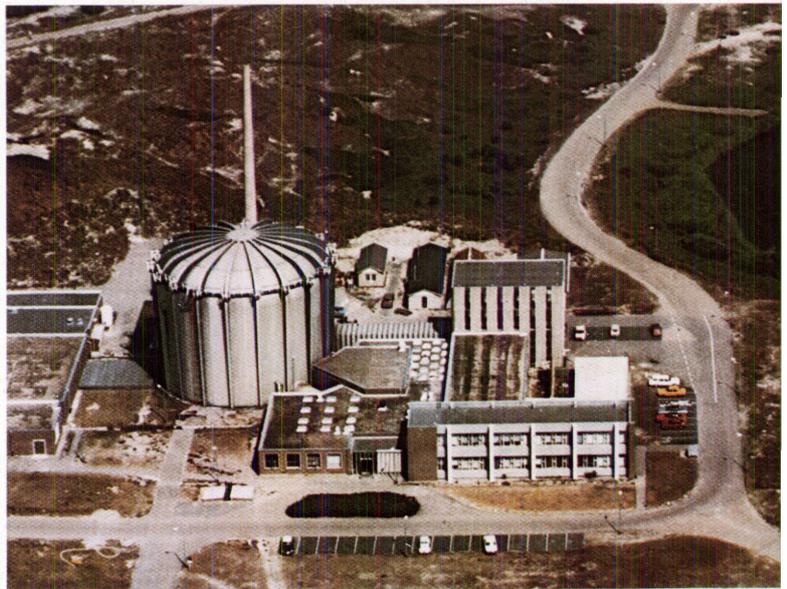




**Multiannual Programme
of the
Joint Research Centre
1980-1983**

Clockwise from top left: The four JRC establishments:
the Central Bureau of Nuclear Measurements (CBNM) at Geel
in Belgium; the Ispra Establishment in Italy; the Institute for
Transuranium Elements at Karlsruhe in Germany; the Petten
Establishment in the Northern Netherlands

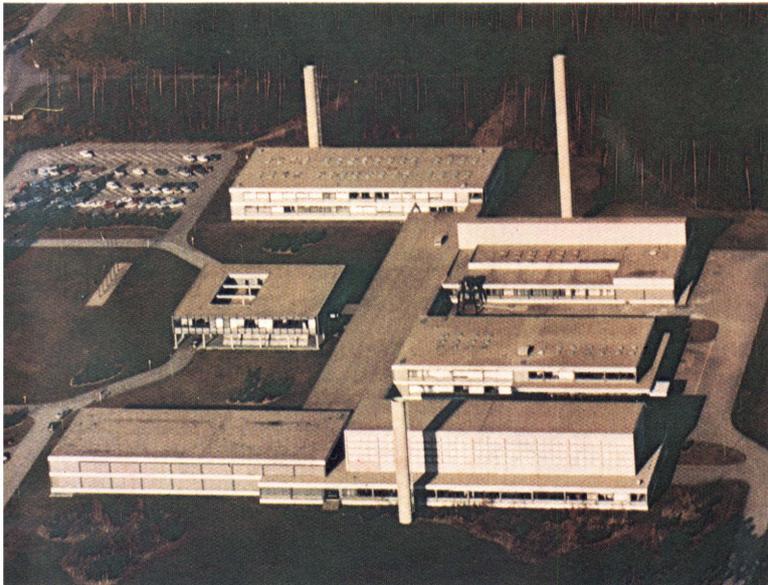


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Introduction

This document presents the new multiannual programme of the Joint Research Centre, covering a four-year period from 1980 to 1983 inclusive.

With effect from 1 January 1980, it prolongs and replaces the four-year programme 1977-1980, which was started on 1 January 1977 and terminated on 31 December 1979. It thus implements the rolling programme concept, adopted under the 1977-1980⁽¹⁾ programme, whereby the fourth year of the earlier programme is replaced by the first year of the new programme.

⁽¹⁾ Official Journal No. L 200 of 8 August 1977

The Role of the Joint Research Centre

Over the years 1975-79, the JRC went through a period of reorientation which, in co-operation with its consultative bodies, led to the definition of a clearer role for it and of the activities to be carried out under it.

The results of the 1977-80 programme led the JRC to conclude that its role was developing in the right direction, that it was integrated better than in the past into the context of the sectoral policies of the Community, and that the JRC had the capacity to execute the tasks which had been entrusted to it.

The Commission has described the JRC's role within the common policy for science and technology⁽²⁾:

- a) **The execution of programmes of a «central» nature** : the concentration of the JRC on research activities — which justify the establishment of a broad research potential at Community level, — which call for the centralization of facilities or functions (e.g. by the creation of large-scale installations), — in which the JRC can act as a focal point or catalyst for co-ordination at Community level, — and finally in which it can promote the application of new technologies throughout the Community.
- b) **The performance of a public service role** : the JRC is developing this by meeting the needs of Governmental organizations, universities and industry for specialized equipment, know-how, products and services. A significant factor in this respect is the independent position of the JRC and its impartial judgment.
- c) **The provision of services to the Commission** : the JRC acts as the Commission's own tool in the provision to it of scientific and technical expertise and support in the formulation and implementation of the sectoral policies of the Communities. An important new development in this respect is the contribution which the JRC can make to scientific and technical co-operation with the developing countries within the development policies of the Community.

In order to consolidate this role and in view of the results achieved in the execution of the 1977-80 programme, the JRC considered that its new programme should broadly represent a continuation of the 1977-80 programme. But, at the same time, the research carried out under this programme required certain changes of emphasis and direction due to the attainment of certain milestones; or because it was proving necessary to adapt this research to the evolution in the requirements of the Community and to developments in the Commission's sectoral policies; or to take into account the development of research carried out under the indirect action programmes; or finally to draw lessons generally from the experience it had acquired.

In this last respect, the JRC has been particularly guided by the concern to ensure continuity in its research to enable the Community as a whole and itself to make full use of the investments made in the activities put in hand under the 1977-80 programme, and by the need to optimize the use of its resources by concentrating them further into activities of significant dimension.

⁽²⁾ Communication from the Commission to the Council of 30 June 1974 «Common Policy for Science and Technology» — see Supplement 3/77 to the Bulletin of the European Communities.

Preparation procedure

The preparation of the present programme involved a long and complex procedure, which started in early 1978, lasted about a year, and required the participation of all the Centre's scientific and technical staff. In total, some 60 groups of internal specialists were set up to develop the individual constituents of the programme as a whole. These were then submitted to open examination by all the JRC staff at a series of internal hearings.

On the basis of this internal advice, a preliminary draft proposal was drawn up by the JRC and submitted for their opinion to the JRC's external consultative bodies (in particular the General Advisory Committee of the JRC, the Scientific and Technical Committee of the European Atomic Energy Community and the Advisory Committees on Programme Management), representing a broad range of scientific views within the Community.

On 19 March 1979 the Commission agreed a formal proposal, which was transmitted to the European Parliament and the Economic and Social Committee for opinion and to the Council for decision.

The Council adopted its Decision on the proposal on 13 March 1980. The Decision is set out in the following pages⁽¹⁾.

⁽¹⁾ OJ No. L 72 of 18 March 1980.

COUNCIL DECISION

of 13 March 1980

adopting a research programme to be implemented by the Joint Research Centre for the European Atomic Energy Community and for the European Economic Community (1980 to 1983)

(80/317/EEC, Euratom)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Atomic Energy Community, and in particular Article 7 thereof,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 235 thereof,

Having regard to the proposal from the Commission⁽¹⁾ presented after consultation, with regard to nuclear projects, of the Scientific and Technical Committee,

Having regard to the opinion of the European Parliament⁽²⁾,

Having regard to the opinion of the Economic and Social Committee⁽³⁾,

Whereas, in the context of the common policy relating to the field of science and technology, the multiannual research programme is one of the principal means whereby the European Atomic Energy Community can contribute to the safety and development of nuclear energy and to the acquisition and the dissemination of information in the nuclear field;

Whereas Article 2 of the Treaty establishing the European Economic Community assigns to the Community *inter alia* the task of promoting through the Community a harmonious development of economic activities, a continuous and balanced expansion and an increase in stability; whereas the objectives pursued by the Community's activities to this end are set out in Article 3 of the said Treaty;

Whereas the non-nuclear projects provided for by this Decision appear necessary for the attainment of these objectives;

Whereas the Treaty establishing the European Economic Community has not provided the specific powers required for this purpose;

Whereas on 14 January 1974 the Council adopted a resolution concerning the coordination of national policies and the definition of Community actions in the field of science and technology⁽⁴⁾;

Whereas the programme was drawn up in accordance with the Council resolution of 17 December 1970 concerning the procedures for adopting research and training programmes⁽⁵⁾;

Whereas the Italian Government has undertaken to take over until 31 December 1980 the Essor complex, made available to it by the Commission within the meaning of Article 6(c) of the Treaty establishing the European Atomic Energy Community;

Whereas it is in the common interest to further experiments in reactor safety, and the Essor plant may be utilized to this end;

Whereas Article 3 of Decision 77/488/EEC, Euratom⁽⁶⁾ provides for a review of the programme during its third year which may lead to the adoption of a new four-year programme (1980 to 1983) with 1980 constituting a year common to both programmes; whereas Decision 77/488/EEC, Euratom, should therefore be repealed;

Whereas, as a result of such repeal, 100 million European units of account assigned to the preceding programme will remain available; whereas this amount should be assigned to the new programme; whereas such a step must be taken into account in determining the level of expenditure commitments necessary for the execution of the new programme.

⁽¹⁾ OJ No C 110, 3. 5. 1979, p. 4.

⁽²⁾ OJ No C 140, 5. 6. 1979, p. 83.

⁽³⁾ OJ No C 297, 28. 11. 1979, p. 9.

⁽⁴⁾ OJ No C 7, 29. 1. 1974, p. 2.

⁽⁵⁾ OJ No L 16, 20. 1. 1971, p. 13.

⁽⁶⁾ OJ No. L 200, 8. 8. 1977, p. 4.

HAS DECIDED AS FOLLOWS :

Article 4

Article 1

A research programme, as presented in Annexes A, B and C, is hereby adopted for a period of four years as from 1 January 1980.

The dissemination of the information resulting from the implementation of the non-nuclear parts of the programme shall be carried out in accordance with Council Regulation (EEC) No 2380/74 of 17 September 1974 adopting provisions for the dissemination of information relating to research programmes of the European Economic Community⁽²⁾.

Article 2

The total expenditure commitments necessary to implement the programme defined in Annex A and the maximum number of staff are fixed at 510,87 million European units of account, including the amounts referred to in the second paragraph of Article 6, and 2,260 respectively. The indicative breakdown of funds and staff is given in Annex B. A scale of financial contributions from the Member States for the supplementary research and training programme of the European Atomic Energy Community is set out in Annex C.

Article 5

The Commission shall be responsible for implementation of the programme and, to this end, shall call upon the services of the Joint Research Centre.

Article 6

Decision 77/488/EEC, Euratom, is hereby repealed with effect from 1 January 1980.

The European unit of account shall be that defined in Article 10 of the Financial Regulation of 21 December 1977 applicable to the general budget of the European Communities⁽¹⁾.

However, amounts which are authorized pursuant to the aforementioned Decision under the relevant headings in the 1977, 1978, 1979 and 1980 budgets, and which on 1 January 1980 have not yet been committed or which have been committed but not yet paid, may be used for the execution of the present programme.

Article 3

The programme shall be reviewed during its third year. Such review may lead to a Council Decision on a new four-year programme in accordance with the appropriate procedure.

Done at Brussels, 13 March 1980.

For the Council

The president

G. ZAMBERLETTI

⁽¹⁾ OJ No L 356, 31. 12. 1977, p. 1.

⁽²⁾ OJ No L 255, 20. 9. 1974, p. 1.

ANNEX A

RESEARCH PROGRAMME (1980 to 1983)

A. NUCLEAR SAFETY AND THE FUEL CYCLE (JOINT PROGRAMME)

A.1 Reactor Safety (nuclear activity)

The programme consists of the following 11 projects :

- project LOBI : study of loss of coolant accidents in light-water reactors,
- project Super-SARA : an in-pile experiment on the behaviour of light-water reactor fuel in the event of loss of coolant,
- project LWR primary circuit integrity : early detection of faults in light-water reactor vessels,
- fast-breeder fuel sub-assembly thermohydraulics,
- mechanical tests of fast-breeder structural materials,
- development of fast-breeder hypothetical accident codes,
- project PAHR : study of the evacuation of residual heat in a fast-breeder molten core,
- project PAHR in-pile,
- study of fuel-coolant interaction under accident conditions,
- study of the behaviour of structures and containments subjected to accidental stresses,
- analysis of reliability, risk assessment and data bank.

A.2 Plutonium fuels and actinide research (nuclear activity)

The programme consists of the following three projects :

- utilization limits of plutonium fuels,
- safety of actinide cycle,
- actinide research.

A.3 Safety of nuclear materials (nuclear activity)

The programme consists of the following four projects :

- risk evaluation,
- protective barriers,
- actinide separation,
- actinide monitoring.

A.4 Fissile materials control and management (nuclear activity)

The programme consists of the following four projects :

- acquisition of data on accountancy and materials balance evaluation,
- development of measurement methods and instrumentation and of methods for the evaluation of the isotopic composition of irradiated fuels,
- containment and surveillance techniques,
- study of safeguards systems for the fuel cycle as a whole.

B. NEW ENERGIES (JOINT PROGRAMME)

B.1 Solar energy (non-nuclear activity)

The programme consists of the following four projects :

- European solar test installation (ETI),
- solar energy for habitat and low-temperature applications,
- solar power plant materials,
- photo-electrochemical and photo-chemical conversion.

B.2 Hydrogen production, energy storage and transport (non-nuclear activity)

The programme consists of the following three projects :

- thermochemical production of hydrogen,
- advanced studies on energy carriers,
- systems studies.

B.3 Thermonuclear fusion technology (nuclear activity)

The programme consists of the following five projects :

- conceptual studies on fusion reactors,
- blanket technology studies,
- studies on structural materials,
- studies on advanced materials,
- operation of the cyclotron.

B.4 High-temperature materials (nuclear activity)

The programme consists of the following three projects :

- high-temperature materials information centre,
- materials and engineering studies,
- high-temperature materials data bank.

C. STUDY AND PROTECTION OF THE ENVIRONMENT (JOINT PROGRAMME)

C.1 Protection of the environment (non-nuclear activity)

The programme consists of the following six projects :

- project ECDIN,
- exposure to chemical products, in particular indoor pollution and organic substances,
- analysis of air quality,
- analysis of water quality,
- heavy metals pollution and health effects,
- environmental impact of conventional power plants.

C.2 Remote sensing from space (non-nuclear activity)

The programme consists of the following two projects :

- agriculture,
- protection of the sea.

D. NUCLEAR MEASUREMENTS (JOINT PROGRAMME)

D.1 Nuclear measurements (nuclear activity)

The programme consists of the following two projects :

- measurement of nuclear data,
- nuclear reference materials and techniques.

E. SPECIFIC SUPPORT FOR THE COMMISSION'S SECTORAL ACTIVITIES (JOINT PROGRAMME)

E.1 Informatics (nuclear activity)

The programme consists of the following three projects :

- data communication,
- Eurocopi,
- European shielding information service (ESIS).

E.2 Support to safeguards (nuclear activity)

E.3 Support to the Community Bureau of References (non-nuclear activity)

E.4 Training and education (nuclear and non-nuclear activity)

E.5 Utilization of research results (nuclear and non-nuclear activity)

E.6 Provision of scientific and technical services (nuclear and non-nuclear activity)

F. OPERATION OF LARGE SCALE INSTALLATIONS

Supplementary programme

F.1 Operation of the HFR reactor (nuclear activity)

ANNEX B

INDICATIVE BREAKDOWN OF STAFF AND FUNDS

Programmes	Expenditure commitments (million EUA)	Total staff	of which research staff
A. NUCLEAR SAFETY AND THE FUEL CYCLE			
1. Reactor safety	151.30 ⁽¹⁾ ⁽²⁾	716	308
2. Plutonium fuels and actinide research	56.35	207	117
3. Safety of nuclear materials	20.85	115	52
4. Fissile materials control and management	20.50	112	55
Total	249.00	1150	532
B. NEW ENERGIES			
1. Solar energy	22.90	117	60
2. Hydrogen production, energy storage and transport	14.10	79	40
3. Thermonuclear fusion technology	26.10	124	60
4. High-temperature materials	14.90	63	38
Total	78.00	383	198
C. STUDY AND PROTECTION OF THE ENVIRONMENT			
1. Protection of the environment	33.90	174	90
2. Remote sensing from space	18.35	97	50
Total	52.25	271	140
D. NUCLEAR MEASUREMENT			
	43.20	184	108
E. SPECIFIC SUPPORT TO THE COMMISSION			
1. Informatics	13.83	69	34
2. Support to safeguards	5.90	25	13
3. Support to the Community Bureau of References	2.62	13	7
4. Training and education	3.31	17	9
5. Utilization of research results	1.74	8	1
6. Provision of scientific and technical services	8.80	52	27
Total	36.20	184	91
SUB-TOTAL	458.65		
F. OPERATION OF LARGE SCALE INSTALLATIONS			
1. Operation of the HFR reactor	52.22	88	41
GRAND TOTAL	510.87 ⁽¹⁾ ⁽²⁾	2260 ⁽³⁾	1110

⁽¹⁾ Including a provisional amount of 6 770 000 EUA reserved for the PAHR in-pile project.

⁽²⁾ Including a provisional amount of 40 610 000 EUA for the second phase of the Super-SARA project.

⁽³⁾ A maximum of 20 staff is added to this figure in 1980 only corresponding to the decrease in Centre staff provided for in Decision 77/488/EEC, Euratom.

ANNEX C

**SCALE OF FINANCIAL CONTRIBUTIONS FROM THE MEMBER STATES FOR THE
EURATOM SUPPLEMENTARY RESEARCH AND TRAINING PROGRAMME**

Flat-rate scale

Operation and utilization of the HFR reactor:

- Federal Republic of Germany : 50%
- Netherlands : 50%

The Programme

Programme description

1. Orientation

The programme for the period 1980-83 does not differ essentially in its orientation from the 1977-80 programme. It is built around a limited number of key topics:

- matters of priority concern in nuclear safety;
- the development of future forms of energy;
- the study and protection of the environment;
- the development and execution of reference measurements;
- the provision of specialized scientific and technical support for the Commission's sectoral activities.

2. Objectives

With regard to its objectives the programme sets out to:

- a) take full advantage, in significant experimental programmes, of a number of investments, which were authorized during the preceding period and which are now in the final stage of implementation (the LOBI loop for reactor safety, cyclotron for fusion materials and the ESTI solar test installation), and in the same spirit to give to certain parts of the research an operational content (the ECDIN project in the protection of the environment and the reinforcement of the High Temperature Materials Information Centre).
- b) bring a number of research topics which hitherto had been confined to preliminary studies (chiefly on design) to a more advanced stage of development by the commissioning of experimental installations (the SUPER-SARA project in reactor safety, and several projects on the management and storage of radioactive waste).
- c) wind up, in the course of the programme, a number of projects which either had less priority or were less well adapted to the specific role of the JRC (the own research section of the non-nuclear Measurements, Standards and Reference Techniques (METRE) Programme), or which did not warrant continuation at existing level under present circumstances (the actinide incineration project in radioactive waste management and storage, decontamination of power station components, thermochemical production of hydrogen).
- d) launch a limited number of new projects (e.g. storage and transport of energy, and indoor pollution in the protection of the environment, solar power stations).
- e) and lastly follow up the activities in progress under the 1977-80 programme for the remainder of the topics envisaged, the only adjustments being those called for by management experience or by changing requirements.

All in all, the evolution of the programme is more apparent in the breadth and quality of the projects to be carried out than in the areas it embraces.

As a general evaluation, half of the programmes can be considered as a continuation of present activities, though with certain adjustments (as set out above) required either by the experience of managing the programmes or by the evolution of requirements. The other half of the programmes represents a significant evolution, whether totally new actions (some 10% of the total), or, within the same research areas, a significant development in their direction or in the nature of the work undertaken (some 40% of the total), or thirdly, actions which are substantially reduced (a small percentage).

3. Structure

The programme centres around six research areas (as against five in the 1977-80 programme):

The area **Nuclear Safety and the Fuel Cycle** is subdivided into four programmes:

- A.1 Reactor Safety
- A.2 Plutonium Fuels and Actinide Research
- A.3 Safety of Nuclear Materials
- A.4 Fissile Materials Control and Management

The fact that the programme on Safeguards and Management of Fissile Materials comes under this heading rather than among the support projects is due to the scale of the research that needs to be done and its potential value as a support to the work of the IAEA.

The area **New Energies** is again subdivided into four programmes:

- B.1 Solar Energy
- B.2 Hydrogen Production, Energy Storage and Transport
- B.3 Thermonuclear Fusion Technology
- B.4 High Temperature Materials

Programme B.2 takes account of the significant progress made in the 1977-80 programmes, and provides for the research to be extended to techniques of storing energy in forms other than hydrogen.

The area **Study and Protection of the Environment** comprises two programmes:

- C.1 Protection of the Environment
- C.2 Remote Sensing from Space

In view of their homogeneity, all the activities associated with Remote Sensing from Space under programme C.2 are grouped together rather than distributed according to their uses, as was the case in the preceding programme.

The area **Nuclear Measurements** is dealt with in a single programme of the same name. Owing to its orientation, the non-nuclear section of the METRE programme is included in topic E under the heading «Support to the CBR» (Community Bureau of Reference).

The area **Specific Support for the Commission** is subdivided into six programmes:

- E.1 Informatics
- E.2 Support to Safeguards
- E.3 Support to the Community Bureau of Reference
- E.4 Training and Education
- E.5 Utilization of Research Results
- E.6 Provision of Scientific and Technical Services on Request

There is no separate programme of support for another important sectoral activity, development aid. Owing to the specific nature of the contributions the JRC will be called upon to make, provision for such support is made under the appropriate programmes, in particular Solar Energy, Remote Sensing and Training.

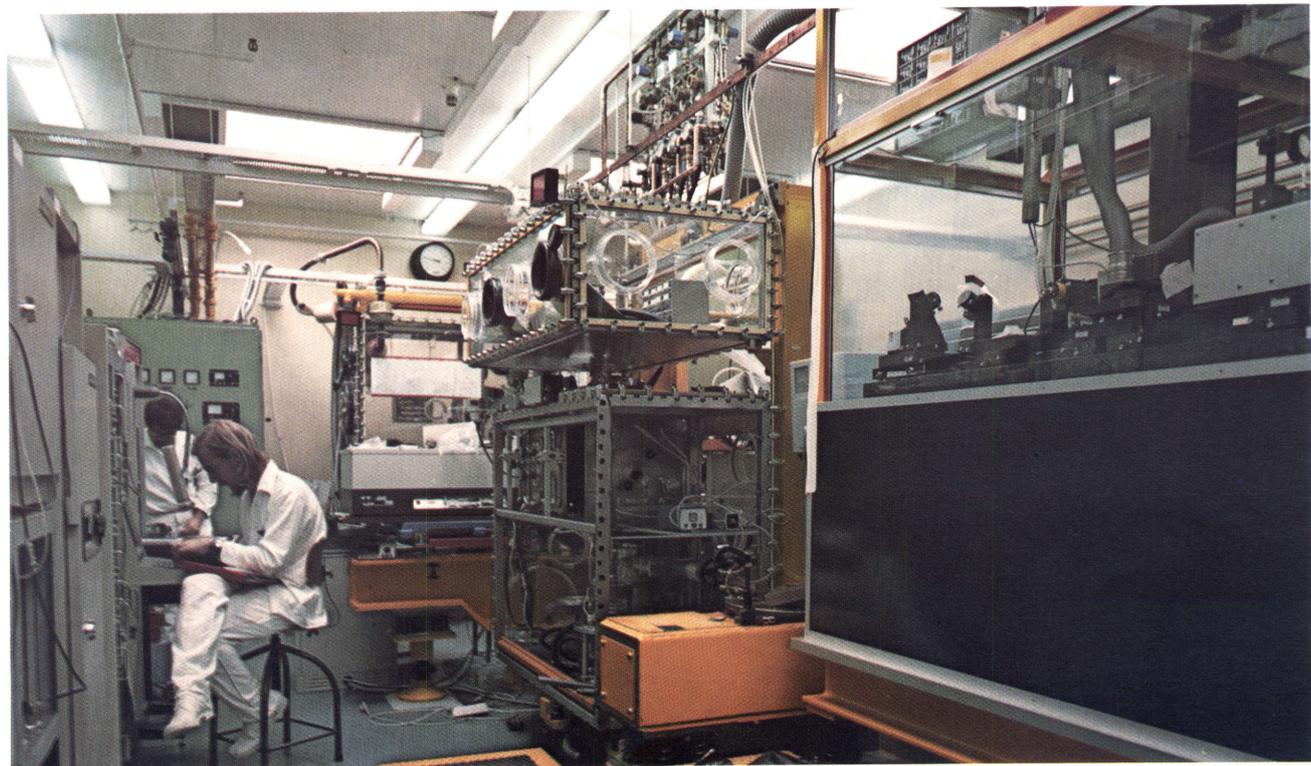
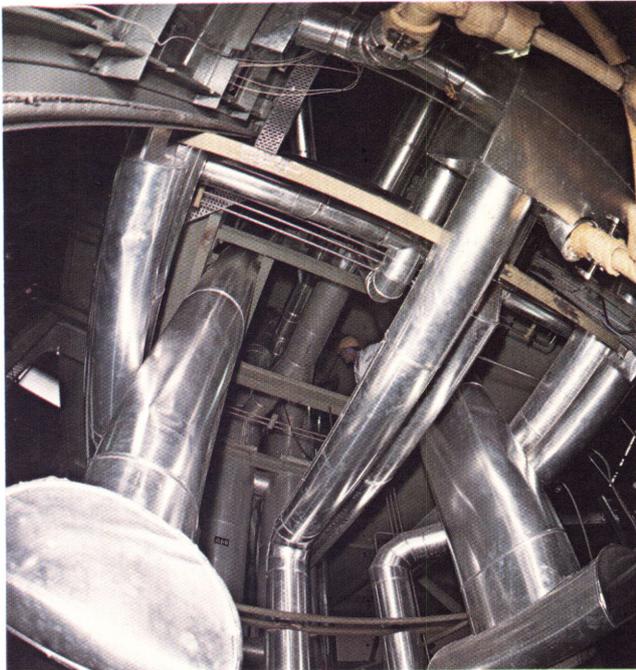
Lastly, the area **Operation of Large-Scale Installations** is represented by one programme only relating to the operation of the HFR reactor.

The structure thus adopted should take into account the specific character of the research objectives, and assure efficient technical and financial management of the programmes. As in the past, moreover, a close link will be established with the indirect action programmes on topics similar to those being studied by the JRC (mainly applicable to programmes A.2, A.3, B.1, B.2, B.3, C.1).

Figure 1 right: Reactor Safety Programme; upper part of reactor pressure vessel model (LOBI project)

Figure 2 below: Reactor Safety Programme; high pressure water testing facility for Light Water Reactor research

Figure 3 bottom: Plutonium Fuels and Actinide Research Programme; installation for laser-heating to temperatures up to 7000 Kelvin of fuel samples for vapour pressure determination



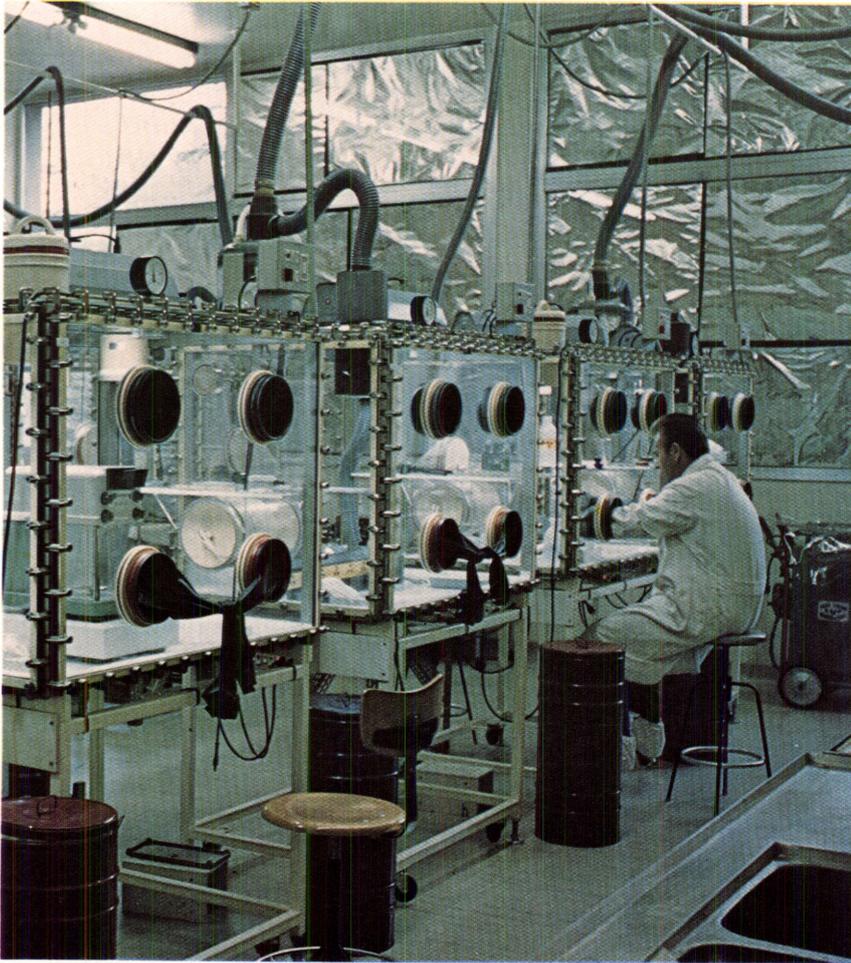
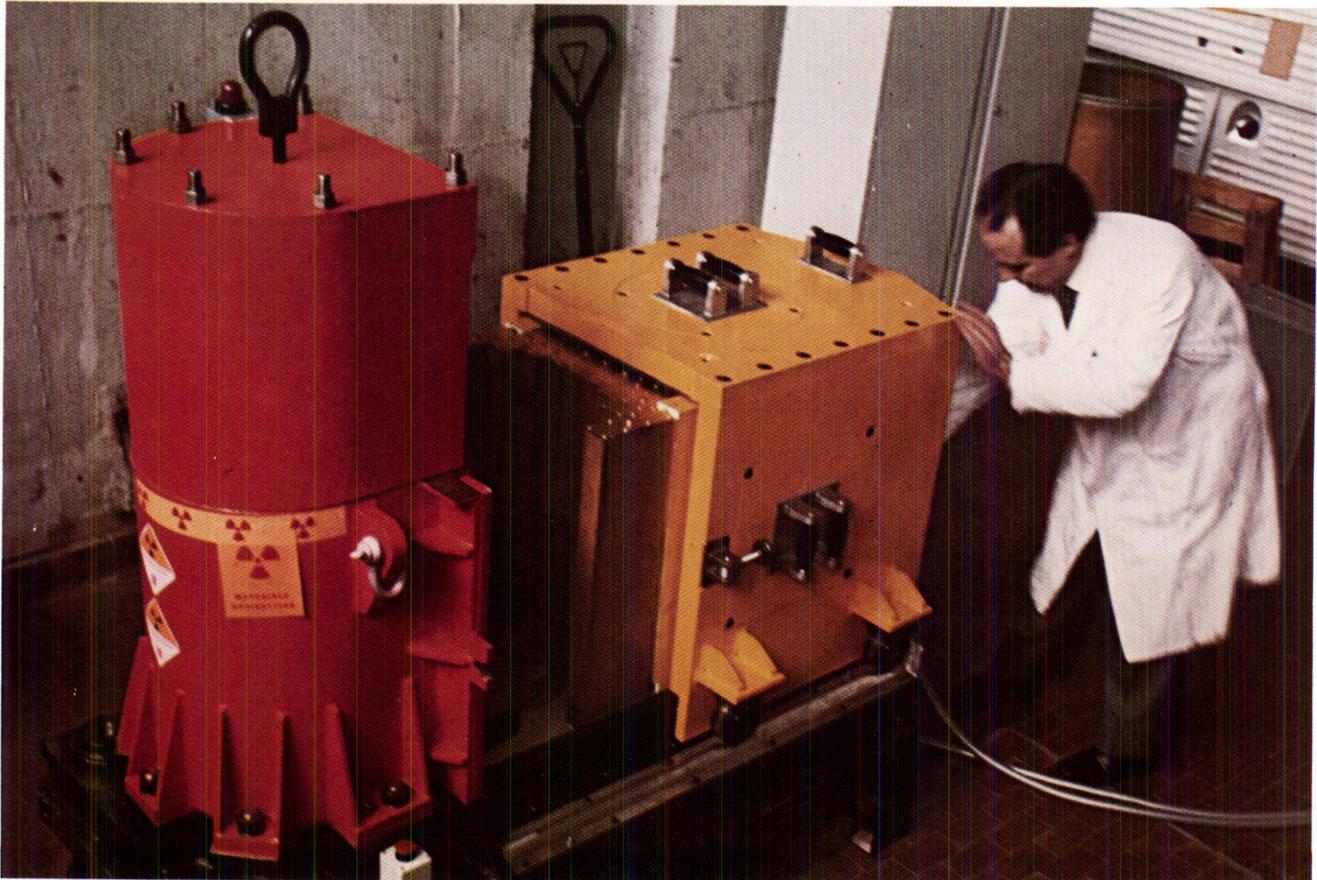


Figure 4 left: Safety of Nuclear Materials Programme; radiochemical laboratory for experiments on actinide separation

Figure 5 below: Fissile Materials Control and Management Programme; instrument developed by the JRC for safeguards inspectors for the determination of large quantities (up to 5 kg) of highly enriched uranium



Contents

A.1 Reactor Safety

As the most ambitious of the JRC programmes, the reactor safety programme utilizes the nuclear facilities of the Centre to the full.

The aim of this research is essentially to satisfy two types of requirements:

1. to provide reactor designers, constructors and operators with the elements necessary to ensure the prevention of accidents and the operational reliability of the plants,
2. to provide the responsible authorities with the tools which allow the degree of safety of these plants to be evaluated.

The JRC activities comprise detailed theoretical analyses and experimental studies. They are oriented towards the analysis of initiating events which may lead to a reactor accident, the analysis of their consequences as well as towards the study of prevention and early detection of possible failures.

The programme breaks down into eleven projects — a large number —, but one that in no way implies dispersal of resources, but rather the intensity of the effort devoted to this field.

a) Projects more specific to light water reactors:

- **project LOBI** (figure 1) : an experimental out-of-pile study of the loss-of-coolant phenomenon in light water reactors;
- **project SUPER-SARA** : an in-pile experiment simulating the behaviour of light water reactor fuel in the event of coolant loss (to be further reviewed before end 1980);
- **project LWR primary circuit integrity** (figure 2) : early detection of faults in light water reactor vessels;

b) projects more specific to breeder reactors :

- **project LMFBR subassembly thermohydraulics** : modelling of the thermohydraulic behaviour of fuel assemblies in abnormal situations;
- **project LMFBR mechanical tests** : study of certain aspects of the behaviour of structural materials;
- **project EAC** : development of codes to describe scenarios of abnormal situations;

Projects PAHR and PAHR in-pile : theoretical and experimental study of molten core behaviour, including in-pile tests. In accordance with the opinion of the General Advisory Committee, some of these tests are to be the subject of a special decision during the course of the programme.

- **project CONT** : study on the behaviour of structures and containments subjected to accident stresses.

c) general projects :

- **project FCI** : study of fuel-coolant interaction under accident conditions;
- **project Reliability, Risk Assessment and Data Bank** : analysis and collection of data on reactor reliability and risk assessment.

It should be noted that this «Reactor Safety» programme is intended to include a large element of international co-operation, with the US Nuclear Regulatory Commission co-operating in the FCI, SUPER-SARA and PAHR projects, EPRI (Electric Power Research Institute, USA) and JAERI (Japan Atomic Energy Research Institute) in the SUPER-SARA programme, the PNC (Power Reactor and Nuclear Fuel Development

Corporation, Japan) in the project CONT, and the Swedish State Power Board in the project Reliability , Risk Assessment and Data Bank. It should be further recalled that the LOBI project has been financed at the start by the Federal German Research Ministry, and that the construction of the experimental loop for the SUPER-SARA project is undertaken with finance from the Italian Government.

A.2 Plutonium fuels and actinide research

This programme comes partly under the heading of fast reactor fuel development and partly under that of fundamental research on actinides. It is mainly conducted in the specialized laboratories of the European Institute at Karlsruhe, and is subdivided into three projects:

- **Utilization limits of plutonium fuels** (figure 3) : their behaviour is studied under normal and abnormal conditions;
- **Safety of the actinide cycle** : theoretical and experimental studies will endeavour to provide an answer to some of the problems raised by the presence of transuranium elements in the fuel cycle;
- **Actinide research** : a study of chemical bonding in solid actinides. This long-term basic research takes the form of fundamental theoretical studies backed up by solid state physics experiments on pure samples prepared and characterized in the laboratory.

A.3 Safety of nuclear materials

The programme centres chiefly on problems relating to the treatment and temporary or permanent storage of radioactive waste. The aim of the theoretical and experimental research is the safety evaluation of waste management procedures.

The programme is divided into four projects :

- **Risk evaluation** : study of safe waste management techniques;
- **Protective barriers** : study of natural and artificial barriers to the migration of radionuclides into the biosphere;
- **Actinide separation and actinide monitoring** (figure 4) : studies of the chemical insulation and control of these very long-life elements.

In this programme the use of hot cells will be considered for experiments with a more direct application on industrial scale.

A.4 Fissile materials control and management

Continuing concern to strengthen safeguards and fissile material management methods calls for a sustained research and development effort. In close collaboration with the Euratom Safeguards Directorate, the national laboratories, the management of nuclear installations and the officials of the IAEA, the JRC is stepping up its contribution in this field. The aim of the programme is to develop various safeguards techniques for application in the main types of nuclear installations. The programme is subdivided into four projects according to the techniques being studied :

- the first is concerned with the **acquisition of data for materials accountancy** and the **evaluation of the material balance**;
- the second relates to the development of **measurement methods and instrumentation** (figure 5) and of **techniques for evaluating the isotopic composition of irradiated fuels**;
- the third is a study of **containment and surveillance techniques**;
- the fourth and last is devoted to the study of **safeguards systems** for the fuel cycle as a whole.

In addition to the cooperation with the IAEA mentioned above, cooperation with the US Department of Energy is also envisaged for this programme.

Figure 6 right: Solar energy programme:
Side view of the light source of the
thermal performance test chamber LS-1.

Figure 7 below: Solar Energy
Programme; self orientating photovoltaic
concentrator system consisting of
Fresnel mirrors and lenses

Figure 8 bottom: Hydrogen Production
Programme; complete view of the
laboratory circuit for the
thermochemical production of hydrogen

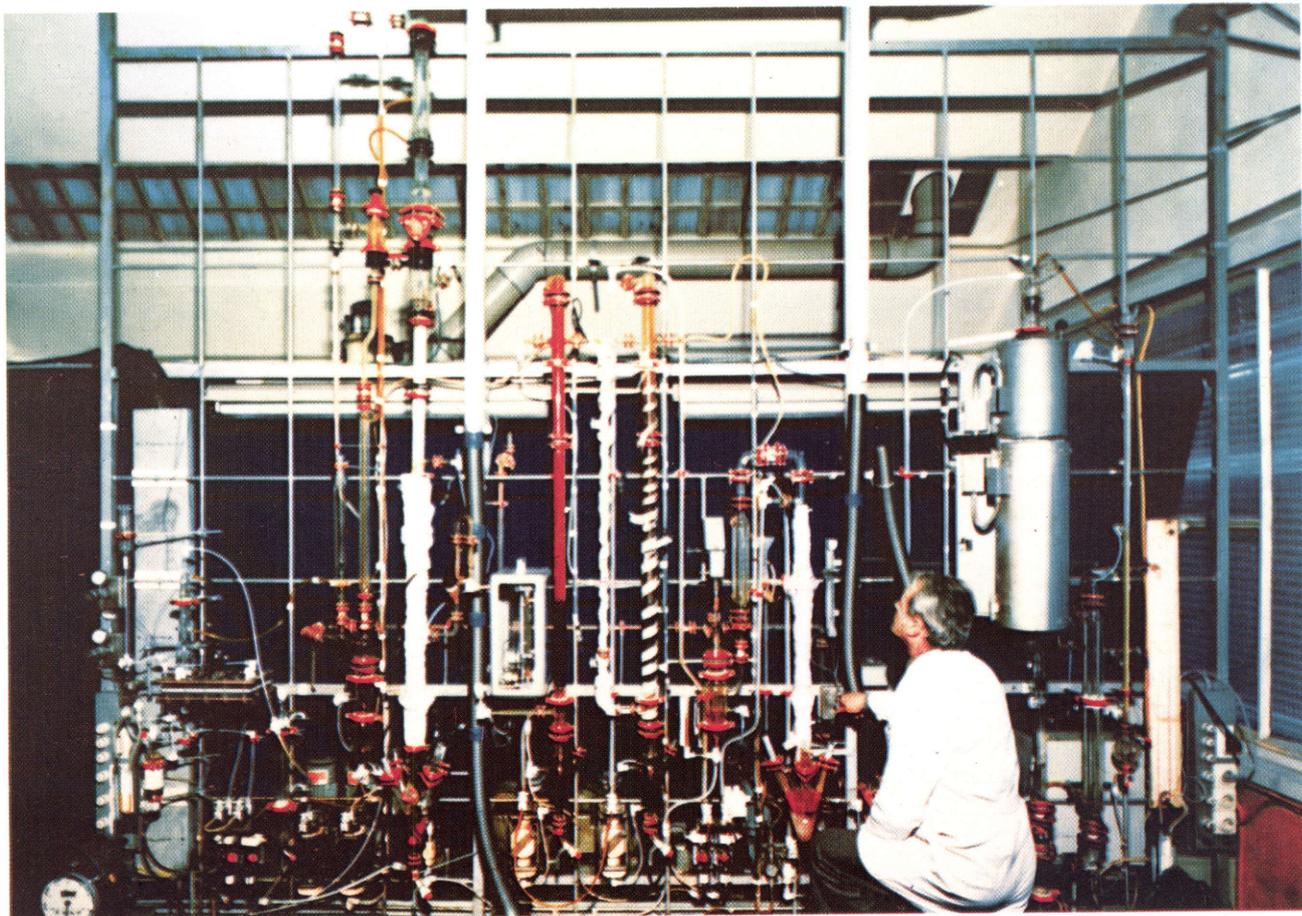
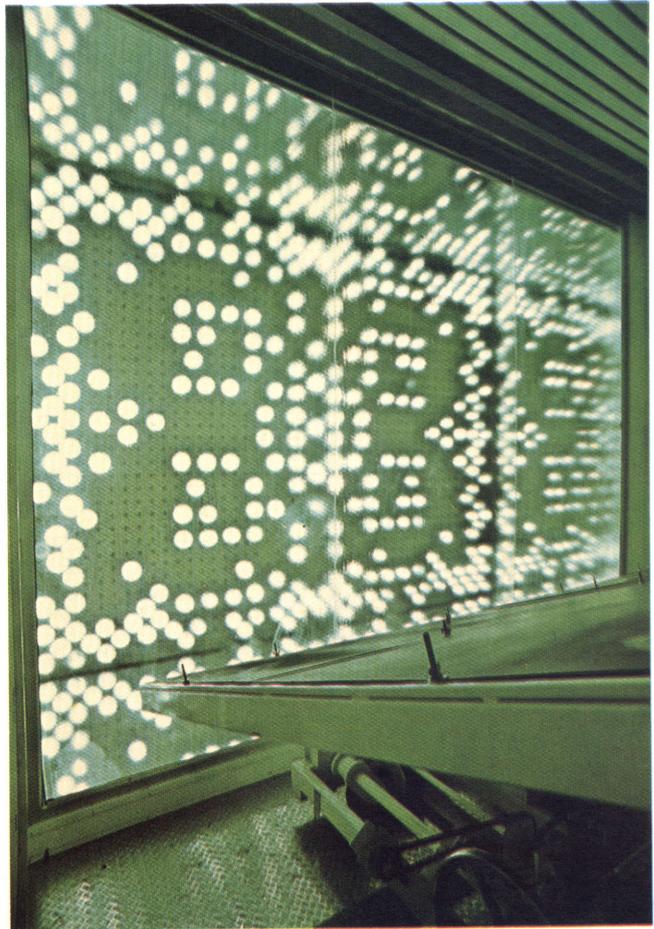
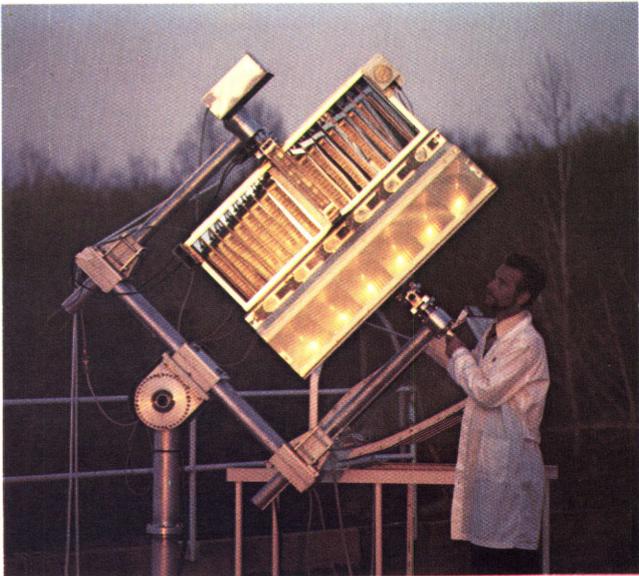
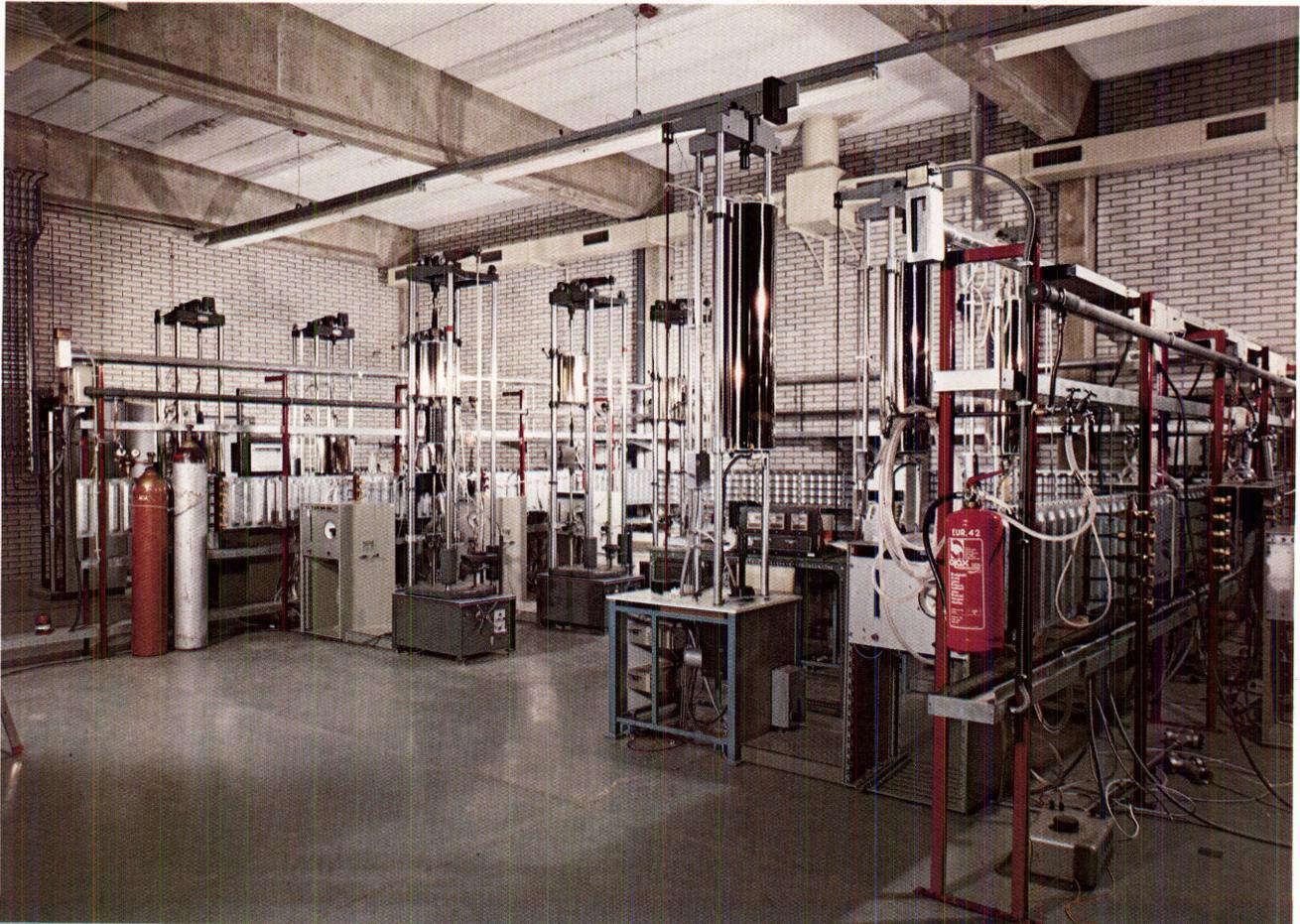




Figure 9 left: Thermonuclear fusion technology programme: View of the cyclotron hall during the assembly of the accelerator and the switching magnet.

Figure 10 below: High Temperature Materials Programme; Environmental Testing Laboratory



B.1 Solar energy

Against the background of the substantial efforts being made in the Community to develop solar energy, the JRC will follow up a number of specialized tasks which correspond more to its own role than others. They are summed up in four projects :

- **project ESTI** (figures 6-7) : exploitation of a large testing facility under natural or simulated radiation for both thermal and photovoltaic systems;
- **project Habitat** : studies of systems that permit the use of solar energy in all seasons, and of high-temperature systems for industrial and agricultural applications;
- **project Solar power plant materials** : a contribution, through materials research and design studies, to improving the economic competitiveness of power plants;
- **project Photo-electrochemical and Photo-chemical conversion** : basic research on new processes for the conversion and storage of solar energy.

The JRC cooperates through this programme in the International Energy Agency (IEA) R & D programme on Solar Heating and Cooling.

B.2 Hydrogen production, energy storage and transport

In the development of new energy sources, a great deal of attention has been devoted to the sources themselves and to systems of production. Nevertheless, the storage and transport of the energy produced are matters that should not be overlooked; in many cases, they are an essential requirement for the economic utilization of the new systems, whether because of the intermittent nature of the source (solar energy), or because of the mode of utilization (mobile applications), or because of the distance between the centres of production and consumption. In these respects, hydrogen holds out attractive prospects — hence the JRC's interest in the production of this energy carrier.

The project on the **thermochemical production of hydrogen** (figure 8) is a continuation of the research on a scale adapted to the evolution of the energy scene, whereas the **advanced studies on energy carriers** and the **system studies** are an extension of the activities towards energy transport and storage problems through systems analysis and the testing of components.

The JRC cooperates through this programme in the IEA programme of R & D on the Production of Hydrogen from Water, and is operating agent for the tasks Chemical Engineering Evaluations of Thermochemical Processes and Assessment of Potential Future Markets.

B.3 Thermonuclear fusion technology

The JRC's work on fusion is integrated into the objectives of the Community's research and training programme in the field of fusion and plasma physics. It is concentrated on technological problems, in which the experience gained with fission reactors can be turned to good use, and is subdivided into five projects:

- **conceptual studies on fusion reactors** : a contribution to the design of the next generation of fusion machines;
- **blanket technology studies** : an essential technological component of the future reactor;
- **studies of structural materials** : notably the evolution of their properties under irradiation;
- **studies on advanced materials** : chiefly exploratory;
- **operation of the cyclotron** (figure 9) : experimental research on the irradiation of materials.

B.4 High temperature materials

This relatively new programme is intended to encourage within the Community the development of these materials which are necessary for the energy technologies of the future.

The work is concentrated on three closely connected projects: a **High Temperature Materials Information Centre**, which relies on the skills developed and maintained within the research project **Materials and Engineering Studies** (figure 10), while the quantifiable data are stocked together in the **Data Bank** which will be developed in the third project.

C.1 Protection of the environment

Within the very large scope of the problems posed by the protection of the environment the JRC will concentrate its activities on a very limited number of research areas and thus will continue the rationalization effort begun in 1977.

Apart from a project devoted to the theoretical and experimental study of the **impact on the environment of conventional power plants** in particular the atmospheric pollution which they cause, all the projects are connected with the problem of the introduction of toxic chemical substances into the environment.

The projects are five in number, and are as follows :

- the **ECDIN project**, which is given a special priority, will be brought to its operational stage as an information and data network on chemical substances;
- the project **Exposure to Chemical Products** which is broken down into a sub-project **Indoor Pollution**, a new activity the aim of which is to make an inventory of the sources of this pollution and to analyse and characterize these pollutants; and a sub-project **Organic Substances**, which is concerned with the development of analytical methods of high precision and with the preparation of reference substances in this special areas;
- the projects **Analysis of Air Quality** and **Analysis of Water Quality** (figure 11) deal with particular aspects of the pollution of these environments;
- the project **Heavy Metals Pollution** is devoted to the problems of exposure to these toxic substances and of their effects on health.

C.2 Remote sensing from space

Even though the techniques of remote sensing from airborne platforms and platforms in space have reached a quasi operational stage in certain cases, they nevertheless require research activities to be continued. The bringing into operation of new systems (e.g. microwave radar) or the development of existing systems (e.g. Landsat-D) continuously offer new perspectives for their application which require trial and verification. In parallel, access for new categories of users of these techniques, in particular the developing countries, must be facilitated by the realization of demonstration projects.

This programme consists of two projects in two areas of general interest for the policies of the Community : a project **Agriculture** (which will be particularly directed towards inventorization and forecasting operations) and a project **Protection of the Sea** (figure 12).

In the execution of this programme, the JRC cooperates with the European Space Agency (ESA), the European Association of Remote Sensing Laboratories (EARSel), and with NASA, whose satellites it uses.



Figure 11 above: Protection of the Environment Programme; measurement of atmospheric pollution around a large fossil fuel power plant

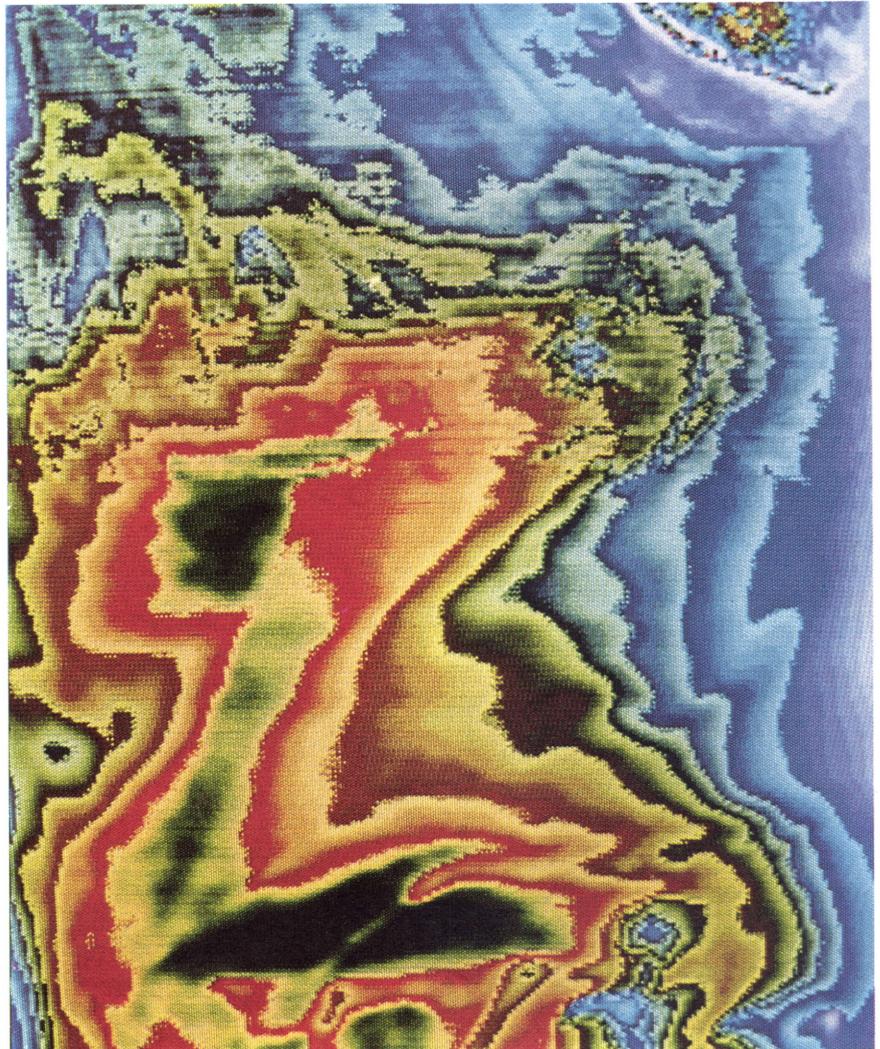
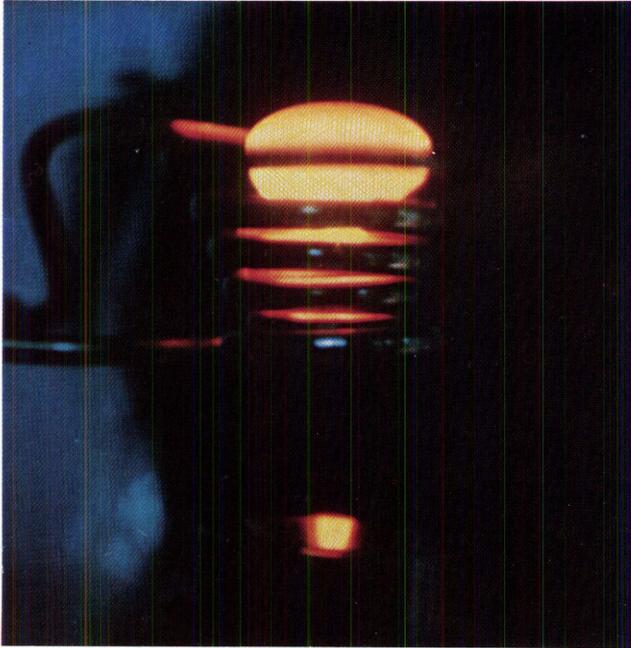


Figure 12 right: Remote Sensing from Space Programme; data from North Sea Ocean Colour Scanner experiment

Figure 13 right: Nuclear Measurement Programme; inside view of Van de Graaf accelerator

Figure 14 below: Nuclear Measurement Programme; levitation melting

Figure 15 bottom: Nuclear Measurement Programme; accelerator sections of LINAC accelerator



D.1 Nuclear measurements

This programme is essentially carried out at the Central Bureau of Nuclear Measurements at Geel.

It consists of two projects :

- **measurement of nuclear data** by means of the large accelerators of the Establishment (figures 13-15);
- **nuclear reference materials and techniques** (figure 14) which covers the development of these materials which are indispensable to the nuclear industry (and to safeguards). In particular, the examination of the possibilities of production, chemical purification and isotopic enrichment by electromagnetic means of rare actinides is undertaken.

E.1 Informatics

These activities closely integrate service and research aspects, in support of the the Commission's policy for the promotion of advanced and efficient informatics systems within the Community. Two of these activities constitute a framework capable of hosting the management teams of the European informatics programme, and consist of two projects of a recognized central character: the project **Teleinformatics** which places the JRC's activities within the CREST-CIDST plan and the COST actions, and which is tied to the development of the EURONET network; and the project **Eurocopi** which will improve the provision of information on computer programmes, in particular by studies of programming techniques and languages (figure 16).

A third project is the **European Shielding Information Service (ESIS)**, the aim of which is the dissemination of information on protection against shielding radiation in nuclear reactors.

E.2 Support to safeguards

As an independent European centre, the JRC plays the role of reference laboratory for the analysis of samples taken during safeguards inspections.

In addition to analytical verification work, the JRC gives technical assistance to the Safeguards Directorate. This assistance includes the adaptation and checking of devices or complete systems destined for scientific installations (figure 17).

E.3 Support to the Community Bureau of Reference

The JRC will continue some tasks of co-ordination and organization of specialist groups and will continue in the earlier stages to provide technical assistance in evaluation and statistical analysis of results. A certain number of specialists from the Ispra, Geel and Petten Establishments will participate part-time in this work, which will be accompanied by a certain amount of actual research.

E.4 Training and Education

This programme covers the organization of the «Ispra Courses», the subjects of which are closely related to the Centre's research. The number of these courses will be increased, and greater consideration will be given to the specific requirements of the countries connected to the Community by co-operation agreements.

E.5 Utilization of research results

The JRC makes a particular effort to promote the utilization of the results of its research and to facilitate the transfer of technology which originates in patents and know-how derived from its work (figure 18). The JRC provides within its programmes specific support for the Directorate-

General «Scientific and Technical Information and Information Management».

E.6 Provision of scientific and technical services on request

This programme covers the JRC's activities carried out at their request in support of other services of the Commission. These services are of two types: **technical evaluations** which concentrate mainly on systems analysis work, or **technical assistance** based on the special skills and equipment of the JRC. This latter type of service includes assistance with the technical management of projects derived from the policies conducted by other Directorates-General. Such activities are particularly beneficial to the coordination of programmes carried out simultaneously by direct and indirect action.

F.1 Operation of HFR reactor

The operation of the reactor will continue to the benefit of the research programmes of the participating Member States (fuel behaviour, basic physics experiments, isotope production), and, following the discussions in the International Fuel Cycle Evaluation programme, of research into the use of low enriched uranium in test reactors. The reactor will also meet the JRC's own requirements (Pu fuels programme, fusion programme, reactor safety programme), and outside customers will be able to use the irradiation facilities on payment.

During this programme, the team will continue the upgrading of the reactor, and to develop and improve the irradiation equipment and apparatus to enable this installation to keep its position among the Community's most important irradiation means (figures 19-20).

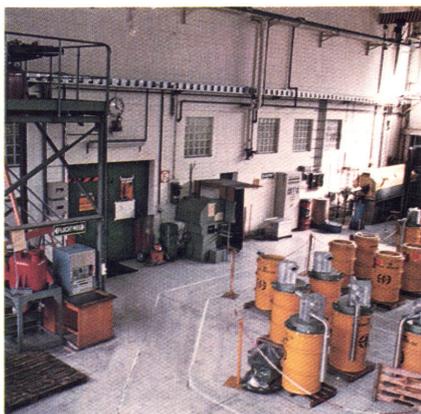


Figure 16 top: Informatics Programme;
Ispra computing centre

Figure 17 above: Support to Safeguards
Programme; automatic fissile materials
control system on fuel pebbles of High
Temperature Gas Cooled Reactor

Figure 18 right: Utilization of Research
Results Programme; the JRC stand at
the Hannover Technology Fair 1979

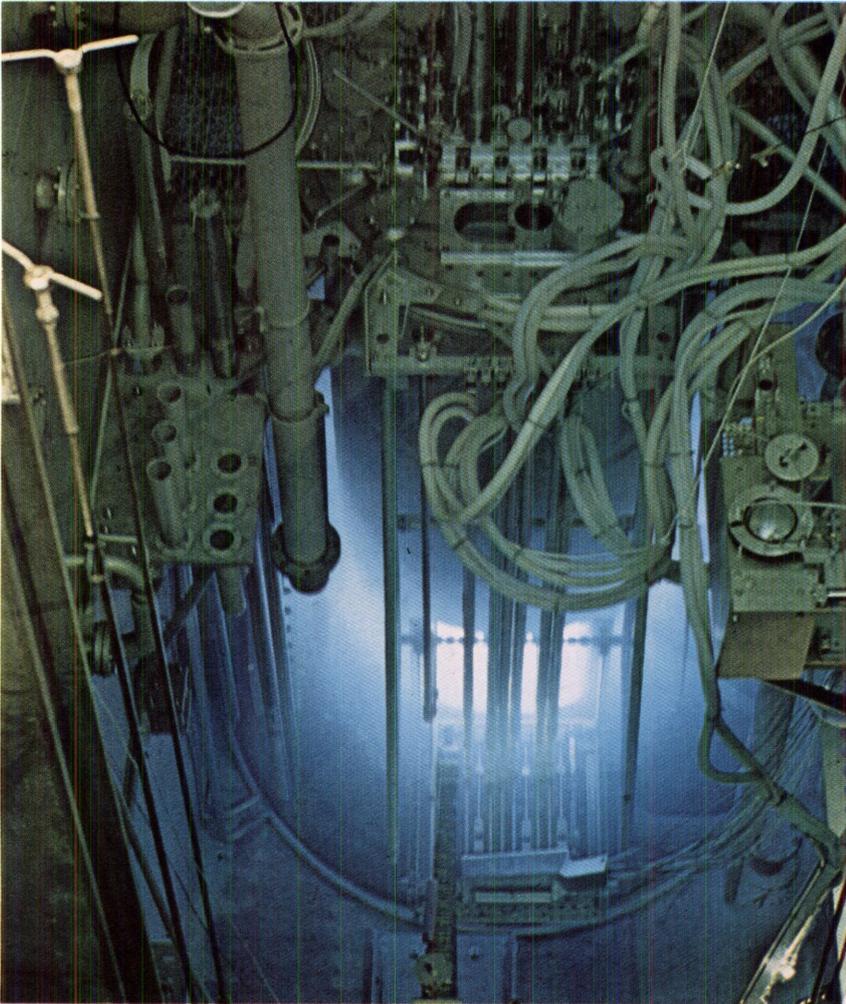
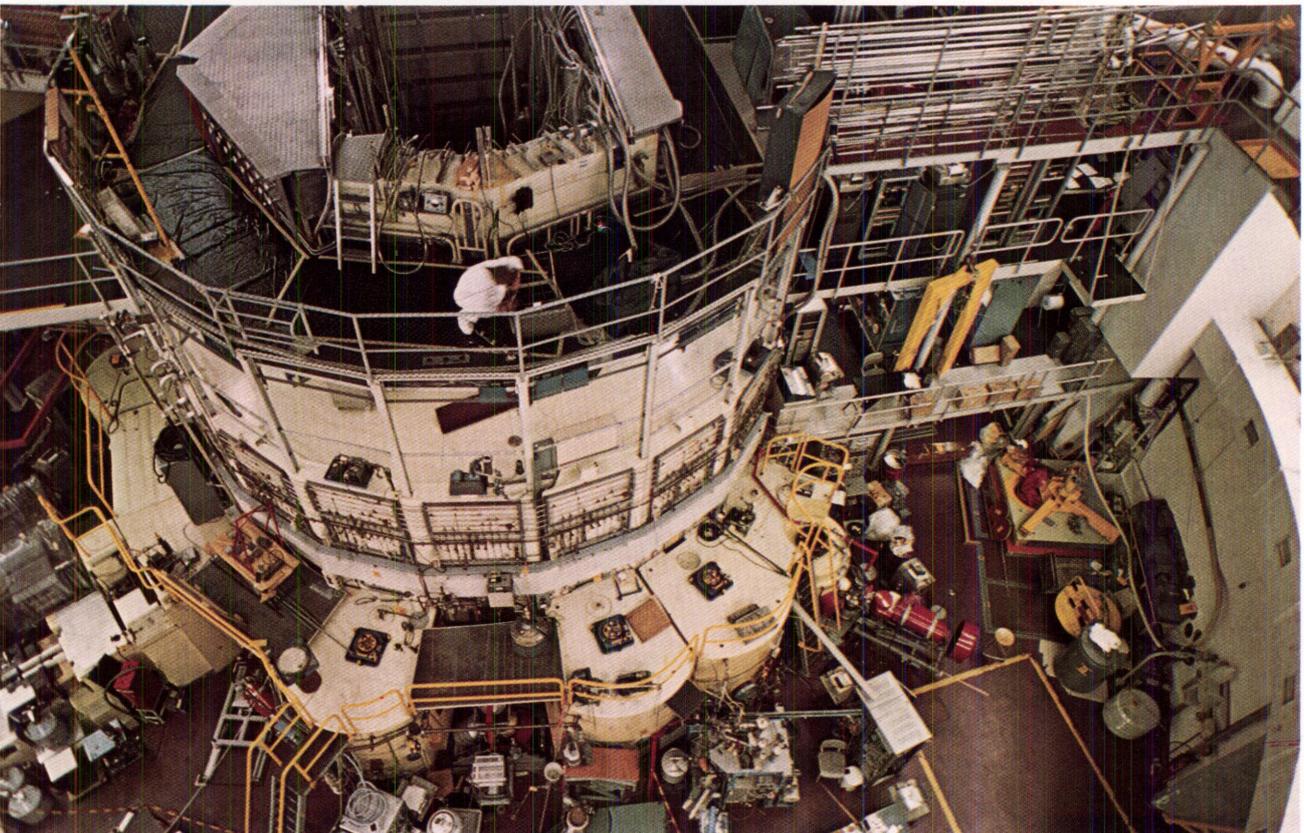


Figure 19 left: Operation of HFR Programme; view of poolside facility with reactor at full power

Figure 20 below: Operation of HFR Programme; 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.



The programmes in relation to the JRC's tasks

The table below gives an overview of the manner in which each of the programmes described above relates to one or other of the aspects of the JRC's role within the common policy on science and technology.

In addition to the three essential tasks — central role, public service, support for the Commission — a particular heading indicates the programmes which are connected with other research actions of the Commission. A particular co-ordination effort obviously takes place within the services of the Commission before this coordination is submitted to examination by the external consultative bodies.

Programme	Central Role	Public Service	Support for Commission	Connection with other Commission research actions
A.1 Reactor safety	A	A	B	A
A.2 Plutonium fuels and actinide research	A	B	C	B
A.3 Safety of nuclear materials	A	A	B	A
A.4 Fissile materials control and management	A	A	A	—
B.1 Solar energy	A	A	B	A
B.2 Hydrogen production, energy storage and transport	B	B	A	A
B.3 Thermonuclear fusion technology	A	C	B	A
B.4 High temperature materials	A	A	C	—
C.1 Protection of the environment	B	A	A	A
C.2 Remote sensing from space	A	A	B	—
D Nuclear measurements	A	A	C	—
E.1 Informatics	B	A	A	A
E.2 Support to safeguards	A	C	A	—
E.3 Support to the Community Bureau of Reference	C	C	A	A
E.4 Training and education	C	A	A	A
E.5 Utilization of research results	C	A	A	A
E.6 Provision of scientific and technical services on request	C	C	A	A
F.1 Operation of HFR reactor	C	A	C	—

A: close correlation
 B: some correlation
 C: little correlation
 —: not applicable

Resources required

Commencement and duration of the programme

- a) The programme covers a four-year period from 1980 to 1983 inclusive. As of 1 January 1980, it has replaced the 1977-1980 programme, which was launched on 1 January 1977.
- b) In this way the Community has implemented the Council Decision adopting the 1977-1980 programme, which provided for a review during the third year and for the possibility, at the same time, of adopting a new four-year programme.
In this connection, it should be recalled that the three-year frequency was adopted, first, in order to make due allowance for the normal time-span of the programme decision process and the budgetary procedures that follow it; second, because of the need to carry on the programme over a long enough period to enable significant experience to be gained; and lastly because it is desirable that the JRC programmes should be adapted regularly and fairly rapidly in the light of the progress of activities and the changing requirements resulting from the evolution of various sectoral policies.
- c) In applying these principles, the JRC carried out a careful analysis of the activities in progress, making an overall review of the resources employed and the results achieved, in order to assess the justification, progress, efficiency, success and usefulness of the work.
Some further particulars in this connection will be given later.

Staff

The total staff complement of the JRC during the new multiannual programme will be 2,260 employees. This is the same level as was laid down for the end of the preceding programme, including the JRC staff then assigned to the ESSOR complex. After a period of continuing contraction, the JRC's staff level has thus been stabilized.

As in the 1977-1980 programme, the staff complement includes:

- personnel directly involved in a specific research activity (including all categories of employees, not only graduate staff); these are the research staff, the most representative unit for measuring the volume and intensity of a particular programme;
- a portion of the personnel commensurate with the requirements of the programme for scientific and technical support (services rendered by the computer centre, central workshops, medium activity laboratories, etc.);
- and lastly, a portion assigned to all general services, and distributed among the various programmes in proportion to the total number of research staff.

These distinctions were originally made because of a need for greater clarity in the internal organization and management of the Centre; this need led to an appropriate change in the structure of the budget from 1977 onwards.

Programme allocation and budget appropriations

- a) The overall budget resources required for the implementation of the programme have been established at 510.87 million EUA for the four-year period 1980-1983.

b) The allocation of resources between the six research topics in the programme is as follows:

- Nuclear safety and the fuel cycle	49%
- Future forms of energy	15%
- Study and protection of the environment	10%
- Nuclear measurements	9%
- Specific support to the Commission's sectoral activities	7%
- Operation of large-scale installations	10%

74% of the total funds are thus concentrated in the field of energy and the environment, whilst the remaining 26% is mainly to cover the JRC's public service functions.

It should also be noted that the JRC's activity until 1972 was entirely devoted to the nuclear field. A gradual evolution has allowed a balanced solution to be reached, with two-thirds of the activities remaining in the nuclear field and the other third concerning other research sectors.

c) In comparison with the preceding programme, the ratio between staff expenditure and scientific and technical operating expenditure has been slightly adjusted in favour of the latter, mainly because of the beginning of major technological programmes. The proportions are 52% and 48% respectively.

Implementation

Evaluation of research

Motivation

For some years, the problems associated with the evaluation of research and the exploitation of results have been receiving increasing attention, and the JRC has been fully conscious of developments in this area. Since it is anxious to make the right choices and assess the true impact of its research, and motivated particularly by the information obtained from the Milan symposium on science and technology policy (1976) and the Copenhagen symposium on the evaluation of research and development (1978) in which it was an active participant, the JRC is gradually setting up a number of procedures which should provide it with greater insight into the manner in which it fulfils the specific tasks assigned to it and into the exact extent to which its research forms a valuable part of the entire European R&D network.

In-programme evaluation

Since it began to diversify its programme (1973) and more markedly, during the period 1977-1980, the JRC has endeavoured to provide an accurate definition of the objectives of its research and the aims of its programme, to assess the implementation periods, the decision points and timetables for the commitment of financial resource and staff.

Corresponding to this definition phase is a phase of monitoring and valuation in which the effectiveness of the current programme is analysed by the achievement of its objectives and which enables any adjustments which may be necessary to be carried out.

Special attention is given in this connection to the appropriate presentation of records and operational reports, in particular through a system of internal financial management reports for each programme, which enable a continuous comparison to be made of the attainment of objectives against the budgets provided, to identify problem areas at an early stage, and to make the necessary planning adjustments.

Evaluation of results

In parallel with the in-programme evaluation, the JRC is endeavouring to evaluate the result of its research, that is to study the effect of its activities on society; this impact may be direct or indirect, immediate or long-term.

In this analysis, the JRC is confronted by the same difficulties as those facing national research laboratories. Since this impact cannot be quantified directly, a number of indicators are used; each of these indicators, in isolation, does not provide the desired answer, but taken together they make it possible to obtain an idea of the extent to which research results are disseminated and used in society. These indicators are linked either to the transfer of information or to cooperation with the outside world.

The first indicators relate to publications (their number, types, quotations from these publications in outside literature), patents and licenses and training and educational activities, whereas the second concern work undertaken on behalf of outside bodies under contract or for other Commission departments, and activities in the field of international cooperation. This last-mentioned indicator is particularly significant; the direct comparison of ideas and results with those of other laboratories and institutions which are active in the same field reveals the relative quality of the work undertaken. This quality can be gauged during «meeting point» activities when symposia, seminars or

expert working parties are organized. It should be pointed out that this quality is recognized in particular by the conclusion of cooperation agreements relating to specific research to which each partner makes its contribution in equitable fashion. Reference can be made to the active participation of the JRC in recent years in a number of agreements within the International Energy Agency, and the setting up of collaborative projects with the US Nuclear Regulatory Commission.

Lastly, reference must be made to a final indicator to which particular attention is paid by the Director-General and his departments: namely opinions generally delivered by the Advisory Committees on Programme Management at the end of each year, which form an assessment of the work conducted under each programme during the preceding 12 months. These motivated technical opinions represent the periodical conclusion of a continuous review procedure and as a result, a particular significance is attached to them.

During the 1980-1983 programme, the JRC will intensify this aspect of the evaluation of results by conducting a precise analysis of the variations of each of these indicators and by studying their particular limitations, for example, the effect of the confidentiality of publications on the dissemination of knowledge, the consequences of granting non-exclusive licences for the interest of potential licensees and the effect of the rigidity of the programme on the possibilities for undertaking work for third parties, etc.

Liaison with other institutions and advisory bodies

- a) The JRC attaches great importance to the existence of a permanent dialogue with the institutions and competent bodies of the Member States.

This dialogue mainly takes place during the successive stages of programme and budget preparation, decision-taking and implementation and follow-up, either through the internal or external Advisory Committees or through the mechanisms of the Community institutions.

- b) The Advisory Committees set up by the Council or Commission participate in the preparatory and execution phases. They have played an effective part in the launching, development and success of the JRC's activities through their debates, advice and opinions. A list of these Committees is :

- The Advisory Committees on Programme Management (ACPM), the role of which is defined as follows: ⁽¹⁾ «... it shall be the task of each Committee to contribute, in its advisory capacity, to the best possible implementation of the programme for which it is responsible (in particular the detailed definition of projects, and to assess the results and ensure better liaison between the implementation of the programmes at Community level and the corresponding research and development work being carried out in the Member States».

In addition, where direct and indirect action coexist, these Committees contribute towards the achievement of a coherent structure for the research undertaken.

As under the 1988-1980 programme, ACPMs will advise the JRC on the execution of each of its main research activities under the current programme.

⁽¹⁾ O.J. C 192, 11.8.1977 — Council Resolution of 18 July 1977 on advisory committees on research programme management.

- The General Advisory Committee (GAC) set up as a part of the reorganization of the Joint Research Centre⁽¹⁾, the members of which are appointed in accordance with a special Council Resolution⁽²⁾.

This Committee which maintains the required contact with prevailing industrial and national scientific policies has played a major part in the reorganization and efficient exploitation of the JRC. It also makes use of the opinions of the ACPMs and assists the Director-General in preparing programmes and regularly reviewing the current status of activities.

In the case of the present programme the General Advisory Committee also held an initial general policy discussion on future activities, and in a second phase analysed the specific proposals and delivered a formal opinion.

- A number of internal Commission committees; these are consulted as part of the interdepartmental coordination of activities which provide the link to sectoral policies.
- The Scientific and Technical Committee, whose consultation is provided for in Article 7 of the Euratom Treaty, and which delivered an Opinion on the nuclear section of the proposal for the present programme.
- The Scientific and Technical Research Committee (CREST) which periodically ensures that the role and objectives of the JRC are suitably in accordance with the objective of and perspectives for a common policy of research and development.
- The European Committee for Research and Development (CERD), composed of high level independent experts, whose task is to council the Commission on the technical content and opportunity of its research programme proposals.

c) Dialogue with the Community institutions mainly occurs at the time of the decision-making procedures relating to proposals for programmes, and during the annual budgetary and financial control procedures.

Naturally, the closest possible relations exist at the level of the different institutional bodies, which are :

- the Council : the Atomic Questions Group and the Budget Committee.
- the European Parliament : the Committees on Energy and Research, on the Environment, on Budgets and on Control.
- the Economic and Social Committee : the Section for Energy and Nuclear Questions.
- the Court of Auditors.

The positions adopted by these institutional bodies have been greatly facilitated in recent years by the substantial preparatory and follow-up activities conducted through the systematic consultation of the Committees which have already been mentioned.

⁽¹⁾ Commission Decision of 13 January 1971, reorganizing the Joint Research Centre (O.J. L 16, 20.1.1971).

⁽²⁾ Resolution of 17 December 1970 of the representatives of the Governments of the Member States meeting within the Council (O.J. L 16, 20.1.1971).

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This document contains a short description of the 1980/83 multiannual research programme of the Joint Research Centre of the European Communities as adopted by the Council on 13 March, 1980.

Ce document expose brièvement le programme pluriennal de recherche 1980/83 du Centre Commun de Recherche des Communautés Européennes arrêté par le Conseil le 13 mars 1980.