environment, and the need to provide a predictable and calculable framework for economic activity, both within the EU and internationally. To address this challenge, our decision-makers need unbiased, policy-relevant, policy-sensitive advice, based on scientific knowledge and experience, shared objectives and concerns, and which is independent of private or national interests. Sound scientific underpinning also provides added credibility to the policy-making process thus helping acceptance of new policies.

For European Union policy-making there is a wellsuited place for such scientific activity namely at the Joint Research Centre of the European Commission. The JRC's mission statement has been refocused to stress its pivotal role in this process:

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

To carry out its mission, the Joint Research Centre has a unique combination of facilities and expertise transcending national boundaries. Moreover through its networks it stimulates collaborative research and broadens its knowledge base.



Earth Observation

Clean Technologies

Systems Analysis and Informatics

Water and Air Quality

Socio-economic Intelligence

Nuclear Energy

Health and Food

Non-nuclear Energies

Normalisation, Standardisation, Benchmaking

Nuclear Safety, Safeguards and Waste



Reshaping the organisation

Modern consumers are increasingly concerned about the food they eat, the beverages they drink and the quality of the goods they buy. EU policy seeks to improve consumer confidence and to ensure that the consumer is not deceived by counterfeit or adulterated products, or exposed to unnecessary risks and hazards by simply making a purchase. In creating a new institute at the JRC the European Commission has highlighted its commitment to improving the quality of life of all European citizens.

The new Institute for Health and Consumer Protection (IHCP) aims to serve this goal by the establishment of clear standards, as well as the development and validation of methods to guarantee the origin, safety and quality of commercial goods such as processed foods, animal feed, cosmetics, drugs, and chemicals.

The IHCP pools resources that were previously allocated to Institute for Advanced Materials in Ispra, the Environment Institute and the Institute for Systems, Informatics and Safety. By gathering the available expertise under one roof, critical mass and increased efficiency can be achieved.

Prompt and accurate response to new health concerns is essential. The new Institute for Health and Consumer Protection (IHCP) recently validated analytical methods for the detection of GMOs (genetically modified organisms) in food. The Institute for Reference Materials and Measurements (IRMM) has produced and certified the world's first reference materials for GMOs to enable these tests to be carried out. These reference materials are now commercially available. These are the first steps in support of the "Novel Food Regulation" which requires genetically modified foods to be labelled.

Other changes were made to rationalise and streamline the organisation, such as concentrating the Institute for Advanced Materials at the Petten site in the Netherlands and reorganising the overall JRC administration. The Environment Institute has been restructured, focusing completely on environmental issues including new activities in the renewable energy field. In addition, the headquarters in Brussels and its Programmes Directorate was reshaped to make it easier for policy makers to interface with the scientific expertise in the JRC institutes.

Three new appointments of Directors took place in 1998: Mr. Cadiou at the IPTS, Mrs. Torell at the Programmes Directorate and Mr. Prado as Director of Administration.

Schematic overview of JRC's activities in 1998

Institutional research activities

In the final year of the Fourth Framework programme the JRC research activities contributed to the following lines of the Community Framework Programmes:

- ► The Industrial Technologies and Materials Technologies programme was carried out by IAM encompassing research on the performance of advanced materials, on surface engineering, and on non-destructive evaluation techniques for the inspection of industrial structural components.
- The Measurements and Testing programme encompassed research on reference measurements and materials, carried out by IRMM, and on the assessment of the reliability of buildings and civil engineering structures, as well as on the safety of vehicles carried out by ISIS.
- The Environment and Climate programme included work on global change and environmental quality, research on the atmosphere, water, soil, and waste pollution, executed by EI, the Centre for Earth Observation (CEO) and applications of remote sensing techniques, carried out by SAI, and natural hazards studies carried out by ISIS.
- The Non-Nuclear Energy programme consisted of research on the standardisation of photo-voltaic devices and energy storage, carried out by EI, and on materials for clean technologies, by IAM.
- The Targeted Socio-Economic Research programme included technology watch with the Science and Technology Observatory function and prospective work carried out by IPTS.
- The Nuclear Fission Safety programme encompassed a number of research activities ranging from studies on reactor safety carried out by ISIS and IAM, to research activities on nuclear safeguards and fissile materials management, executed at ISIS and ITU. ITU also carried out research on the safety of nuclear fuels and actinides.
- The Controlled Thermonuclear Fusion programme (Technology and Safety) was carried out by ISIS and IAM, with work on fusion materials and remote handling.

The institutional research activities executed in the eight JRC institutes are summarised in *Table 1*, and accounted for 65% of JRC's institutional programme activity in 1998. A more detailed description per institute is provided in the second part of this document. However, a short summary of the key activities performed in 1998 is given here.

At the Institute for Reference Materials and Measurements (IRMM), important reference materials were prepared and distributed for environmental monitoring, for quality assurance in production of foodstuffs and for neutron dosimetry. Particularly important for consumer health were the reference materials produced to detect genetically modified organisms in food and those to detect BSE contamination in animal feed.

The expansion of the International Measurements Evaluation Programme (IMEP) continued, helping laboratories worldwide to compare their measurement results. New measurement methods were also developed to identify oxidative hair dyes and for speciation of selenium in animal foodstuffs, both important for consumer health.

At the Institute for Transuranium Elements (ITU), the actinide research carried out continued to improve the understanding of the complex behaviour of actinides in different parts of the fuel cycle including waste management. Considerable progress was achieved in the area of thin actinide films and in the determination of high temperature properties of mixed oxide uranium and plutonium fuel. High burn up studies on fuel continued and the investigation of the molten bundle from the PHEBUS reactor safety experiment was completed and evaluated.

First preliminary leaching results on fuel simulating conditions of 500 years of storage were obtained. The Institute also continued its efforts to help decreasing the long-term hazard of highly active nuclear waste. An important breakthrough was achieved in the demonstration of the DIAMEX process for partitioning and transmutation.

As a spin-off of the Institute's basic research, medical applications of actinides are studied. Testing of alphaimmunotherapy has been extended to different cancer types, carried out in several European hospitals.







The Institute for Advanced Materials (IAM) continued research on improving the performance of materials for industry and transport applications, both in designing new materials and in implementing new types of surface treatments, e.g. to reduce needs for liquid lubrication in machining. A new facility allows for assessing the damage produced by the effect of hydrogen on steel, e.g. in vessels.

The activities in the NESC, ENIQ and AMES networks, which address issues in structural integrity, continued in 1998, resulting i.a. in the ENIQ Recommended Practices for Technical Justification.

In 1998, the Institute for Prospective Technological Studies (IPTS) addressed various technological matters to ensure a Europe-wide assessment of scientific and technological change and to gain a better understanding of technology in the socio-economic environment.

A major initiative "the Futures project" was launched to analyse the likely impacts of changes in Europe in the next ten years. In order to secure direct access to a large network of specialists, IPTS has also further developed the European Science and Technology Observatory (ESTO) to more than 30 European S&T organisations.

The Environment Institute (EI) continued the study of atmospheric processes, contributing to international programmes. Work was performed in the measurements of ozone and its chemical precursors. In the area of water quality, studies were performed to harmonise existing analytical methods. The European Reference Laboratory for Water Pollution (LEPE) was established to consolidate the scientific and technical support to the Community policy in the field of water.

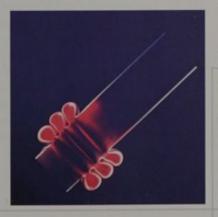
Expertise in specific technologies to improve the use of photo-voltaics has been continuously increased and the high level position of the institute in this area has been consolidated.

The Institute for Systems, Informatics and Safety (ISIS) has contributed to implementing policies alleviating the dangers of natural and man-made hazard, in analysing the cyclic behaviour of construction materials under earthquake conditions or the resistance of transport means in a crash using its unique ELSA and LDTF facilities.

New tools and instruments were developed to increase the efficiency and effectiveness of Safeguards, avoiding that nuclear material falls in the hands of non-authorised people. New challenges are faced by the excess of nuclear weapons world-wide and the enlargement of the European Union. Work also continued on strategies in case of severe nuclear accidents, using the FARO and KROTOS facilities.

The Space Applications Institute (SAI) contributed to global vegetation monitoring in installing an operational tropical forest information system and in developing the World Fire Web. Forestation has an important impact on the greenhouse effect and is a contributing factor to achieve the guidelines set in the Kyoto protocol. It continued its activities to develop a high-quality data-archive on marine resources and coastal zones as well as the development of remote sensing systems applied to environmental issues.

As for the Centre for Earth Observation, an important effort was devoted to the presentation of the results of CEO-initiated projects and the launching of the Earth Observation data and information exchange system (INFEO).





Institutional support activities

The JRC's scientific and technical expertise continued to be made available to the various services of the Commission to support the conception, implementation and monitoring of Community policies. The content of these support activities is defined in collaboration with the customer services. They accounted for 35% of JRC's institutional programme activities in 1998. They are summarised in *Table 2*.

The institutional support activities are customer driven and are developed in close relationship with the decision-makers in the Community policies that are benefiting from them. A detailed description per institute is provided in the second part of this document. However, a short summary of some of the key activities performed in 1998 is given here.

Support to the Environmental Policy provided necessary neutral, technical and scientific background for the definition and implementation of Community policy on chemical and atmospheric pollution, water quality, chemical waste, industrial risks and nuclear safety. This support has taken practical form in 1998 i.a. in:

- Risk assessment and documentation work carried out at the European Chemicals Bureau (ECB) where more than 700 chemicals were classified and labelled
- Support for the harmonisation of air-pollution measurements, focusing on benzene and carbon monoxide, in preparation of a European directive
- The validation of non-animal test methods for photo-toxic potential and for identifying skin corrosives (ECVAM)
- Delivery of new tools and systems to support planning and monitoring in the area of major hazards (MAHB)
- Support to the European Environmental Agency in the European Topic Centre for Land Cover
- Development of BAT (Best Available Techniques) Reference Documents for the implementation of the Integrated Pollution Prevention and Control (IPPC) directive in the European IPPC Bureau.

Support to the Consumer Policy and Agricultural Policy in carrying out activities to improve food quality, the information given to consumers, the registration of pharmaceutics i.a with:

- The delivery to the European Medicine Evaluation Agency of a new information system for market authorisation of medicinal products (ETOMEP)
- Supporting activities for the validation of analytical methods to control the quality or origin of food products and the effects of material in contact with food

- The supply of reference materials to assure the quality of food products in industrial production processes
- The co-ordination of the large-scale pilot project on electronic animal identification and tracing methods and the development of a supporting database
- The provision of satellite-based data on crop growth and on the identification of vineyards.

Consumers are increasingly reluctant to eat meat unless its origin can be clearly identified and labelled. The large-scale testing project (IDEA), which involves electronic tagging of over one million farm animals, could significantly reduce legitimate consumer concerns. ISIS is responsible for the development and implementation of new systems to increase efficient animal monitoring, especially with regard to health and intra-community transport.

Support for Nuclear Safeguards aims to improve the security of storage, processing and transport of nuclear materials. The JRC designs and implements new systems, procedures and instruments to achieve this goal. It also contributes to the training of inspectors carrying out the monitoring tasks involved in the system of Nuclear Safeguards. In 1998 this was done i.a. with the following activities:

- Supply of nuclear reference materials for neutron dosimetry
- The development of highly precise measurement methods
- The installation of on-site laboratories in Sellafield and la Hague
- Training of inspectors and the design and implementation of a training centre in Russia.

In addition to the above mentioned support activities, the JRC has also provided help to Industrial Policy in high performance computing and networks as well as in reliability and safety of systems. Furthermore, its pre-normative research work results in useful inputs for the standardisation and normalisation in industry.

The JRC has also continued to support the Commission's anti-fraud services with specialised software, systems and satellite data. An example of this activity is the provision of satellite based data on olive tree populations to control declarations.



Competitive activities

Suitably targeted competitive work nourishes the JRC's capacity to give impartial support to Community policies by incorporating new expertise and know how, validation and benchmarking. Project selection takes into account the present and future needs of the political agenda and the existing JRC expertise and research focus, while closely respecting the subsidiarity principle. The JRC positions itself in relation to other research centres as a preferred partner for the promotion of European excellence.

In line with the refocused mission statement, there was a noticeable trend towards more competitive work linked to the Commission and less third party work. This is consistent with the alignment of all research projects with the core business of the JRC in the support of Community policies. It should not be interpreted as abandoning the principle of third party work, but rather as a change in balance in the different activities.

Two JRC projects have received highest ratings in the INNOVATION programme's call. The first one concerns the clinical testing of Alpha-immunotherapy cancer treatment on Non-Hodgkin Lymphoma (ITU). The second one is related to the transfer of the STARS systems design software developed for industrial applications to the area of risk management in capital fund investments (ISIS-IHCP).

HFR Supplementary Programme

The Commission operates the High Flux Reactor (HFR) at Petten in accordance with the Euratom/Netherlands agreement of 25 July 1961. On 27 June 1996, the Council adopted a four-year (1996-1999) supplementary research programme at the HFR to be implemented by the JRC for the European Atomic Energy Community. Three countries support the supplementary programme: Germany, the Netherlands and France.

Besides traditional work for the nuclear R&D and industry, it was decided to dedicate a large part of HFR activities to medical applications. On the basis of contractual relationships, the reactor is now a major contributor to the production of medical radioisotopes for the European radio-pharmaceutical industry.

The first thing to highlight in the operation of the HFR throughout 1998 is the large number of operational days, which exceeded 270, and an 80% occupancy rate for the reactor, without any risk.

The major event of the year was the inauguration by Mrs. Cresson of the Boron Neutron Capture Therapy (BNCT) cancer treatment facility. The production of isotopes for medical applications was maintained. A number of successful transmutation experiments have also been carried out.

able 1 – JRC Research Activities RAMEWORK PROGRAMME LINES	IRMM	ITU	IAM	ISIS	IHCP	EI	SAI	IPT
HAIVIEWORK PROGRAIVING LINES								
ndustrial Technologies and Materials Technologies								
Advanced Materials and Standards for Industrial Innovation			_					
Surface Engineering for Improved Properties and for New								
Industrial Applications								
Non-Destructive Evaluation, Testing and Inspection of Industrial								
Structural Components								
Aeasurements and Testing								
Prenormative Research in Support of Construction Norms				-				
and Standards, including Seismic Design Codes (Eurocodes)								
Measurement and Testing for Car Safety								
Reference Materials	1000							
Reference Measurements	1							
nvironment and Climate								
Glabal Change								
Global Change Centre for Earth Observation (CEO)							-	
Atmospheric Processes over European Regions						100000		
Remote Sensing for Terrestrial Biosphere (Land Degradation						100		
in the Mediterranean Region, Forest Monitoring)								
Remote Sensing for Marine Biosphere (North Atlantic Ocean,								
Mediterranean Sea)								
Advanced Earth Observation Techniques (Environment and Road								
Conditions Monitoring and Land Mine Detection)								
Environmental Quality						-		
Techniques & Equipment for Environmental Quality Monitoring								
Innovative Environmental Technologies High Performance Information Technologies for Environmental								
Protection								
Natural Hazards / Seismic Research								
Integrated Environmental Assessment								
Natural Hazards / Flooding, Droughts				1				
on-Nuclear Energy								
Photovoltaic Energy and Electricity Storage								
Materials for Clean Combustion Engines								
argeted Socio-Economic Research								
Technology Watch / Technology-Employment-Competitiveness								
luclear Safety and Safeguards								
Reactor Safety								
European Networks on Component Ageing, Inspection								
Techniques & Structural Integrity Severe Accidents including Probabilistic Studies				_				
				_				
Fuel Cycle Safety Basic Actinide Research								
Safety of Nuclear Fuels								
Mitigation of Long-lived Actinides and Fission Products			1					
Spent Fuel Characterisation in view of Long-Term Storage								
Safeguards and Fissile Materials Management								
Safeguards R&D		- 10						
ontrolled Thermonuclear Fusion								
Fluid Separation and Analysis								
Fluid Separation and Analysis Fusion Materials								
Remote Handling								

Table 2 – JRC Support Activities FRAMEWORK PROGRAMME LINES	IRMM	ITU	IAM	ISIS	IHCP	EI	SAI	IPT
Information Technologies								
Safety and Reliability of Systems								
Geographic Information Systems								
High Performance Computing and Networks								
Environment and Climate								
Environmental Quality								
European Reference Laboratory for Air Pollution (ERLAP)								
European Chemicals Bureau (ECB)					100			
European Centre for the Validation of Alternative Methods (ECVAM)								
Support to the European Environment Agency (EEA)								
Analysis of foodstuffs and chemicals in support of industrial policy								
European Technical Office for Medicinal Products (ETOMEP)								
Quality Control of Consumer Products (Consumer Protection)	100							
S&T Support to the Commission antifraud Services								
Co-ordination Unit of the Alpine Observatory								
Innovative Environmental Technologies								
Industrial Reliability – Biotechnology and Environment								
Major Accident Hazards Bureau								
Agriculture and Fisheries								
Remote Sensing for Agriculture								
Electronic Identification of Animals and Volume Measurements								
European Office for Wine, Alcohol and Spirit Drinks (BEVABS)					100			
Reference Measurements and Materials for Quality Control					100			
of Foodstuffs and Microbiology of Foodstuffs								
Targeted Socio-Economic Research								
Prospective Technological Studies								
luclear Fission Safety								
Reactor Safety								
European Networks on Component Ageing and Inspection			100					
Techniques and Structural Integrity								
Harmonisation of Safety Criteria								
Safeguards and Fissile Materials Management								
Euratom Safeguards Support: General	-							
Euratom Safeguards Support: On-site Laboratories and ECSAM								
IAEA Safeguards Support	A STATE OF							







The JRC as partner

Relevant scientific and technical support to European policy-makers needs full involvement with the issues at stake. Collaboration and individual contact with the international research community and industry is crucial. Interactions with external entities can be either via collaborative research networks, involving no exchange of funds, or through shared cost actions and other competitive activities. Such activities are always gauged in terms of their positive impact on the JRC's core role and selected accordingly.

In 1998 IPTS began a major prospective activity called "The Futures Project". The objective of the Project is to analyse the likely impacts of the major transformations, which Europe will be going through in the next ten years, on Technology, Employment and Competitiveness policies. In the framework of this project, five Panels of more than 80 experts have been set up. The Panels analysed the political and economic changes, the demographic and social trends, the future of natural resources and the environment, the developments in information and communication technologies and the information society and the developments in life sciences and their effect on society. This work will be used to develop a series of scenarios on Technology, Employment and Competitiveness by 2010. The results of this activity will be presented at a final conference in June 1999.

The JRC is active in a significant number of research collaborations, with partners throughout all the Member States. Such partnerships contribute to the scientific integrity of the JRC's advice that underpins European policy-making. By excelling in its core competencies, the JRC is capable of attracting the best available expertise and competence from research centres in the Member states and elsewhere.



A collaboration agreement was signed between the JRC and CEN (Comité Européen de Normalisation) by which the JRC will provide results of pre-normative research indicating areas in which future norms and standards might be needed by industry.



Technology transfer

The JRC produces results with potential industrial interest. This is a useful by-product of its institutional work. A number of initiatives were undertaken in 1998 to improve the efficiency of the transfer of results into industrial products or processes. Transferring JRC's results also has a positive impact on its expertise and capacity to support the conception and implementation of the EU policies in innovation.

Secondments

The Secondment Programme was launched to train scientists from industry or other research centres in one of 17 specific scientific areas at the Joint Research Centre and vice versa. Transfer of know-how takes place through carrying out research. The seconding organisation continues to support the salary and other charges of the secondee. Transfer of intellectual property rights to the seconding organisation can be arranged where appropriate.

Entrepreneurship Training

During 1998 the concept of an Entrepreneurship Training Programme for scientists was developed, with the objective of teaching business skills to JRC short-term contract staff. This was done in collaboration with key training schemes in entrepreneurship in Europe. The JRC would also communicate best practice and serve as a role model for other (training) initiatives.

Training

More than 45 workshops were organised in 1998, most of them in a specialised scientific area. These workshops were well attended. In 1999, more visibility will be given to these workshops, to increase the access by interested parties.

Access to large installations and specialised labs

The "Access to large installations and specialised labs programme" was developed to offer researchers from industry or other research institutes the opportunity to use one of 40 JRC specialised facilities within their own research project on a time-sharing basis.

European Technology Transfer Network (ETTN)

The European Technology Transfer Network was launched as a pilot project for European policies in industry, innovation and enterprise, to validate and demonstrate the use of Information and Communication Technologies in fostering technology transfer and collaborative research across geographically distant locations. The JRC is both the co-ordinator and catalyst of the project.

Eight new production or distribution licence contracts were signed in 1998 (six on the animal tagging bolus, Generis, Astra) and one new company was created by a former JRC-staff member.

Business innovation centre

A detailed implementation plan on the creation of a European business innovation centre in Ispra was drawn up. This plan includes facilities (use of shared premises and equipment) and the accompanying services to promote/detect innovative projects, evaluate and plan their implementation, and to search for funding and partners. At the other sites—due to their smaller size—discussions have started to involve local initiatives to offer similar support to start ups.





Communications

An important effort was undertaken in 1998 to make the activities of the JRC visible on a larger scale both in the written press and television. A variety of target audiences was tackled through the scientific press, specialised broadcasts or the general press. The resulting coverage, with respect to the JRC's scientific work, has been extensive and very positive.

The JRC has actively participated in the joint communication activities of the "Communication Cell" set up by DG XII (Science, Research and Development), XIII-D (Exploitation of Research), the JRC and DG XXII (Education, Training and Youth). These actions have contributed to increase the JRC's visibility to the general press and its audience. The profile of the JRC has been improved and the general public's awareness of the JRC has been raised.

The following, non-exhaustive list gives examples of press conferences/briefings in 1998:

- A regional press conference on the waste incinerator project, "The JRC research activities in the field of environment for the region Lombardia".
- A press briefing on the creation of the new IHCP.
- ▶ A press conference on the demining symposium, resulting in several positive TV reports and many articles in the European press. For example, the BBC produced a 20-minute programme totally dedicated to the de-mining issue and followed up with 3-minute prime-time news reports.
- A press briefing and a video have been produced for the inauguration of the Boron Neutron Capture Therapy installation at the Petten site. The first European clinical tests on Glioblastoma, a very aggressive type of brain cancer, have been widely publicised by the European press and broadcasted by several European television stations.

- A press briefing and a video release have accompanied the launching of a large scale testing of electronic identification of animals (IDEA). The subject has raised great interest because of the potential outcome of the project, especially with regard to the present BSE context.
- ▶ The official opening of the Russian Methodological and Training Center at Obninsk, 100 km south of Moscow, was given the necessary publicity because of its importance in the future system of nuclear control in Russia. A press briefing and a video were released explaining the pioneering role of the EU in this Russian/European/American project. The scope of the subject was perceived by the European press and TV stations, which gave it a wide coverage.
- A press conference was held in Milan concerning tropical rain forest mapping.

During the year, many journalists visited the different JRC Sites and some journalist organisations like the European Union of Scientific Journalists Associations (EUSJA) and the Union of Italian Science Journalists (UGIS) were contacted to promote the JRC's work. These contacts resulted in articles in the general press and in broadcasts on radio and television.

The JRC was present with a stand i.a. at the following fairs and conferences:

- Entsorga, a fair about treatment of waste, May, Cologne.
- Expo 98, world exhibition, May-September, Lisbon.
- SITEF, a fair on innovation technologies, October, Toulouse.
- ► ENC, European Nuclear Congress, October, Nice.
- Materialica, a fair on new materials, September, Munich.
- Innovation Congress, November, Vienna.

The JRC received more than 10.000 visitors at the different sites, on the occasion of conferences, workshops or visits to the laboratories by industry, press or other interested parties.

The figures

Staff

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

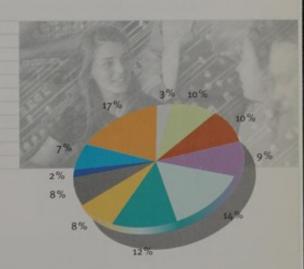


In these figures, about 1600 staff members can be considered as scientific staff out of which some 600 are employed on short term contracts (1-3 years). In 1998, there has been a decrease in the number of statutory staff and an increase in grantholders and visiting scientists. This is explained by a change in emphasis on the staff table from technical-scientific staff (B-grade) to senior scientific staff (A-grade) which was not possible to fulfil with the present staff table. An increase of the authorised number of A-grade staff has been approved by the Budgetary Authority and new recruitements of A-grade temporary staff will take place in 1999. There has also been an increase in seconded national experts.

In 1998, a first step has been made to the implementation of the new Commission staff policy for staff financed on the research budget (NPPR). In this policy a flexible portion of temporary agents (35% of the statutory staff on 5-year contracts, 25% on 3-year contracts) complements a stable foundation of officials (40% of the statutory staff). In 1998, 125 statutory staff members have left the JRC (retirement or end of contract). 77 new statutory staff members have started. An important effort has taken place to replace key senior staff members, who started their career at the early stages of the JRC, by fresh high level scientists. This effort will continue in the next few years when many other staff members will retire.

Staff distribution

	1996	1997	1998
DG and Programme management	51	61	57
Institute for Reference Materials and Measurements	181	189	189
Institute for Transuranium Elements	186	190	187
Institute for Advanced Materials	267	291	166
Institute for Systems, Informatics and Safety	276	287	250
► Environment Institute	222	240	211
Space Applications Institute	100	147	141
Institute for Health and Consumer Protection	-	-	150
Institute for Prospective Technological Studies	35	43	42
► Administration	428	426	130
▶ Ispra Site Infrastructure			300



Budget and expenses-institutional activities

The available credits to the JRC are sub-divided in staff expenses, means of execution (maintenance of buildings and equipment, electricity, insurance, consumables, etc.) and operational credits (scientific acquisitions). The credits come from the institutional budget,

made available directly from the European budget to the JRC, from associated countries and from competitive activities. On the institutional budget the following sums were committed:

(in mio ecu)	1996	1997	1998	1996	1997	1998
Staff expenses	143	155	160		TO TO	
Means of execution	45	48	51			
Operational appropriations	38	44	48	1987		
Total (rounded)	226	247	259		The second second	AX

The increase in commitments in 1998 is explained by a particular effort to attract grantholders, bringing in fresh resources and new expertise.

Competitive activities

The results of the competitive activities over the four years of the Fourth Framework programme are presented in the following table. 1998 was a transition year for competitive activities. The Fourth Framework Programme drew to a close, with very few calls for pro-

posals. This resulted in a decrease in shared-cost actions. This was also the final year for the availability of the "competitive support" budget line. In the forth-coming Fifth Framework programme, this mechanism, which allowed all the Directorates General of the Commission to financially support competitive activities, is being discontinued.

	Inscribed in 1995 accounts	Inscribed in 1996 accounts	Inscribed in 1997 accounts	Inscribed in 1998 accounts	Totals
Shared-Cost Actions	3,9*	9,8*	15,5*	10,0*	39,2*
Competitive Support	4,8	10,6	18,5	19,8	53.7
Competitive Activities outside the FWP	1,3	4,2	6,1	5.4	17,0
Third Party Work	18,5 **	13,6**	11,1**	6,8**	50,0**
Totals	28,5	38,2	51,2	42,0	159,9

The figures for shared cost actions only indicate the additional external funds obtained, "Matching funds" from the JRC's budget are not included.

Publications

Institute	EUR Reports	Conferences*	Articles**	Special Publications	Total
IRMM	4	57	65	2	128
ITU	2	84	59	1	146
IAM	30	128	22	19	199
ISIS	28	211	38	29	306
/EI	29	151	60	10	250
SAI	27	149	31	36	243
IHCP	7	22	20	4	53
IPTS	28	20	4	11	63
General Management	5	2	2	42	51
Total	160	824	301	154	1.439

^{*} Conferences include oral and poster presentations and proceedings.

^{**} Not including the activities related to the HFR reactor.

^{**} ARTs include also conference papers published in periodicals.

The work-package for the coming years

As a Commission service, the JRC will closely follow legal and regulatory activities, and react quickly to new concerns or policy needs. As a research organisation with close scientific links throughout Europe, it is in an unparalleled position to alert the Commission to new developments, emerging problems or opportunities requiring policy action. Furthermore, the JRC also has the research capacity and organisational structure to support longer-term policy building and implementation. It is involved in the practical implementation and monitoring of EU policy e.g. through pre-normative research, the provision of reference materials and other tools helping to create a safe, efficient and transparent market.

During 1998, a screening of all the scientific projects was made with regard to the mission statement and the targeted community policies. Each activity was analysed on its relevance, its deliverables, the subsidiarity and critical mass. The results of this analysis were very important for the definition of the JRC's specific programme for 1999-2002. It takes into account the considerable changes undergone in recent years by society and industry. It has been drawn up in close collaboration with Commission policy-makers and will be continuously monitored and adapted where appropriate. The activities are thematically organised around the following four main themes:

Serving the Citizen

- Consumer protection
- Medical and health applications
- Benefiting from the information society
- Safety of the citizen.

Enhancing Sustainability

- Integration of environmental protection in other EU policies
- Pollution prevention and control
- Global change
- Energy and transport
- Agriculture, rural development and fisheries.

Underpinning European Competitiveness

- Employment, technology and industrial competitiveness
- Normative support to the international trading system
- Innovation and technology transfer
- Enlargement, pre-accession and international cooperation.

Safety and security of Nuclear Energy

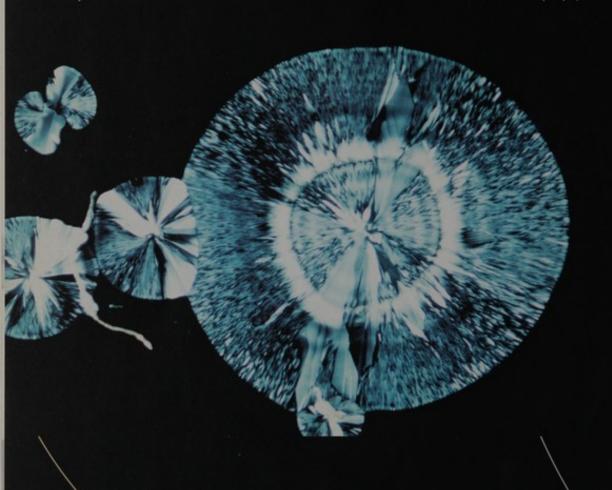
- Nuclear fission safety
- Control of nuclear materials and nuclear safeguards
- > Decommissioning and waste management.

In addition, two horizontal elements run through the research themes. The first of these, measurements, standards and testing, constitutes one of the key specialities of the JRC. The second is a techno-economic intelligence that can provide the EU institutions with timely advice concerning the development of new technologies, the likelihood of breakthroughs, the social challenges they pose and their possible impact on policy.

During a one week event, in a series of thematic workshops, the draft specific programme was presented to and discussed with policy makers in the European Commission's Directorates General. Following useful feedback and policy indications, the final programme was defined. Efforts to organise the new specific programme in a logical and accessible way were much appreciated. This novel approach was greatly appreciated by Commission representatives, and constituted a first step in ensuring a broader understanding and endorsement of JRC activities.







ities of the Institutes in 1998

Reference materials

irm

Institute for Reference Materials and Measurements

The mission of IRMM is to promote a common European measurement system in support of EU policies, especially internal market, environment, health and consumer protection standards. IRMM's prime objectives are to develop and perform specific reference measurements, to produce certified reference materials, to organise international measurement evaluation programmes, to establish transnational databases, and to carry out pre-normative research.

Throughout 1998, the Institute continued to provide substantial support to EU policies in areas such as safety and control of food, environment and health protection, nuclear safeguards and specialised training in measurement sciences.

Its activities are structured around three main areas:

- Reference materials
- Reference analytical measurements
- Neutron data measurement.



IIRMM further extended its tasks and responsibilities for the storage, stability control, distribution, sales administration and re-certification for BCR (Bureau Communautaire de Référence) certified reference materials. Developing such reference materials is expensive, requiring in-depth technical knowledge and relevant experience. The IRMM now holds 500.000 samples in storage and the revenue of the sales of reference materials exceeded 1 Mio ECU in 1998.

The following list gives a flavour of the diversity of new certified reference materials (CRMs) prepared throughout 1998:

- A set of environmental reference materials was prepared for the measurement of rare earth elements in tuna muscle, mussel tissue and sediment. This will assist the monitoring of environmental pollution by these increasingly used elements.
- Preparation of a sludge and a fly ash reference material for the measurement of contamination by polychloro-dibenzo-dioxins (PCDD) and polychloro-dibenzofurans (PCDF) for use in environmental monitoring. This will assist compliance with EC Directive 94/67 EC on the maximum emission of PCDD/DF during waste incineration.
- Reference materials to assist restoration and conservation techniques were also prepared. These include bronze reference materials for corrosion studies on bronze antiquities, and will help calibration of analytical methods for examination of bronze antiquities. Determination of the homogeneity of the produced bronze materials using XRF and PIXES.
- ➤ Certifications of reference materials of foodstuffs continued (butter oil, starch and milk powder and sugar mixtures) to fulfil quality control requirements for the enforcement of European legislation. This is in the context of adulteration of butter oil with other fats (Regulation 95/454 EEC), tracers in butter oil for monitoring the use of rebated butter (Regulation 88/570 EEC).
- Materials for neutron dosimetry were produced for the nuclear energy producing industry and research institutions operating test reactors. These dosimeters are used for neutron fluence rate measurements in the reactor, for safety surveillance purposes and for optimising reactor performance.
- ▶ The supply of nuclear samples to external customers, in particular for reactor neutron dosimetry, was continued. Uranium-doped glass reference materials for the analysis of uranium contaminated soil samples and method validation in High Performance Trace Analysis for Nuclear safeguards were prepared.

As part of the fight against BSE, the IRMM, in co-operation with the IHCP, produced proficiency-testing samples for the evaluation/validation of methods to detect bone meal in animal feed and for the evaluation of the efficiency of heat treatments of animal feed. IRMM is also deeply involved in the evaluation of candidate official post-mortem BSE tests. Approximately 10.000 individually coded fresh frozen spinal cord and brain stem samples originating from more than 1.000 BSE-free and BSE-infected cows are being prepared.

Reference Materials for the detection of genetically modified organisms in soja and maize were certified in collaboration with industry. These CRMs enable the validation of analytical methods applied in the enforcement of the Regulation on Novel Food (EC 258/97). The production of additional concentration levels (1% and 5% respectively) of genetically modified organisms in non-modified materials (soyabean and maize respectively) was initiated to complement the existing series of materials. In addition, the production of materials containing different GMOs is planned.







Reference analytical measurements

The expansion of the International Measurement Evaluation Programme (IMEP), which enables field laboratories worldwide to compare their results to SI-traceable values, continued in 1998.

Comparison round-table discussions on trace elements in water, in serum and in polyethylene were successfully completed. Examples include the discussion on metals in water that was selected by the Consultative Committee on Amount of Substance of the BIPM (the International Bureau of Weights and Measures, France) to act as a Key Comparison. This will involve the participation of more than 10 international metrological institutes and will be co-ordinated by IRMM. This round of discussions has also been selected by European Accreditation Laboratories (EA) to act as a pilot project for result-orientation evaluation of measurement results. Thirty laboratories selected by EA will participate.

First Primary Isotopic Gas Standards; isotope ratio materials are frequently used when studying environmental and climatologic problems, e.g. atmospheric chemistry (for carbon, oxygen and sulphur). However, virtually all of the world's present isotopic comparison samples are not calibrated. A new co-operation was set up between IRMM and a leading multinational company supplying specialised gases for absolute measurements. IRMM has started to certify the isotope ratios for some key gases (e.g. nitrogen, xenon, SF6) which will become available as Primary Isotopic Gas Standards.

Scientific and technical support was provided to the European Commission's consumer protection policy in the field of cosmetic products, co-ordinating the working group "Methods of chemical analysis of cosmetic products" and developing a candidate reference method for identification and determination of oxidative hair dyes.

IRMM continued work on the validation of a ¹³C isotopic measurement method for the diagnosis of stomach diseases. Such non-invasive techniques will allow a substantially more cost-effective and less intrusive diagnosis of internal diseases, such as those caused by infection with Helicobacter pylori which, according to medical findings, is a major cause of ulcers and stomach cancer.

As trace elements play a key role in biological processes, particularly when essential for enzyme activities or when toxic, the development of analytical reference methods to determine these elements in foodstuff is of great interest. One of the most important trace ele-

ments is selenium. This metal protects membranes from damage caused by the peroxidation of lipids. Selenium compounds also catalyse the reactions of intermediate metabolism and inhibit the toxic effects of some heavy metals. For human health, selenium is an essential trace element at low concentrations. At higher concentrations, selenium becomes toxic for man, animals and marine organisms. Methods for speciation analysis of selenium in animal foodstuffs have been developed at IRMM, supporting the implementation of several Community directives (75/63 EEC, 87/153 EEC).

Neutron Reference Measurements

The interaction of neutrons with matter is of fundamental importance for many areas of science like material science, astrophysics and medical science as well as for various technological applications in energy production, mining, non-destructive testing, etc. For these applications a complete and accurate neutronic database is required which is freely accessible to scientists and engineers working in various disciplines. The mission of the JRC Reference Laboratory for Neutron Data Measurements is to establish such a database that will not only support the above-mentioned activities but will also enable the safety assessment of developments in the nuclear energy sector (increased fuel burn-up, plutonium recycling, plans for waste transmutation).

With the two versatile neutron sources of the Institute (LINAC and 7 MV Van de Graaff), neutron interaction data measurements were performed for applied purposes, following the recommendations of the OECD.

New neutron reference measurements for the safety of energy production, for waste transmutation and for shielding applications were performed in 1998. Work concentrated on three important standard cross-sections: ³⁰B(n,a), ²³⁵U(n,f) and H(n,n). The total cross section data of ¹⁰B, measured within the framework of an international collaboration on the ¹⁰B neutron cross section standard, were analysed.

At the 7.0 MV Van de Graaff, activation cross sections for about 30 reactions leading to short-lived activation products were measured. Accurate measurements and data analysis were performed to improve the set of neutron data measurement standards, in particular for the total cross section of ¹⁰B, and the fission fragment mass-yield and kinetic energy distributions for the neutron induced fission of ²³⁸U.







Institute for Transuranium Elements

The mission of ITU is to protect the European citizen against risks associated with the handling and storage of highly radioactive elements. ITU's prime objectives are to serve as a reference centre for basic actinide research, to contribute to an effective safety and safeguards system for the nuclear fuel cycle, and to study technological and medical applications of transuranium elements.

Nuclear energy continues to supply about a third of Europe's electricity, and vigilance is still required to ensure a continuation of Europe's outstanding safety record and to efficiently manage the processing and long-term storage of waste. With its considerable infrastructure, equipment and laboratories, ITU collaborates with leading European research laboratories, authorities and industries in the following areas:

- Basic actinide research (research on heavy elements including uranium)
- Safety of nuclear fuel
- Spent fuel characterisation for long term storage
- Mitigation of long-lived actinides and fission products
- Nuclear safeguards.

ITU also provides scientific and technical support for the conception, monitoring and implementation of European Union policies, notably in the areas of nuclear safety and safeguards. In addition, ITU carries out contractual work at the request of various customers.

ISO 9001 Certificate for ITU. After the introduction of a Quality Management system in 1996 and the subsequent audit in March 1998 by DQS (Deutsche Gesellschaft zur Zertifizierung von Qualitätsmanagementsystemen mbH), ITU, as one of the first European nuclear research establishments, was awarded the ISO 9001 certificate.

Basic Actinide Research

The management of highly active wastes is an issue of major public concern. Major programmes in this field are in progress in the Member States including new and innovative fuel cycles, like for example, partitioning and transmutation. A pre-requisite for such fuel cycle activities is the availability of basic, physical, chemical and material science reference data of actinides and actinide containing new fuels, products and waste streams.

The Actinide Group continued work to further elucidate the complex structure of elements and compounds of actinides, which, due to their radioactive properties, are difficult to investigate. Significant achievements during 1998 included isolating a layer of plutonium just one atom thick (a monolayer) for the first time and demonstrating that this monolayer had different properties from plutonium in the bulk. Another first was the successful series of high pressure experiments on two actinides, americium and curium, conducted at the European Synchrotron Radiation Facility, Grenoble and in collaboration with Oak Ridge, USA. Extreme caution was necessary due to the hazard of contamination when handling these elements.

Actinide research also has medical applications. ITU is actively involved in pioneering research in a therapy for cancer treatment, alpha-immunotherapy. Clinical trials got underway with the delivery of the radionuclide, Bi-213, to the Memorial Sloan Kettering Hospital in New York where 15 patients with acute myeloid leukaemia are being treated. The radionuclide is also being used to investigate the effectiveness of alpha-immunotherapy for multiple myeloma, colon cancer and non-Hodgkin's lymphoma in collaborations with the universities of Nantes, Heidelberg and Göttingen.

High-pressure experiments on plutonium compounds have shown abrupt changes of the electronic structure. The work performed demonstrates how a new type of information can be obtained when combining 3 approaches, namely the measurement of lattice constants and electrical properties under pressure together with theoretical calculations (in collaboration with the University of Dresden).

Safety of Nuclear Fuel

The safety of nuclear fuel is of prime concern for operators of nuclear power reactors and fuel fabrication plants, for national and international regulatory authorities and, of course, the citizen. ITU undertakes vital research into factors that limit higher burn-up such as fuel cladding, mechanical and chemical interaction, and enhanced fission gas release. Studying the phenomena occurring during the irradiation of nuclear fuel enhances both safety and efficiency of the nuclear fuel cycle. Results achieved throughout the year include:

- The extension of the high burn-up models of the TRANSURANUS code to heavy water reactors and the treatment of burnable absorbers.
- The extension of porosity distribution determinations of light water reactor (LWR) fuels to very high burn-up.
- The continued development of improved fuel fabrication processes like the Sol-gel process.



Melting point of MOX (mixed oxide) fuel. The thermal properties of reactor fuel (thermal conductivity, specific heat, and melting point) determine fuel behaviour and reactor safety and must therefore be measured very precisely. ITU has developed advanced laser techniques to measure these properties effectively and accurately up to and above the melting point.

Phebus degraded core. The degraded core from the second nuclear safety experiment conducted in Cadarache was investigated thoroughly at the Institute. 14 sections were cut from the molten bundle and examined by various techniques in the ITU hot cells. Results were discussed and evaluated together with European partners.

Spent Fuel Characterisation for Long-term Storage

For long-term storage of irradiated fuel, safety relevant data on the corrosion and dissolution behaviour of fuel under realistic conditions are of utmost importance. After about 500 years of storage (i.e. the guaranteed lifetime of the containers), the fuel's radioactivity will be largely due to alpha-decay. Alpharadiolysis will therefore be a key parameter in determining the dissolution behaviour of the fuel. Preliminary results from experiments with uranium dioxide indicate a significant increase in uranium-leaching rates due to alpha-radiolysis. Similar experiments are performed with so-called 'inert' matrices (i.e., fuel without uranium) in the framework of plutonium incineration programmes.

Mitigation of Long-lived Actinides and Fission Products

ITU is heavily committed to reducing the potential long-term hazard of highly active nuclear waste, and to exploring alternative waste management options. The Institute's contribution to this European effort is essentially in the area of partitioning i.e. the effective separation of long-lived radionuclides, and the fabrication of fuels for "transmutation" or "incineration" of these long-lived actinides and fission products.

Experimental data gathered are compared with theoretical predictions and serve to establish reference data to evaluate the potential benefits/drawbacks of such a waste management concept.

In the framework of a European transmutation programme, fuel pins with high amounts of plutonium were fabricated with advanced technology to study the 'incineration' behaviour at the HFR Petten.

Breakthrough in advanced reprocessing technique. As part of the ITU partitioning programme, the French DIAMEX process was successfully tested in June 1998 on genuine high level waste from reprocessing of commercial spent LWR fuel. The experiment was performed in a centrifugal extractor battery installed in ITU's hot cells. Decontamination and separation factors obtained were excellent, and in all cases higher than the target values. This demonstrates that the DIAMEX process is an excellent choice if partitioning and transmutation are considered an option for waste management.

In the area of fuel targets fabrication, major progress was achieved with the fabrication of three pins for the TRABANT 2 experiment and the final design and start of construction of the minor actinide laboratory. Good progress was also made with the development of a modified powder metallurgy process for high burn-up fuel.

Nuclear Safeguards

Nuclear safeguards are a set of activities by which the International Atomic Energy Agency (IAEA) and the Euratom Safeguards Directorate of the Commission (Luxembourg) seek to verify that states or plant operators are not using nuclear material or equipment to develop or produce nuclear weapons. In its work, ITU has developed new separation chemistry which permits downscaling of sample quantities to just a few nanograms (10° g) of plutonium. Further downscaling to picogram-sized samples is currently under way.

The age of seized nuclear material was successfully determined by a highly sensitive mass spectrometer after separation of the daughter nuclides. A measurement method, which can be used in the field to determine oxygen isotope ratios in uranium oxide, was also developed.

ITU supports the Euratom Safeguards Directorate with the installation and commissioning of the On-Site Laboratory at Sellafield, UK, and the Laboratoire sur Site at Cap de la Hague, France. At Sellafield, the introduction of an improved analytical approach enabled a fifty per cent reduction in waste from the initially expected amounts. The non-destructive measurement equipment was automated to allow unattended and overnight operation. A comprehensive analytical quality control concept was also developed and implemented for a laboratory information management system.

Construction of the Laboratoire sur Site at Cap de la Hague was completed. A robotised glove-box was developed, designed and built, and analytical equipment was tested and shipped to La Hague.

ITU improved the high performance trace analysis/ environmental sampling techniques to cope with increased amounts of samples and also swipes coming from hot cells. ITU supported Member State authorities and the International Technical Working Group of the P-8 group in the area of illicit trafficking of nuclear and radioactive materials.



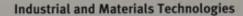


jam

Institute for Advanced Materials

The mission of IAM is to support the sustainable development and competitiveness of European industry through research on the structural integrity and performance of materials in components and processes in areas of concern to the public. The prime applications are in the sectors of energy, transport, chemical processes and civil engineering. The Institute manages the High Flux Reactor (HFR) for the benefit of the European nuclear industry and supports nuclear and radiation applications in medicine.

In 1998, the institute was restructured in order to tackle more efficiently industrial materials issues. As a consequence, the institute is now solely on the Petten site. Former activities related to consumer protection were transferred to the recently created Institute for Health and Consumer Protection (IHCP). Activities related to renewable energies (photo-voltaics, hydrogen, biomass) were transferred to the Environment Institute (EI).



A clear need for support has been identified in the European Industry for strategic research and prenormative/standardisation activities in the areas of materials and surface engineering. Furthermore, the experience of Non Destructive Evaluation (NDE) technology gained from the nuclear field has various applications benefiting non-nuclear industries and standardisation and thus needs to be promoted.

In that sense, IAM carried out its work along three main lines in the field of Industrial and Materials Technologies:

- Advanced materials (standards for application)
- Surface engineering for improved properties
- Non-destructive evaluation NDE (testing and inspection of structural components.

Advanced materials research continued on improving the performance of materials for industry and transport applications, focusing on pre-normative support to standardisation in the field of testing and measurement, and on the experimental and computational characterisation of materials.

Main scientific achievements include the setting up of a neutron diffraction facility for the measurement of residual stresses in industrial components, the implementation of a test facility for combined creep and thermal fatigue in components, the design and prototyping of an apparatus for the testing of fibres used to reinforce continuous fibre ceramic matrix composites, the development of a new ceramic matrix composite material system and of the associated processing route, the improvement of the corrosion resistance of relatively low cost steels to a level rivalling that of more expensive higher-alloy steels. In addition, IAM participated in 1998 in VAMAS Steering Committees meetings as well as various meetings of CEN Technical Committees where IAM contributed to drafting of standards. IAM is also active in ISO Technical Committees.

This experience was used to serve the Kyoto protocol, as increased efficiency is the key to decreasing emissions in advanced power plants. This objective can be achieved by new materials technology. One example of these achievements is a Thermie Shared-Cost Action where IAM's role consisted in studying design properties of newly developed materials for application in high-efficiency supercritical steam power generation plant.



A new Ceramic Matrix Composite (CMCs) material was developed, based on a two-step fabrication process of aqueous ceramic powder slurry followed by a low viscosity liquid polymer infiltration. This technology, for which several patents have been filed, leads to low cost near net shape components (discs, rings and tubes). The concept has been successfully demonstrated with C/SiC composite brake lining discs.

In surface engineering, the development of hard, low friction coatings was continued to reduce needs for liquid lubrication in machining. A number of such coatings were synthesised by co-deposition of titanium nitride (TiN) and molybdenum disulphide (MoS₂) using a reactive arc process and magnetron sputtering. Tests with coated drills under dry machining conditions revealed a considerably higher lifetime compared to normal TiN coatings. Use of radiotracer methods for determination of materials release was further expanded in 1998 to include a laboratory for automotive engine testing. This laboratory became licensed and operational at the end of 1998.

A novel chemical synthesis technique was developed to produce nano-crystalline particles of cerium oxide for use as the oxygen storage component in the wash-coat layer in 3-way catalytic converters. The new technology will enable exhaust emissions from automobile engines to be reduced. A patent application covering the synthesis technique was filed.

In the area of Non Destructive Evaluation (NDE), three separate projects were carried out: NDE Applications, EPERC (European Pressure Equipment Research Council) and assessment of hydrogen damage. The potential of ultrasonic waves for non-destructive assessment of the bond integrity of thermal barrier coatings (NDE) was successfully demonstrated. Within EPERC, dedicated Technical Task Forces were launched to address important topics of new fatigue design, use of high strength steels, harmonisation of inspection procedures, and flanges and gaskets, all of which are relevant to the new Pressure Equipment Directive.

At the HFR a new stress diffractometer, the Large Component Neutron Diffraction Facility (LCNDF), was installed. It is a unique instrument designed for the investigation of residual stresses in large (up to 1000 kg) structural components. Residual stresses in structural components resulting from the manufacturing process may cause component failure. These stresses need to be quantified to optimise the manufacturing process. Two large pre-normative research "round robin" campaigns have already been successfully completed with the LCNDF facility.

Hydrogen attack is a well-known phenomenon in the petrochemical industry which causes degradation of the mechanical properties of the steel used for pressure vessels in hydroprocessing units. A special facility was developed at IAM to examine such effects by allowing the introduction of hydrogen damage into the wall of a tubular component subjected to high pressures and temperatures. Furthermore, the effect of hydrogen on the creep behaviour could be quantified and the synergism between stress and hydrogen attack was revealed.

A special facility for creep testing full-scale model components under pressure has been installed. It provides the possibility to safely test full-scale model components representative of actual steam piping systems, whereas the existing rigs use scaled-down tubular test-pieces. At present only internal pressure loading is foreseen. However scope exists for incorporating actuators to apply additional loads if required. Periodic pressure cycling is also possible. The components are maintained at temperature using purpose built resistance furnaces.

Nuclear Fission Safety

Supporting industry in the nuclear safety area as well as the Commission actions relating to Nuclear Energy and Reactor Safety, IAM continued to play a dual role of operating agent and reference laboratory for three separate networks (NESC, ENIQ and AMES). These networks address different topics of structural integrity in nuclear power plants.

In NESC, the Network began the detailed evaluation of the results of the spinning cylinder test (to study Pressurised Thermal Shock in a PWR). This work, which involved an advisory group of 12 experts, focused on destructive analysis. An early and crucial result (concerning crack growth from two of the major defects implanted in the cylinder) confirmed the predictions of the structural integrity experts within the technical Task Groups. In parallel to the destructive analysis the Evaluation Task Force has been supervising many evaluation tasks.



The ENIQ Recommended Practices for Technical Justification has been published. It consists of two parts, firstly as a recommended practice to assist those involved in inspection qualification on how to use the concept of technical justification and secondly to aid those producing technical justifications to identify the material that might be included and to ensure a uniform format throughout Europe. These two recommended practices are already used extensively by industry in the EU and Eastern Europe as reference documents on how to write a technical justification in the framework of qualification of NDT.

Other key reference documents include The European Methodology for Qualification of NDT which is widely used for inspection qualification by all EU countries which operate nuclear power plants (and also some Eastern European countries). The work on the ENIQ pilot study to verify the feasibility of the European Methodology continued with the completion of all inspections and final reports are currently in preparation. Recommended practices detail the way the European Methodology should be implemented.

The IAM Reference Laboratory carried out two successful irradiations in 1998 within the AMES network. Comparison of estimated doses with the full dosimetry were made. The next irradiation programme for the study of model alloys was designed and prepared. In addition, experimental studies on thermal embrittlement and annealing of steels addressed thermal treatments, impact and hardness testing, NDT and some limited micro-structural analysis. In particular, a special NDT technique for ageing assessment based on thermoelectric power measurement was developed and demonstrated.

During 1998 IAM also continued to give scientific and technical support to the European Commission Directorates General in areas relevant to the above-mentioned nuclear fission safety networks. Considerable assistance was provided to the Codes and Standards Working Group in its actions on Inspection and Monitoring and Materials. Part of the support involves informing the Nuclear Regulator's Working Group (NRWG) Task Force on inspection qualification on the status of the ENIQ pilot study in view of using the results for applications at national level. IAM also provided substantial support to DG I A by leading a JRC consortium (involving ITU and ISIS) for specifying requirements and monitoring assistance projects to Eastern European States and the CIS.

Other bodies, including the European Non-Destructive Evaluation Forum (ENDEF) and the European Plant Lifetime Ageing Forum (EPLAF) received considerable input from IAM throughout the year.







Institute for Systems, Informatics and Safety

The mission of ISIS is to support EU policies with systems-oriented research in areas where safety and security are of concern. Its prime objectives are to develop techniques for the assessment of risk in complex systems and to apply information, communication and engineering technologies for improving their reliability, safety and security.

Throughout 1998, the institute's research supported the European Union policy in the areas of dependable information, fraud control, consumer protection, natural and man-made hazards, nuclear safeguards, nuclear safety and sustainable development.



Dependable information

The EU's "information society" initiative signals a recognition that advances in technology are driven by market forces but that they need to be accompanied by a regulatory framework to prevent the stifling of innovation by legislation, to assure interoperability and to protect individuals from new risks.

ISIS is supporting this initiative by helping the responsible Commission services develop a research programme on dependability and by developing a number of systems to increase the access of individuals to trustworthy information including:

- a distributed global network of information servers to help developing countries contribute to and access environmental information;
- the Global Educational Multimedia system to allow users to search a dynamic database of resources, courses and events;
- the joint JRC-EUROSTAT European Statistical Laboratory to allow the dissemination and exploitation of research results relevant to official statistics and to facilitate collaborative work amongst partners. JRC's own research concentrated on neural networks and time-series analysis.

ISIS also uses its expertise to support Commission initiatives enabling disabled and sick persons to share in the benefits ensuing from new developments in information technology.

Fraud control and consumer protection

ISIS continued to support the Commission's anti-fraud service (UCLAF) firstly by developing information systems and software tools and secondly through the development of statistical procedures to estimate fraud with a view to understanding how to optimally sample for controls.

In consumer protection, the IDEA project on electronic identification of farm animals using electronic eartags, injectables and boluses was launched in March 1998. Six countries participate in a pilot project involving about 1 million animals in total. JRC provided technical support (quality control of devices, central database), in-field follow-up and global evaluation of the project. A central database collecting information from all the IDEA participants was designed and implemented.

Natural and man-made hazards

The European Union has a number of measures to protect individuals against hazards. These measures include building norms, car safety standards and the obligation to report certain types of accidents. ISIS plays an active role in implementing these policies and in supporting the development of new safety measures.

The primary objective of the European Laboratory of Structural Assessment, ELSA, is to promote the basic understanding for the formulation and assessment of European design specifications for civil engineering structures. A secondary objective is to develop innovative methods for protecting existing buildings, particularly those of historic or architectural importance. Work in 1998 included:

- Specific efforts to understand the cyclic behaviour of welded connections following the finding that their failure had been a major factor in the damage inflicted by the Northbridge and Kobe earthquakes.
- ▶ The installation of an innovative rubber dissipative bracing device in a two-storey concrete building not originally designed to modern seismic standards. Tests were also performed on the same structure strengthened with carbon-fibre materials.
- Testing of a full-scale model of the cloister of San Vicente de Fora in Lisbon to determine how retrofitting techniques could protect this architecturally important building against seismic damage.

The Large Dynamic Test facility (LDTF) is used to increase the uniformity and decrease the costs of crash tests for transport safety and to promote fundamental knowledge of impact processes. Work in 1998 included:

- Preparation of new precision crash testing techniques capable of measuring locally inside a car the flow and repartition of mechanical energy during crashes.
- The development and testing of a Liquid Jet Crash Energy Absorber for absorbing the kinetic energy of colliding vehicles by the formation of a high speed liquid jet.
- The preparation of a precision testing technique for road safety barriers.

The European Co-ordination Centre for Aircraft Incident Reporting Systems (ECCAIRS) entered the production phase. The software was distributed to twelve European aviation authorities, three of whom are in the process of adopting it for future usage. Incidence information of four EU member states is now being collected at the central office.

The Major Accident Hazards Bureau (MAHB) supports Community legislation in the area of major accident hazards. In 1998 a prototype geographic information system-based version of the "Seveso Plant Information Retrieval System" was developed. Complementary activities have also been pursued in the areas of land use planning, benchmarking risk assessment methodologies and safety management systems for small and medium enterprises etc. A major project to establish a system to monitor the dispersion of toxic substances following an accidental release was completed.

Assessing sustainability

The main planks of the European Union's Fifth Environmental Action Programme are an integration of sustainability considerations in all policies and the replacement of the command and control approach with shared responsibility between government, industry and the public. ISIS supports both these objectives through impact assessment, systems analysis and information integration to assess knowledge. In 1998 the work included:

- ▶ The development and testing of new techniques for participatory decision-making by developing a software tool for linking personal lifestyle choices with carbon dioxide production, by evaluating sustainable options for Venice and by using multi-criteria analysis and in-depth interviews to present alternatives for water resource allocation to stakeholders in Eastern Sicily.
- The development of new data fusion techniques to calibrate computational model predictions with satellite data and ground measurements.
- ► The development of tools to assess sustainable transport policy options.



Nuclear safeguards

The EURATOM Treaty of 1957 empowers the European Commission to satisfy itself that fissile materials are not diverted from their intended use and collaboration agreements were signed with the International Atomic Energy Agency (IAEA) in 1977.

ISIS provides technical support to the Commission's Energy Policy and helps DG I (External Relations) to support IAEA. In addition ISIS carries out research to develop new techniques to increase the efficiency and effectiveness of Safeguards and to cope with new challenges of material released from excess nuclear weapons and the enlargement of the Union. Work in 1998 included:

- Improvement in measurement techniques and testing facilities.
- The TEMPEST calibration laboratory was made fully operational including a quality accreditation audit for EN 45001 at the end of 1998.
- Techniques, developed at JRC, for the remote reading of seals and identification labels were tested onsite.
- A data encryption architecture was set-up to meet specific Safeguards requirements for transmitting data over public communications networks.
- Surveillance techniques were improved.
- Training courses have been held for inspectors from the Euratom Safeguards Directorate (ESD) and from the IAEA.

The Commission, through the TACIS Programme, is supporting the Russian Federation's efforts to improve nuclear material accountancy and control. In November 1998, a Safeguards Methodological and Training Centre (RMTC) was officially opened in Obninsk, in the Kaluga region of Russia. ISIS played a major role in designing and implementing the Centre. RMTC trains MINATOM plant operators and Gosatomnadzor domestic inspectors in accounting and safeguarding fissile materials. JRC gave advice on the infrastructure, provided instrumentation and trained the instructors. RMTC is already training operators and inspectors at a rate of 700 trainees/year.

Nuclear reactor safety

ISIS continued to provide technical back-up to the Commission in matters of nuclear safety, helping DG XI (Environment, Nuclear Safety and Civil Protection) by reviewing technical documents on reactor safety, and DG I A (External Relations) in the specification and monitoring of Assistance Projects to Eastern European (PHARE) and CIS (Russia, Ukraine) States.

Both analytical and experimental work continued on developing strategies for mitigating the impact of severe accidents in reactors. In the unique FARO and KROTOS facilities an increased understanding was reached of the consequences of dropping molten corium material into water—both inside and outside the reactor pressure vessel. Preparation of the next two Phebus-FP tests is at an advanced stage and a "international standard problem" exercise was successfully completed, based on a STORM aerosol suspension test.

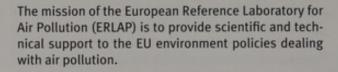
Technology transfer

ISIS aims to make the technology it develops available to European industry. In 1998, projects included robot-handling software for industrial use, surveillance technology developed as part of the Safeguards programme, holographic imaging, a miniature folded optical fibre coupler used as a sensor probe, software for advanced warning against runaway events; and a bar transducer for measuring seismic waves.





Air quality



ERLAP contributed to the harmonisation of air-pollution measurements in European air-quality networks by a number of actions. These focused on the preparation and maintenance of reference and calibration methods for benzene and carbon monoxide (CO) in view of the formulation of the corresponding directive by the end of 1998. ERLAP also assisted in pilot measuring campaigns in Athens and Bologna for the monitoring of primary air pollutants by using advanced sampling and analysis techniques including optical methods (DOAS-Differential Optical Absorption Spectroscopy) and diffusive sampling techniques.

ERLAP has further contributed to the development, validation and standardisation of the diffusive sampling technique. This has led to the successful achievement of the MACBETH project (Monitoring of Ambient Concentration of Benzene in European Towns and Homes).

The AUTO-OIL II programme focuses on establishing an integrated strategy on ambient air quality in Europe. Current air quality standards and objectives are reviewed and real-time modelling for predicting the evolution of air quality under different abatement scenarios defined. During 1998, the modelling work took into consideration both regulated and non-regulated pollutants, which could be harmful to human health. Eleven European cities with different characteristics were selected: Athens, Berlin, Dublin, Helsinki, Bologna, London, Lyon, Madrid, Milan, Reggio nel'Emilia and Utrecht.

As part of the shared-cost action "EMMA", El contributed to the development of an "Integrated Environmental and Warning Systems for Metropolitan Areas", which was fully operational in four European cities. The success of this product attracted worldwide attention due to the accurate 24 hours air quality forecasts for practically all atmospheric pollutants, providing easy and coherent access to practical air quality information for decision-makers.

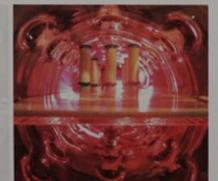


Environment Institute

The mission of EI is to carry out research in support of EU policy for the protection of the environment and the citizen. Prime objectives of EI are to investigate the level and fate of contaminants in the air, water and soil, to assess the effects of those contaminants upon the environment and individuals and to promote a sustainable energy supply.

Throughout 1998, the institute was restructured focusing completely on the environment, including new activities in the renewable energies field, in particular, the programmes developed by the former Energy Systems Testing Unit of IAM. Its former activities relating to consumer protection were transferred to the recently created Institute for Health and Consumer Protection (IHCP). The activity of the EI can be summarised along the following lines:

- Air quality
- Atmospheric Processes in Global Change
- Water and soil quality
- Environmental assessment
- Radioactivity monitoring
- Renewable energies.



Atmospheric Processes in Global Change

Understanding changes in the chemical composition of the atmosphere and their effect on regional and global climate forms the basis of suitable environmental policy. The Institute continued the study of atmospheric processes, contributing to international environmental programmes such as IGBP (International Geosphere Biosphere Programme), IGAC (International Global Atmospheric Chemistry) and EUREKA. A unique combination of expertise has developed in the fields of aerosol physics, gas-phase photo-chemistry, plant physiology, biosphere interactions, advanced organic and inorganic analysis with state of the art instrumentation, and modelling.

In 1998, efforts were devoted to finalising the results obtained from campaigns carried out in 1997, i.e. BEMA (Biogenic Emissions in the Mediterranean Area), ACE-2 (Aerosol Characterisation Experiment) and EUPHORE (European Photo-reactor). Several projects were initiated as a follow-up of BEMA and ACE-2.

An extensive scientific field study of photochemical smog formation was performed during May-June 1998. This campaign, called PIPAPO (Pianura Padana Produzione di Ozono) was carried out as a joint effort by scientists from Italy, Switzerland, Germany and France and from the JRC, within the EUROTRAC (EUREKA) project LOOP. Measurements of ozone and its chemical precursors, in addition to a detailed physical and chemical characterisation of aerosol particles, were performed. In a study aimed at linking the emission of volatile organic compounds from vegetation and aerosol formation, a series of compounds (dicarboxylic acids) was identified for the first time.

Water and soil quality

Research continued in the field of water reuse technologies, with particular emphasis on physico-chemical techniques. In the context of the "AQUACON" project activities continued with a number of laboratory performance studies in order to harmonise existing analytical methods for water quality.

The "CHESS" project studied the influence of land-use and climate changes on pollutant loads (nutrients and pesticides) to water bodies in a number of inland and coastal watersheds across Europe.

Other projects include the development of cost-effective satellite-based tools for managing aquatic environments, and defining instruments to safeguard the quality of the surface water resources. During 1998 the European Reference Laboratory for Water Pollution (LEPE) was established to consolidate the scientific and technical support to the European Commission on the definition and implementation of the EU policy in the field of water.

The "EUROMARKER" project in support to DG XXI (Taxation and Customs Union) is a good example of the exploitation in a different sector of the analytical capabilities developed within the EI. It aims to select a uniform marker for rebated gas oil and kerosene investigating the applicability of different types of markers and the corresponding analytical methods by inter-laboratory tests with custom laboratories in the different Member States.

Environmental Assessment

Methodologies based on biomarkers to evaluate the impact of hazardous chemicals in the environment and on human health were developed. The approach is multidisciplinary including molecular biology, biochemistry, and cell biology and *in vitro/in vivo* studies on sensitive target organisms.

Much of the work was focused on endocrine disrupting chemicals (EDCs), along the lines of the strategy paper of the Commission (co-ordinated by DG XI Environment, Nuclear Safety and Civil Protection). Direct research on EDCs was devoted to the identification of end-points and the establishment of criteria for priority setting of chemicals or groups of chemicals combining QSARF (quantitative-structure activity relationship) with *in vitro* and *in-vivo* bioassays.

Under the auspices of the WHO (World Health Organisation) international programme on Chemical Safety (IPCS), a Global Endocrine Disruptors Research Inventory (GEDRI) is now housed at the El. The institute is also involved in the preparation of the IPCS-Global Assessment on EDCs (GAED) and the EU/US Transatlantic Agreement of co-operation on EDCs.



Radioactivity monitoring

In support of the EU environment policy, the radioactivity Environmental Monitoring (REM) project concentrated on establishing an automatic information system for collecting and evaluating radioactivity levels in normal and in emergency conditions. This work is complemented by El's participation in the Nuclear Fission Safety Programme in activities related to nuclear emergency response, including:

- Real-time On-line DecisiOn Support (RODOS) system.
- Centre for Information and Valorisation of European Radioactive contaminated Territories.
- Real-Time Modelling evaluation exercise (RTMOD).
- Joint Study Programme "Atlas of Caesium deposition on Europe after the Chernobyl accident".

Renewable Energies

The renewable energies unit uses its unique competencies and facilities to provide support for the implementation of renewable energy technologies.

In 1998 work concentrated on increasing the knowledge base in participating in a number of Shared Cost actions (22 projects) and in providing support to the European Commission's energy policy. On the other hand, an important reflection has taken place to orient and focus activities towards the 5th Framework Programme.

The new Laser Scan Facility played a major role in the European development of CdTe (cadmium tellurium) thin-film solar cells. This facility identifies defects in adhesion and contacts which otherwise would go undetected. In addition, a new ultraviolet test facility, unique in its size and spectral irradiance, was set up to satisfy the increasing demand in PV module testing of large area modules.

Expertise in electromagnetic silicon-casting was expanded. This technology is important for resolving materials feedstock for crystalline solar cells. Electricity efficiency was also another focus with strategies aimed at minimising consumption of personal computers and photocopiers. As a new field, support to the European "Green Light" Programme was started, by assessing available technologies and developing measurement protocols of the influence of high-efficiency lamps on power quality.







Space Applications Institute

The mission of SAI is to develop and promote the use of space derived data in combination with geospatial information from other sources, especially in disciplines relating to agriculture, fisheries, transport and anti-fraud. SAI also seeks to make the best use of information from space systems, to maximise the return from European investments in space and to help the Union reinforce its role in international action on the environment and sustainable development.

SAI's activities are organised along the following lines:

- Technology for the Detection and Positioning of Mines
- Global Vegetation Monitoring
- Marine Environment
- Agriculture and Regional Information Systems
- Environment and Geo-Information
- Strategy and Systems for Space Applications.



The "Baveno Manifesto" calls for renewed attention in political and policy making circles to global environmental changes. It emphasises the strategic importance for Europe to develop global monitoring capabilities that can inform on a regular basis on the conditions of the environment around the world. Such a system is, among others, needed in the context of implementing international conventions like the Kyoto Protocol on Climate. The Manifesto was initiated at the SAI Annual User Conference and subsequently supported by the major European and national space agencies and organisations.

Technology for the detection and positioning of Mines

The work performed aims to address the obligations of the signatory states under the Ottawa treaty and to reinforce the EU's contribution in its action against anti-personnel mines with emphasis on the assessment and implementation of appropriate technology.

A successful conference on "De-mining Technologies", organised by the Space Applications Institute, brought together experts from all over the world, as well as donors for mine clearance, developers and operators and representatives of non-governmental organisations (NGOs). It provided a unique opportunity to discuss and present recent developments in mine clearance and to consider the problems involved (technological, economic, social and political) from differing viewpoints. SAI will act as the central focus for the Commission's Research and Development efforts in supporting civilian de-mining.

In addition to the organisation of the demining conference in the autumn of 1998, the activities in this area in 1998 included:

- The development of a "Demining Technologies Action Plan" as part of the Commission's actions against Landmines
- The execution of measurement campaigns to assess a multi-sensor suite for the detection and identification of Anti-Personnel Landmines
- The initiation and establishment of the ARIS (Action for Research and Information Support in Civilian Demining) network of excellence
- The collection of optical and radar signatures of anti-personnel mines and environmental components for future application to RTD data fusion activities.

Global vegetation monitoring

In 1997 the EU signed the Kyoto Protocol on Climate Change, committing to reduce its yearly carbon dioxide and other greenhouse gas emissions by 8%, compared to 1990 levels. Some human-induced land use changes (particularly deforestation and biomass burning) contribute significantly to the release of carbon dioxide into the atmosphere. By the same token, however, afforestation and reforestation can be exploited to lock carbon in the biosphere for prolonged periods. In 1998 the SAI consolidated its global forest monitoring programme (TREES II) and installed an operational tropical forest information system at DG XI (Environment, Nuclear Safety and Civil Protection). Linked to the deforestation work was a new development, the World Fire Web, delivering the first elements of a near real time global wild fire monitoring system and producing an animated map documenting the patterns and spread of fire throughout the world.

12 experts from around the world met with SAI staff to produce a first ever atlas of tropical deforestation hot spots.

Marine environment

In response to a need for a Community strategy for integrated planning and management of marine resources and coastal zones, SAI focused its 1998 activities on the development of a high-quality data archive from the most advanced Earth Observation satellite sensors in the visible and thermal range (Sea WIFS, MOS, AVHRR). Activities in 1998 included:

- Upgrade, validation and archiving of satellite-derived ocean colour and temperature data.
- Design and implementation of a prototype DESIMA (Decision Support for Integrated coastal zone Management).
- Development of a European Network for the application of Earth Observation data in coastal water quality monitoring.
- Final phase of a feasibility study for the definition of a decision support system for coastal area management in Thailand.

Agriculture and Regional Information Systems

In support of the Common Agricultural Policy, the project "OLISTAT", providing statistical estimates of Olive tree populations in Mediterranean Member states, was completed in 1998. Research projects included investigations into the use of high resolution imagery into the mapping and identification of vineyards, with test sites in Italy, France and Spain, as well as the technical definition and supervision of a project on the quality assurance of geometrically corrected imagery.

The MARS bulletin has been upgraded on user request. Information for an extended area (including PHARE countries) is now presented in more detail to more than 100 subscribers. Also, the area estimation with remote sensing has come to a conclusion. The activity will be re-designed in 1999.

In support to the European Environment Agency, SAI continued to act as co-leader of the European Topic Centre for Land Cover, i.a. in participating in the "LACOAST" (Land Cover changes on European coastal zones) project. The activities on soils were concentrated, resulting in the European Soil Information System (EUSIS) available within the European Soils Bureau (ESB).

In the pilot project activities on Droughts, Floods and Forest Fires the collection of datalayers for risk and damage assessment has started. Earth Observation derived information, combined with data from other data sources has been integrated within a Geographical Information System as input for modelling. Specific algorithms for burnt area mapping, flood damage assessment and drought monitoring are under development.

Environment and Geo-Information

The research and development work in this area is concerned with the application of remote sensing to environmental issues, primarily regarding soil, vegetation and their interface with urban occupation in Europe. It concentrates on three main themes:

- Mapping and monitoring the main permanent large ecosystems of Europe
- b. Developing monitoring and protection methods based on the combination of remote sensing dynamic models, applied to ecologically sensitive regions
- c. Developing mapping and monitoring methods to follow the urban dynamics.

The main effort under (a.) has been the "FIRS" project (Forest Information from Remote Sensing) with the development of a forest information system using remote sensing and geo-coded data to serve the need of DG VI (Agriculture) and in particular the EFICS programme (European Forest Information and Communication System).

The action under (b.) is concerned with defining and implementing methodologies to model and monitor land and vegetation degradation, including landslides, in the Mediterranean Environments. It was extended to the Southern Mediterranean (Morocco, Algeria, Tunisia, Egypt, Israel).

Action under (c.) is mainly concerned with evaluating very high-resolution Earth Observation data to map and model the development of main cities and transport networks in Europe.

A new image processing technique was developed, based on textural and morphological features for urban land use mapping using the latest generation very high resolution satellite data. It was combined with advanced 3-dimensional visualisation methods of remotely sensed and thematic data using virtual reality technology.

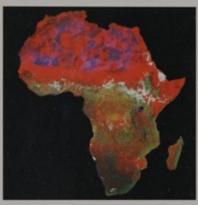
Strategy and Systems for Space Applications

The objective in this area is to develop integrated strategies and establish resultant applications and systems with respect to the convergence of information from satellites (Earth observation, communication and navigation satellites) relevant to European Union policies. In 1998, a study was conducted in collaboration with DG XII (Science, Research and Development) to assess the potential role of satellite Earth Observation (EO) in information required by EU policies. The study, under the Centre of Earth Observation (CEO) programme, aimed to identify the possible 'pull effect' of EU policies on future EO missions and focused on policies which have a strong geographical, spatial or environmental component. As a result, three documents were produced, addressing the policy needs, the EO contribution, and the potential involvement of the EC in Future EO Missions. A fourth summary document was produced to provide a high-level overview of the study results.

Presentation of CEO-initiated projects: four two-day workshops were organised during the second half of 1998 to present projects undertaken for the Centre of Earth Observation (CEO) Programme. The workshops focused on the results which were discussed with over 350 customers and service providers working in the main thematic areas (water, coastal areas, land applications, environment, air and meteorology, hydrology, etc.) in Europe.

The new interactive Earth Observation data and information exchange system, called "INFEO", was launched at the end of 1998. It was developed during the 4th FP within the framework of the CEO Programme's system development activities. The internet-based virtual database and its search, navigation and population facilities replace the European-Wide Service Exchange (EWSE), which was operated for several years as a prototype for INFEO.







Institute for Health and Consumer Protection

The mission of IHCP is to support EU policies for health and consumer protection. IHCP works to improve the understanding of the hazards, exposure and risks posed by food contaminants, drugs, chemicals and products of various kinds through the development, validation and application of advanced methods and strategies of a high scientific quality.

Consumers increasingly express concerns about the food they eat, the beverages they drink, the quality of the goods and services that they buy and use, the biomaterials and products, like prostheses, medicines and vaccines they are given.

The EU policies seek to ensure that the consumer is not deceived by counterfeit on adulterated products or exposed to unnecessary risks and hazards by simply making a purchase, and that medical treatments they undertake are the best the technology can offer. The IHCP aims to support policies designed to eliminate hazards associated to dangerous environments, goods and events which represent a threat to the citizen's health and to improve the quality of life, independent of special private and national interests.

The work-programme is demand-driven from social needs, in support of EU policies, through dialogue with national and international regulatory authorities, European industries, and healthcare organisations. The IHCP contributes to establish standards, developing and validating methods to guarantee the origin, safety, quality of commercial goods such as food products, animal feed, cosmetics, drugs, chemicals, services and systems, parts of our living environment. The result for the European citizens is an improved, predictable and efficient regulatory environment. The direct users of the IHCP are the other European Commission services, European agencies, European industries, healthcare organisations, consumer associations, universities, Member State laboratories and other interested parties.

The work of the IHCP is organised along five scientific lines:

- Analysis of food and consumer products
- Toxicology and Assessment of Chemical Substances
- ▶ Bio-compatible Materials and Systems
- Validation of Biological Testing Methods
- Pharmaceutical Regulatory Activities.

Analysis of Food and Consumer Products

Assessment of the compliance with labelling and legislation, monitoring of ingredients, additives and contaminants and validation of analytical methods were carried out in the field of food products, feeding stuff, food contact materials and other consumer products. The food contact laboratory has carried out a European monitoring study concerning the concentration of BADGE (a specific compound in the lacquer of cans) in canned fish.

The implementation of a web site on materials and products in contact with food has been completed (http://cpf.jrc.it/webpack/). Activities have been started in the field of phthalates in childcare articles. The BEVABS database (European Office for Wine, Alcohols and Spirit Drinks, monitoring adulteration of wine by addition of sugar or water) has been extended by data on the 1997 vintage and by the values of oxygen stable isotopes.

Several analytical methods have been validated by coordination of collaborative trial studies with laboratories from the EU Member States: determination of mycotoxins in various food matrices, heat treatment of animal meals, detection of animal meals in feeding stuff, detection of GMO in food.



A screening method within the frame of genetically modified organisms (GMOs) based on the detection of DNA in two plant products (soy beans and corn) has been successfully validated involving 29 laboratories from 13 countries.

The biotechnology web site has been made public in July 1998, containing data on deliberate GMO field trials in the EU (http://biotech.jrc.it/). Tasks are routinely carried out on dairy products (water content in milk powder, milk fat content), chocolate (vegetable fats), honey (origin) and cosmetics (updating of ingredients inventory).

Toxicology and Assessment of Chemical Substances

The assessment of risks which may be posed by existing and newly developed chemicals to health and the environment, the development of testing methods, the notification procedure for new chemicals and the Export/Import scheme are routinely performed in the European Chemicals Bureau (ECB). In 1998, 710 chemicals were classified and labelled as dangerous. The Unit built up a system to support the authorisation of biocidal products.

A Risk assessment on LAB (Benzene C 10-13 Alkyl derivatives), was performed in a comprehensive way, concluding that there is at present no need for further information and/or testing or for risk reduction measures beyond those which are being applied.

Moreover, four Risk assessment reports were finalised in the Existing Substances Programme: DEGBE (2-(2-butoxy-ethoxy)ethanol), DEGME (2-(2-methoxy-ethoxy)ethanol), Chloroalkanes (C 10-13) and LAB (Benzene C 10-13 alkyl derivatives). Further information and testing on the environment are needed for Chloroalkanes. "There is a need for limiting the risks" is the conclusion derived for Chloroalkanes with respect to the environment and for DEGBE and DEGME with respect to human health (workers and consumers).

Validation of Biological Testing Methods

The European Centre for the Validation of Alternative Methods plays a leading role at the European level in the independent evaluation of the relevance and reliability of tests for specific purposes, through research on advanced methods and new test development and validation. It contributes to the improvement of the regulatory process, so that chemicals and products of various kinds, including medicines, vaccines, medical devices, cosmetics, household and agricultural products, can be manufactured, transported and used more economically and more safely, whilst the current reliance on animal test procedures is progressively reduced.

Areas routinely addressed are:

- topical toxicity (e.g. phototoxicity; skin irritation, corrosivity, sensitisation; percutaneous absorption; eye irritation);
- target organ toxicity (e.g. to the liver and kidneys);
- target system toxicity (e.g. to the blood-forming, immune, nervous and reproductive systems);
- and special testing (metabolism-mediated toxicity; the blood-brain barrier; metal toxicity; long-term toxicity testing; integrated testing strategies; the quality control and safety testing of biologicals and biomaterials).

Non-animal test methods for photo-toxic potential and for identifying and classifying skin corrosives have been scientifically validated and were accepted in 1998 by DG XI and DG III. Validation studies on non-animal tests for embryo-toxicity, certain kinds of blood cell damage, skin irritation, eye irritation, and passage across the blood-brain barrier, are in progress.

ECVAM has also established a unique information service on alternative methods.

Pharmaceutical Regulatory Activities

Development/harmonisation and validation of chemical and pharmaceutical systems have been continued. The EudraNet and EudraTrack systems have been completed and implemented. Research and development activities were carried out in the field of cryptosecurity systems including biometrics identification and authentication systems (involving electronic commerce and electronic payment system and regulatory transaction systems for the tracking analysis of the market authorisation of new medicinal products).

The Eudratrack System for Market Authorisation of Medicinal products in EU has been developed on top of the EudraNET, the network of all European Pharmaceutical regulators. The system has become operational and is processing all mutual recognition files created by Member States in the EMEA. Presently the system holds more than 4000 files.



Bio-compatible Materials and Systems

In 1998, in the field of bio-compatible material interface, data were collected on the design of prosthesis/bone interface for the life endurance of human implants. Coatings or surface treatment were performed for dental implants to overcome bio-compatibility problems associated with the transgingival zone of the implant itself: a plasma source was used to make a coating with uniform thickness and quality all over the implant.

The production of radio-tracers (1231) for diagnostic purposes continued in the cyclotron. The Thin Layer activation method is being used in the field of food processing. Wear problems of hip and knee prostheses, due to release of debris of ultra high molecular weight polyethylene (UHMW-PE), were studied and improvement of the material was eventually achieved by specific pre-reticulation treatments.

Improved osteo-integration of metallic implants was achieved by application of graded bio-compatible coatings. Specific problems have been overcome by developing a double deposit, obtained by a single vacuum plasma spray processing, which consists of a deposit of OC (osteo conductive coatings) of either high or low crystallinity and high and low porosity on a VPS Ti pre coating.







Institute for Prospective Technological Studies

The mission of the Institute for Prospective Technological Studies is to provide techno-economic analyses in support of the European policy-making process. IPTS's prime objectives are to monitor and analyse science and technology developments, their cross-sectoral impact, and their interrelationship with the socio-economic context and their implications for future policy development. IPTS operates international networks, pools the expertise of high level advisors and presents information in a timely and synthetic fashion to policy makers.

In 1998, IPTS addressed various technological matters, to ensure a Europe-wide assessment of scientific and technological change independent of special interests, and to gain a better understanding of technology in the socio-economic environment. Prospective studies have been carried out in major research areas of relevance, exploiting synergies and crossbreeding between those areas.



In 1998, work has been developed in the following fields: Energy; Environment; Mobility and Transport; Regulatory Frameworks for Emerging Technologies; Technology, Knowledge and Organisational Change; Innovation, Diffusion and Growth; Development and Resource Management in the Mediterranean region; and Perspectives for Europe.

In order to secure direct access to a large network of specialists, IPTS has further developed the European Science and Technology Observatory (ESTO). ESTO is now a network of more than 30 European S&T organisations which share the responsibility of providing timely access to information on scientific and technological change of socio-economic relevance. It contributes to IPTS studies and the IPTS Report, which is the Technology Watch bulletin of IPTS, directed to European decision-makers.

More information about IPTS activities on its Web page: http://www.jrc.es/extprojects.

In addition to the major prospective project "The Futures project", a number of other activities in areas of high policy relevance were performed.

Mediterranean activities

Building on the already very successful co-operation with countries around the Mediterranean in the field of renewable energies, where projects like "INTERSUDMED" have delivered substantial tangible results, IPTS has extended the benefit of its networking methods to other areas of interest.

To this end, a first meeting of a Techno-Economic-Analysis Network in the Mediterranean (TEAM) was organised. TEAM is a platform for prospective dialogue on joint initiatives and strategies, bringing together eminent members of the S&T community from throughout Europe and the Mediterranean region. The network identified areas of collaboration on concrete topics related to the needs of this region and with a high potential to contribute to its sustainable socioeconomic development. Main areas of interest are S&T Poles Development, Remote Sensing for Land Use, Food Technologies, Knowledge & Skills Building, Life Styles and Health (diabetes). Joint working groups will elaborate background analysis on the above mentioned topics and will draft original project proposals to be submitted to funding institutions. DG I B (External Relations: Southern Mediterranean, Middle East, Latin America, South and South-East Asia and North-South cooperation) and DG XII (Science, Research and Development) attended this first meeting and expressed keen interest to participate in the project.

Mediterranean countries are also facing the challenge of securing both quantity and quality of water for future generations. Experts agree that there is a need to couple progressively water demand-side strategies with supply-side options. IPTS strongly supports this concept, which implies the combination of both technical means, e.g. reduction of water losses, efficient irrigation techniques, re-use of wastewater, and socioeconomic, cultural, legal and regulatory tools, e.g. education, public information, and pricing which affect the user's behaviour.

These principles were applied in a comprehensive study developing a reference framework for DG XVI (Regional Policy and Cohesion), and for the relevant services in national administrations. The results will equally serve as a building block for the European Spatial Development Perspective.

Selected impacts of Information and Communication Technologies (ICT)

A project on the "Diffusion and Utilisation of ICT" explored how EU policies could benefit from recommendations for action formulation as a result of benchmarking tools. Major differences between the best results reached globally and the current national performances in Europe have been highlighted in an operational way. The role of IPTS was to support the European Commission and the Member States in studying the worldwide utilisation and diffusion patterns of ICT in 3 test sectors; namely banking/financial services, mechanical engineering and textiles. Besides the need for uniform European level regulations and standards, the project identified, for all the sectors investigated, the shortage of the ICT-professionals and generally the lack of ICT-skills as one of the highest priority areas for policy action. This activity was carried out in support of DG III (Industry), which communicated the results to the Industry Council in Autumn 1998.

In support of the European Parliament, two studies have also been developed: "The EMU and Electronic Payment systems" and "Towards a European Solution for the management of waste from Electric and Electronic equipment".

Environment

IPTS activities in the area of Environment have been oriented along the following lines of action:

- Integration of Environmental Protection in other EU policies
- Clean technologies: innovation, competitiveness and employment

- Reducing material flows: the development and up-take of new technologies
- New frameworks for environmental policy-making a more realistic basis for action.

In 1998, IPTS work on environment has greatly benefited from the existence of the European IPPC Bureau (EIPPCB) in the same IPTS unit. This bureau was set up by agreement between DG XI (Environment, Nuclear Safety and Civil Protection) and JRC to carry out the technical exchange of information on "best available techniques" BAT, within the framework of article 16(2) of the Directive 96/61/EC on Integrated Pollution Prevention and Control.

Working with a number of Technical Working Groups each involving industrial and Member States' representatives, the EIPPCB has developed the first drafts of reference documents for three initial industry sectors: (a) pulp and paper; (b) cement and lime; and(c) iron and steel. Other sectors will be addressed in the new JRC specific programme.

In parallel to these working groups, the development of the European Information System has proceeded to phase 2, involving the development of specialised software to collect information and to track its flow into a user-friendly information base.

IPTS is presently embarking on a major study dealing with the impact of EU regulation on innovation. Workshops organised with DG III (Industry) during 1998 show that the analysis has to consider the styles and structures of policy implementation. Innovation must be recognised as a complex evolutionary and dynamic process, embedded in a wider institutional context, which is often strongly determined by national and sectoral factors.

In 1998, IPTS was asked by DG XI (Environment, Nuclear Safety and Civil Protection) to contribute to the identification of possible new priorities for Europe's environmental strategy. Key results are the exploration of elements of a sustainable future and the identification of what stops us from getting there. Solutions include the integration of the environment into relevant policy areas, the elimination of institutional and organisational barriers and legal frameworks that avoid giving incentives to environmentally damaging behaviour.

A study on "Incineration of non-hazardous Waste" has also been concluded in 1998 for the European Parliament.

Energy

Energy and related services constitute one of the biggest markets within the global economy. An efficient energy supply system is an indispensable prerequisite for economic prosperity but it must also be balanced against environmental and other concerns. Hence, continued access to energy resources and related services at an acceptable cost and conditions for everyone, has always been a major concern of policy makers.

The main IPTS activities in this field include technology assessment work, global warming and other carbon-related issues, together with the study of technology diffusion and implementation mechanisms (notably for renewable energies). IPTS is contributing to the creation of a common knowledge base addressing the problems of coping with the threat of global warming.

IPTS also contributes to economic forecasts, both on an EU and on a global scale, to techno-economic analyses, market penetration studies, focussing on the identification of the most promising technologies for a global climate strategy. IPTS has also contributed to the monitoring and assessing global change research and CO₂ mitigation technologies in order to provide recommendations for decision making. In this line, together with other research institutes, IPTS has compiled and analysed energy legislation affecting renewable energies in EU countries. The work has been carried out in support of DG XII (Science, Research and Development) and DG XVII (Energy) activities.

Transport and Mobility

The main focus of IPTS's work on transport and mobility is an analysis of the technological developments and socio-economic conditions required to achieve sustainable transport systems. Emphasis is placed on exploring strategies to ensure high quality and efficient mobility while reducing transport externalities such as congestion, pollution, resource depletion and safety.

Strategic management of market niches is a new method that was conceived with the view of facilitating the introduction of sustainable transport technologies. An international conference was organised on this subject in June 1998 in Seville, where a large number of experts, transport operators and policy makers presented and discussed results of several experiments, from all over Europe, aiming at improving sustainable mobility in urban areas. The work was carried out in support of DG XII (Science, Research and Development) and DG VII (Transport) activities.





Glossary

AMES

Ageing Materials Evaluation and Studies

BAT

Best Available Techniques

BCR

Bureau Communautaire de Référence

BSE

Bovine Spongiform Encephalopathy

CIS

Confederation of Independent States

CRM

Certified Reference Materials

DIAMEX

DIAMide Extraction process

ECB

European Chemicals Bureau

ECU

European Currency Units

ECVAM

European Centre for the Validation of Alternative Methods

EI

Environment Institute

ELSA

European Laboratory for Structural Assessment

EMEA

European Medicine Evaluation Agency

ENIQ

European Network for Inspection Qualification

ESTO

European Science and Technology Observatory **ETOMEP**

European Technical Office for Medicinal Products

EU

European Union

FARO

Fuel Melting and Release Oven

GMOS

Genetically Modified Organisms

HFR

High Flux Reactor

IAEA

International Atomic Energy Agency

IAM

Institute for Advanced Materials

IDEA

IDentification Electronique des Animaux

IHCP

Institute for Health and Consumer Protection

IPPO

Integrated Pollution Prevention and Control

IPTS

Institute for Prospective Technological Studies

IRMM

Institute for Reference Materials and Measurements

ISIS

Institute for Systems, Informatics and Safety

ITU

Institute for Transuranium Elements

KROTOS

Small scale steam explosion facility-Italy

LDTF

Large Dynamic Test Facility

LINAC

Electron Linear Accelerator

MAHB

Major Accident Hazards Bureau

MARS

Monitoring Agriculture with Remote Sensing

NDE

Non-Destructive Evaluation

NESC

Network for Evaluating Steel Components

PHARE

Poland-Hungary: Assistance for Economic Restructuring

PHEBUS

French Test Reactor-Cadarache (France)

PIXE

Particle Induced X-ray Emissions

PWR

Pressurised Water Reactor

SAI

Space Applications Institute

STORM

Simplified Tests On Resuspension Mechanism

TRABANT

Transmutation and Burning of Actinides

VAMAS

Versailles Agreement on Advanced Materials and Standards

XRF

X-ray Fluorescence Analys

List of Members and Participants

JRC Board of Governors

Chairman

Prof. Fernando ALDANA

Director General
Oficina de Ciencia y Tecnología
Rosario Pino 14-16 - planta 18
E-28020 Madrid
Tel. +34 91 336 04 91
Fax +34 91 336 04 93
aldana@cicyt.es
(Sec.: Ms. María José Ruanes)
-Replaced Prof. Flemming
Woldey on June 1998

Members

Mr. Jacques Wautrequin

Secrétaire Général Honoraire Services Federaux des Affaires Scientifiques, Techniques et Culturelles Rue du Pinson 162 B-1120 Bruxelles Tel. +32 2 673 97 49 / +32 81 58 00 89 Fax +32 2 673 97 49 / +32 81 58 97 89

Dr. Hans Bjerrum Møller

Frederiksborgvej 71 DK-4000 Roskilde Tel. +45 46 35 98 81 Fax +45 46 35 98 81 hbm.fsk@post.tele.dk

Dr. Werner Gries

Director General
Bundesministerium für Bildung,
Wissenschaft, Forschung und Technologie
Heinemannstrasse 2
D-53175 Bonn
Tel. +49 228 57 31 70
Fax +49 228 57 36 12
5@BMBF.Bund400.de
(Sec.: Ms. Götten)

Dr. Dimitrios NIARCHOS

Vice President
NCSR "Demokritos"
Director of Institute of Materials Science
N.R.C. "Demokritos"
GR-153 10 Aghia Paraskevi Attikis
Tel. +30 1 652 2872/653 3706
Fax +30 1 651 9430
dniarchos@ims.ariadne-t.gr

Prof. Félix YNDURÁIN

Director General
CIEMAT
Avda. Complutense 22
E-28040 Madrid
Tel. +34 91 346 64 11/346 60 00
Fax +34 91 346 60 82
Felix.Yndurain@ciemat.es
(Sec.: Ms. Consuelo Sanz)
—Replaced Prof. Fernando
ALDANA on 1.12.1998

Mr. Bertrand BARRÉ

Directeur
Commissariat de l'Energie Atomique
Direction des Réacteurs Nucléaires
31-33 rue de la Fédération
F-75752 Paris Cédéx 15
Tel. +33 1 40 56 24 40
Fax +33 1 40 56 27 50
(Sec.: Ms. Quéré)

Dr. Killian HALPIN

Director
Office of Science & Technology
Policy Division
Forfás, Wilton Park House
Wilton Place
IRL-Dublin 2
Tel. +353 1 607 30 49
Fax +353 1 607 32 60
Halpink@forfas.ie

Ing. Carlo MANCINI

Direttore ENEA Lungotevere Thaon di Revel 76 I-00198 Roma Tel. +39 06 362 72 304/323 11 51 Fax +39 06 362 72 739 (Sec.: Ms. Melorio)

Mr. Paul LENERT

Premier Conseiller de Gouvernement Ministère de l'Education Nationale et de la Formation Professionnelle 1 rue de la Libération L-5632 Mondorf-les-Bains Tel. +352 66 89 22 Fax +352 66 89 22

Mr. Jan W. WEEHUIZEN

Director Electricity
Ministry of Economic Affairs
P.O. Box 20101
NL-2500 EC Den Haag
Tel. +31 70 379 6471
Fax +31 70 379 7841

Ministerialrat Dr. Kurt PERSY

Bundesministerium für Wissenschaft Verkehr, Gruppe III/A Rosengasse 4-6 A-1014 Wien Tel. +43 1 531 20 63 50 Fax +43 1 531 20 64 80 Kurt.Persy@bmwf.gv.at

Prof. José Carvalho Soares

Presidente
Istituto Tecnologico e Nuclear
Strada nacional 10
P-2685 Sacovem
Tel. +3511955 00 05/955 00 21
Fax +3511955 0117
Soaresjc⊗alf1.cii.fc.ul.pt
(Sec.: Ms. E. Rosa)

Prof. Jarl Forstén

Deputy Director General
Technical Research Centre of Finland (VTT)
Vuorimiehentie 5 · Espoo
P.O. Box 1000
FIN-02044 VTT
Tel. +358 9 456 41 30/456 41 31
Fax +358 9 456 70 00
jarl.forsten@vtt.fi
(Sec.: Ms. I. Hirvonen)
Irmeli.Hirvonen@vtt.fi

Prof. Janne Carlsson

External Relations
Kungl Tekniska Högskolan • KTH
Royal Institute of Technology
Valhallavägen 79
S-100 44 Stockholm
Tel. •46 8 758 68 54/790 82 05
Fax •46 8 768 18 15
jannec@kth.se

Prof. Sir John CADOGAN

Department of Chemistry Imperial College - room 103B GB-London SW7 2AY Tel. +44 171 594 57 84 Fax +44 171 594 58 00

Participants

Dr. Axel Björnsson

Nordic Volcanological Institute University of Iceland Grensasvegur 50 IS-108 Reykjavik Tel. +354 525 4496 Fax +354 562 9767 axel@norvol.hi.is

Mag. Gerhard BECK

Amt für Volkswirtschaft Gerberweg 5 FL-9490 Vaduz Tel. +4175 236 68 71 Fax +4175 236 68 89

Dr. Andreas Mortensen

Ministry of Trade and Industry P.O. Box 8014 Dep N-0030 Oslo Tel. +47 22 24 03 01/03 Fax +47 22 24 03 15

Prof. Arnan SEGINER

Director Neaman Institute for Advanced Studies in Science Technion City 32000 Haifa - Israel Tel. +972 4 823 7145/6 Fax +972 4 823 1889

The Joint Research

Directorate-General	Brussels	C. Directorate for the	Ispra
		Ispra site Infrastructur	e
Director-General	Herbert J. ALLGEIER	12.00	0.00
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(DG XII, CCR, XIII-D, XXII, reporting to the			
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		Transuranium Elements	
		Institute Director	Jacques VAN GEEL
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Directorate		Institute Deputy Director	
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Director		2. Technological physics	Jean-Paul GLATZ
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Human resources	Bruno DE BERNARDI	4. Nuclear technology	Didier HAAS
2. Contracts	Michèle Actis-Dato	5. Nuclear chemistry	Lothar Koch
3. Budget, finances and accounting	Roberto Cuniberti	6. Actinides	Gerard LANDER
4. Public relations, documentation and Publications	Michel LE DET	7. Radiation protection	Werner WAGNER
- Management information and	Addison Francisco		

5. Management informatics and

communication networks

Adriano ENDRIZZI

Centre Organisation Chart

F. Institute for Advanced Materials	Petten	I. Institute for Space Applications	Ispra
Institute Director	Kari Törrönen	Institute Director	Rudolf WINTER
Advisor	Marcel VAN DE VOORDE	Head of Unit acting as	Jean Meyer-Roux
1. Management support	Michael Cunpy	Institute Deputy Director	
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		for space applications	
		and approximately	
G. Institute for Systems,	Ispra		
Informatics and Safety			
Institute Director	David WILKINSON	J. Institute for Health	Ispra
Head of Unit acting as	Marc Cuypers	and Consumer Protecti	
Institute Deputy Director			
Advisor (Brussels)	Jean-Pierre Aubineau	Institute Director	Herbert J. ALLGEIER actin
Management support	Martyn Dowell	Advisor	Livio Manes
2. Reliable information technologies	Fernand SOREL	Management support	
3. System analysis and	Alfredo Lucia	2. Foodstuffs	Elke Anklam
information evaluation		3. Validation methods for drugs	Michael BALLS
4. Safeguards and verification	Marc Cuypers	and cosmetics	
techniques	mare corrects	4. Toxicology and chemical	Gerald VOLLMER
5. Nuclear safety	Horst WEISSHÄUPL	substances	octoro rocemen
6. Safety of mechanical structures	Michel GÉRADIN	5. Support to pharmaceutical	Flavio Argentesi
or surery or meeriament structures	miches denotin	regulation	THE PRODUCTION OF THE PROPERTY
		6. Bio-compatible materials	Paolo FENICI
		and cyclotron	Tuoto TEME
		and cyclotron	
H. Environment Institute	Ispra		
Institute Director	Jean-Marie MARTIN		
Advisor	Helmut KNÖPPEL	K. Institute for Prospectiv	e Seville
Management support	Emanuela Rossi	Technological Studies	
2. Environmental impact	Peter Pärt		
3. Air quality	Dimitrios Kotzias	Institute Director	Jean-Marie Capiou
4. Atmospheric processes in		1. Management support	Claude TAHIR
global change		2. Technologies of sustainable growth	
5. Soil and waste		3. Technology, competitiveness,	Peter FLEISSNER
6. Water research and monitoring	Andrea TILCHE (1.10.1998)	employment and society	
7. Renewable energies	Heinz Ossenbrink	4. Technologies for life science,	
. Melichanic chergies	HEIR OSSERBRINK	di recumonoQues ron une science!	

information and communication

European Commission

Joint Research Centre

Directorate-General

200 Rue de la Loi B-1049 Brussels Tel. +32 2 296 35 22 Fax +32 2 295 01 46

Programmes Directorate

200 Rue de la Loi B-1049 Brussels Tel. +32 2 296 72 16 Fax +32 2 295 01 46

Institute for Reference Materials and Measurements

Retieseweg B-2240 Geel Tel. +32 14 571 292 Fax +32 14 584 273

Institute for Transuranium Elements

Postfach 2340 D-76125 Karlsruhe Tel. +49 7247 951 350 Fax +49 7247 951 591

Institute for Advanced Materials

P. O. Box 2 NL-1755 ZG Petten Tel. +31 224 565401 Fax +31 224 563393

Institute for Systems, Informatics and Safety

I-21020 Ispra (VA) Tel. +39 0332 78 9947 Fax +39 0332 78 9923

Environment Institute

I-21020 Ispra (VA) Tel. +39 0332 78 9834 Fax +39 0332 78 9222

Space Applications Institute

I-21020 Ispra (VA) Tel. +39 0332 78 9765 Fax +39 0332 78 9536

Institute for Health and Consumer Protection

I-21020 Ispra (VA) Tel. +32 2 296 35 22 Fax +32 2 296 24 81

Institute for Prospective Technological Studies

Isla de la Cartuja s/n E-41092 Seville Tel. +34 95 448 82 73 Fax +34 95 448 82 74

Public Relations, Documentation and Publications Unit

I-21020 Ispra Tel. +39 0332 78 9180 Fax +39 0332 78 5409 E-mail: prp@jrc.org **European Commission**

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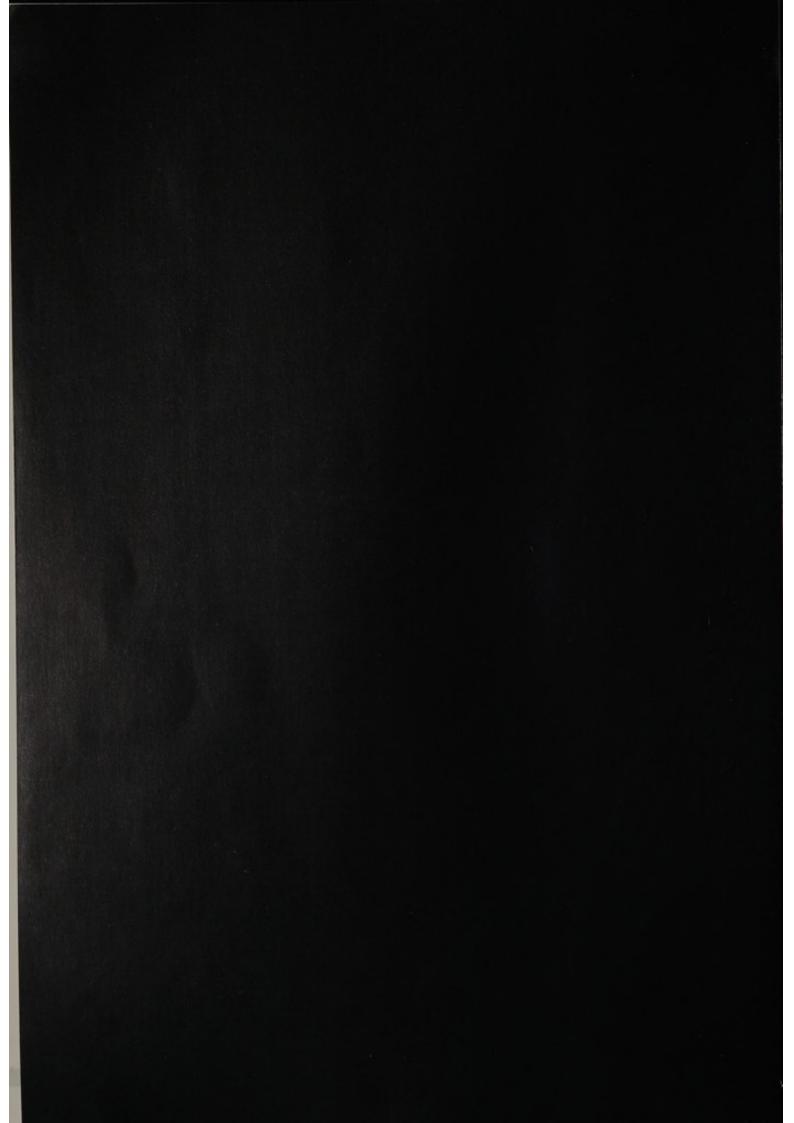
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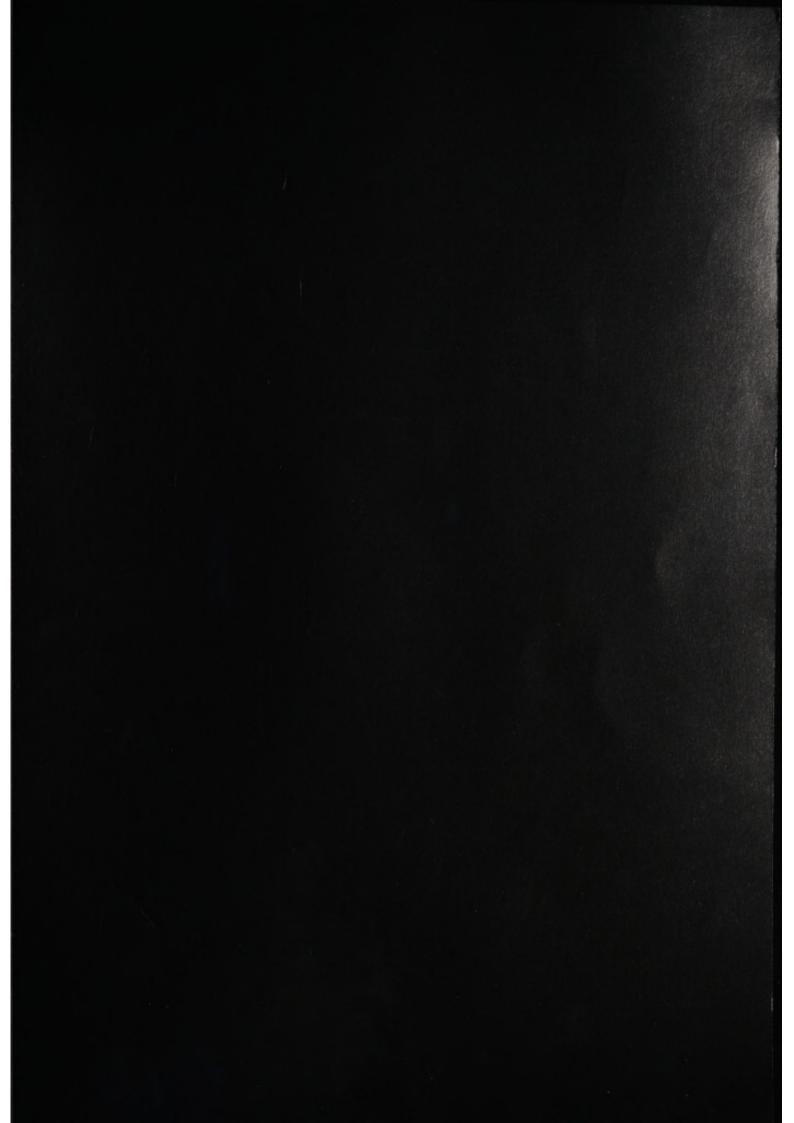
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Abstract

Report on the activities, accomplishments and resources related to the JRC work carried out in 1998. An overview is given of the organisational charges, the mission and its implementation, the scientific activities abd the relations with the outside world.





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



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