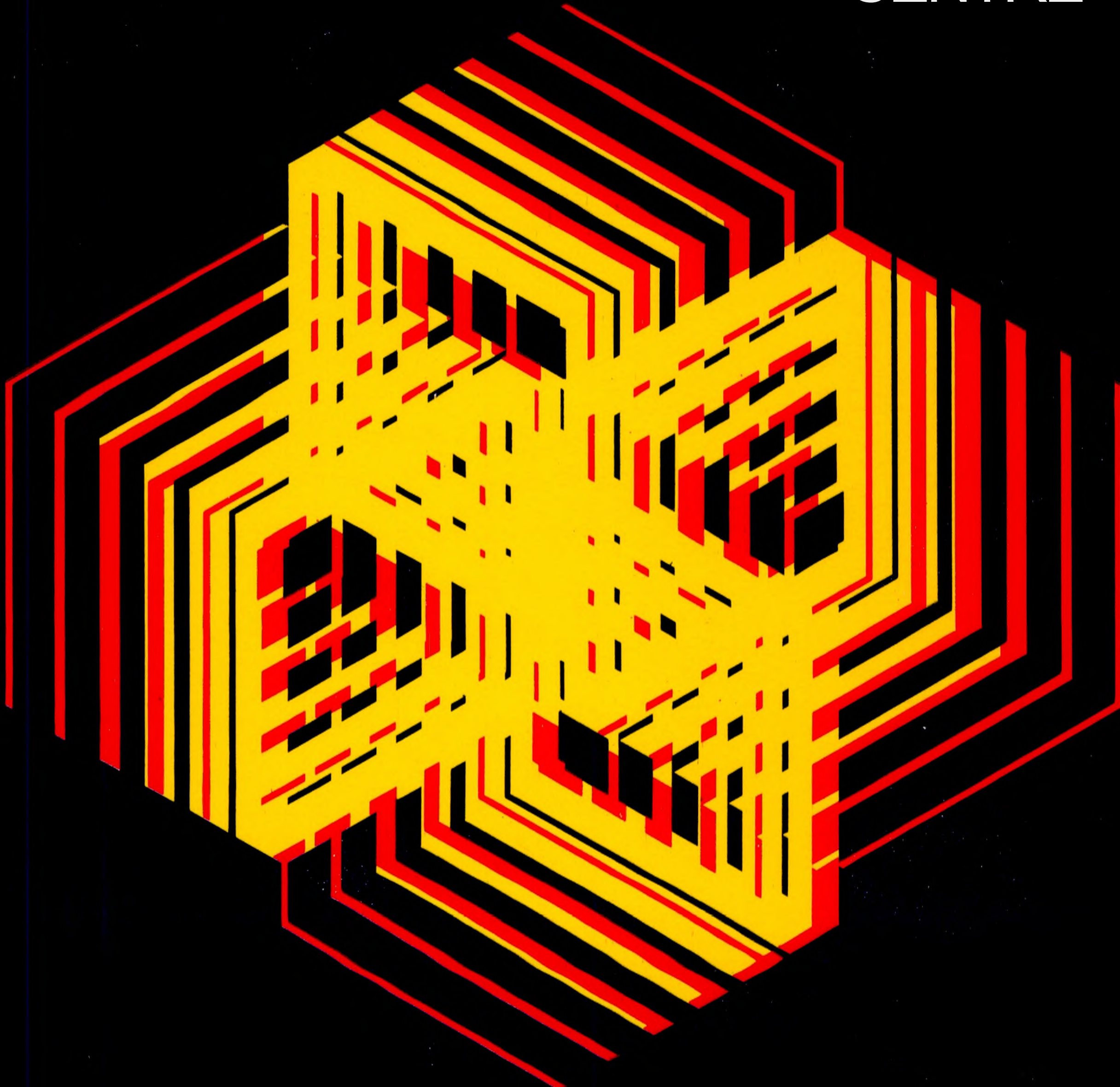
COMMISSION OF THE EUROPEAN COMMUNITIES

JOINT RESEARCH CENTRE



Foreword

by Guido Brunner
Member of the Commission of the European Communities

Twenty years of the Joint Research Centre is a cause for congratulation. It also offers the opportunity to present the European Community's own research.

The mark of these twenty years of the Joint Research Centre's development is the continuous search for European solutions to the problems of science and technology. Originally established as a nuclear research centre, the Joint Research Centre now possesses a wide-ranging research potential. Its installations include two nuclear reactors, several accelerators and other highly specialised nuclear research laboratories. The construction at Ispra of the most sophisticated testing installation for solar collectors in Europe is further proof of its capacities.

Nuclear Safety, New Energies, the Environment and Nuclear Measurements are the key points of the Joint Research Centre's new research programme for 1980-83.

The JRC is a clear evidence of the progress achieved in Europe's integration: the European Community is not only a matter of decisions, regulations and guidelines. With its team of over 2,200 persons and its research projects of immediate relevance to current problems, the JRC is contributing to laying the scientific and technological basis of our continued industrial competitiveness and to meet the challenge of Europe.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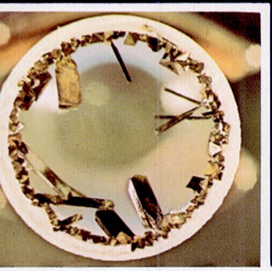
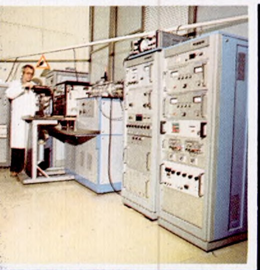




Contents

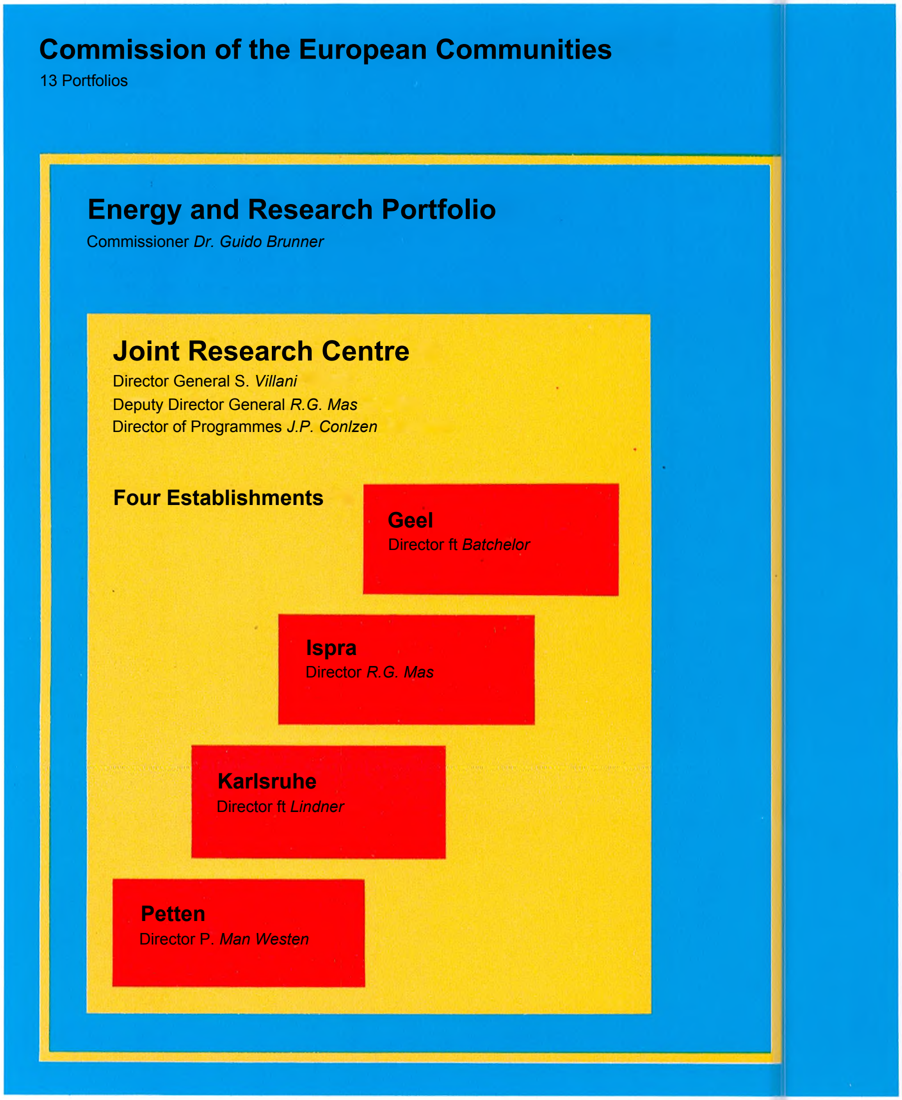
Introduction

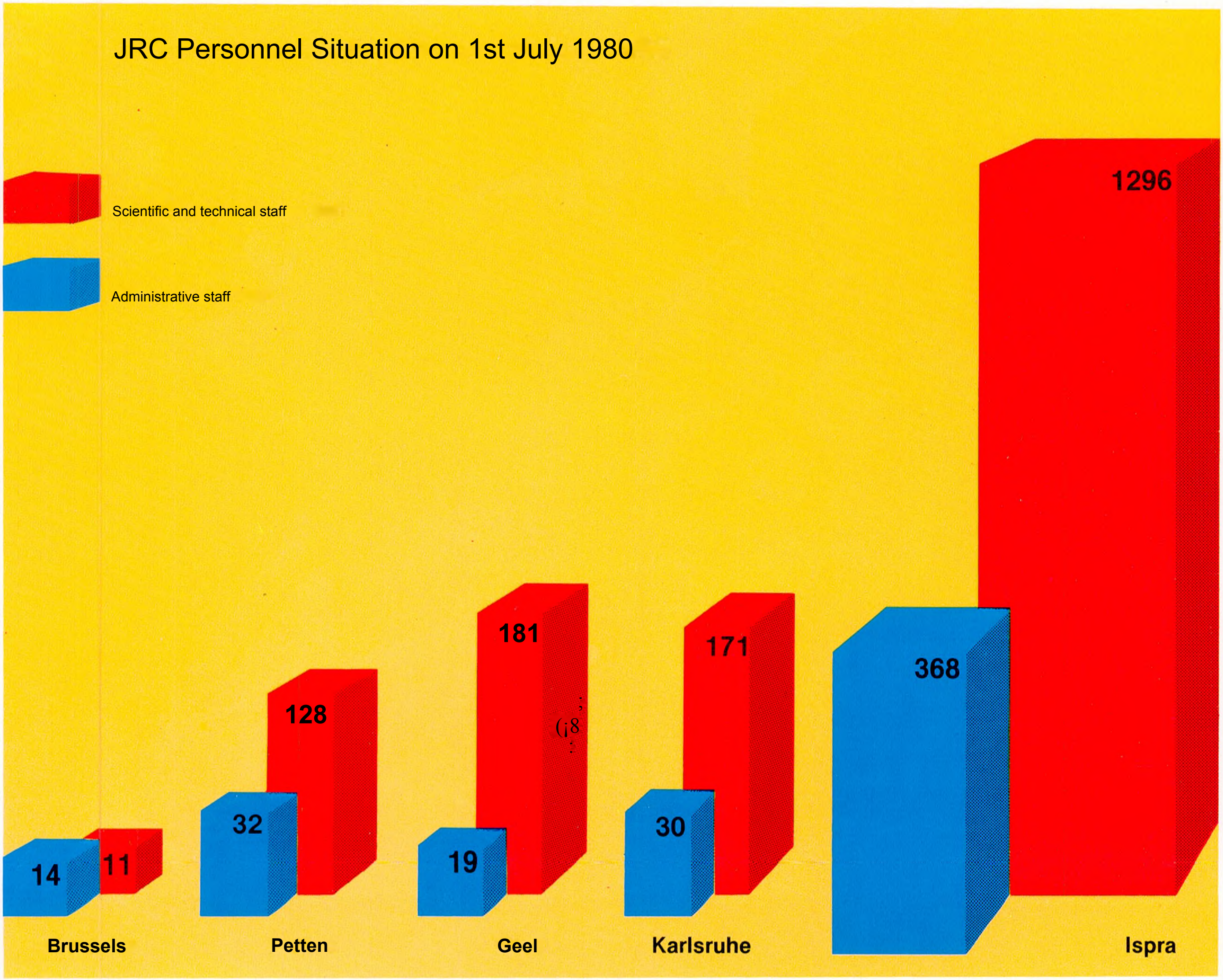
The Joint Research Centre was established under the Euratom Treaty as a nuclear research centre. It became operational in 1960/1961.

Since the beginning of the seventies, the JRC has broadened the scope of its work, expanding into various areas of interest to the European Community. It now carries out research into new energy techniques, investigates a variety of environmental problems and provides support for sectoral activities of the European Commission as diverse as informatics and consumer protection.

Altogether the four establishments which make up the Centre — Geel in Belgium, Ispra in Italy, Karlsruhe in Germany and Petten in the Netherlands — employ over 1,800 scientists and technicians and some 450 administrative personnel. Over the last 18 years 500 patents have been filed. The first patent registered by the European Patent Office at Munich originated from the JRC.

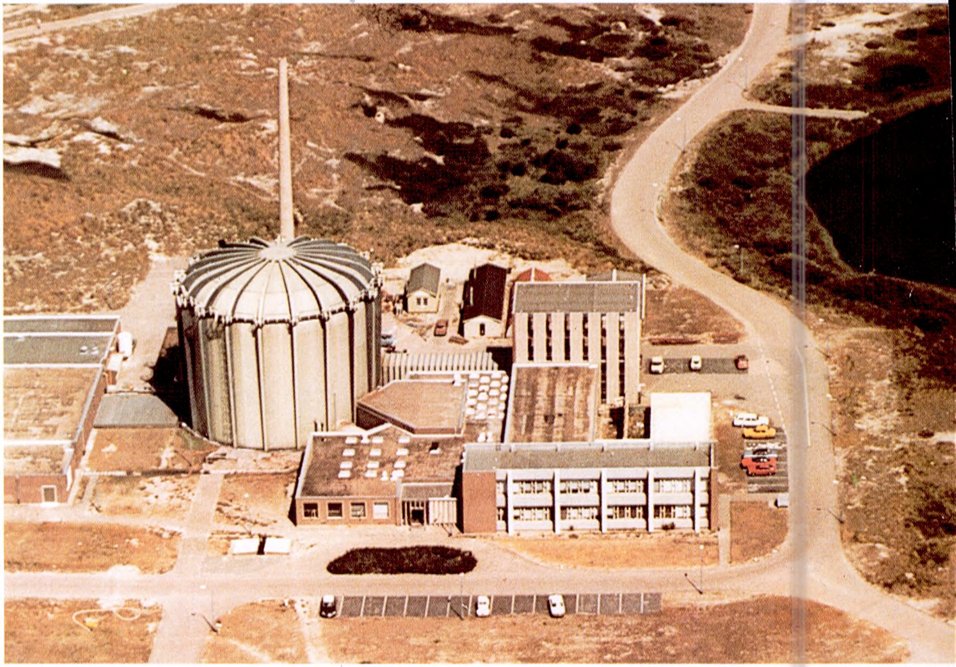
The JRC research results have been described in about three thousand publications.




JRC Personnel Situation on 1st July 1980
Scientific and technical staff
Administrative staff
14
11
32
128
19
181
30
171
368
1296
Brussels
Petten
Geel
Karlsruhe
Ispra

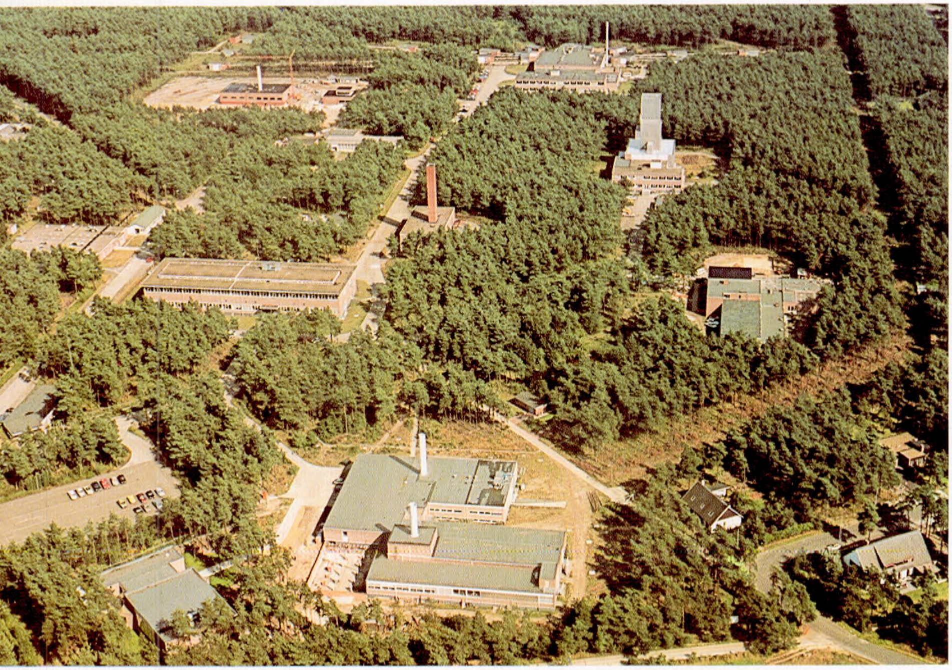
The Four Establishments

The **Petten Establishment** is situated in Northern Netherlands and specialises in research into high-temperature materials. Its High Flux Materials Testing Reactor is one of the largest irradiation facilities in the EC and in 1979 confirmed its position as one of the busiest materials testing reactors in the world. Apart from performing tasks for the benefit of interested Member States, surplus irradiation space is made available to outside users against payment and the centre collaborates with most nuclear research centres inside the EC.



The **Ispra Establishment** which is situated on 400 acres of land on the banks of Italy's Lake Maggiore, is by far the largest of the JRC's four establishments, employing three quarters of the JRC's total staff.

Although it was initially intended as a purely nuclear research centre with the emphasis on nuclear safety, well over 30% of Ispra's budget is now devoted to other fields. These include, for instance, research into alternative sources of energy and, in the environmental field, the use of satellites for agricultural purposes. It has its own research reactor, the ESSOR reactor.

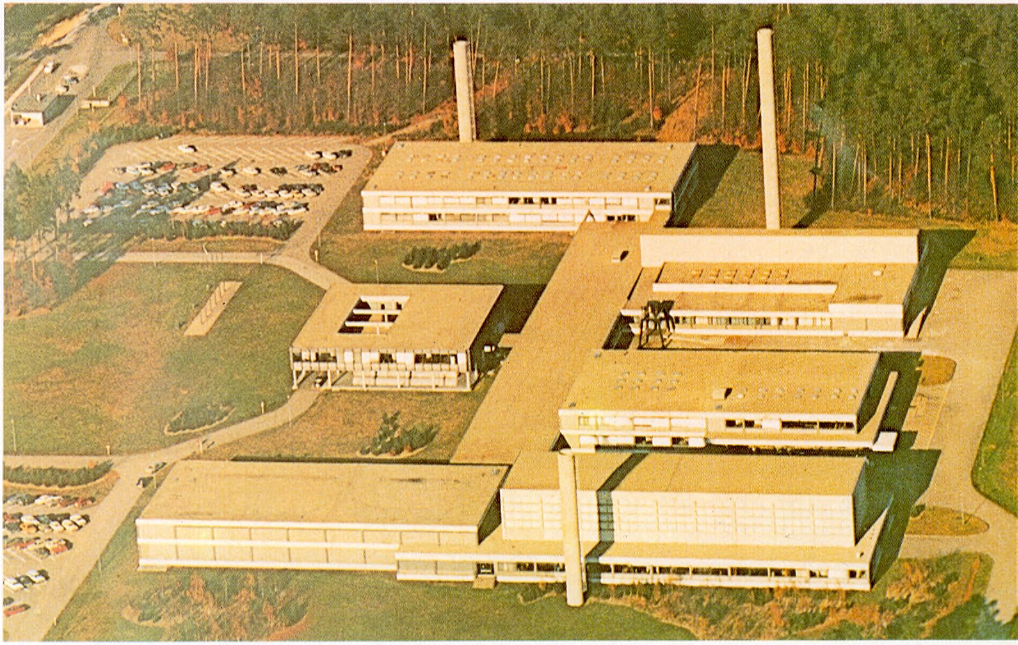


The **Central Bureau for Nuclear Measurements** (CBNM) at Geel in Belgium is specifically described in the Euratom Treaty as "a bureau of standards specialising in nuclear measurements for isotope analysis and absolute measurements of radiation and neutron absorption".

Its two major accelerator facilities have been designed to provide nuclear measurements of basic importance to the development of nuclear power reactors. In addition the bureau has a series of well-equipped laboratories for studying the decay of isotopes and for preparing and assaying reference material used in the nuclear energy industry.

Research into plutonium and other actinides, the so-called transuranium elements (highly radioactive substances not occurring naturally, but predominantly produced in nuclear reactors) is carried out at the **Institute for Transuranium Elements** in Karlsruhe, which is located on the site of the German national nuclear research centre.

The research forms part of the JRC's nuclear safety programme. Because the transuranium elements are highly radioactive and radiotoxic, the institute is equipped with highly specialized facilities.



Research at the JRC

The Commission draws up four-year programmes for the Joint Research Centre which it submits to the European Parliament for its opinion before they are approved by the Council of Ministers. The 1980-1983 programme will cost about million EUA* — a large sum, though representing less than 1% of the non-military research budgets of the nine Community countries.

The contribution of the JRC to an overall EC research policy is defined in terms of three criteria:

a) The execution of research programmes of a «central» nature. This includes the JRC's activities, which justify the establishment of a broad research capacity at Community level; which call for the centralization of facilities or functions; and in which the JRC can act as the focal point or catalyst for coordination at Community level.

b) The execution of a public service role. The JRC seeks to meet the needs of Governments, organizations, universities and industries for specialised equipment, know-how, products and services. The JRC's independent position, which guarantees impartial judgement, is a significant factor in this context.

c) The provision of services to the Commission. The JRC provides technical expertise and support to the Commission in the formulation and implementation of the Community's sectoral policies.

There are six main areas of research in the 1980-1983 JRC programme:

- nuclear safety and the fuel cycle;
- new energies;
- study and protection of the environment;
- nuclear measurements;
- specific support for the Commission's sectoral activities, and
- operation of large scale installations, and in particular the High-Flux Reactor HFR at Petten.

This "direct action" through the JRC is separate from the indirect EC research activity through joint funding provided for work in national laboratories. In many areas the work of the JRC is complementary to and closely coordinated with the indirect action programmes. This is particularly true in the fields of nuclear materials, radioactive waste, solar energy, hydrogen, thermonuclear fusion and environment. In 1979 the Community budget for direct and indirect action was 196 million EUA*. Total funding for scientific research therefore represents about 1.8% of public R & D funds in the Member States of the European Community.

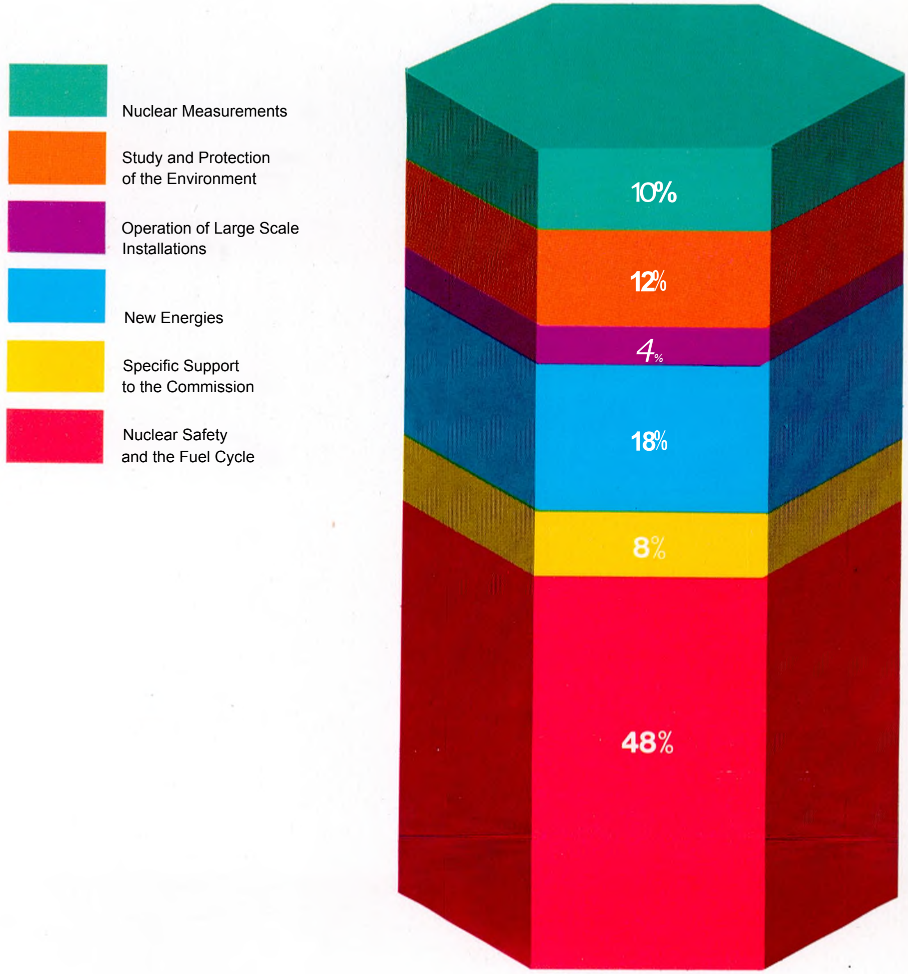
The JRC not only has close links with the indirect action programme, but also cooperates with well over a hundred major research laboratories inside and outside the Community and with international organizations, such as the International Energy Agency of the OECD, the International Atomic Energy Agency and the European Space Agency. Contacts with developing countries have also been considerably strengthened in recent years through the provision of technical know-how and expertise.

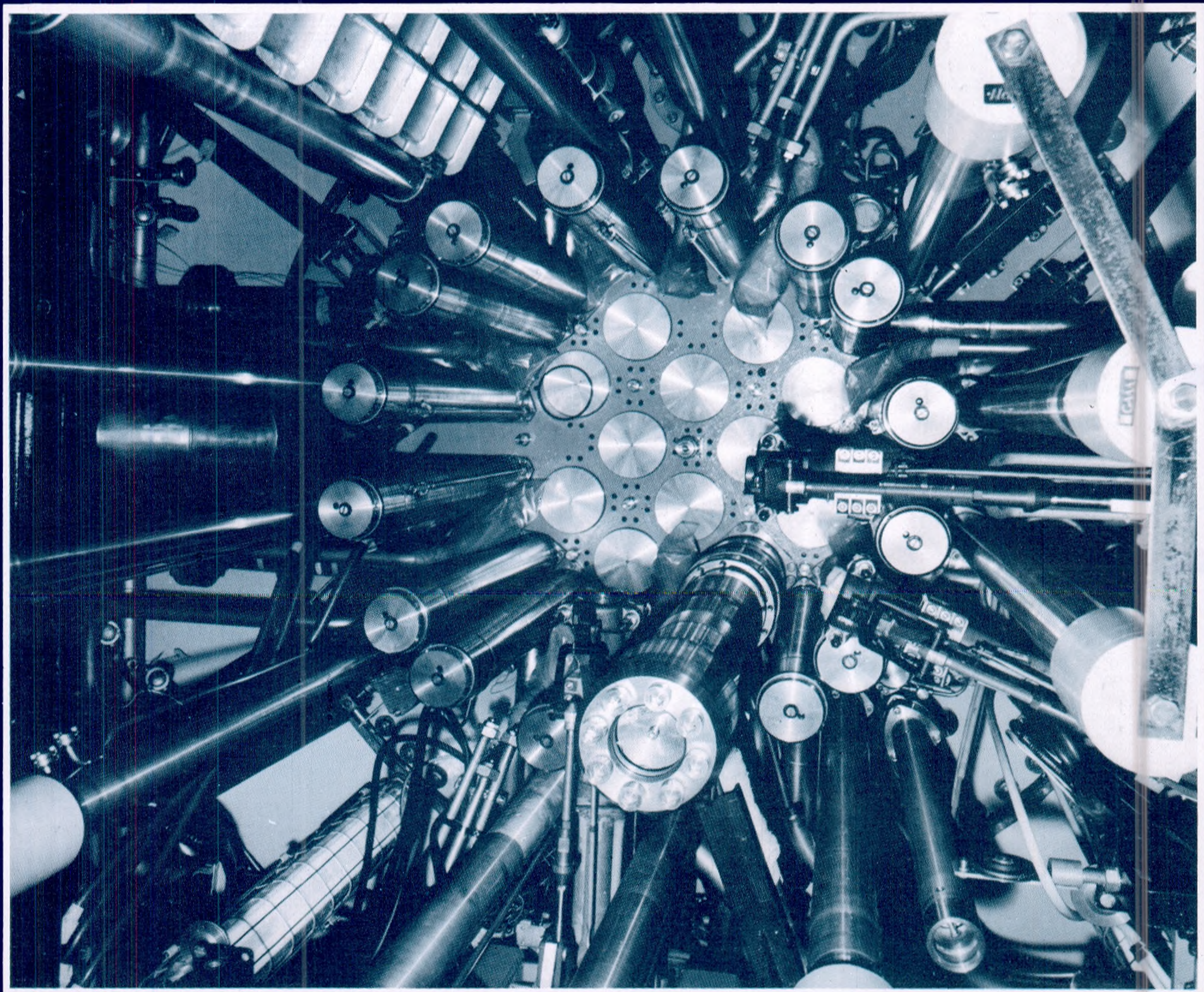
* Jan. 1980: 1 EUA (European Unit of Account) = FB, FLUX 40.46; DM 2.49; HFL 2.75; £ sterl. 0.63; DKR779; FF5.84; LIT 1162; 1RL£0.67; US$ 1.44

Because of their geographical dispersion and because of their specific requirements, the four establishments of the JRC enjoy a large degree of autonomy in their day-to-day management. The overall coordination within the JRC is assured by the Director-General and his small staff in Brussels. The introduction of new staff regulations for Community research workers in late 1976 provides for greater staff mobility and flexibility. Frequent consultation and information of the JRC staff and their representatives help avoid social conflict and ensure the necessary degree of mutual confidence and respect.

Research Areas within the Overall JRC Programme

(Approximate deployment of staff)





The reactor core of ESSOR viewed from the upper reactor level

Research area 1

Nuclear safety and the fuel cycle

1.1 Reactor safety

1.2 Plutonium fuels and actinide research

1.3 Safety of nuclear materials

1.4 Fissile materials control and management

1.1 Reactor safety

Reactor safety has always been a cornerstone of JRC activity and accounts for about 35% of its budget. The need for intense reactor safety research will continue to exist as long as, in an increasingly difficult world energy situation, nuclear power remains one of the few ways to meet the European Community's energy needs. The JRC's research into nuclear safety is of direct use to licensing authorities, the nuclear industries and power plant operators.

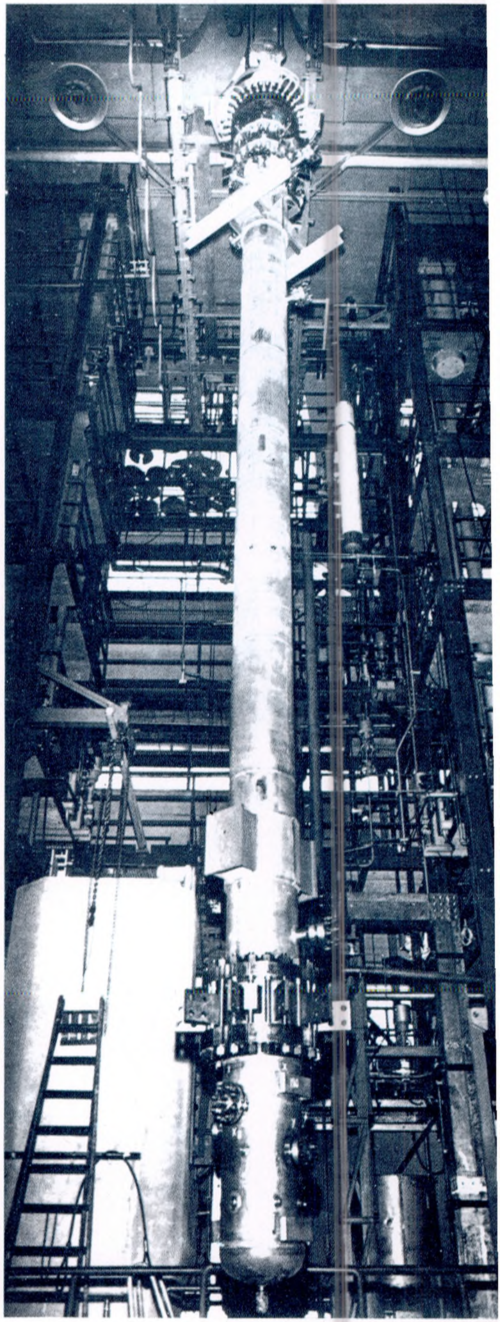
77% of the power plants in the EC are Light Water Reactors and it is on these that the JRC focuses in particular. But it is also concerned with the safety of Fast Breeder Reactors because of their potential use in the future.

In the case of the safety of Light Water Reactors work is concentrated on the evaluation of hypothetical loss-of-coolant accidents. The JRC's programme includes detailed theoretical analysis and experimental studies under various small, medium and large break conditions of the primary coolant circuit of a reactor.

Accidents are simulated out-of-pile in the Loop Blowdown (LOBI) facility built in collaboration with the German government at the Ispra Establishment. The LOBI facility

Right: LOBI - mounting of the reactor pressure vessel model

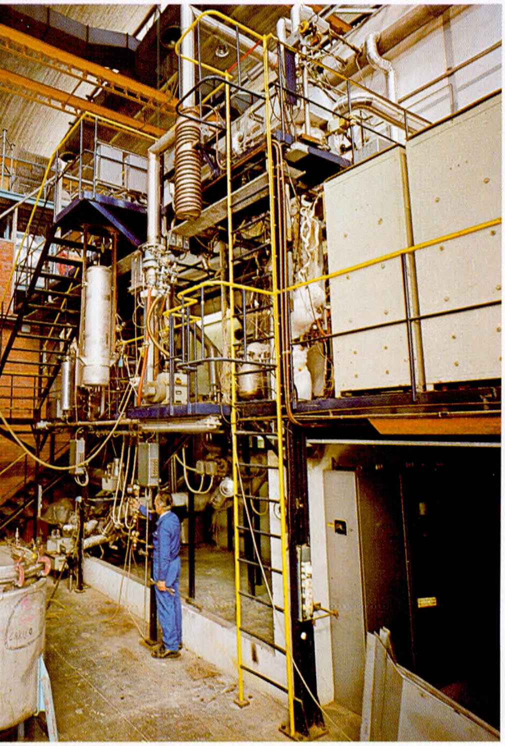
Below: LOBI - upper part of the reactor pressure vessel model

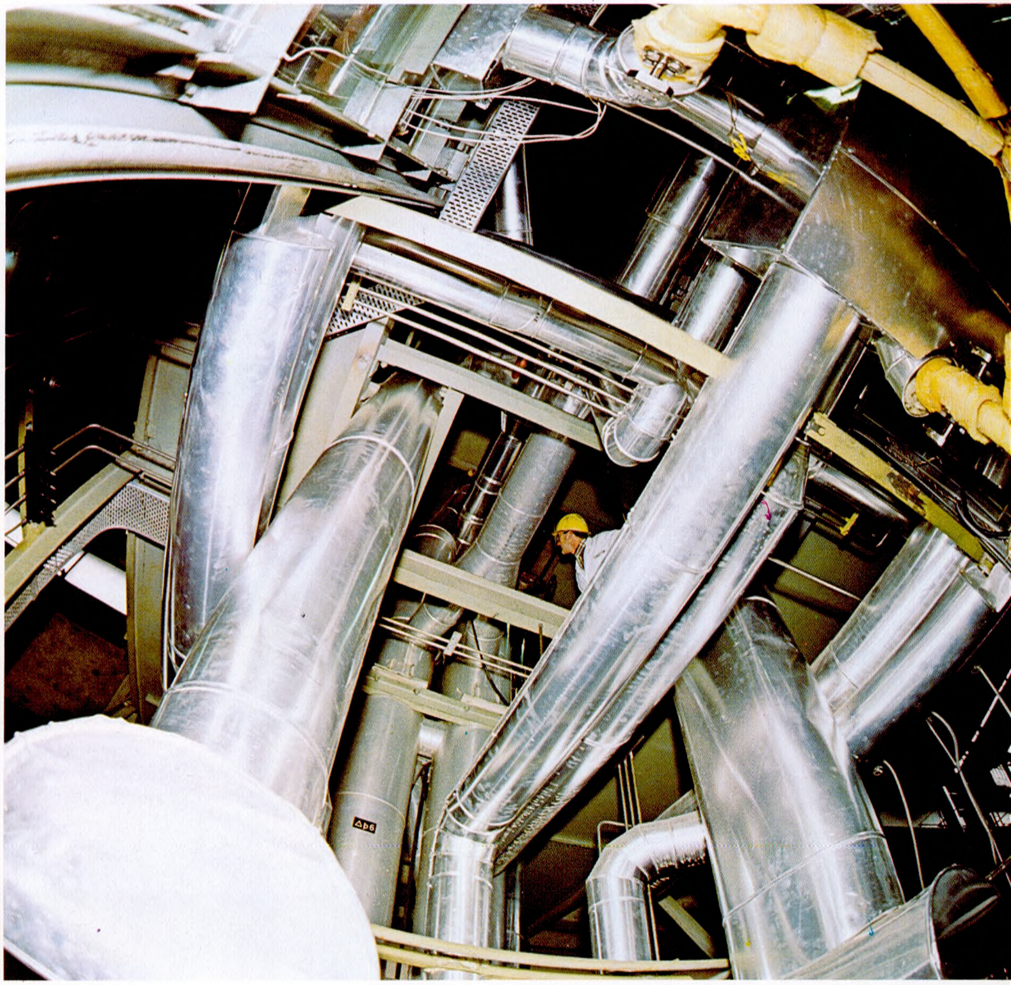


became operational in December 1978. It is the only high pressure integral test facility within the European Community and it is bigger than the only other two comparable installations outside the Community. The experimental results obtained from LOBI will be used to check and to refine existing computer codes which define present safety requirements.

Below left: Sodium thermohydraulic testing facility for liquid metal fast breeder research

Below: High pressure water testing facility for Light Water Reactor research





Reactor safety

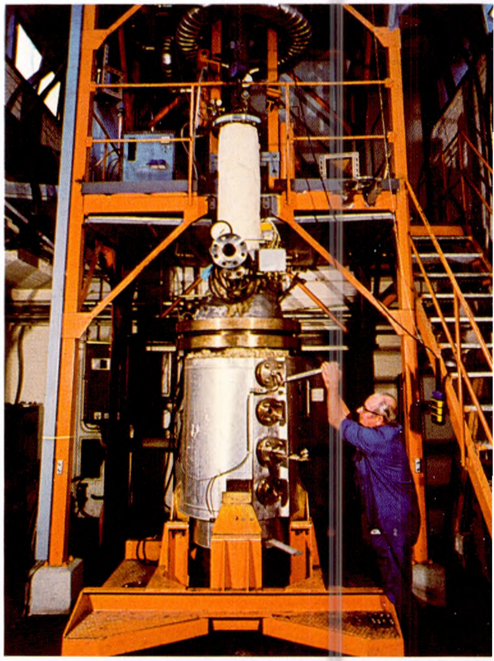
For in-pile experiments into loss-of-coolant accidents the ESSOR research reactor at Ispra provides unique experimental possibilities.

The Super-Sara test loop, which is under construction and which will be placed in the ESSOR reactor, has been designed to study the behaviour of large fuel bundles (36 fuel rods, 2 m long) under various small, medium and large break conditions in the coolant system of the reactor. The number of rods and their length are particularly important factors for the validity of the experiment. The Super-Sara Project rates second in the world and first in the EC in this respect. It is therefore expected to make a significant contribution to international reactor safety research. The significance of the project is underlined by the fact that both the United States and Japan are interested in participating.

In the case of fast breeder reactors emphasis is on testing the behaviour of structures in a core meltdown. An out-of-pile facility is to be built at Ispra for this purpose and a collaboration agreement has been signed with Sandia Laboratories in the United States.

Other JRC activities in this field include testing the interaction of molten fuels and coolant under accident conditions, testing strains on reactor containments, studying structural failure and metal fatigue, developing equipment for detecting structural failure and working out a European Accident Code which will provide mutually compatible computer codes throughout Europe for covering various hypothetical accidents in a fast breeder core.

The results of all these reactor safety research projects are used in comprehensive reliability and risk assessment studies carried out by the JRC both on liquid metal fast breeder reactors and light water reactors.



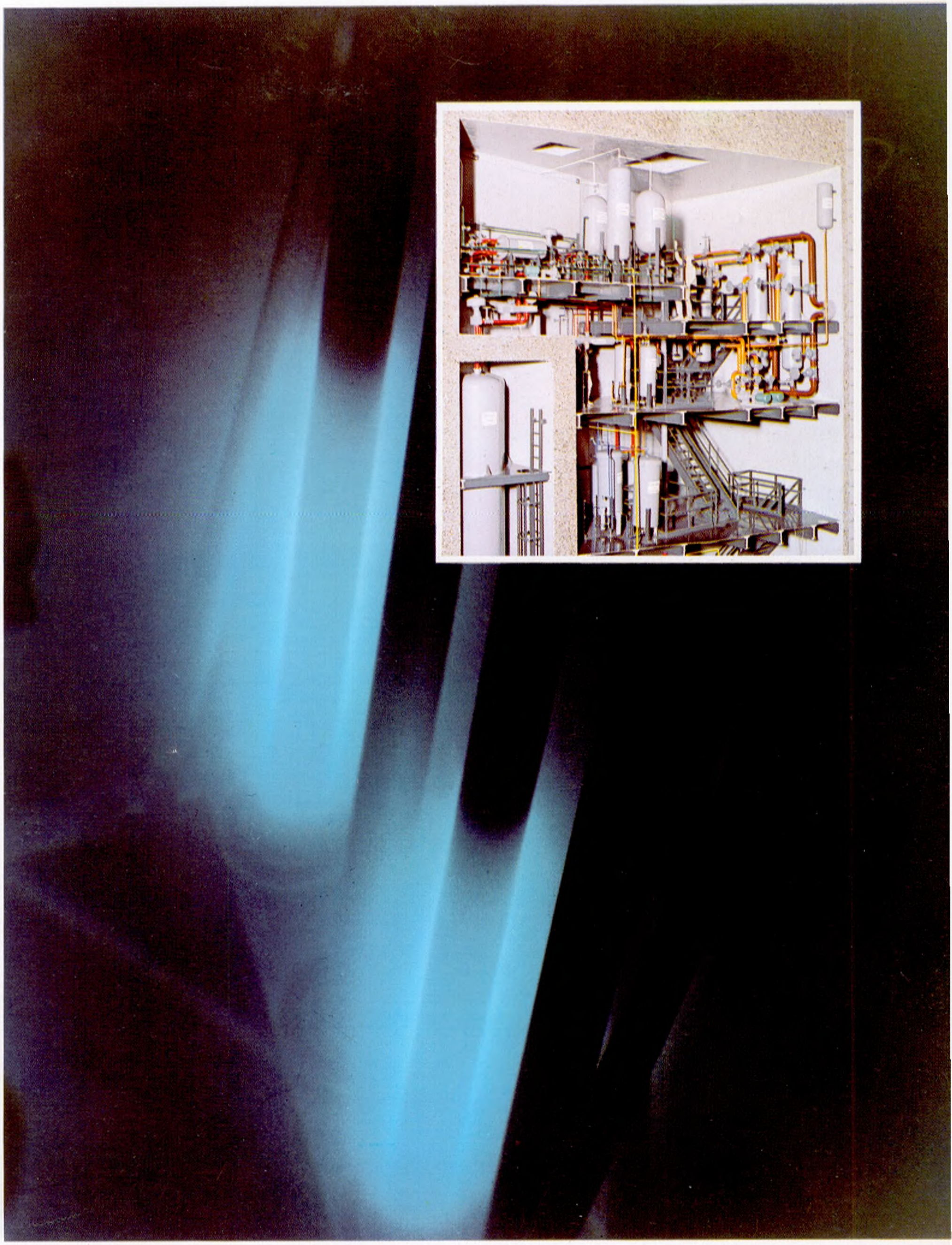
Right: ESSOR reactor fuel rods

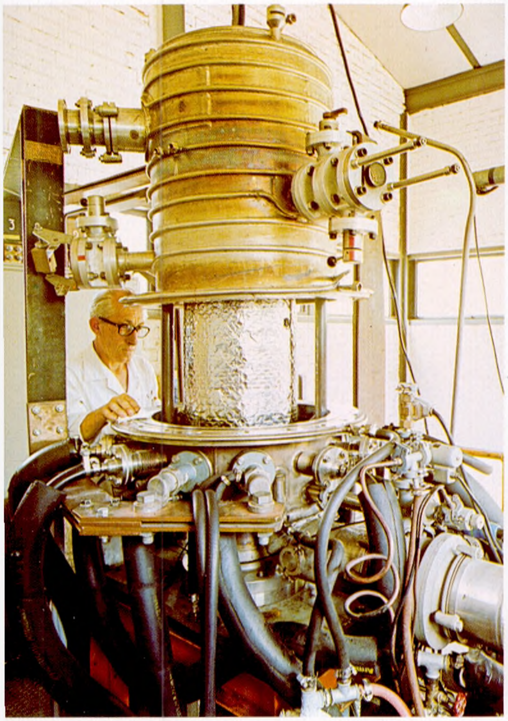
Right insert: Mock-up of the Super Sara project

Left: Rig for fuel-sodium interaction studies

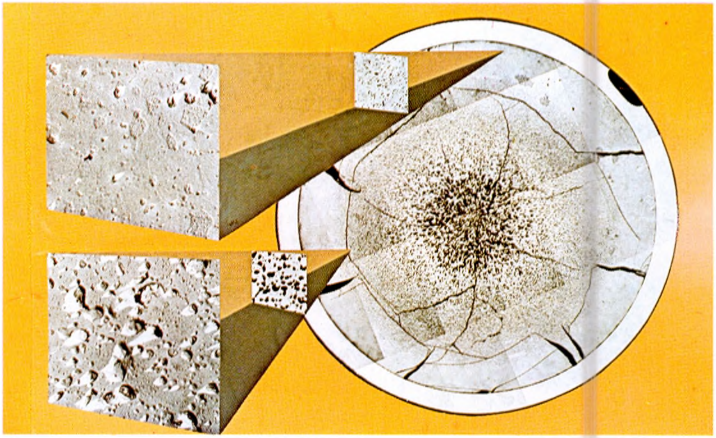
Below left: Cutting of a steel plate to verify non-destructive testing procedures of reactor pressure vessels

Below: High temperature melting facility



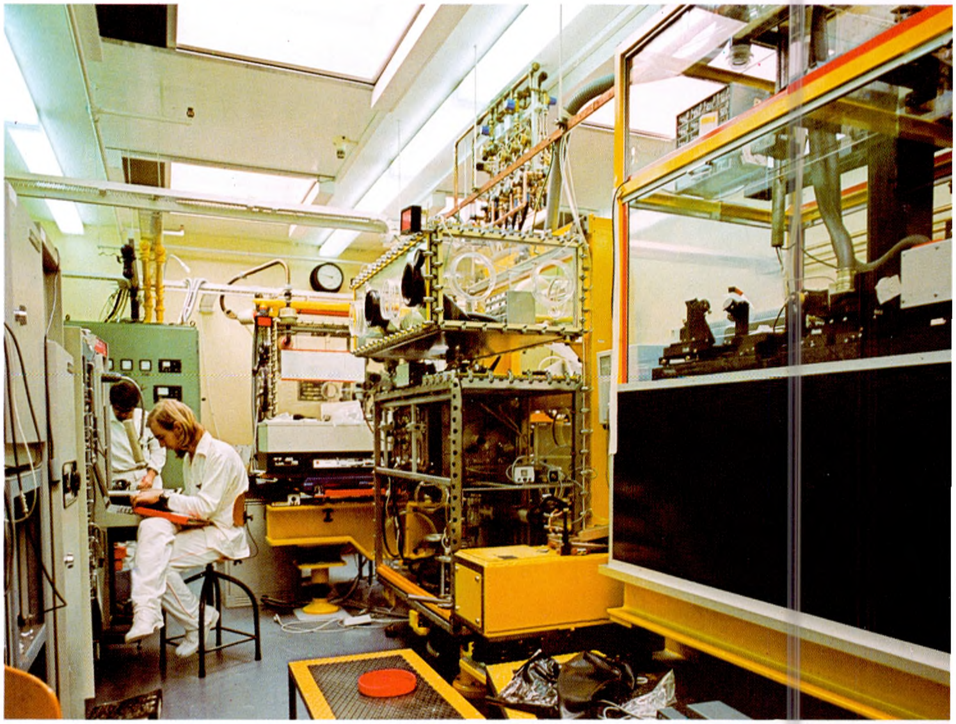


1.2 Plutonium fuel and actinide research



The programme which is carried out at the Karlsruhe Establishment, is intended to help improve reactor safety, safety for workers in the nuclear industry and the safety of the population at large. The work is also relevant to the problems of radioactive waste disposal.

The programme is in three parts. One project concentrates on understanding the safety limits in the use of plutonium fuels for fast breeder reactors. The second project is concerned with the generation of transplutonium elements in-pile (i.e. within the reactor core) and the problems of handling and reprocessing such advanced fuels. The third project involves fundamental research on the solid state and chemical properties of the actinides.



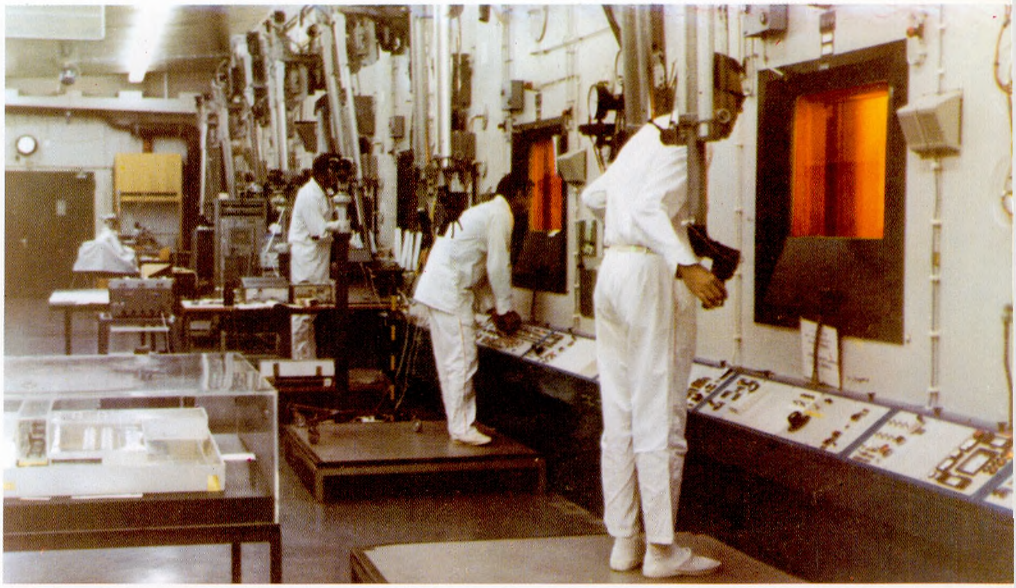
Above right: Fission gas bubble formation during irradiation causing swelling in (Uranium, Plutonium)-carbonitride fuel

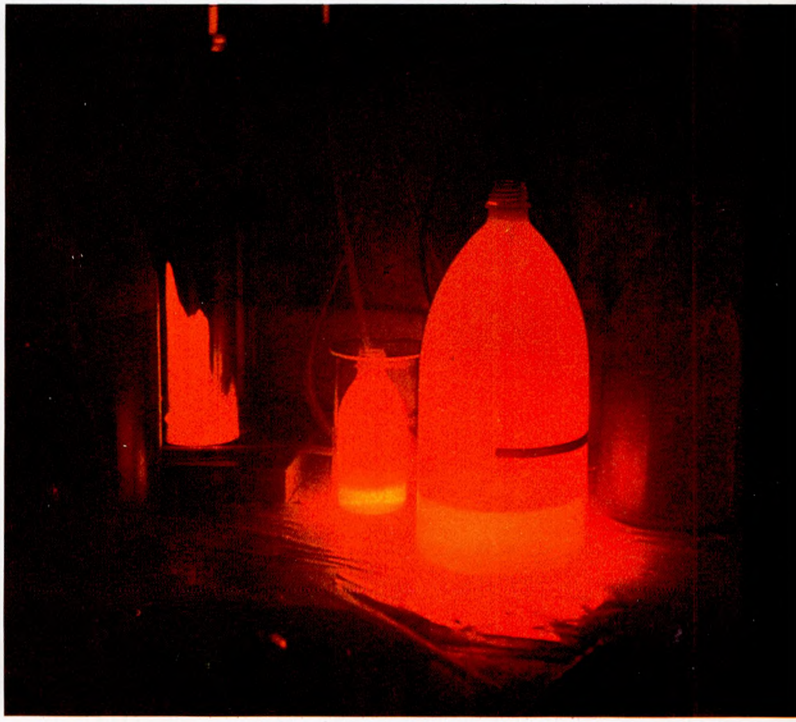
Below right: Installation for laser-heating to temperatures up to 7000 Kelvin of fuel samples for vapour pressure determination

Right: Laboratory with a-tight hot cells for post irradiation analysis of fuel

Below left: Single crystal of Uranium dioxide for physical property measurements

Below right: Radioluminescence of Curium during recovery and purification



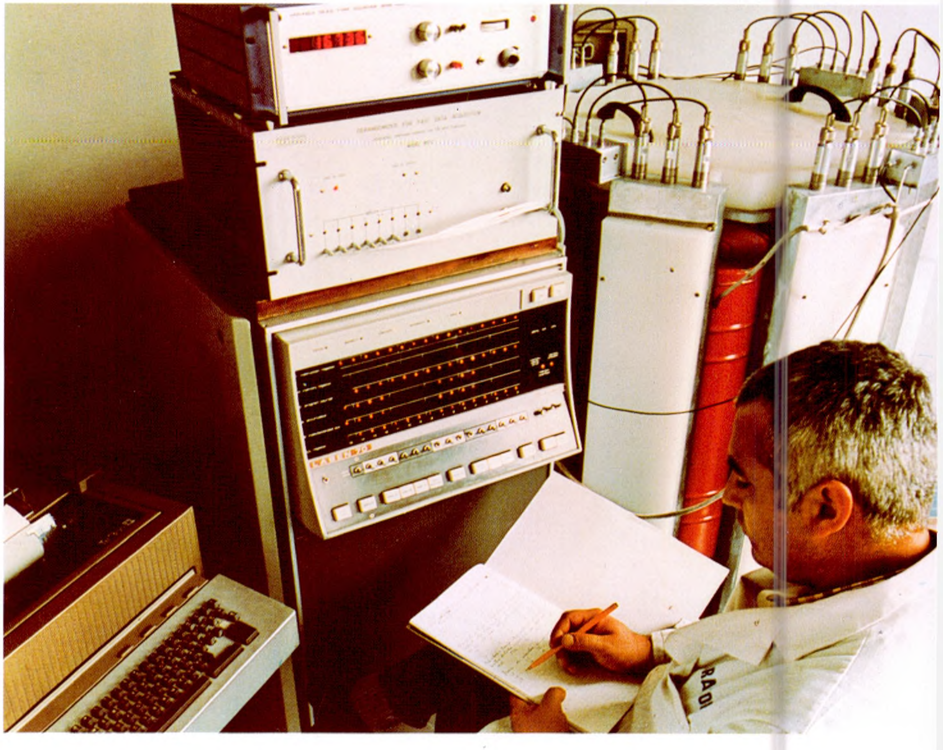


1.3 Safety of nuclear materials

The main purpose of this programme is the evaluation of the long-term hazard of radioactive waste disposal in geological formations. The evaluation of the long-term hazard requires the development and application of waste hazard analytical models and experimental studies concerning the stability of conditioned waste and migration of the actinides in the environment.

A second important objective of the programme is the development of methods for reducing the radioactive actinide content in wastes; these elements are mainly responsible for the long-term hazard. The possibility of the separation of the actinides from the high activity waste and of their recycling in nuclear reactors is being investigated.

A third objective of the programme is the development of monitoring systems for plutonium contaminated wastes. This requires the setting-up of control techniques which avoid direct handling of the contaminated wastes.



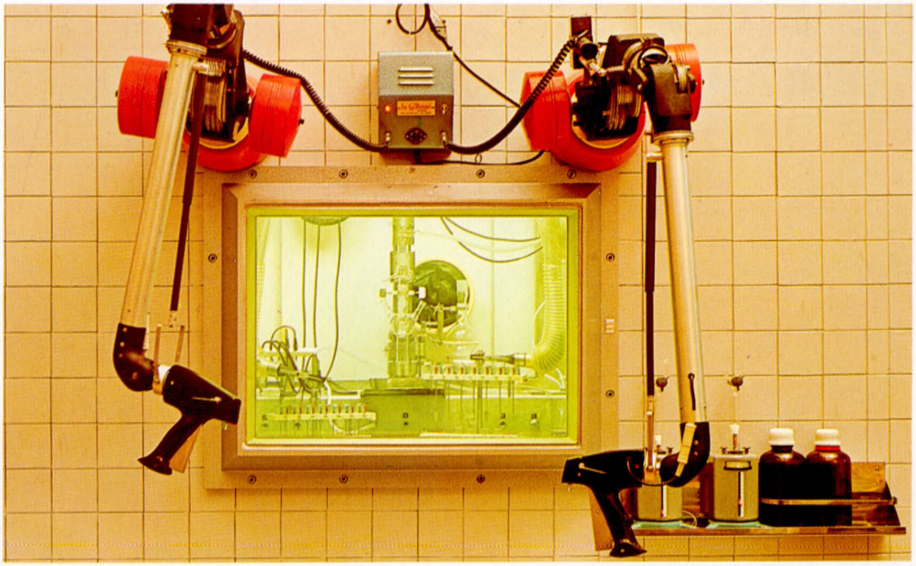
Above right: Computerized system for monitoring plutonium contaminated wastes by passive neutron assay

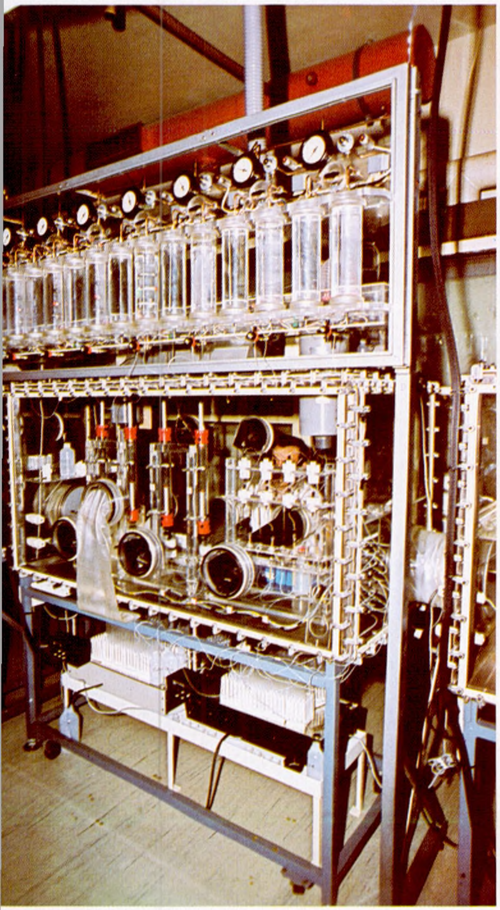
Right: Gamma spectrometry for monitoring plutonium contaminated wastes by passive gamma assay

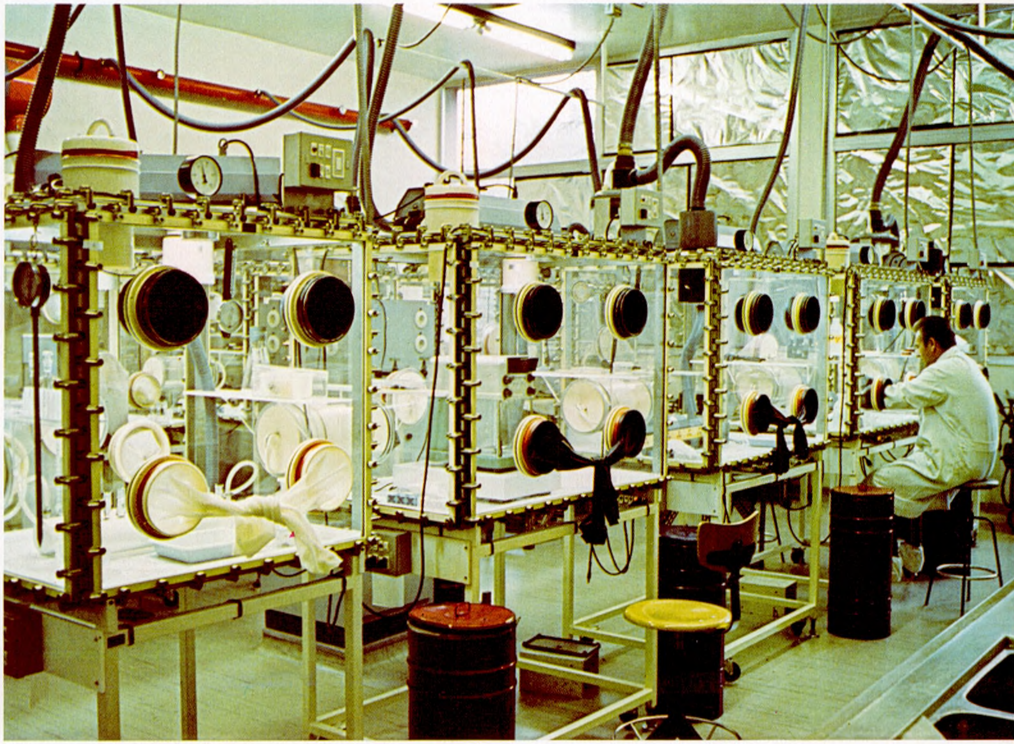
Right: Lead cell used for experiments on actinide separation from high activity waste

Below left: Radiochemical laboratory set-up for experiments on actinide separation

Below right: Apparatus for studies on actinide migration in geological formations



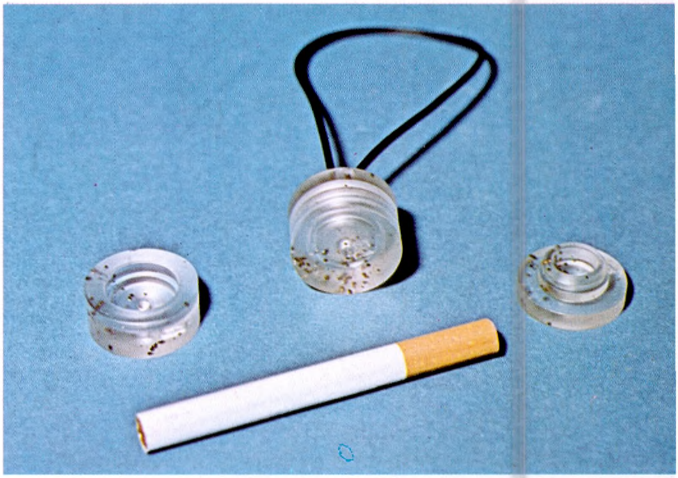


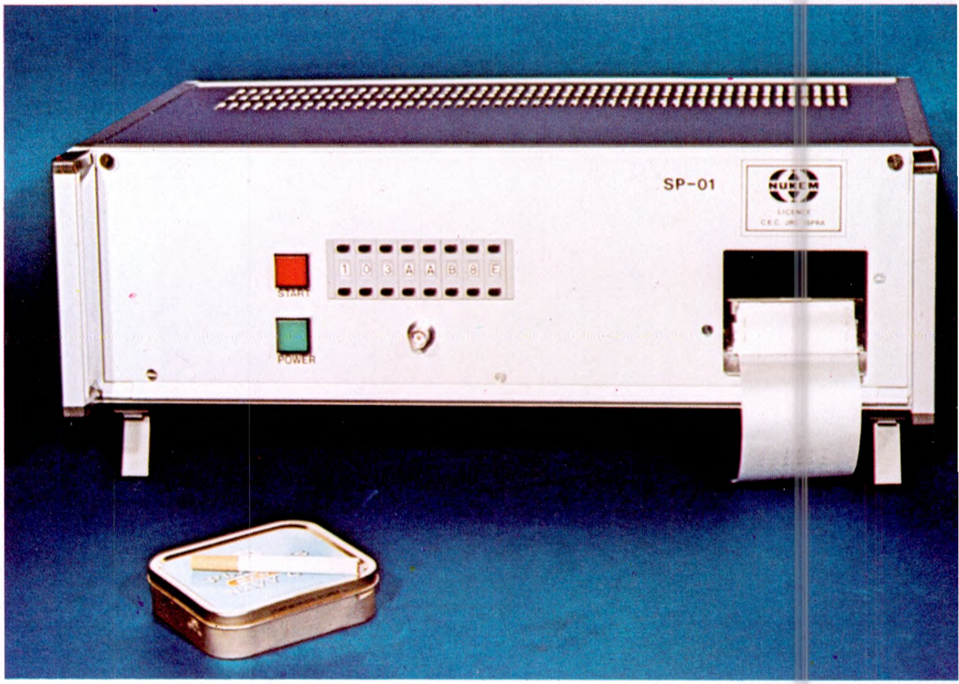


1.4 Fissile materials control and management

The potential dangers of diversion of nuclear materials necessitate a tight control of all nuclear fuels used in power stations and elsewhere.
Precise accounting, containment and surveillance methods are required in order to guard any diversion. The European Community has its own Euratom safeguards system which functions in close cooperation with the system of the International Atomic Energy Agency (IAEA).

The JRC programme is designed to refine the accounting methods and techniques used by plant operators and safeguards inspectors. Much of the equipment used by the Euratom Safeguards Directorate has been developed by the JRC.





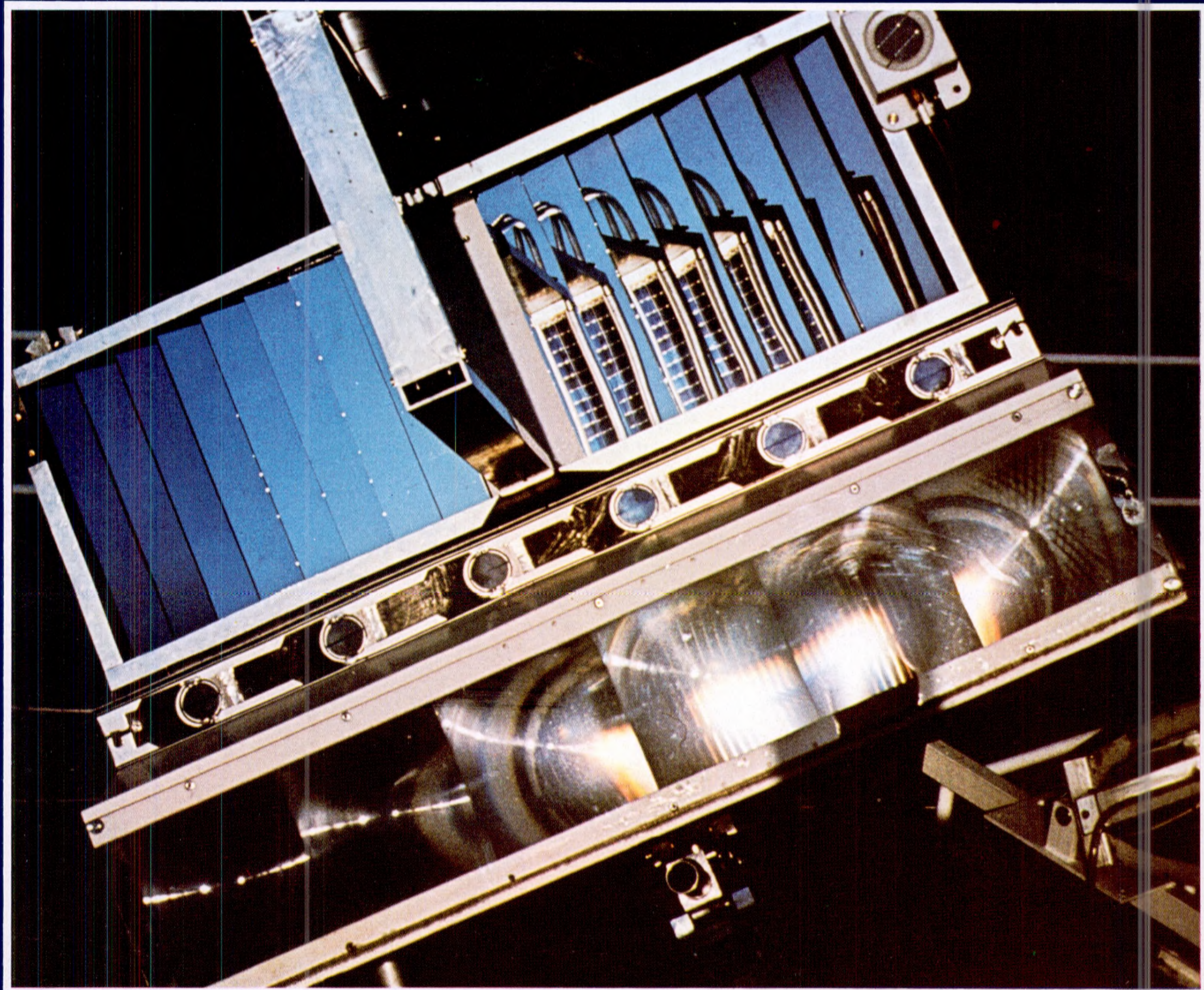
Above right: Plexiglass seals with metallic inclusions used for the sealing of containers with fissile materials or the access to storage areas

Right: Electronic equipment for the identification of seals by ultrasonic techniques

Right: Gamma radiation measurement equipment and mechanical scanner for the verification of the fissile material content of fuel rods in nuclear fuel fabrication plants

Below: Instrument used by safeguards inspectors for the determination of large quantities (up to 5 kg) of highly enriched uranium. The technique is based on fast neutron activation and prompt fission neutron counting

Below right: Mobile mass spectrometer for the determination of the isotopic composition of various uranium compounds



Light concentrators and photovoltaic cells for conversion of solar energy into electricity

Research area 2

New energies

2.1 Solar energy

2.2 Hydrogen production, energy storage and transport

2.3 Thermonuclear fusion technology

2.4 High temperature materials

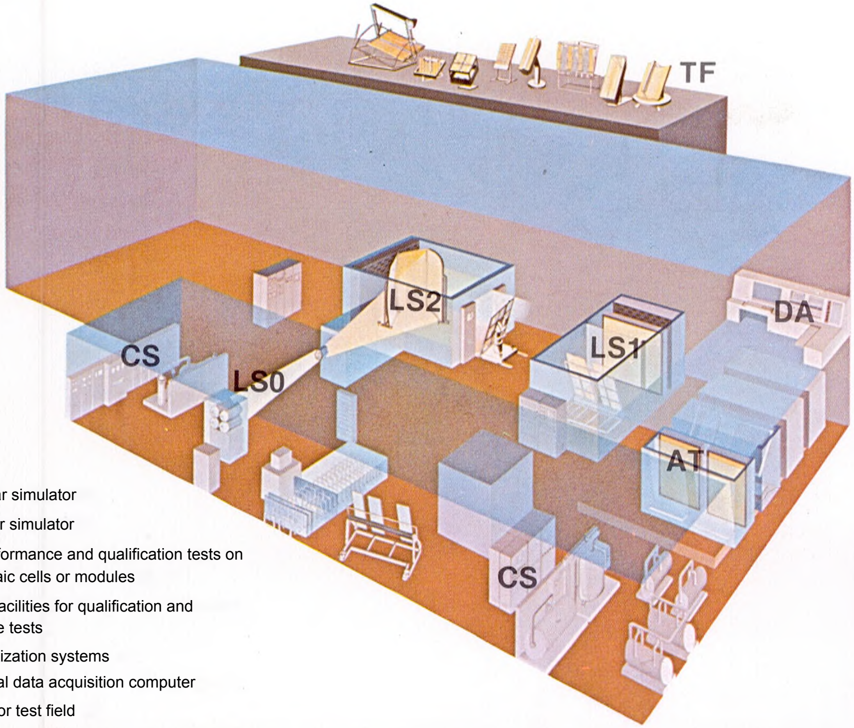
2.1 Solar energy

Contribution to an extended application of existing solar technology is the goal of two projects: Habitat and European Solar Test Installation (ESTI). In the project Habitat complete solar systems for heating and cooling are tested, using a Solar Laboratory of 160 sq.m (ground surface which can accommodate 100 sq.m of various types of solar collectors). The European Solar Test Installation is an indoor and outdoor laboratory with several facilities for testing solar thermal collectors and photovoltaic cells. They are tested to measure performance and to estimate endurance, resistance to corrosion, rain, hail, snow (since solar energy is feasible even in colder climates providing the summer is reasonably warm), salt, dust, etc. The facilities are used to define test procedures and methodologies, and are available to test equipment from other laboratories and firms.

The JRC's researchers at Ispra are trying both to accelerate the introduction of solar energy on a commercial scale by refining existing technology and to develop longer term applications in areas where an industrial effort is not yet justified. The latter mainly comprises research into semiconductor-electrolyte solar cells as an alternative to conventional solid state solar cells and theoretical studies into the bioconversion of solar energy by photosynthesis.

Right: Aerial view of the Solar Laboratory for studies on room heating and cooling systems

Below: The inclined south wall of the Solar Laboratory at sunset. Solar collectors are connected with a water reservoir for heat storage and equipped with a heat pump



LS1: Solar simulator

LS2: Solar simulator

LSO: Performance and qualification tests on photovoltaic cells or modules

AT: Test facilities for qualification and endurance tests

Cs: Climatization systems

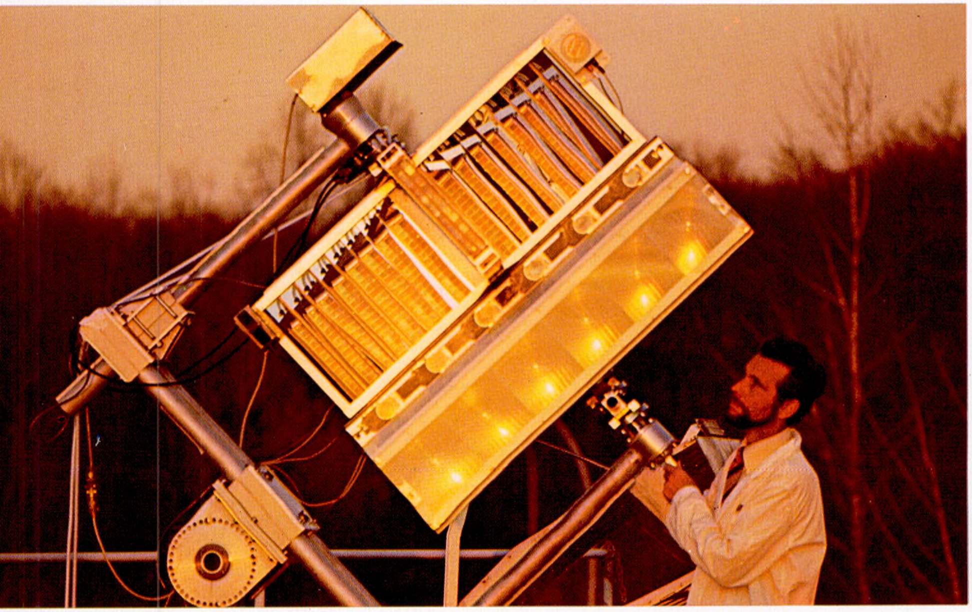
DA: Central data acquisition computer

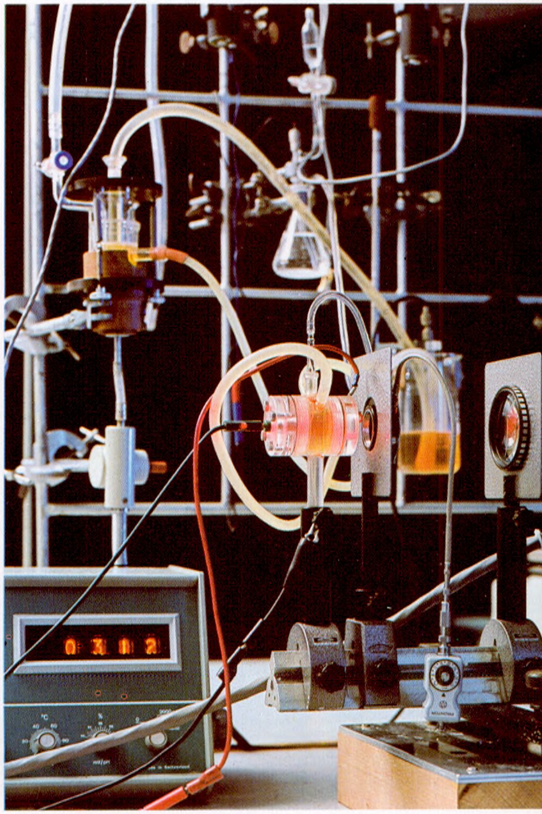
TF: Outdoor test field

Above left: Artist's view of ESTI (European Solar Test Installation) with indoor facilities for testing performance and lifetime of thermal collectors and photovoltaic cells (total indoor working space 1200 sq.m.)

Below left: Self-orienting photo voltaic concentrator system, consisting of Fresnel mirrors and Fresnel lenses. Concentration factors of 15 and 30

Below right: Semiconductor electrolyte junction test cell for the decomposition of water by solar light





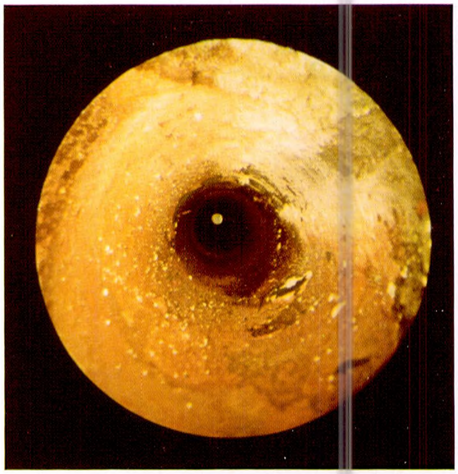
2.2 Hydrogen production, energy storage and transport

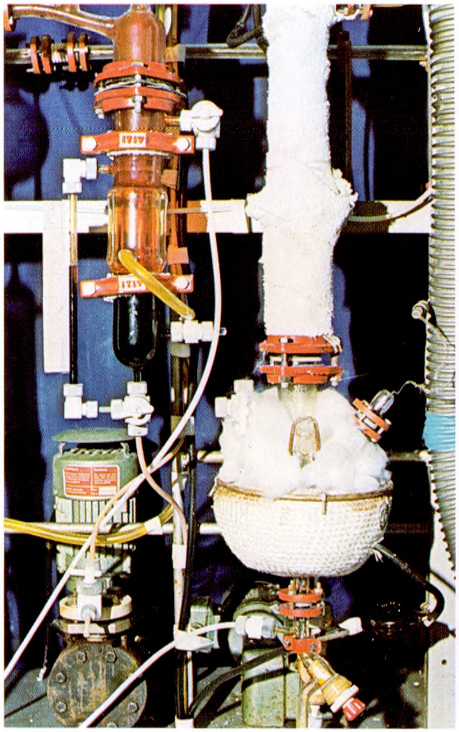
In 1978 the Ispra Establishment was the first in the world to demonstrate on a bench-scale that thermochemical production (as an alternative to electrolytic production) of hydrogen from water was possible. Although hydrogen is not currently an economic energy carrier, it has long-term potential as means for storage and transport of energy and as an adaptable artificial fuel, which could, for example, be used to power aircraft and cars.

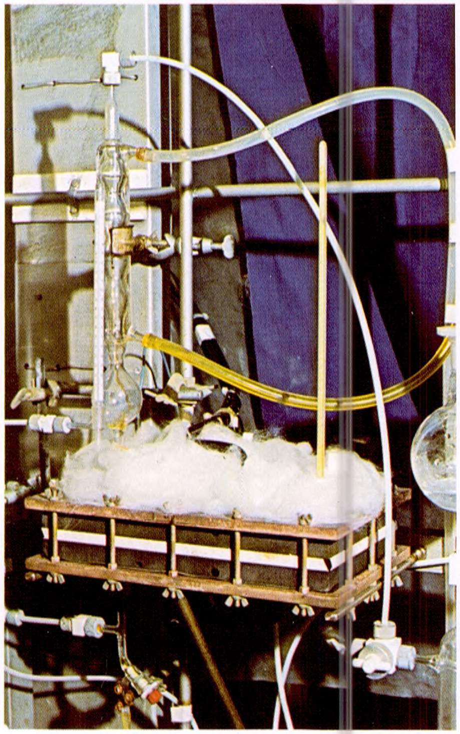
Now that thermochemical production of hydrogen has been established as feasible, the JRC is concentrating on developing techniques for storing and transporting energy by chemical and electrochemical methods. These techniques could help solve the problems associated with the increased use of renewable energies. Because these energies are often remotely located or only intermittently available, economic storage and transport are crucial.

Right: Internal view of a tubular metallic reactor for sulphuric acid decomposition. (Corrosion test for new methods of hydrogen production)

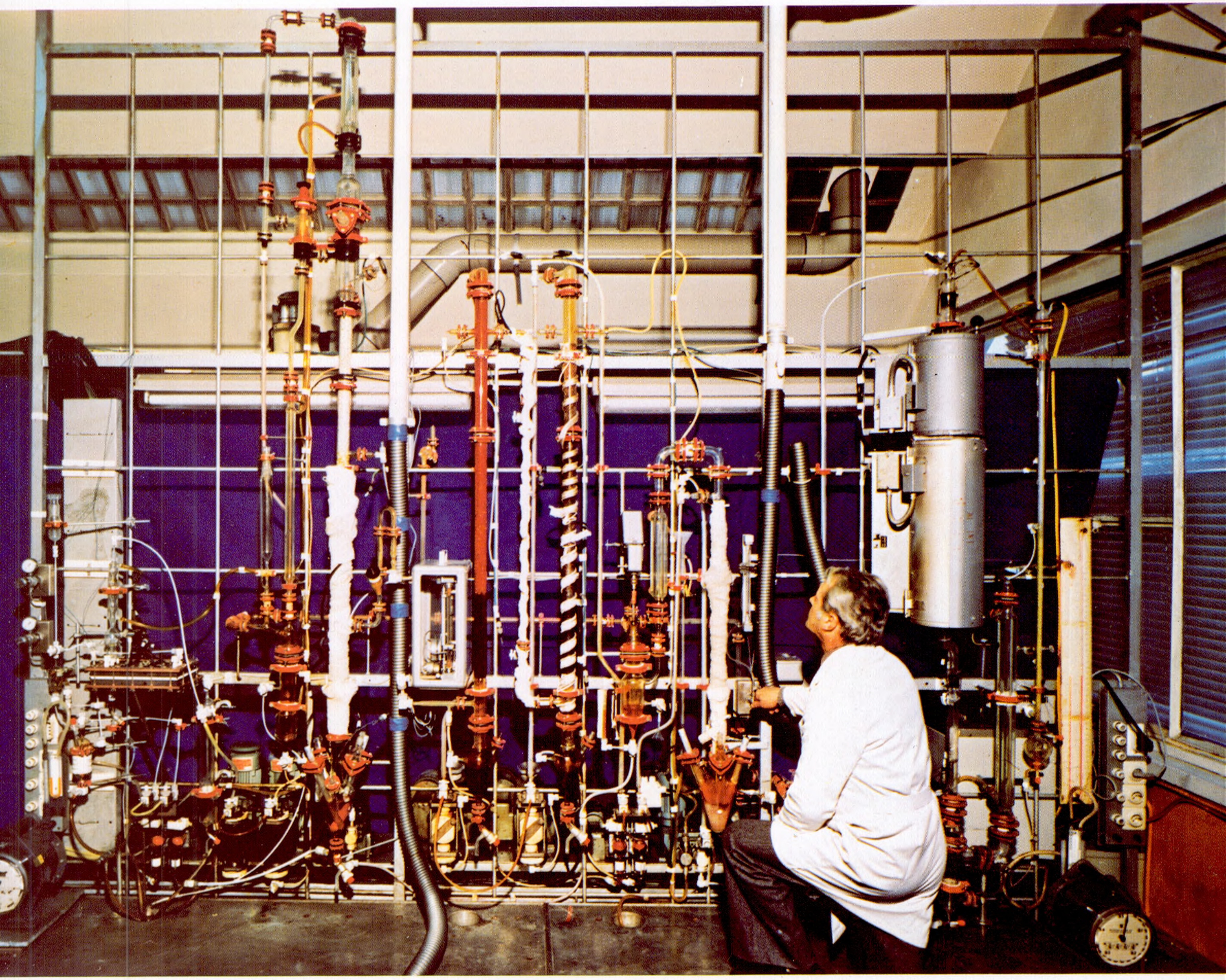
Opposite: A complete view of the laboratory circuit for the thermochemical production of hydrogen: the only inputs are water and energy (mainly heat), the output is hydrogen and oxygen (production 100 l H_2/h)







Right and far right: Close-up view of the components of the laboratory circuit: the bromine distillation tower and the electrochemical cell for the decomposition of the hydrobromic acid. The chemicals are circulated and regenerated inside the circuit.



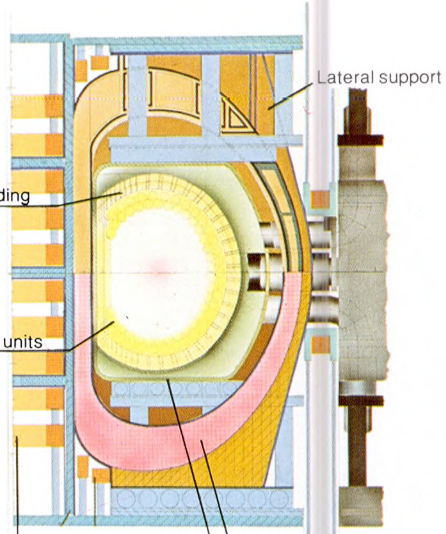
2.3 Thermonuclear fusion technology

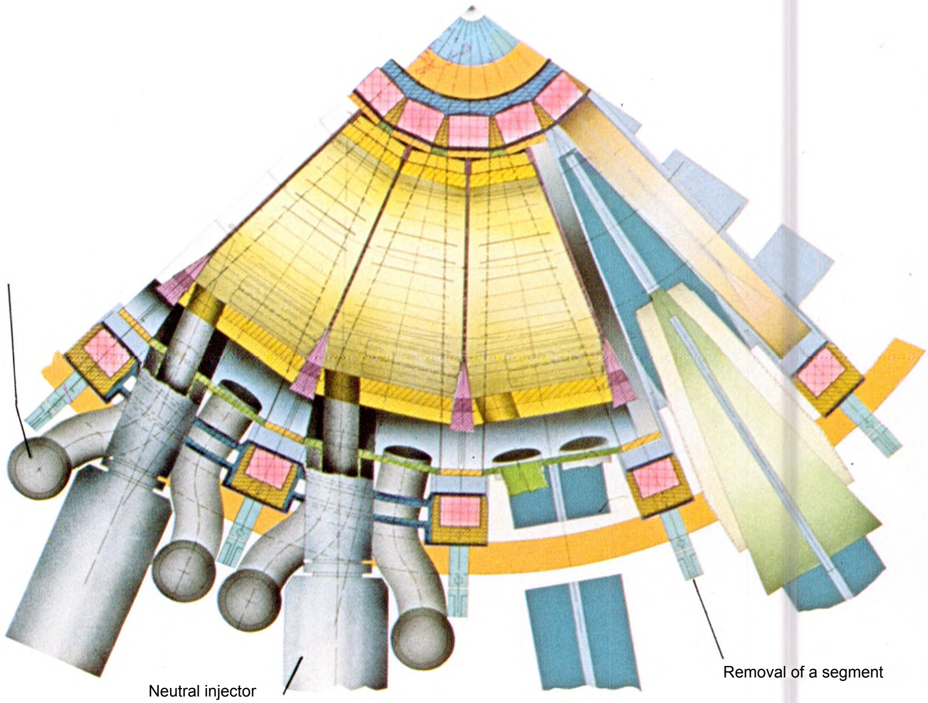
In thermonuclear fusion work, the Joint Research Centre is looking beyond the project to build a Joint European Torus (JET) at Culham, which is being funded jointly by the EC as such and by individual Member States. The JRC's function is to carry on work toward the concepts and materials that will be needed for fusion reactors. The programme includes the design of a demonstration fusion power plant towards which JET is a preliminary step. Special attention is being given in this work to potential safety problems and the economic feasibility of such a plant.

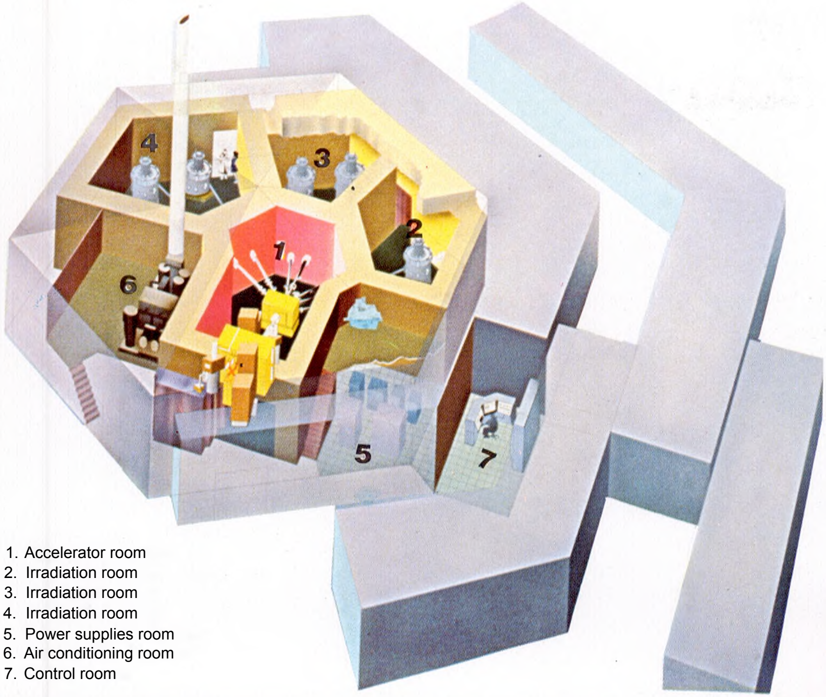
The safety research is concerned among other topics with the properties of materials to be used in the construction of fusion reactor components. The behaviour of materials under the extremely high fluxes and temperatures in the fusion process are not yet known and have therefore to be studied. To this end a cyclotron is being mounted at Ispra for simulation-measurements by light ions of the radiation damage in fusion environment.

The economic feasibility of a fusion plant will depend on the availability of tritium, the fuel for the fusion process. In analogy to the fast breeder technology the JRC's research is based on the concept to make the fusion reactor produce its own fuel from lithium.

Right and below: Vertical and horizontal cross-sections of FINTOR-D (Frascati Ispra Naples TOkamak Reactor Demonstration) a power reactor concept designed to prove technologies related to commercial fusion





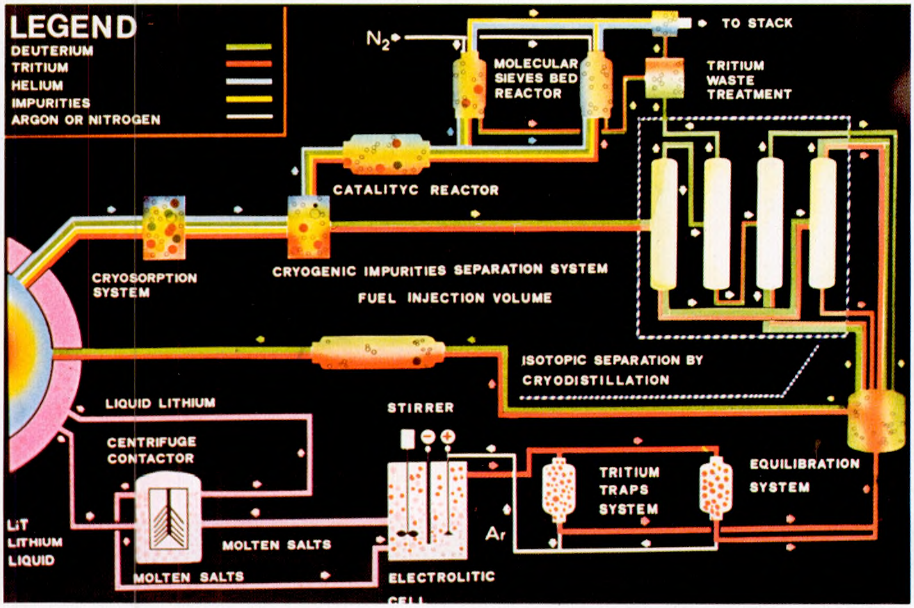


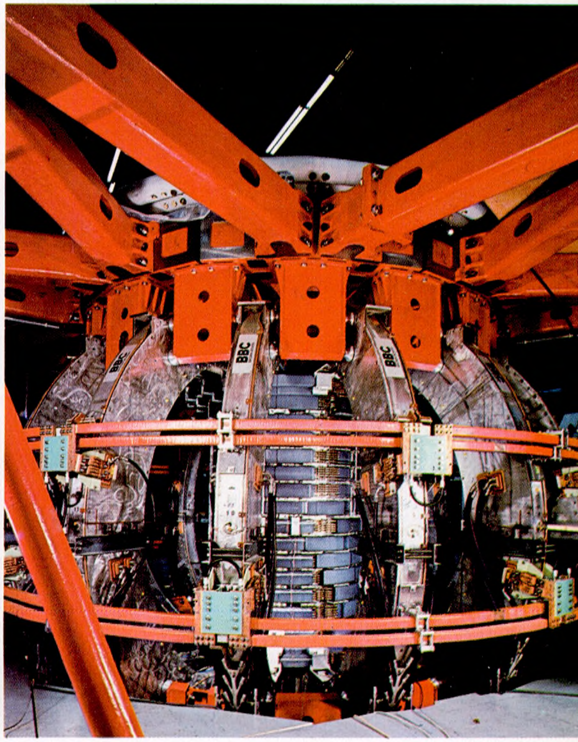
1. Accelerator room
2. Irradiation room
3. Irradiation room
4. Irradiation room
5. Power supplies room
6. Air conditioning room
7. Control room

Left: An artist's view of the Ispra MC-40-type cyclotron scheduled for operation by middle 1980

Below left: Layout of the fuel cycle in a Fusion power reactor (Plasma exhaust processes and tritium recovery fram blanket)

Below: A view of the ASDEX device at the Max-Planck Institute for Plasma Physics, Garching (Euratom-IPP Association) representative of the current generation of Tokomaks





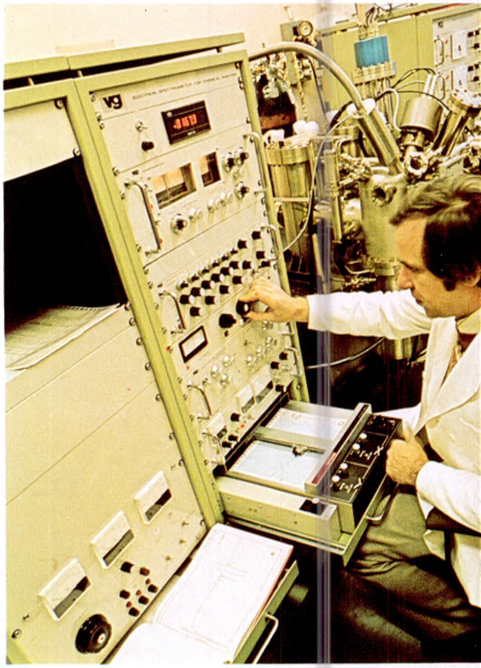
2.4 High temperature materials

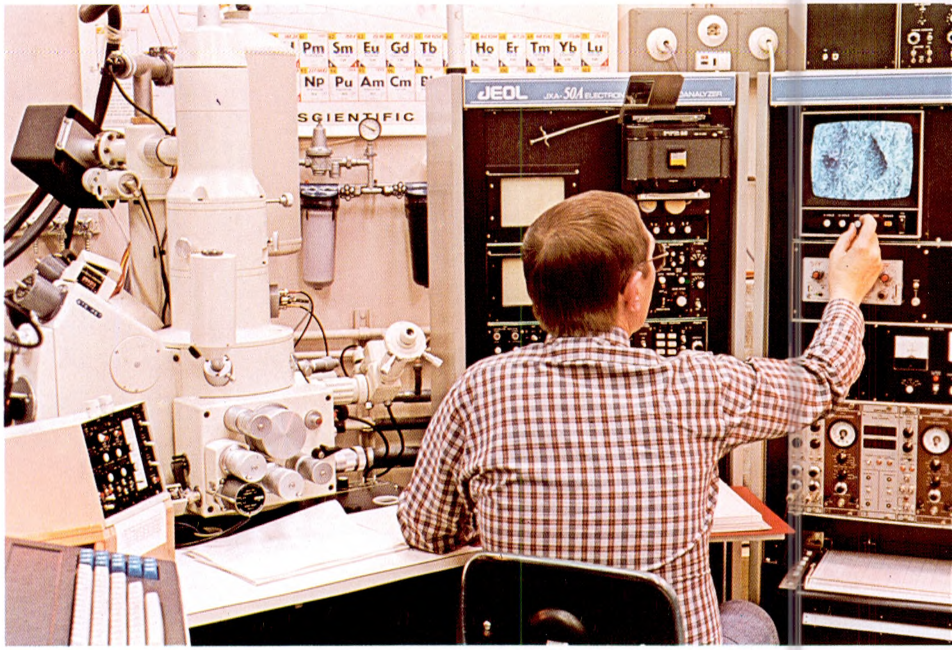
The high temperature materials programme carried out at Petten studies the ability of materials to resist the increasingly high temperatures at which energy and industrial processes operate. This work is expected to become more and more important with the development of new energy technologies: the research programme is in three parts: an information centre, which is a focal point for developing contacts with government and industrial R&D in the same fields elsewhere in the EC; a high-temperature materials data bank; and materials and engineering studies. The work on the problems of corrosion, metal fatigue, carburisation and oxidation, particularly in tubular components and gas turbine components, is of use to the petrochemical industry, in conversion of coal to synthetic fuels, and in nuclear, solar and other energy applications.

Three electronic methods for the examination of the structure and chemical composition of materials employed in the high temperature materials programme

Right: Method 1. Auger and X-ray photoelectron spectroscopy for detailed studies of surface chemical composition

Below: Method 2. Scanning electron microscope and microprobe analyser used for the determination of surface structure and composition

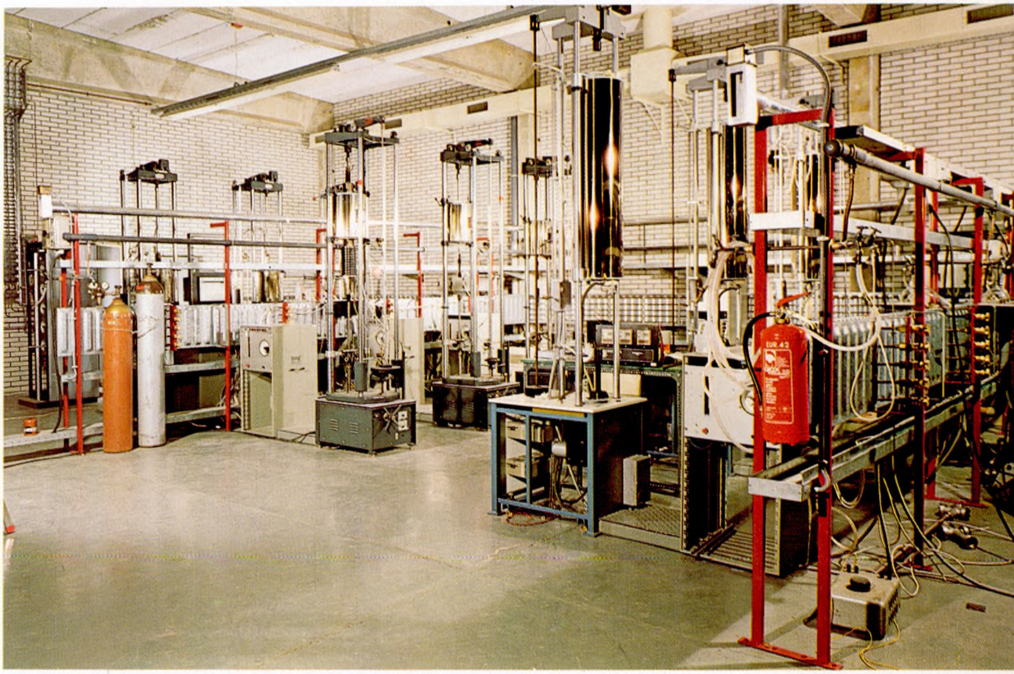


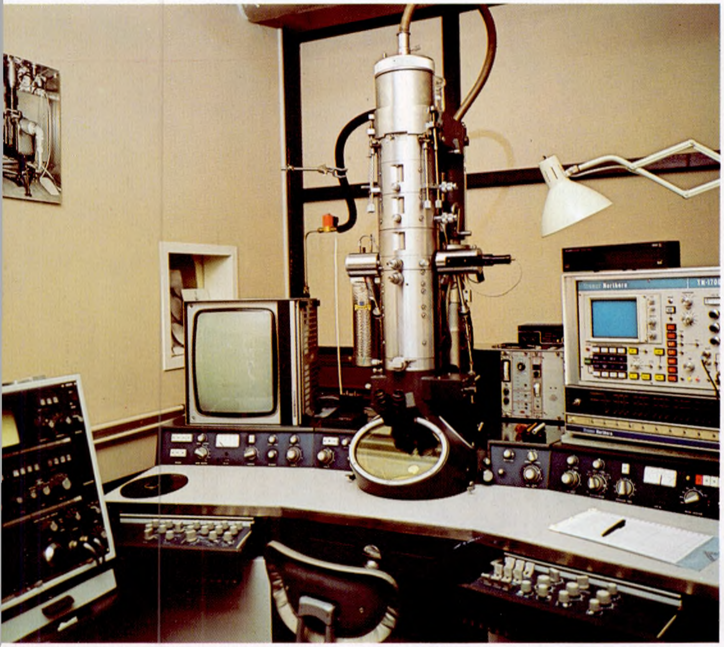


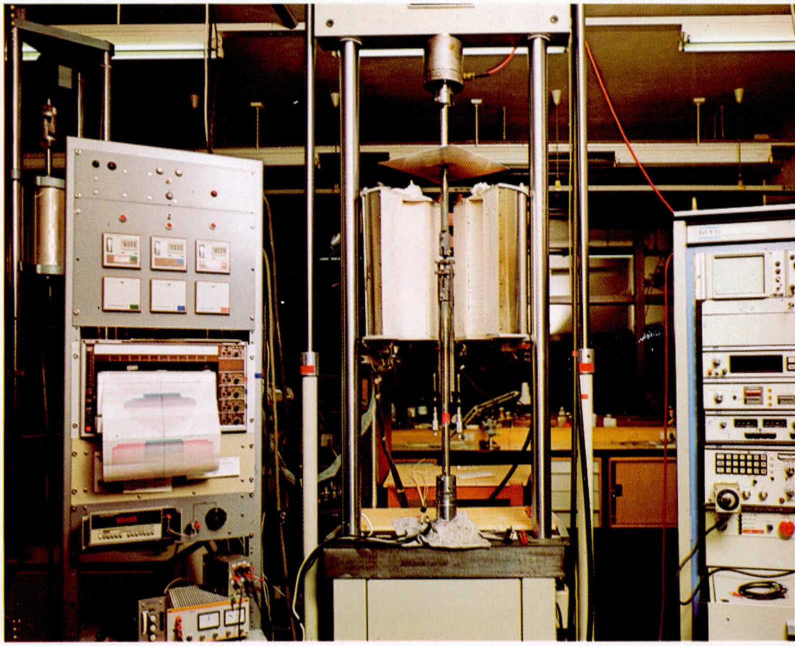
Below: Method 3. Transmission electron microscopy used in the study of microstructures and the X-ray analysis of extremely fine precipitates and inclusions.

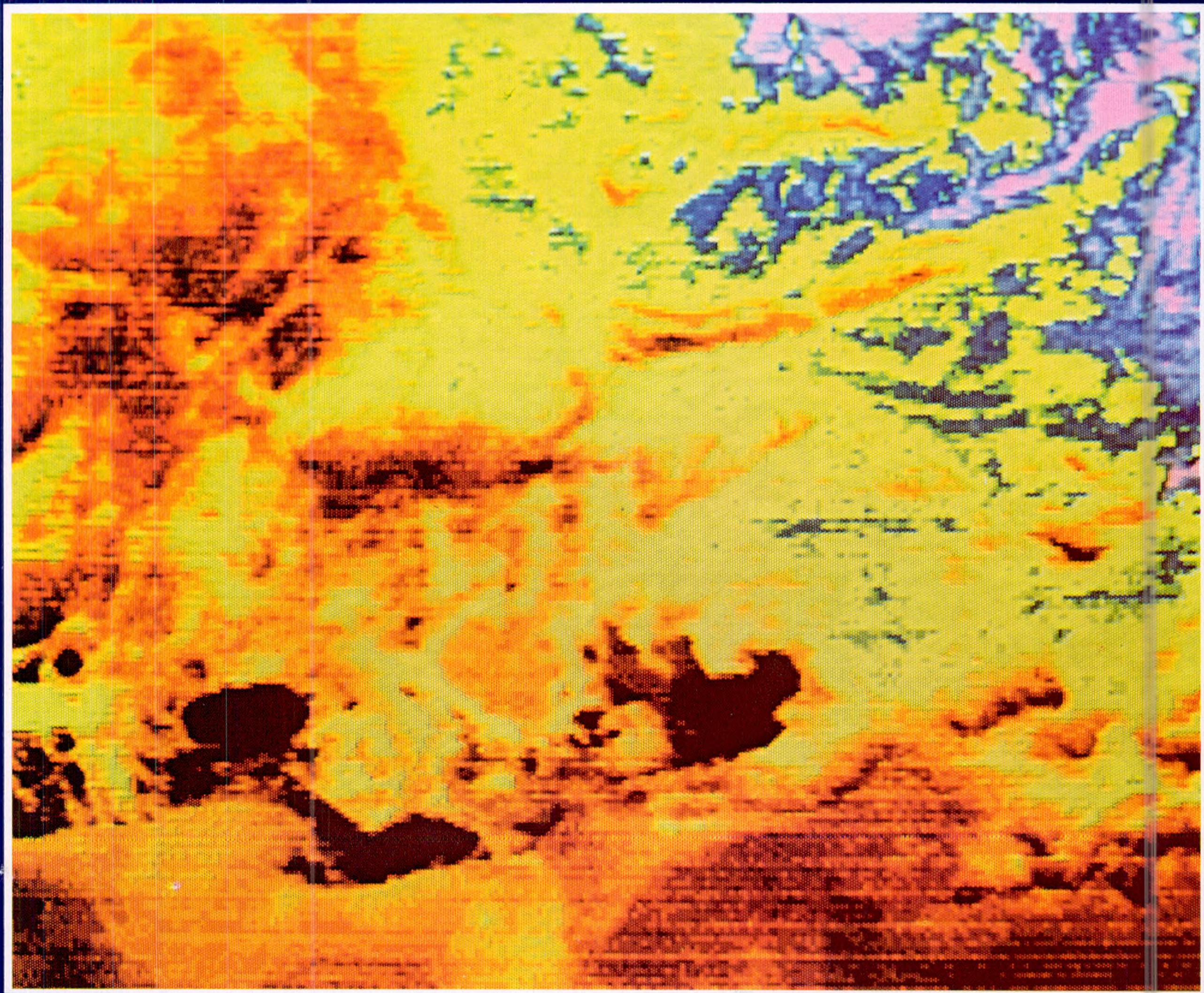
Right: High temperature mechanical testing is performed in the atmospheres to which materials will be exposed in service

Below right: Servo hydraulic equipment used to test mechanical properties of materials under various conditions and temperatures up to 1100°C









Night time thermal image of the Rhone Delta, France. This image was obtained from the Explorer-1 satellite

Research area 3

Study and protection of the environment

3.1 Protection of the environment

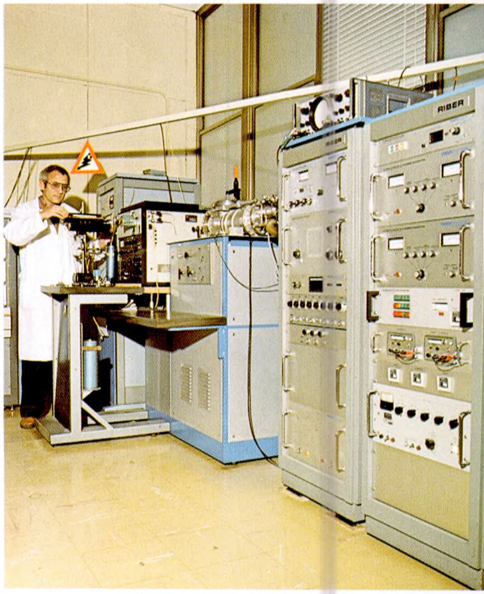
3.2 Remote sensing from space

3.1 Protection of the environment

By far the largest of the environmental protection projects - accounting for half of the total budget for this programme - is ECDIN, the Environmental Chemicals Data and Information Network. Centred on Ispra's computer facilities, it collects and stores information on industrial chemicals (mainly organic). It stores data on chemical names, manufacture, use, hazards and legislation. This information helps the Commission in drafting directives and regulations in this field. It can also provide vital data on chemical properties in the event of a chemical accident, such as Seveso. Industrial users have access to ECDIN through EURONET, the EC telecommunications and data-processing network.

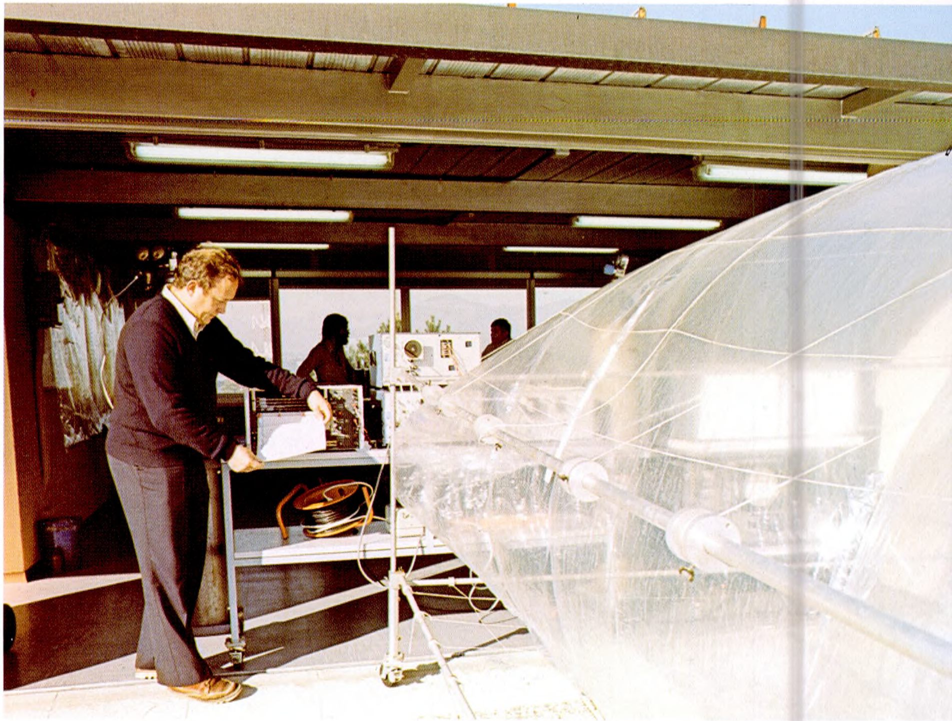
At the same time the JRC is studying the effect of exposure to chemicals both indoors (in home, schools and at work) and outdoors through gases and particles in the atmosphere. Fields of special interest are the determination and control of carcinogenic materials and the determination of toxic organics which may enter foodstuffs from their polymeric packaging materials.

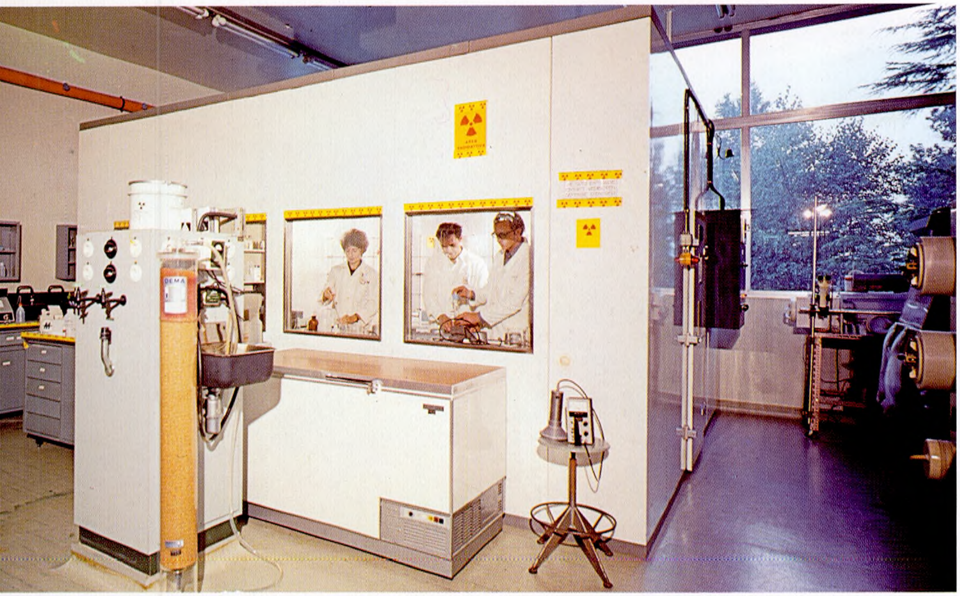
The JRC is also carrying out studies into the effect of chemical pollutants



Right: Analysis of organic micropollutants: Gas chromatography coupled with a high resolution mass spectrometer and a computer-aided spectrum library. With this instrument developed at the JRC, Ispra, "environmental chemicals" from air, water, soil can be identified in extremely small quantities

Below: Simulation of photochemical reactions: In a plastic bag the photochemical reactions of atmospheric pollutants like nitric oxide, hydrocarbons and sulphur oxide with ozone and dust particles, are studied under natural sun light conditions





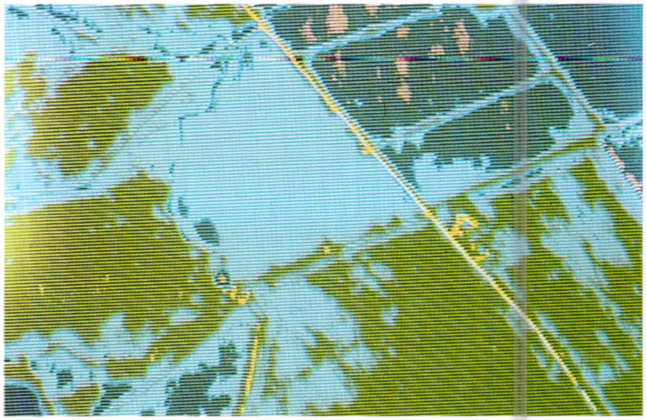
on water quality and the effects on individuals of exposure to heavy metals which may be harmful to health. Man is liable to be exposed to these substances in the production of energy, the incineration of municipal waste or possibly in the use of fertilizers. Lead in petrol which enters the blood is another example:

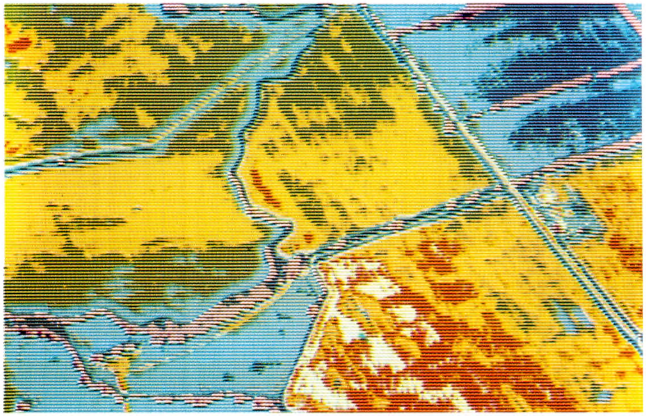
Precise measurement techniques are developed by the Ispra establishment for data collection on sulphur dioxide and nitrogen oxide. These two toxic chemicals are discharged from power plants using low-grade coal and other fossil fuels.

Above left: Preparation of biological samples exposed to heavy metals. In a cold room facility cellular components of human tissues and laboratory animals are prepared for further radiochemical analysis of trace metals

Left: E.C. Turbigo-campaign on remote sensing of atmospheric pollutants: JRC Ispra participates with 4 mobile teams measuring atmospheric pollution around a large fossil fuel power plant.

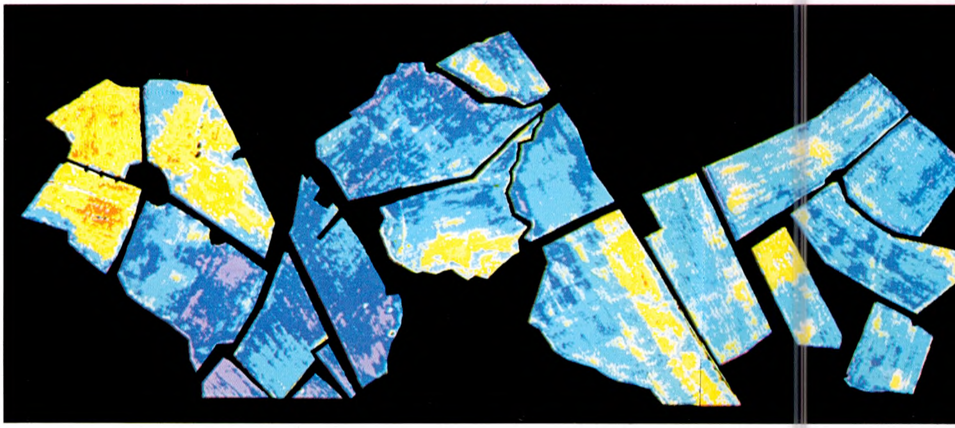
3.2 Remote sensing from space





Remote sensing techniques from space offer opportunities for application in agriculture, hydrology, land-use, geology, environmental pollution and related earth sciences. Under the JRC programme community-wide pilot projects on inventory and yield forecasts of various agricultural species such as rice and poplar groves (AGRESTE project and LANDSAT satellite), measurement of soil moisture and related agrometeorological parameters (TELLUS project, HCMM satellite) and monitoring of sea water quality parameters like chlorophyll, sediments, yellow substances (EURASEP project, Nimbus-7 satellite) are carried out.

In these projects data from U.S. satellites are used together with data from airborne sensors and ground-truth measurements. The JRC acts as a focal point for overall coordination and dissemination of all relevant information to European investigators.



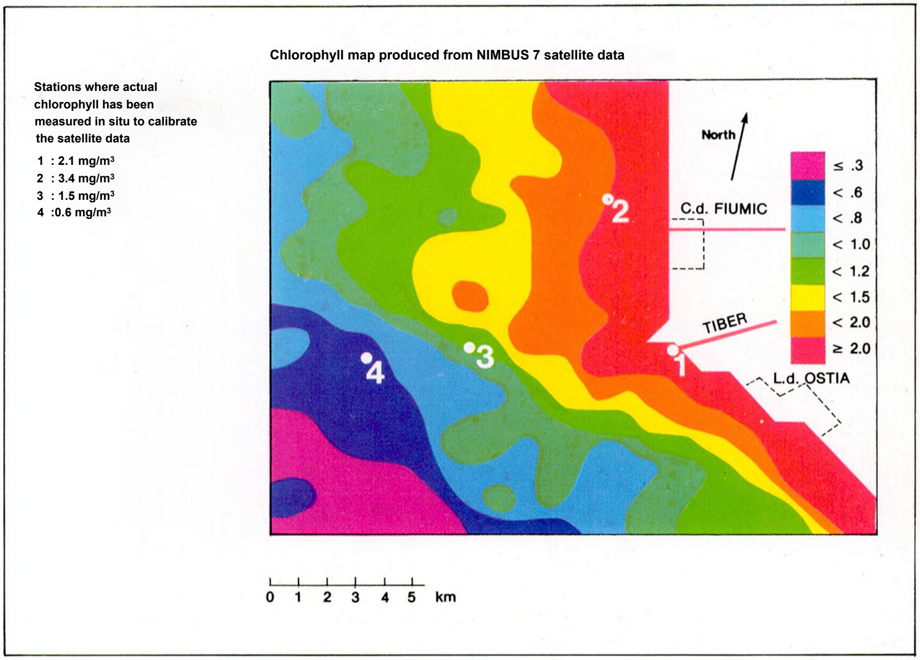
Right: Soil moisture map of the Grendon Underwood Catchment Area, Bucks, U.K. This map was prepared at the JRC Image Processing Centre from the night and day thermal images above

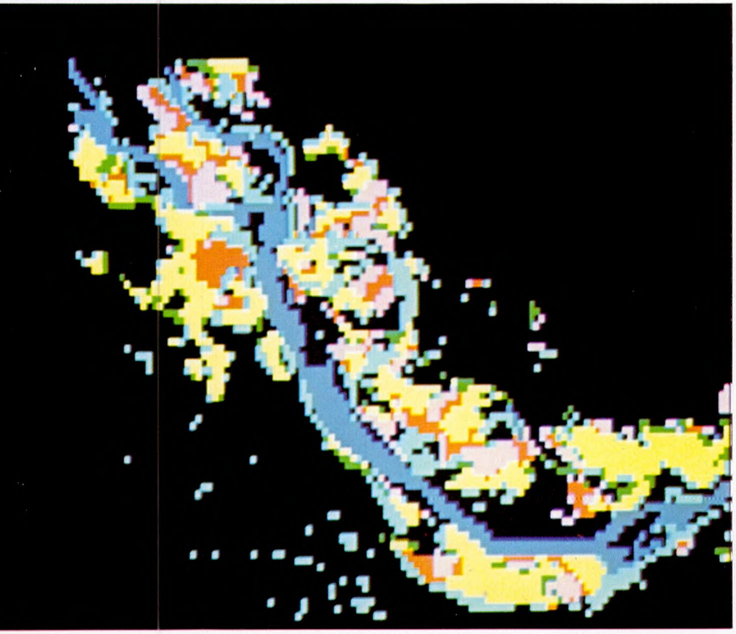
Top and middle left: Night-time and daytime airborne thermal image in the Grendon Underwood Catchment Area, Bucks, U.K.

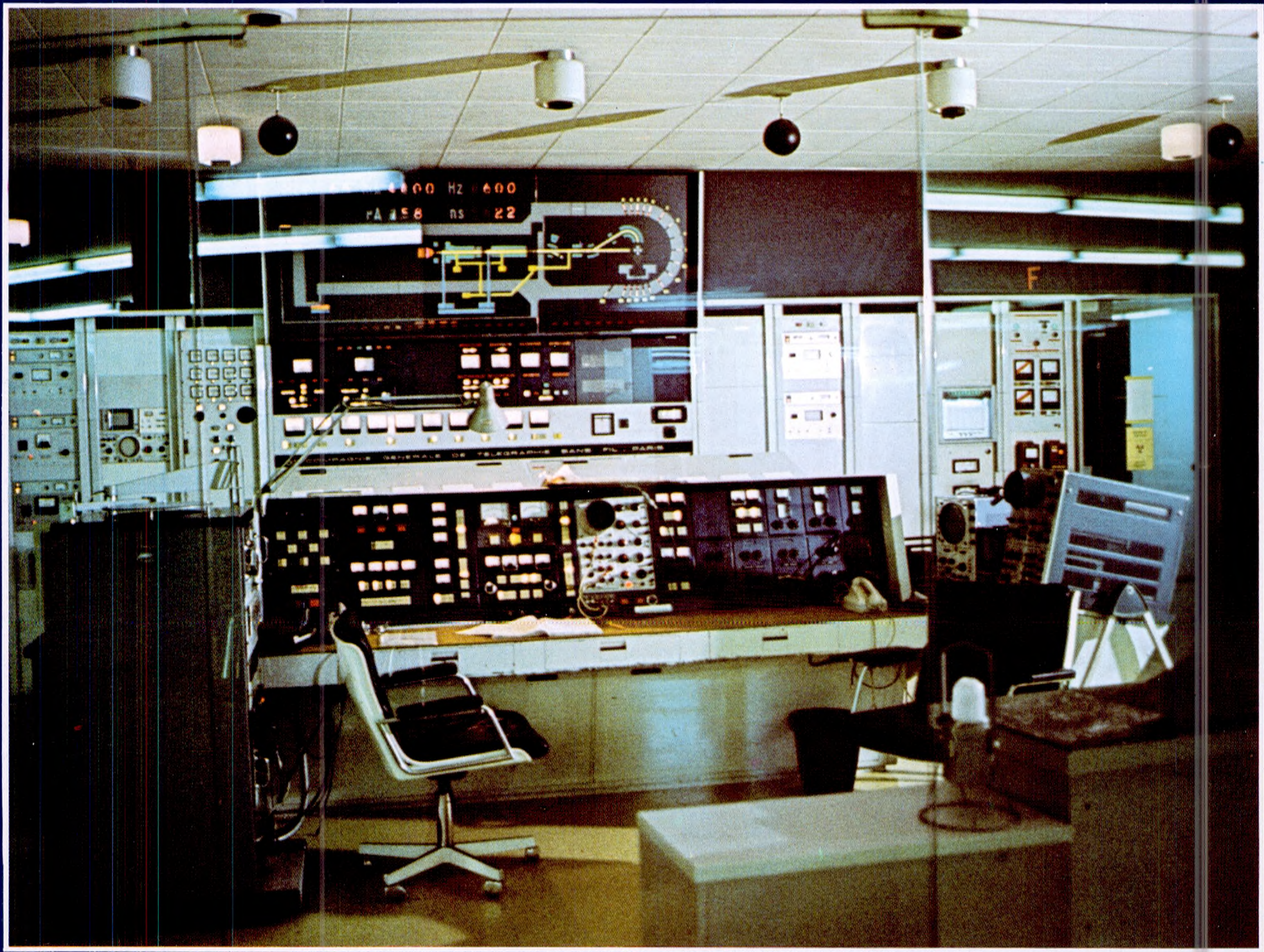
Right: Chlorophyll concentrations in the Tiber estuary, derived from satellite data (NIMBUS 7) and measurements at sea

Below: Classification of poplar groves using LANDSAT imagery

Below right: JRC instrument package for turbidity, chlorophyll, temperature and salinity measurements in coastal waters







Control room of the linear accelerator LINAC

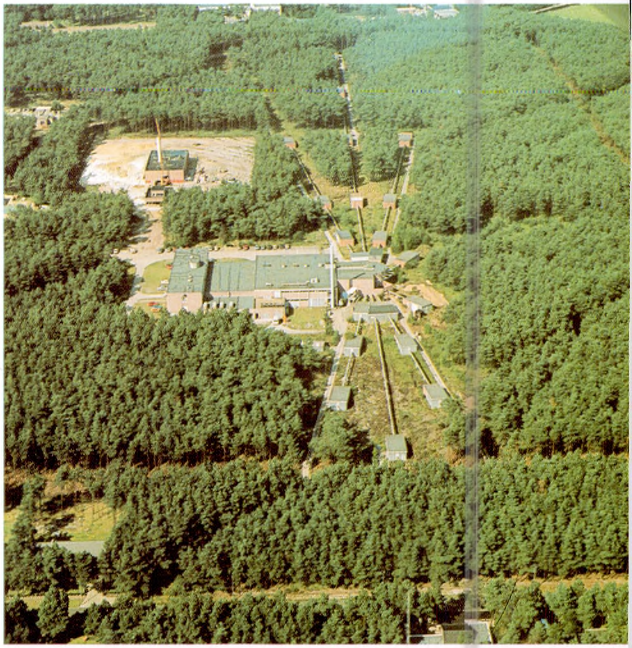
Research area 4

Nuclear measurements

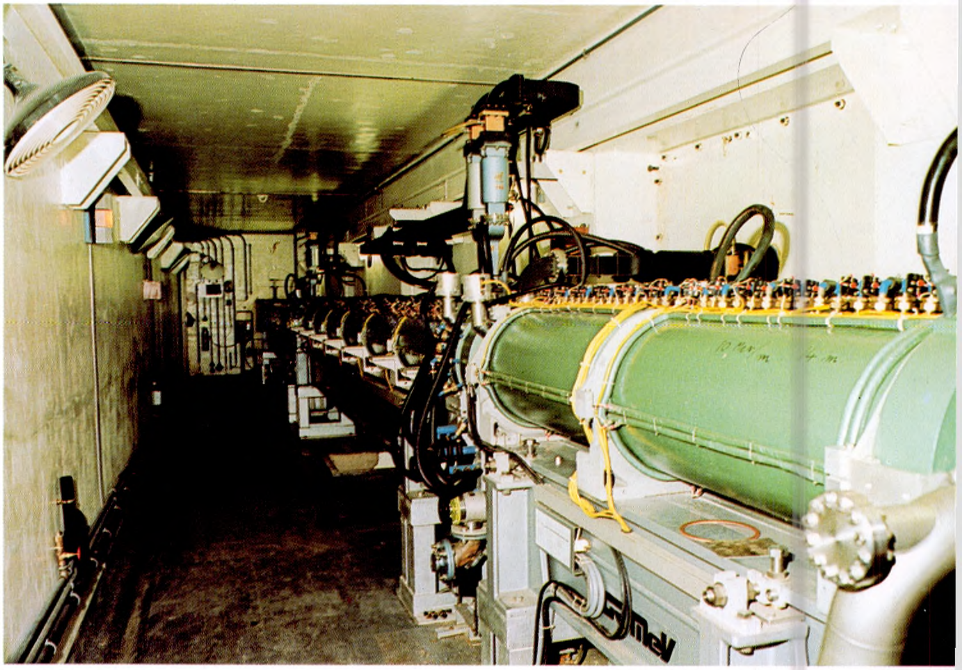
4.1 Nuclear data

4.2 Nuclear materials

4.1 Nuclear data



Nuclear data measured under this programme at the Geel Establishment of the JRC are used mainly by the nuclear industry, but in addition some are applied to environmental work and to bio-medicine. The data concerned with the interaction of neutrons with materials and components used in the construction of nuclear reactors are obtained with the use of two accelerators, one a 150 million electron volt and the other a 7 million electron volt Van de Graaff. The work concentrates on data for fission reactors, but is beginning to aim at problems related to the assessment of thermo-nuclear fusion. The Central Bureau for Nuclear Measurements also possesses a large number of devices for studies on radionuclide decay. They permit very accurate measurements of half-lives and the intensities of emitted radiations.



Above right: Aerial view of the 150 million electron volt linear accelerator (Linac)

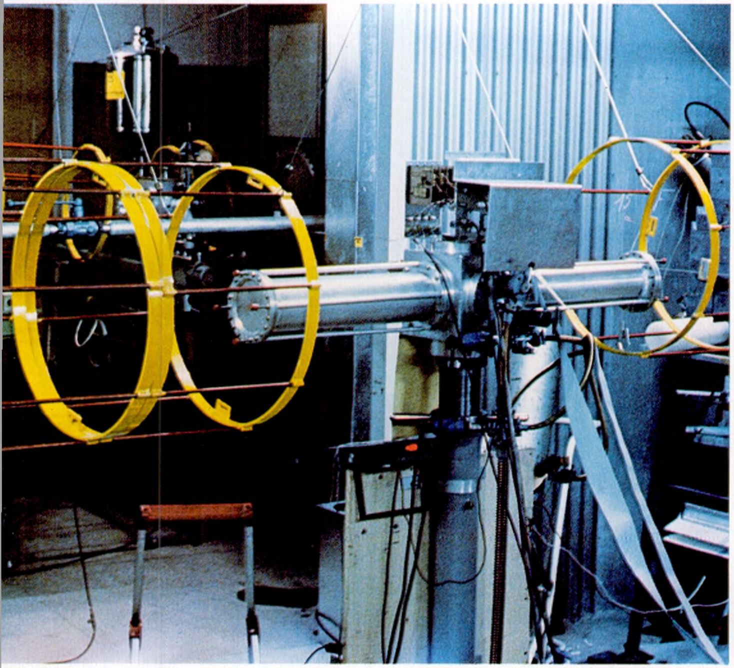
Right: Accelerator sections of Linac

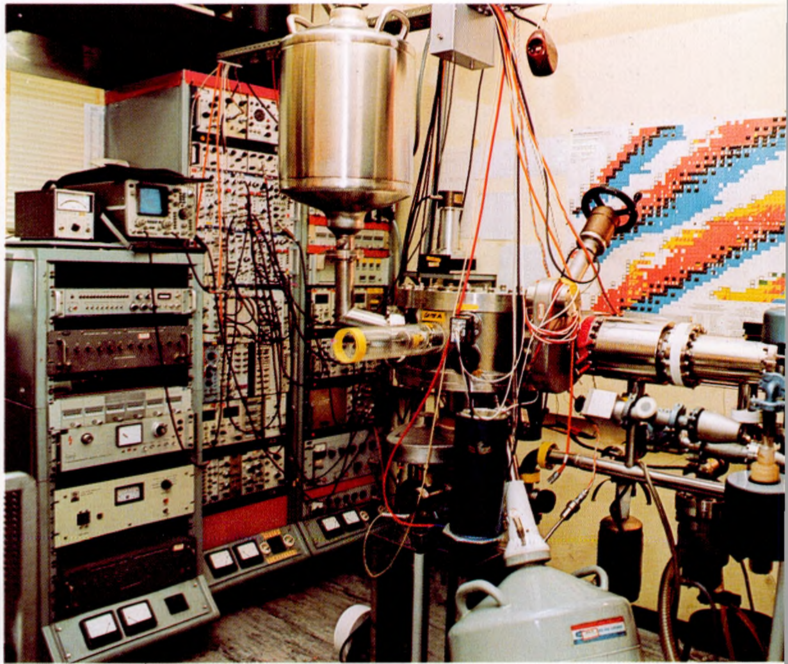
Far left: Inside view of Van de Graaff

Left: Van de Graaf accelerator with high voltage electrode removed

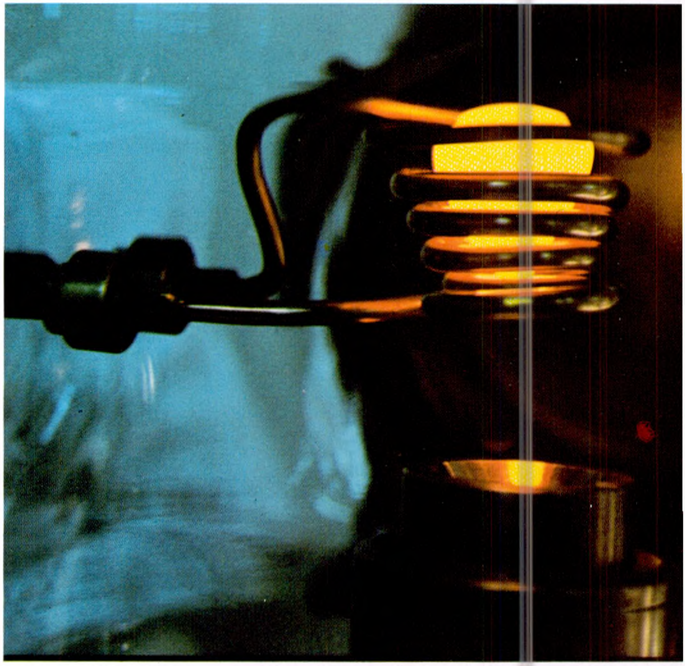
Below left: Detector for measuring neutron reactions

Below: LEXES, the low energy X-ray and electron spectrometer



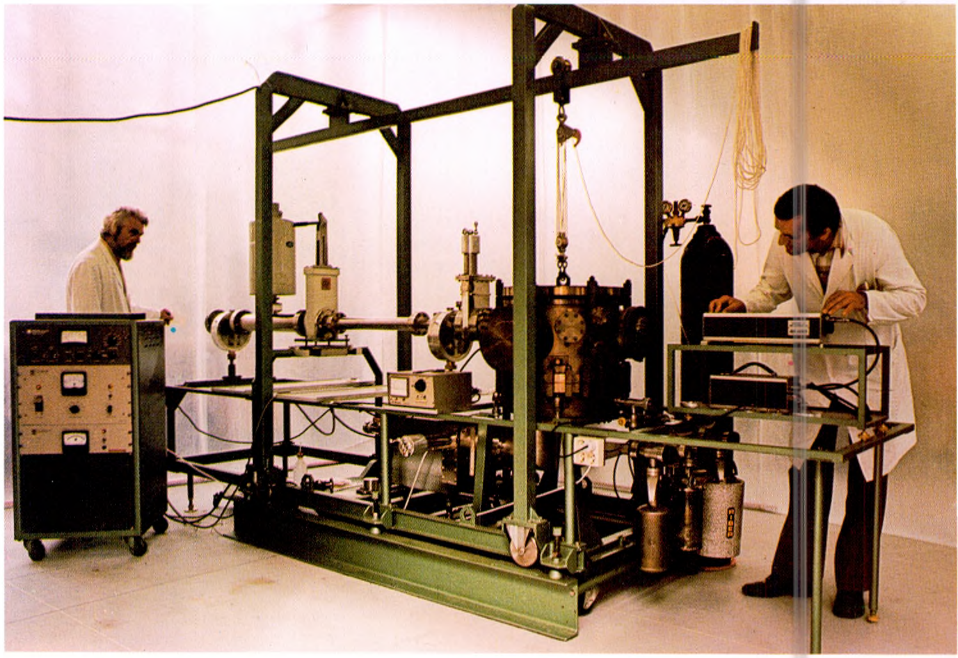


4.2 Nuclear materials



The second aspect of the CBNM programme relates to the preparation and assay of a large variety of reference materials used for nuclear measurements. Emphasis is placed on the accurate definition of parameters such as thickness, grain size, chemical and isotopic composition, and radioactivity.

Characterized reference materials which set an international standard for interlaboratory comparison are supplied to laboratories in Europe and in the United States. Some of these materials are also used as standards by the Euratom Safeguards Directorate to supervise nuclear installations within the European Community.



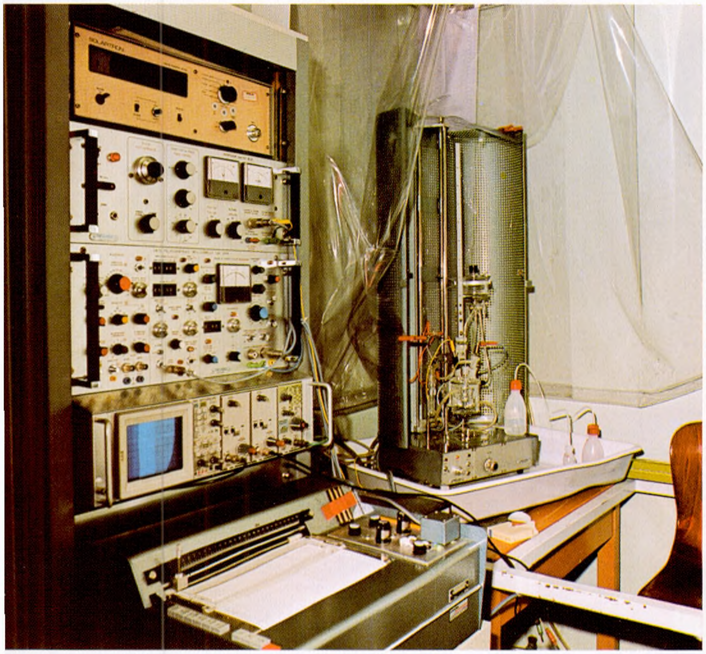
Above right: Levitation melting: under the influence of a high frequency field metals are lifted and molten in inert gas

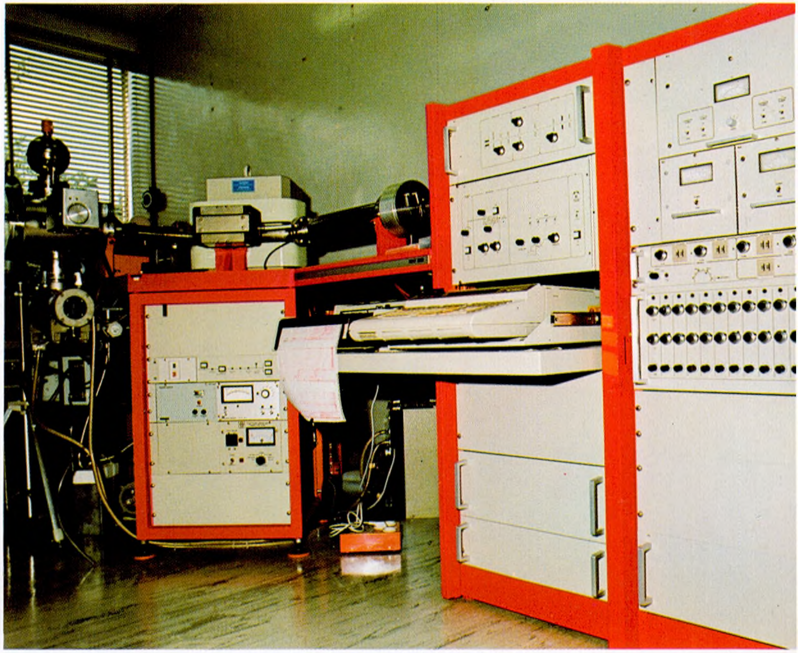
Right: Equipment made in the mechanical workshop of CBNM in Geel

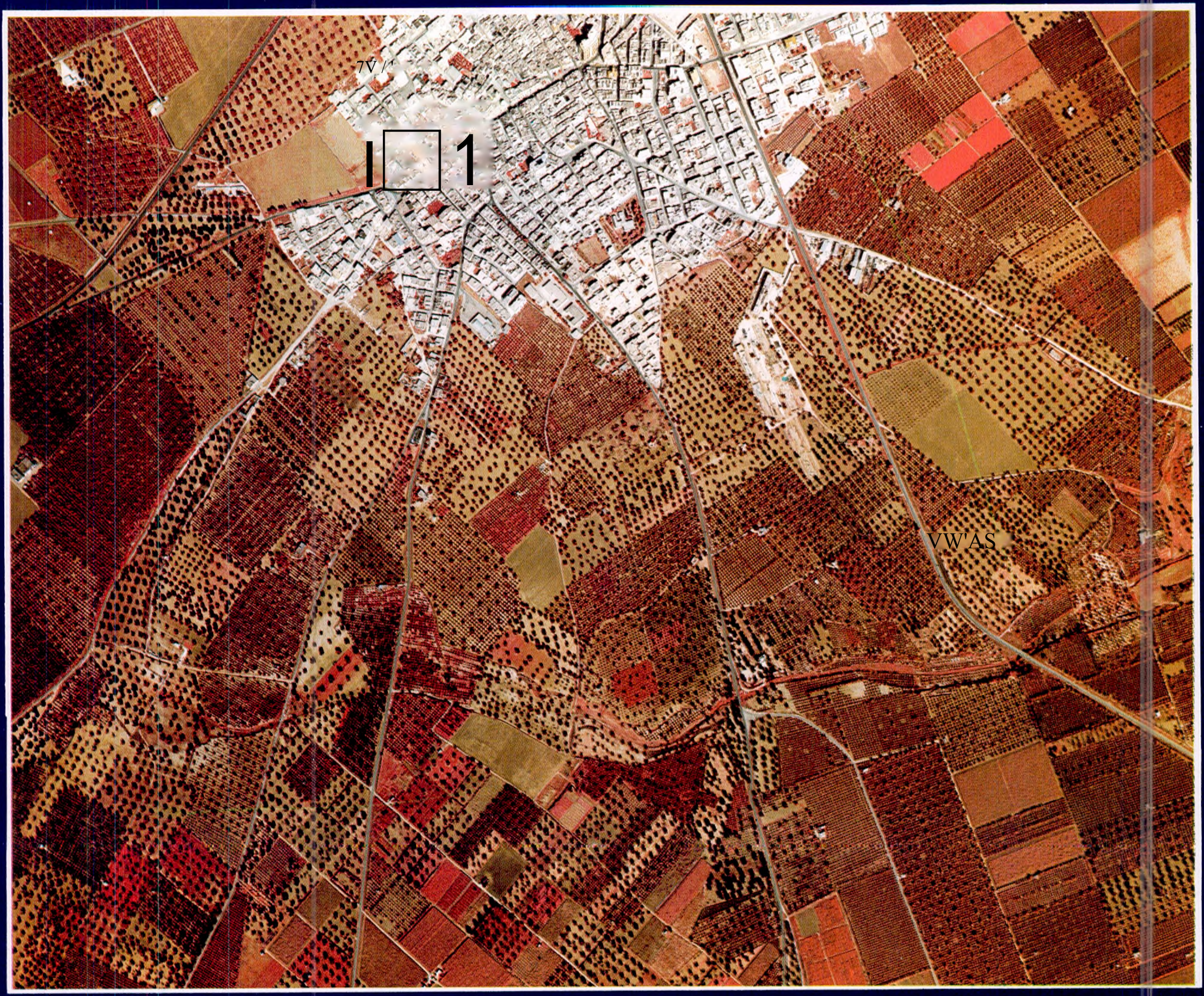
Right: Preparation of samples in glove-box

Below: Polarograph for chemical analysis

Below right: Mass spectrometer for measuring isotope concentrations







Aerial infra-red picture made in view of the realisation of a Community olive tree register

Research area 5

Specific support to the Commission

5.1 Informatics

5.2 Support for safeguards

5.3 Support for the Community Bureau of Reference

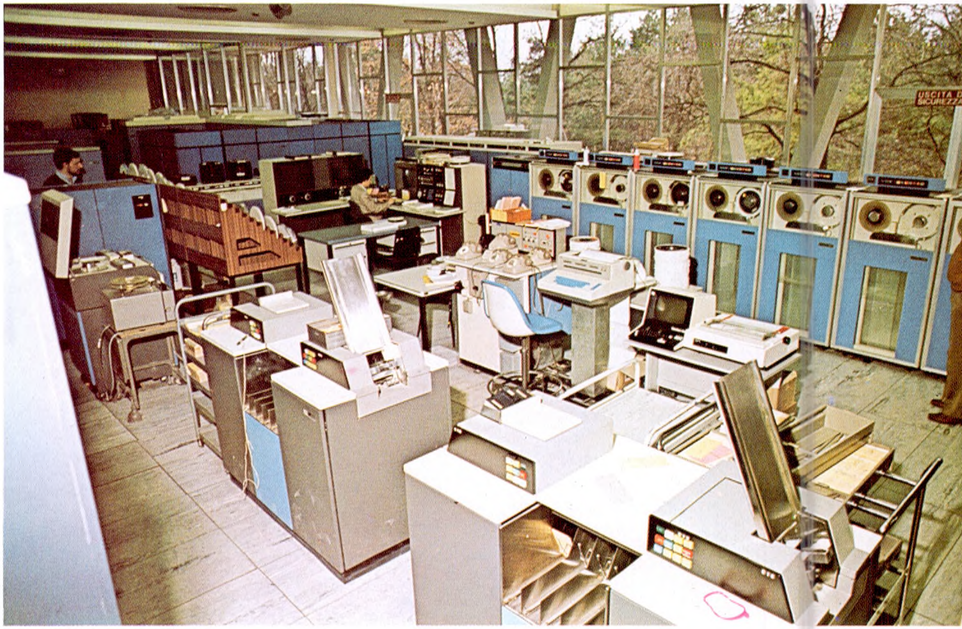
5.4 Training and education

5.5 Exploitation of research results

5.6 Provision of scientific and technical services on request

5.1 Informatics

The JRC's informatics projects are designed to contribute to the extended use of Europe-wide computer networks, while at the same time broadening the range of processing applications, and to harmonise the activity of the European Association for Software Access and Information Transfer (EASIT) through EUROCOPI, the European Computer Program Library. The JRC's teleinformatics project is tied to EURONET, the EC public data network. The research efforts are centred on subjects such as technical standardization problems or the development of a common network language which require a joint approach in a technically highly diversified field.
The EUROCOPI project concentrates on increasing the portability and readability of computer programmes and providing a programme library and information service.

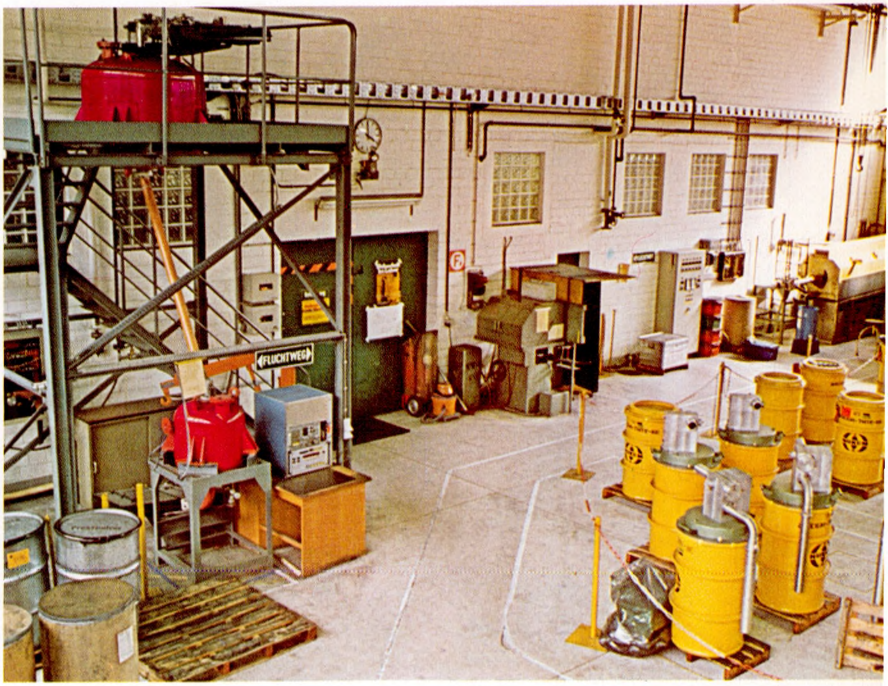


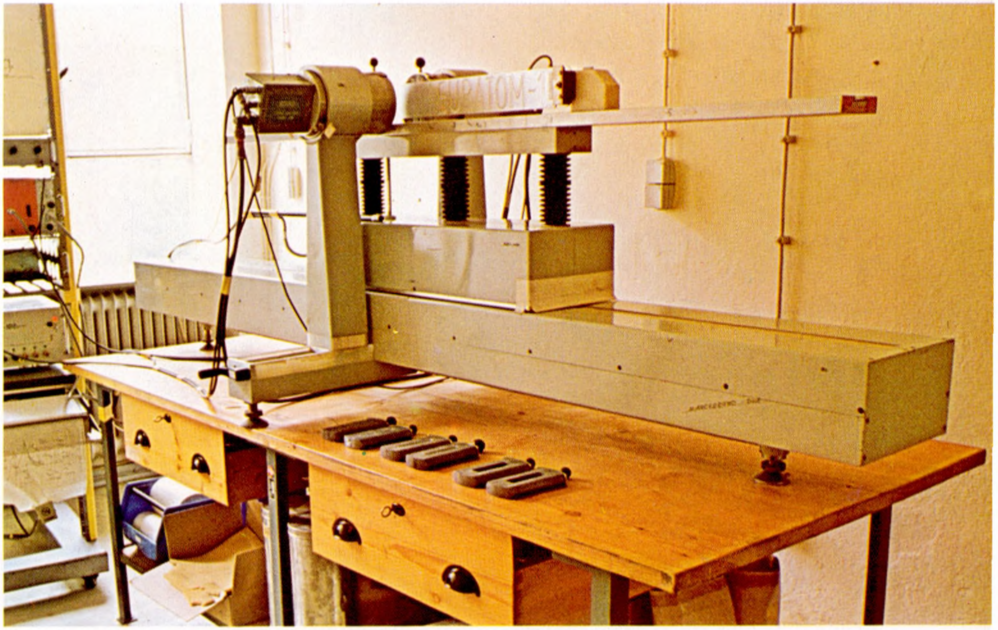
Right above: The gateway processor, one of the very first in Europe, supports all standard access methods to/from EURONET.

Right: The powerful computer at Ispra: 4 Mega-bytes high speed memory and 4 Giga-bytes on line secondary storage.

5.2 Support for safeguards

The JRC's competence and experience in the nuclear field is of special interest to the Euratom safeguards Directorate in Luxembourg (see also Area 1.4). Samples taken during safeguards inspections are analyzed in the Geel, Ispra and Karlsruhe laboratories of the JRC. Its technical support also covers the adaptation and testing of measuring devices for specific nuclear installations within the Community.



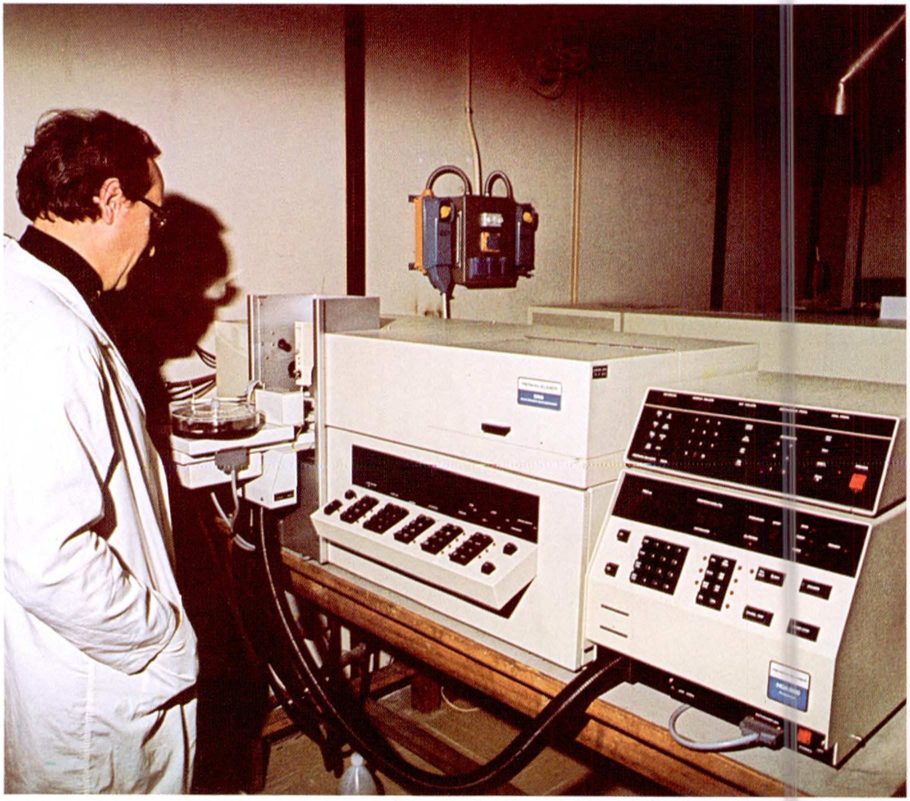


Above right: Fissile materials control system on fuel pebbles (High Temperature Gas Cooled Reactor T.H.TR). The system provides automatic sampling of pebbles (6 cm diameter) and measures fissile material using delayed neutron counting techniques

Right: Calibration of gamma radiation instrument for the assay of the U-235 content of Material Testing Reactor fuel elements in a fuel fabrication plant

5.3 Support for the Community Bureau of Reference

The Community Bureau of Reference, an Indirect Research Action, serves as a focal point for laboratories active in the field of reference materials and measurements. The JRC collaborates in this activity through a number of coordination tasks, through statistical processing and through technical data evaluation.



Right: Atomic Absorption Spectrometer equipped with a graphite tube atomizer and with an autosampler attachment for accurate trace-metals determinations in various matrices for certification purposes

5.4 Training and education

About 20 courses or seminars a year are organized at Ispra to disseminate JRC research results and to improve exchanges between scientists throughout the EC. Courses last from a few days to several weeks. In 1979 the number of participants totaled some 550 persons from all nine member countries.

The seminars are organized at research level and present the latest developments in rapidly evolving research areas, whereas the Ispra courses are designed to provide the fundamentals of highly specialized disciplines. In addition, a special programme for participants from developing countries is to be launched.

Right: The «Ispra Courses» auditorium during the opening session of the Advanced Seminar on Fracture Mechanics, April 1979

5.5 Exploitation of research results

On JRC patents non-exclusive licences are granted to those persons and organizations of member countries able to make effective use of the JRC inventions.

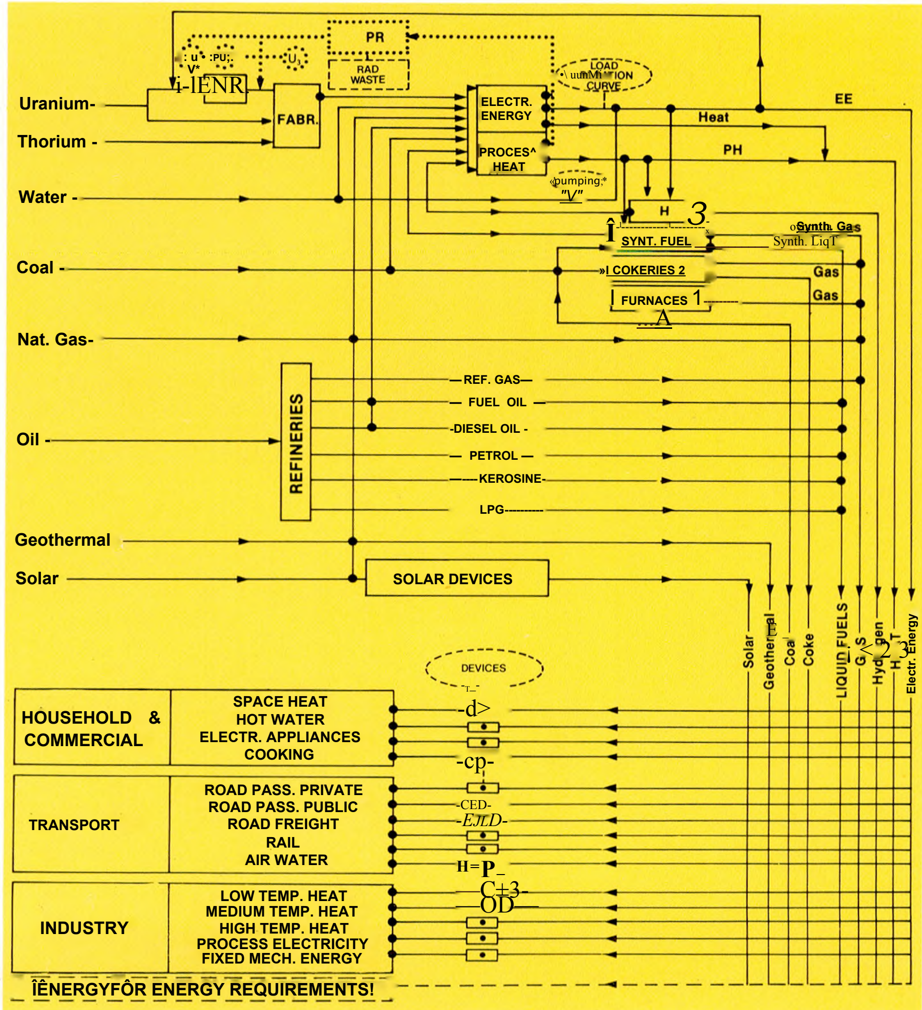
Responsibility for dissemination of technical information and technology transfer rests with the Directorate General "Scientific and Technical Information and Information Management" Luxembourg.

The JRC is taking part in this activity by providing technical support to interested parties.

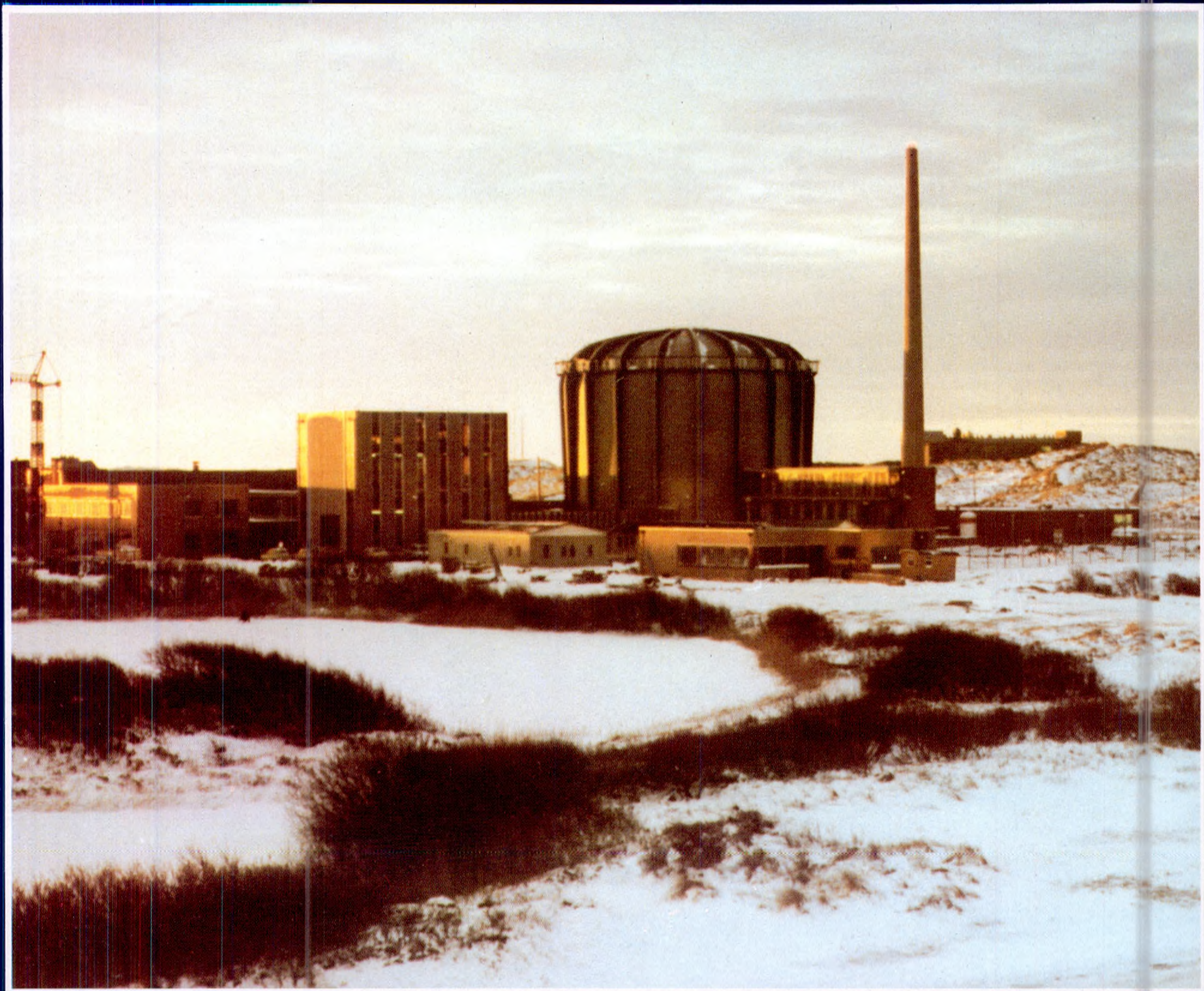
Right: The JRC disseminates scientific results not only through its publications but also by way of participation in special exhibitions and fairs. The photograph shows the JRC stand at the Hanover Technology Fair 1979.

5.6 Provision of scientific and technical services on request

The JRC is available on request to provide technical evaluations and assistance to the Commission in fields where it has expertise — energy systems analysis, regional development models, studies of agricultural production patterns, ecological models or energy conservation, for example. The JRC can provide independent and confidential advice to the Commission when it is drawing up new regulations in a variety of technical fields such as cosmetics, inflammability of construction materials, atmospheric pollutants or the release of toxic elements (such as cadmium) from materials used in domestic kitchenware.



Right: The conversion section of the computer model developed at the JRC for the simulation of the energy system



The High Flux Reactor at Petten in the Northern Netherlands

Research area 6

Operation of large scale installations

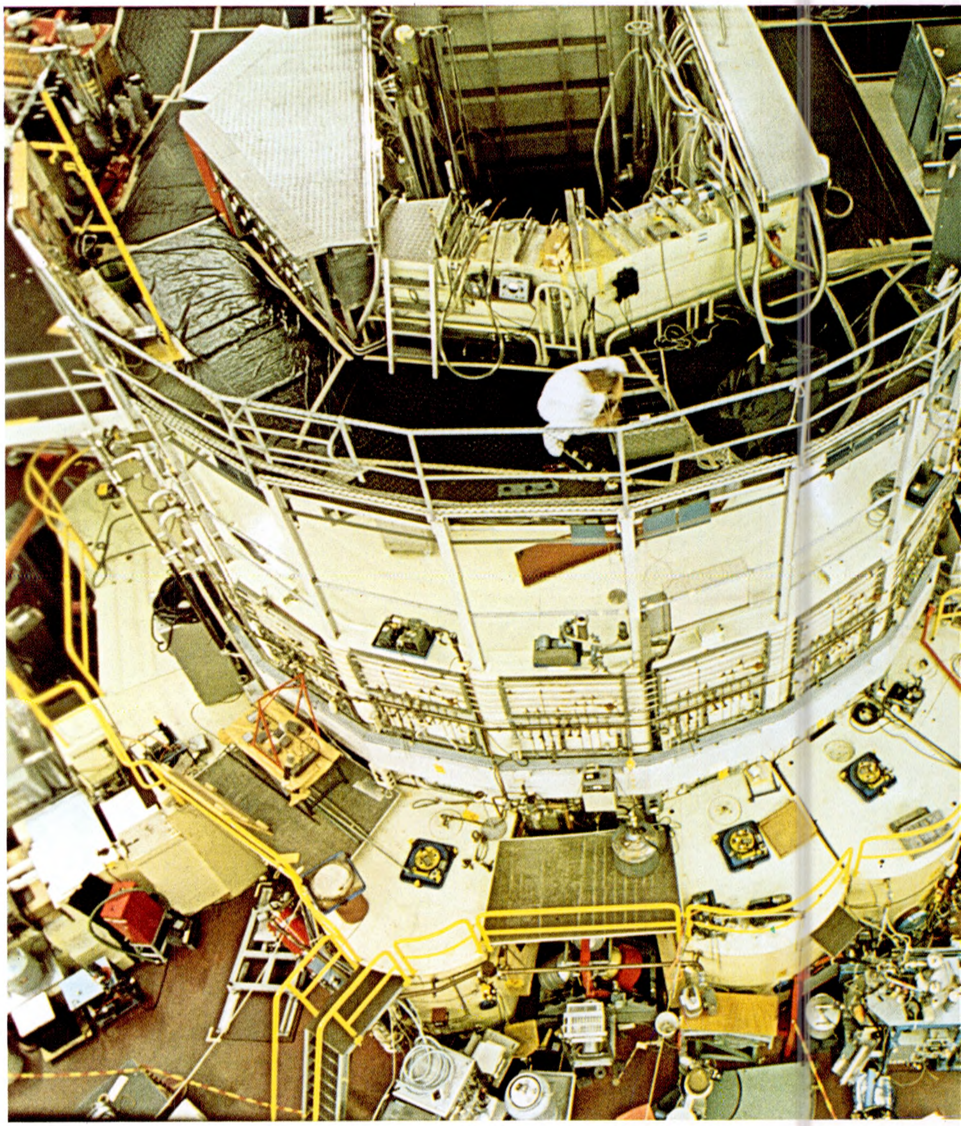
6.1 Operation of the High Flux Reactor

6.1 Operation of the High Flux Reactor

The JRC operates the High Flux Reactor HFR at Petten as a service for the benefit of nuclear research programmes of member states and industries within the EC. It is one of the most important irradiation facilities available in the Community.

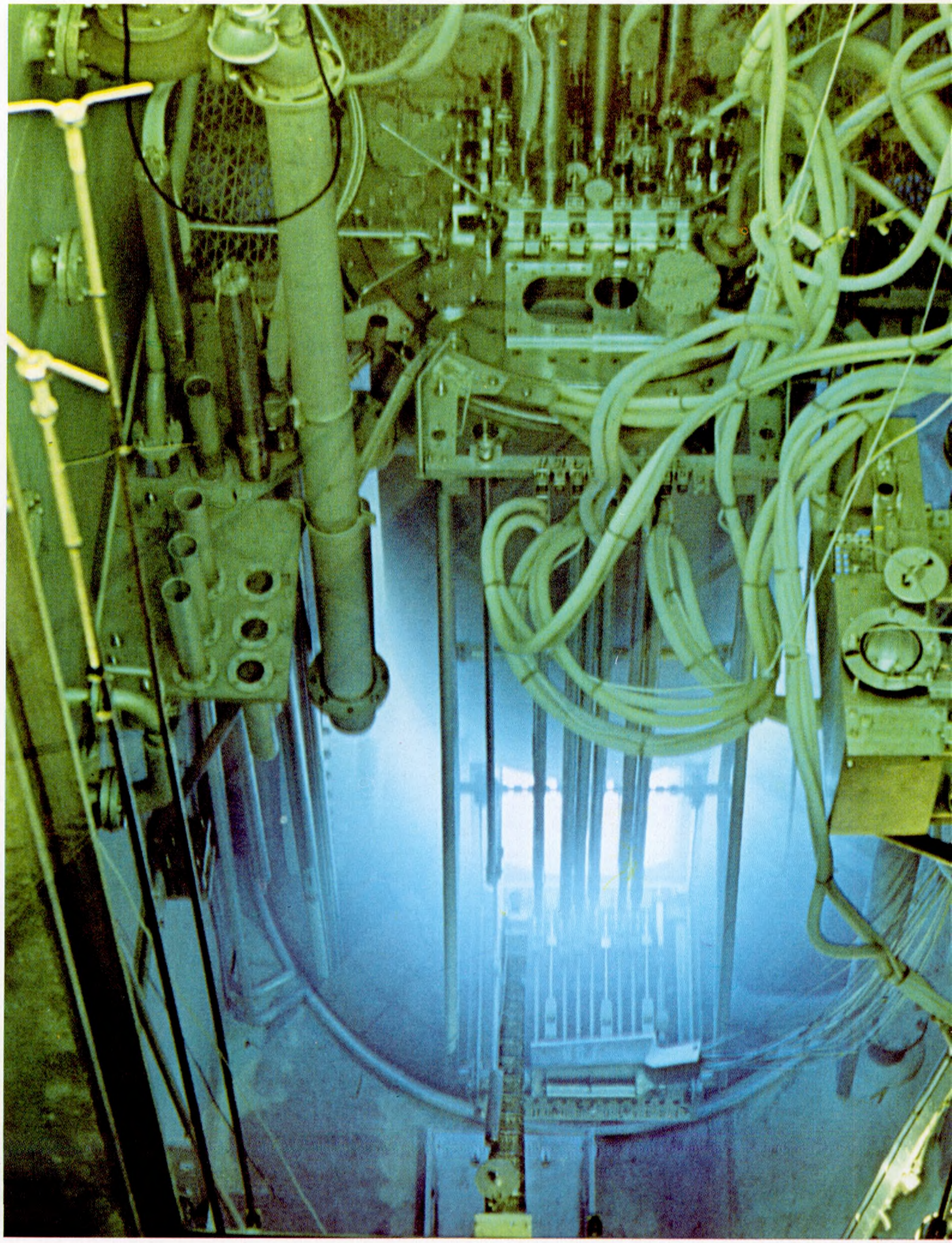
In 1979 the HFR achieved an average occupation by irradiation experiments of 76%. This figure constitutes not only a record in the 16 year history of the HFR, but also in comparison with other materials testing reactors. The HFR is used for experiments in reactor safety, tests on advanced fuels for High Temperature Reactors and Fast Breeder Reactors and for performance testing of Light Water Reactor fuel elements.

Its particularly high neutron flux is used to test the behaviour and efficiency of materials utilized in the construction of reactors of all types.



Right: The HFR from above. Materials testing experiments are introduced from above and their behaviour measured and recorded by equipment in the galleries below. On the main floor can be seen physics experiments for the study of the properties of matter.

Far right: View of the poolside facility with the reactor at full power. The blue light is emitted when charged particles pass through the water at a speed greater than the velocity of light in that medium. This is known as CHERENKOV radiation



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