EUROPEAN ATOMIC ENERGY COMMUNITY

EURATOM

THE COMMISSION

SIXTH

GENERAL REPORT

on the

Activities of the Community

(March 1962 - February 1963)

MARCH 1963

EUROPEAN ATOMIC ENERGY COMMUNITY
EURATOM

THE COMMISSION

SIXTH

GENERAL REPORT

on the

Activities of the Community

(March 1962 - February 1963)

MARCH 1963

Table of contents

Annexes

INTRODUCTION

I. The salient feature of the year 1962 was the drafting of the Community's second five-year research and training programme (1963-1967). This programme, which was drawn up by the appropriate departments of the Commission and on which exhaustive and valuable discussions were held with the technical authorities of the Member States, was adopted, in line with the terms of the Treaty, as early as July by the Council of Ministers, which accepted the Commission's recommendations entirely as to its structure and in very large measure as to the proportions which it should assume. The Commission considers that the slant given to the programme as it took shape in the drafting stage is broadly in keeping with the Community's requirements. With such extensive financial resources placed at its disposal for a second five-year period, the Commission will be in a position not only to forge ahead with the research projects launched but also to expand their scope considerably during the first programme.

The extent of the funds appropriated will enable the Community to remain on an even keel, primarily through the possibility which they afford of initiating projects on a long-term basis. On the other hand, a heavy onus of responsibility will be imposed on the Commission as regards the fixing of definitive programmes, the choice between various possible courses of action and the apportionment of the credits available.

The Commission has repeatedly pointed to the underlying principle of the five-year programme, which is that Euratom is responsible for welding together the individual efforts in the nuclear field to form an integrated grand design at Community level, an objective which means that the Euratom programme and the endeavours of the Member States must be dovetailed and meshed together to create a coherent overall pattern. Each of the

Member States engages in research activities on which it has embarked independently and which it is pursuing. Euratom is the focal point at which the national programmes are compared and the sum of them is blended into the Community programme. The Euratom programme is thus in the nature of an instrument by means of which it will be possible in the coming five years to coordinate and supplement the various national programmes at European Community level.

⁂

II. During this five-year period (1963-1967), the atom, which has hitherto been considered as belonging in a laboratory, will gradually take its place in the European economy; the most recent forecasts on the subject corroborate the view already advanced by the Commission in its Third General Report. It is now certain that unit installation prices of a nuclear kW are going to follow a downward trend. The progressive increase in installed capacities is also an established fact. The position with regard to the calculation of nuclear energy costs is becoming clearer and the likelihood is that at the end of the second programme the nuclear kWh will in some regions, primarily because of special conditions, be an economically viable and reasonably priced product. It is agreed not only by Community but also by United States experts that by 1970 this situation will probably become general.

This means that in the years ahead nuclear energy will exert an increasingly marked influence on the entire European power economy and that it will contribute to both greater reliability in supplies and a stabilization of electricity prices at a relatively low level. Furthermore, over and above all energy considerations, the atom will on the technological plane be the dominant factor in ever-expanding sectors of industrial activity.

While the reduction in the production cost of the nuclear kWh is one of the key factors in nuclear energy development, it

is also evident that the place to be occupied by nuclear energy will be determined by the overall context, the predominant feature of which is a substantial growth in Europe's electricity demand. In the foreseeable future, therefore, the rôle of energy of nuclear origin will be a basically complementary one.

As for several years now there has been something of a glut on the energy market, nuclear power plants are being called upon to meet power demand solely in the light of the longer-term data of Europe's energy problem. But the outlook from this angle indicated an exceptionally steep rise in man's energy needs, and it is possible even at the present juncture te demonstrate that nuclear energy will sooner or later become a sine qua non for maintaining the pace of the development of civilization.

In view of these two facts, therefore, the need for coordinated and unified action by the three Communities in the energy field is greater than ever. The Euratom Commission's feeling is that the difficulties at present involved in working out a European energy policy must be solved without delay. What is required is to harness all the sources of energy which Europe will need to have at its command, including nuclear power, applying the most appropriate method in each case, under the conditions most calculated to promote economic progress and the raising of living standards.

It is for this reason that the memorandum on energy policy adopted by the Inter-Executive Group on Energy on 25 June 1962, and submitted by the High Authority and the two Commissions to the Special Council of Ministers of the ECSC, refers explicitly to Euratom's second five-year programme. In the Inter-Executive Group's opinion, this programme constitutes a major step towards enabling the Community's nuclear industries to play to the full, in the public interest, the important part which they should assume from the time when nuclear energy is no longer confined to the research sphere but has firmly established itself in the everyday economy.

III. The main task which falls to Euratom in this context is that of creating, as provided by the Treaty, the necessary conditions for the setting-up and growth of nuclear industries, with the accent on stimulating economic expansion and intensifying international exchanges. In the present context, therefore, research, the training of scientific and technical personnel, the dissemination of information, the observation of the first industrial-scale nuclear experiments and questions relating to health and safety are topics of current concern which cannot be left out of account in the programmes and plans adopted. These, then, are the key sectors in Euratom's activity and must be assigned their due place in a forward-looking analysis of nuclear energy development, which has to be more clearly defined, and within the framework of an industrial policy which is already being launched.

With regard to the more specifically industrial features of its activities, the Commission has drawn up its programme for the participation in the construction of full-scale power reactors. A first series of projects under the Euratom/United States Agreement is in progress; among those already included in the programme are the SENN (Italian), SENA (Franco-Belgian) and KRB (German) projects, totalling an installed capacity of over 600 MWe.

Euratom is also contributing to power plant construction through contracts of participation proper in connection with the contracts pertaining to the three power plants SENN, SENA and SIMEA. More recently, the Euratom Commission decided to participate in the KRB project and a Dutch project.

The Commission is giving particular attention to the creation of the conditions or circumstances necessitated by the advent and utilization of nuclear energy. However, a large-scale nuclear industry can only develop if it is possible to employ, without the risk of a bottle-neck, a number of well-organized services having an economic value—in particular, facilities for the reprocessing and fabrication of fuel elements in the Community and

plutonium technology with a view to the re-use of this element for peaceful purposes.

The Commission also attaches particular weight to the long-term aspects of ore and nuclear material supplies and has already undertaken detailed studies in this field in cooperation with Community groups involved. The efficient working of the safeguards and controls system laid down in the Treaty continues to be one of the Commission's constant concerns.

The health and safety measures would have no scientific basis without as much coordinated programming as possible in the field of biology, nor would they be practicable without the most far-reaching harmonization of the laws of the six Member States in line with the Basic Standards laid down by Euratom. Mention should also be made of the regulations governing insurance and transportation and the questions involved in the training of specialists, which are of particular importance and for which the Commission, by means of its programme for participation in power reactors, is on the way to finding a solution.

In the field of nuclear insurance, the appropriate departments of the Commission have taken part in the drafting of a Supplementary Convention to the Paris Convention on nuclear liability. As the result of a diplomatic conference held in Brussels from 28 to 30 January 1963, eight European States have so far signed this Supplementary Convention. The Commission hopes that ratification will be possible in the very near future without waiting until a blanket solution has been devised for nuclear insurance problems on a world-wide scale.

As regards nuclear propulsion for merchant vessels, the policy pursued by the Commission in 1962 aims at aligning the excessively divergent measures which have been taken in Europe over the past few years and determining from the dual standpoint of technology and economics which project has the most to commend it.

In order to boost the applications of radioisotopes, particularly in industry, medicine and agriculture, the Commission

has set up an information bureau ("EURISOTOP"), which has now become active.

The past year also witnessed a considerable expansion of the Community's policy with regard to the dissemination of information. In this field, approximately a hundred patent applications were filed in connection with the Commission's research programme, nearly 150 scientific and technical reports were published (against ten in 1961) and the Information and Documentation Centre was rapidly built up.

It is clear, then, that the more widespread the use of nuclear energy becomes, the greater will be the importance assumed by the machinery designed to afford protection to and thus inspire confidence in the general public, who, often mistakenly, are alarmed by the very novelty of these activities; here we see the part which health and safety measures have to play, as well as one facet of the safeguards and controls set-up.

Despite the present and future importance of the applications of nuclear techniques in biology and medicine, the advantages afforded by radioactive isotopes, the possibilities, doubtless significant but of a more long-range nature, offered by nuclear propulsion for shipping and space travel drives, coupled with the staggering but probably even more remote prospects held out by thermonuclear fusion—the paramount peaceful use to which nuclear energy is put at present is still the production of electrical energy by nuclear fission. In other words, this subject is no longer restricted to the purview of the scientist but is already of concern to the engineer, the economist, the financier and, ergo, the politican.

It is from this angle that Euratom's primary aim of the moment must be viewed, namely that of bringing about the smooth transition from the laboratory to industry of a form of energy which can then be produced on economically reasonable terms compared with other currently known sources of power generation.

IV. In the present conjuncture, and with this progressive laboratory-to-industry transition in view, the bulk of Euratom's effort, under the second as in the first five-year plan, continues to be focussed on research into new and the improvement of existing techniques.

This policy, in line with the Treaty—wich also laid down the procedure to be adopted for the initial programme—is being followed up by Euratom not only in its own establishments but also under contracts placed with public or private organizations in the nuclear field.

When it first came into being before the setting up of the Joint Research Centre, the Commission proceeded to adopt the expedient of contracts. Under the second five-year programme, about half the credits are for research projects to be carried out by the Commission itself, the other half being earmarked for research contracts and contracts of association. The striking of a balance between intra-Euratom and extra-Euratom research was one of the Commission's leading preoccupations at the time of the discussions on the second five-year programme. The maintenance of the balance thus arrived at is particularly vital from the point of view of enabling the Commission to discharge its task of coordinating and underpinning the work performed in the various Community countries.

Contracts placed under the first five-year programme reached a very high figure, i.e. 414, approximately 200 of which were awarded in 1962. The contract-holders fall into three main groups, namely research institutes or universities, public bodies and private industry. Some of these contracts are designed to open the way for Euratom's participation in large-scale projects initiated by enterprises in the Member States and thus constitute actual associations under joint management. In such cases, the work is carried out jointly by national teams and research workers on the staff of the Commission. Contracts of association, as well as presupposing a unification of programmes and a pooling of financial resources and research results, offer the additional asset,

on the human relations plane, of bringing about close collaboration among the members of "mixed" teams.

V. The Treaty provided for the setting up of a Joint Nuclear Research Centre with the basic function of supplementing the range of activities already in progress in the Member States or having laboratories specializing in the more theoretical studies calculated to serve the interests of all research workers in the Community.

This Joint Research Centre has been duly created, as also have four branch establishments on the territory of Member States. For reasons of expediency and economy, the Commission has deliberately adopted a policy of not creating entirely new nuclear centres but has concentrated on the development of centres already in existence, which some Member States agreed to transfer to the Community. Thus the Ispra and Petten establishments, former national centres, have now been either wholly or partly handed over to the Community. The same practical considerations underlay the setting up of the Central Nuclear Measurements Bureau at Geel, in the immediate vicinity of the Belgian Nuclear Centre (Mol), and the European Transuranium Institute next door to the German Centre at Karlsruhe.

The Commission has displayed justifiable caution in developing the Joint Research Centre, since there must be no risk of its covering the same ground as national centres in the Community. It is true that in a field such as nuclear research the possible areas of study are so vast that there are still a great many tasks for the Joint Centre to perform. This is, however, a problem for the Joint Centre which it is right to bear in mind.

The number of employees engaged on research work at the present time is over 2,000. This is scheduled to be increased to 3,200 by 31 December 1967—a figure which, moreover, is below that proposed by the Commission as being commensurate with the scope and character of the second programme. The Commission had put forward the higher figure despite the difficulties encoun-

tered in Europe as regards the recruitment of qualified manpower, a situation which the regulations currently applying in the Community institutions tend to aggravate rather than to alleviate.

VI. The present Report outlines the large-scale projects initiated over the past five years, most of which will get into top gear during the second five-year programme. These consist more particularly of studies of proven-type reactors, which include graphite- or light-water-moderated reactors. It will bear repeating that the six Member States' primary aim in setting up the European Atomic Energy Community was energy production. To be more precise, it was to explore, in the period due to elapse before nuclear energy becomes absolutely essential to help meet a constantly growing demand, the various technical solutions for producing a nuclear kWh on an economically profitable basis. Some of these possibilities have already evolved virtually to the conventional stage and are being further developed, as it were, on this level. Through its participation programme, Euratom is obtaining the resultant information. It is the task of the research bodies to parallel these particular activities by canvassing the other possibilities available, more particularly at the recently created centres.

— These use of natural uranium has the advantage that there are substantial resources in the Community and at the moment the world market offers ample opportunities of obtaining supplies on commercial terms. The efforts made by the French and British to employ natural uranium have yielded extremely valuable results, but they do not exhaust all the possibilities as far as the moderator and coolant are concerned. Hence the interest aroused by the heavy-water reactors which have been developed in some Community countries, and hence also the fact that the Commission has been prompted to undertake a study of the ORGEL string, in which an organic liquid is used as coolant. The bulk of this study is being carried out at Ispra, with the assistance of Community laboratories and firms and in close liaison with the research on allied subjects, more particularly that

being performed in the United States and Canada. Furthermore, the ORGEL string constitutes the focus of a series of research projects which would otherwise be liable to be more widely scattered.

— Another approach to the improvement of power generation is a stepped-up operating temperature, since the current reactors run at lower temperatures than the generators of conventional electricity plants. It is for this reason that so much importance attaches to investigating the possibilities of reactors operating at higher temperatures, such as nuclear superheating reactors. The same considerations underlie Euratom's participation in the DRAGON project and also the projected association with the Jülich Centre, both of which are concerned with the study of high-temperature gas reactors, whose main advantage is the very high burnup attainable.

— In the case of current thermal-neutron reactors, on the other hand, the degree of utilization of the energy potential in the nuclear materials is still extremely low, about 1%, a fact which underscores the value of developing other reactors known as breeder reactors, which consume an infinitely higher proportion of this potential. The vital necessity, for the development of nuclear energy, of promoting reactors of this type is now being stressed by the leading authorities on such problems. Euratom's rôle in this process is the important one of a stimulating and coordinating body, as evidenced by its large scale participation, as to both manpower and credits (35% of the scheduled expenditure), in the projects undertaken by the French Atomic Energy Commission (CEA) and the German Centre at Karlsruhe and also, during the implementation of the programme, in the activities currently envisaged in Italy. The cardinal importance of this sector of research is mirrored in the fact that it absorbs the lion's share of the appropriations under the second five-year programme.

— The outlook for the nuclear industry is contingent in no small measure on the use of plutonium. This fact, apart

from explaining why it is so essential to go ahead with research aimed at deriving a better knowledge of the element, as well as studies on its systematic recovery and use for power production, also indicates the hopes set by the Commission on the projected European Transuranium Institute.

It is, moreover, abundantly clear that all technical and economic progress is bound up with the furtherance of basic research, the fons et origo of all the major achievements of our day and age. This makes it desirable for the Euratom Joint Centre, following the initiation of the extensive applied research programmes, to accord special attention to basic research, with the accent on low-energy and solid-state physics. By the same token, the Commission feels that it would be in the Community's interest to cooperate, at European level, in the research on the development of space-travel drive, in view of the fact that nuclear energy is marked out for a leading rôle in this field during the coming years.

It is not the purpose of this introduction to review all the various Community research activities, details of which will be found in the appropriate chapters of the present Report. The examples quoted here are merely intended to illustrate the policy pursued by the Commission in connection both with strictly Euratom activities and those designed to widen the scope of particularly important projects undertaken by the Member States.

⁂

VII. As regards the Community's external relations, the events of 1962 have highlighted the increased interdependence between the activities of the Member States and those of the Community; a correct understanding of the Community's best interests would thus call for greater coordination in this field. The relations between the Community and the countries possessed of developed nuclear industries provide a clear instance of the kind of results that can be achieved by cooperation founded on equality of rights and obligations when the Community acts as a Community. The

same reasons which in the case of the Economic Community dictate the gradual establishment of an economic union within and a common trade policy towards the outside world apply with equal force to cooperation in the nuclear field.

Substantial progress has been made in the implementation of the agreements for cooperation concluded by the Commission since 1958 with non-Community countries which are particularly well-advanced on the scientific, technical and industrial levels.

On 9 July, an annex and an amendment to the Euratom/United States Agreement came into force. The principal effects of these measures are (1) to enable the industrialists in the Community to lease the fissile materials needed to fuel power reactors constructed by them under the Euratom/United States joint programme and (2) to make available to the Community, by sale or lease, either for research or for power reactors not covered by the joint programme, any quantities of highly enriched uranium which are left over from the quota allotted to the programme.

Cooperation with Canada has also developed along satisfactory lines, the stress here being on heavy-water-moderated organic-liquid-cooled reactors. In this connection, mention should be made of the three-cornered cooperation between the Community, Canada and the United States, a scheme which opens up promising vistas.

On 4 September 1962, the Commission signed an agreement for cooperation with Argentina in Buenos Aires.

In the course of the year under review, many links with a number of other countries were maintained and reinforced in the technical sphere.

VIII. But the most vital issue to claim the Community's attention in 1962 far transcended the realm of external relations as contemplated by Chapter X of the Treaty, relating as it did to the United Kingdom's application for membership.

The Commission's attitude towards this question was defined in a statement made on its behalf by the President on 14 November 1962 to the delegations of the Six and the United Kingdom. It set about playing the part which fell to it within the framework of these negotiations in a constructive spirit.

While unable to do any more than note with regret that factors outside its own particular province caused the talks to be suspended, the Commission decided to take a realistic view and to turn to account what the discussions had already yielded on the credit side. Thus it is possible to envisage an intensification and a widening of the collaboration under the agreement concluded with the British Government in 1959 for scientific and technical cooperation between the Commission and the United Kingdom Atomic Energy Authority.

⁂

IX. On result of these negotiations, so abruptly broken off, was that the Community institutions themselves were put to the test. The Euratom Commission for its part faced up to the new circumstances with the spirit of solidarity demanded by the Treaty and can thus look to the future with reasonable confidence. During this crisis—which, things being what they are, is neither its first nor will it be the last—the European Community showed that it was a thoroughly viable organism, although still young and thus exposed to the afflictions of adolescence while already shouldering adult responsibilities. Even at this stage, two all-important facts stand out—firstly, as a result of the interdependence which the six Member States have created between themselves, the Community has already reached the point of no return, and secondly it is by Community methods that the institutions are overcoming their difficulties, thus clearly testifying to the realism inherent in the Treaties.

What are the next steps? It is difficult to say at the time of writing, but what can be stated is that the building of Europe may proceed in three simultaneous or consecutive stages. The

first of these consists in improving the existing structures as regards both organization and powers, more particularly those vested in the Community organs. The second consists in extending the scope of the activities performed jointly by the Member States to fields other than those expressly referred to in the Treaties. The third takes the form of a geographical expansion, either through the granting of membership to new states accepting the same obligations as the six founder members or by forging links of all kinds with other states. This latter procedure is quite in keeping with the Treaties, which have laid down that associations may vary as to type, objective and conditions so as to make allowance for the situations of and contingencies affecting the different European states.

The Euratom Commission, for its part, is aware that its own contribution to the building of Europe will have practical consequences of an economic and scientific character but that it will also be of political value. It is because they are imbued with the political responsibility that devolves upon them in this undertaking, which for ten years has been making gradual but definite progress, that the members of the Commission have made the cordial and realistic collaboration which unites them as colleagues the object of their utmost efforts and their highest hopes.

CHAPTER I

RESEARCH AND TRAINING

I. Elaboration of programme

A. *Liaison with national and Community bodies*

1. The distinguishing feature of the year 1962 was the drafting of the second five-year research and training programme, one of the main characteristics of which was that it provided a variable

but frequently substantial reinforcement of the ties established between the programmes of the individual Member States as well as between these programmes and the aims pursued by the Community. This pattern of interwoven endeavours, the creation of which is paramount among the Community's objectives, will find its clearest expression in the new associations which will be formed in addition to those already in existence and which will serve, as did their predecessors, as a framework for most or even all of the projects undertaken by the Six in various important fields.

On a proposal from the Commission, and after a period of preparation devoted to the thorough analysis of the document, in collaboration with both the Scientific and Technical Committee and the Consultative Committee for Nuclear Research, the programme was approved by the Council of Ministers on 23 July 1962.

The Commission was particularly appreciative of the assistance provided by the Scientific and Technical Committee, which played an effective part in all stages of the work involved in drafting and putting the finishing touches to the second five-year programme. The Commission, for its part, has given every consideration to the opinions formulated by the Committee. Furthermore, it has endeavoured to dovetail the work of the Scientific and Technical Committee with that of the Consultative Committee for Nuclear Research, an organisation having different aims and different terms of reference. This coordination has been mirrored primarily in the creation, on the initiative of the STC, of a working group in which the representatives of the two Committees have carried out a joint examination of the problems bound up with the development of the ORGEL Programme in the course of the second five-year period.

Moreover, the Scientific and Technical Committee has been kept regularly informed of the work of the Consultative Committee, while at the same time its own opinions have been made known to the national experts, a system which has made a

valuable contribution to the coordination, on the Community level, of the national research programmes.

In line with the policy which it has been pursuing since 1958, the Commission has consulted the STC on all the major problems stemming from the launching and execution of its programmes relating to both the scientific field and that of industrial promotion. Among the problems scrutinised in 1962/1963, particular attention should be drawn to those concerning the construction at Ispra of the critical experiment ORGEL and of the ESSOR reactor, the activities carried out in the field of fast reactors and advanced gas reactors, as well as the setting up and development of the European Transuranium Institute.

2. The work of the *Consultative Committee for Nuclear Research,* on the other hand, as well as helping to bring about interdependence between the programmes of the Member States and those of the Community, has in fact enabled each side to find out about the programmes, in which others were engaged and the resources provided for carrying them out, to make a comparison between these programmes and, in certain areas, to distribute effort carefully in line with the general interest. Even in cases where circumstances would still seem to militate against the pooling of research, the periodic meetings held by this Committee continue to be important for the opportunities which they offer for far-reaching exchanges of information as well as for wide-ranging discussions on the programmes of each in the spirit of Article 5 of the Treaty.

3. *Direct contacts with the nuclear research bodies,* either public or private, have by no means been neglected. These connections have enabled the Commission to keep abreast of the activities undertaken by the individual states and, to a certain extent, of the trends to be followed in the future by research centres and institutes within the Community. Unfortunately the information conveyed to the Commission by these bodies has

not in all cases been as complete as could have been wished and it will be the task in the years ahead to arrive at a better mutual understanding and thus to perfect programme coordination .

B. *Groups of experts and study committees set up pursuant to the terms of the treaty*

The committees and working groups already mentioned in the previous reports have all pursued their activities regarding information, study and coordination in their respective fields, with the exception of the high flux reactor group, which has not met this year. The bringing into operation of materials testing reactors in the Community raises in fact problems which are, above all, technical and for the study of which the group, whose terms of reference were of a general nature, had brought about the creation of a certain number of specialist sub-groups. Paragraphs 4 to 9 below give an account of the activities carried out by the working groups in the fields of dosimetry, hot laboratories, irradiation devices, radioisotopes and biology.

a) *Dosimetry*

4. The work required by this group, concerned with the development of an standard method for thermal neutron flux measurement, was successfully concluded by a sub-group headed by Mr. MOTTE (CEN), which focussed its attention on problems connected with the measurement of spectra and of integrated fast neutron fluxes. Two publications deal respectively with the standardization of the cobalt method for the measurement of integrated thermal neutron fluxes ([1]) and on the effective cross-sections for activation neutron detectors, which the group recommends should be adopted by all Community laboratories ([2]).

([1]) Paper SM 36/106 by Mr. F. MOTTE at IAEA Symposium on the detection and dosimetry of neutrons and the standardization of neutrons sources, Harwell 10-14 December 1962.

([2]) Document compiled by Mr. BEAUGE of the CEA on behalf of the Dosimetry Working Group.

A survey on in-pile gamma radiation measuring methods has likewise been launched by the group with a view to subsequent standardization.

Finally, a report on the group's activities was given at the IAEA Symposium and published as a Euratom report (Report Euratom No. EUR 88 f.).

b) *Hot Laboratories*

5. In the course of the two meetings held in 1962, the hot Laboratory Design Committee drew up a list of the remote-control handling devices used in the Community and compared their respective merits. Regulations governing the construction and use of hot laboratories have been analyzed with a view to carrying standardization a stage further. The Group's attention was likewise engaged by problems connected with work carried out under water and the equipment used in hot cells for operations involving cutting and post irradiation tests. Progress reports on the various hot metallurgy laboratories under construction have enabled the experts to obtain an overall picture of the situation in the Community.

c) *Irradiation Devices*

6. The meetings held by this group have made it possible to carry on with the exchange of experience and information acquired on the technical problems linked with the construction and use of irradiation devices in materials testing reactors within the Community. These problems bear mainly on the irradiation behaviour of these devices and the samples which they contain.

A study on the behaviour, in devices exposed to irradiation, of the thermocouples in use and the development of new thermocouples designed for the measurement of higher temperatures has been undertaken by sub-group comprising experts from the testing stations concerned, whose attention has been mainly focussed on a thermocouple development programme which the Community is to launch shortly at Petten in collaboration with the national research centres.

A survey on the safety standards applied in the Community has been started by the group with a view to bringing them subsequently into line.

d) *Irradiation Capsules*

7. This group, which is working in close collaboration with the previous one (irradiation devices), has been engaged on the study of problems bound up with the production of cobalt 60 in reactors as well as on various other questions coming within its scope.

e) *Radioisotopes*

8. It was decided to set up in 1963 two new study groups whose respective tasks would be the study of analysis and control methods in radioisotope production and the codification of radioisotopes used in medicine.

The decision was also taken to set up a Liaison Committee for the radioisotope producers.

f) *Biology*

9. In 1962, the studies of the Consultative Committee on Biology were centred on the range of activities set out by the Commission in the field of biology in the draft for the second five-year programme.

The plan was, however, revised after the adoption of this programme, since the funds provided for this period fell short of expectations. Under the revised plan, the development of biological research in the light of experience will call for a tightly-knit system of coordination between the projects undertaken on the national level, the necessity for which was clearly acknowledged by the Council of Ministers at the time this decision was made. The above Committee, moreover, has had an extremely useful part to play in the sifting of research proposals submitted to the Commission by the national laboratories.

II. Resources and facilities

10. The aim of the Community consists, by definition, in the pooling of all the efforts of its members. As far as Euratom is concerned, this pooling of effort is effected on the one hand by a Joint Nuclear Research Centre—a true Community enterprise—and on the other hand through the coordination, mainly by way of research and association contracts, of the research efforts made in the various countries.

The paragraphs below contain some general pointers on the development of the establishments of the Joint Centre as well as on the work carried out under contract. A detailed description of the research and of the results obtained may be found under point III entitled "Carrying Out of Programme".

A. *The establishments of the Joint Centre*

General Considerations

11. During the period under review, the establishments at Ispra and Geel reached an important milestone in their development: the phase of large-scale investment for building up the infrastructure is coming to an end, while the stage involving the installation of working teams is well advanced. On the other hand, a start has only just been made on the creation of the Petten and Karlsruhe establishments.

The following paragraphs are intended to provide a detailed picture of each of these establishments. In a general way however, it should be pointed out that cooperation between all the establishments, a constant concern of the Commission, finds its expression in exchanges of staff and in numerous contacts at all levels.

The gradual satisfaction of the personnel requirements of the various departments has also made it possible to institute a useful system of staff rotation between the Euratom head office, the Joint Centre and the associations.

1) *Ispra*

a) *Development of the Establishment*

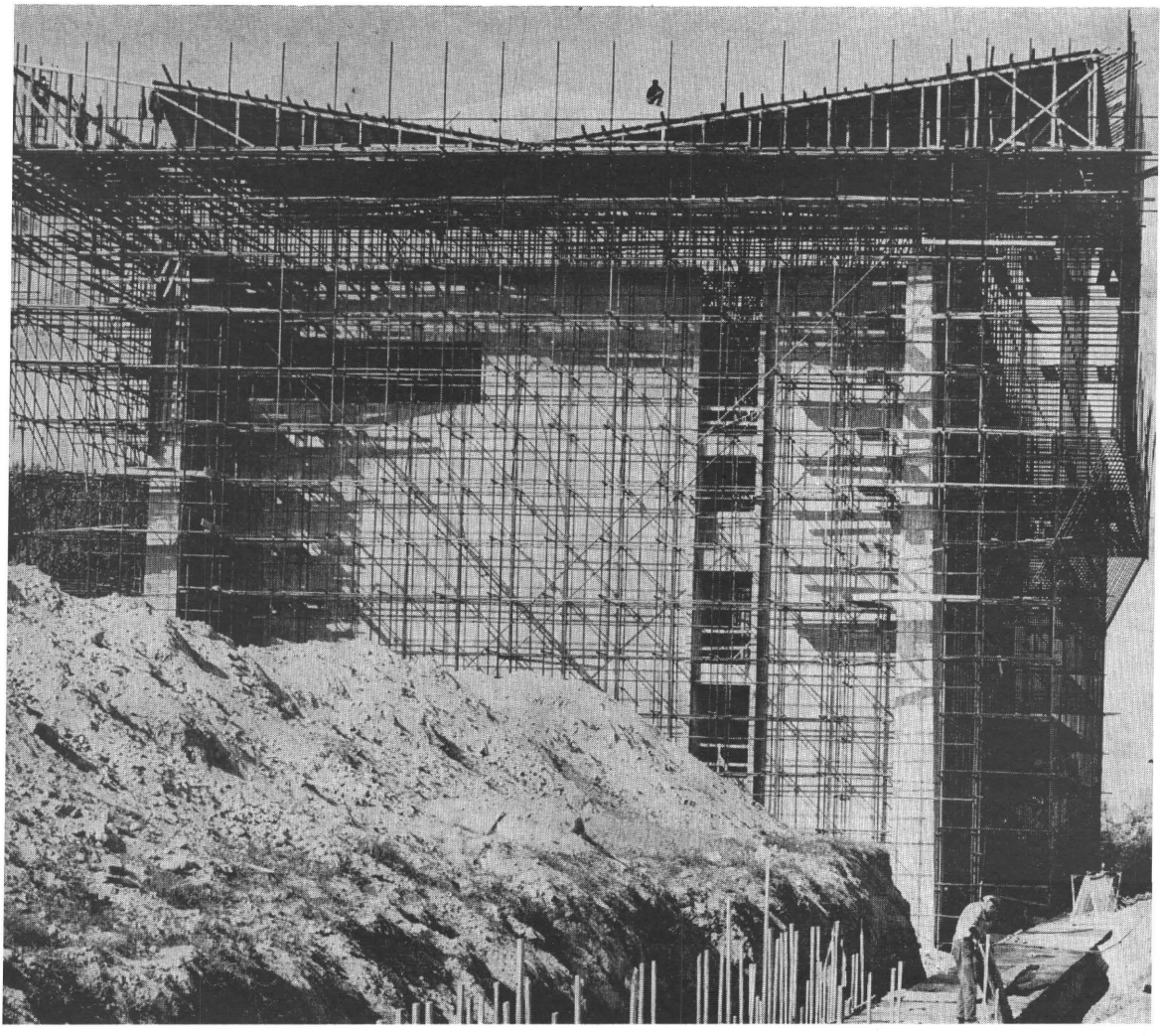
12. In the course of the reporting period, the *staff* of the Ispra establishment have reached a figure very near to that authorized by the Council in 1962, while the instruction programme, as well as the installation and fitting out of the laboratories, have all gone ahead. The groups concerned with industrial safety and radiological protection habe been merged to form a single department.

13. As provided for in the agreement governing the handing over of the Ispra Centre to the Community, the *Ispra I research reactor* continued to operate under Italian Government supervision, being transferred to Community control on the expiry of the transition period on 1 March 1962. Under the Ispra agreement, the experiments of the Italian programme will have priority for another two years.

14. The buildings, worth 9 million EMA units of account, to be borne by the CNEN under the terms of the agreement with the Italian Government, have been nearly finished. Plan revision, coupled with salary raises and rising construction costs, have caused the original estimates to be exceeded by about 10%. As of 1 March 1963, only one building to accommodate offices, a technology laboratory, a metallurgy workshop and some extras forming part of the infrastructure remained to be completed under this programme.

In the autumn of 1962, the metallurgy department, which had previously been occupying laboratories rented from SORIN at Saluggia, was able to move into its new buildings at Ispra.

At the end of 1962, a construction programme financed by Euratom and covering the building for ECO, medium-activity metallurgy laboratories, an extension of the dining hall and various annexes, was launched. Furthermore a start was made on



The four existing establishments of Euratom's Joint Research Centre are at Ispra, Petten, Karlsruhe and Geel. Large scale construction work was carried out at all four sites in 1962. The above photograph shows the ECO reactor building in an advanced stage of construction at Ispra (located about 45 miles from Milan). ECO (expérience critique ORGEL = ORGEL *critical experiment), which forms part of the* ORGEL *reactor string, is used for evaluating the neutronics of heavy water/organic liquid lattices.*

(Euratom photograph)

the drawing up of plans for a building to house the reactor physics department.

At the present time, most of the laboratories are fully equipped and have at their disposal the best available apparatus and instrumentation. The central workshop has been transferred to its final building, a move which has made it possible to install and organize it on an extremely rational basis.

The overall development of the Centre calls for a substantial extension of the road network and of the drainage and piping system (electricity, water heating, effluents). The work is already in progress but is being held up considerably by the limited funds allocated to construction.

15. The *housing* problem has been eased to a certain extent by private initiative, but rents are still in many cases too high for employees in grades B and C, and the construction programme to be financed by the Italian Government has been seriously delayed. Work is expected to start on the construction of the first 400 units at Varese in the spring of 1963. The start of the second phase of the construction schedule for the *European School* has likewise been held up by about 9 months, which means that the secondary school will not be able to move into its new building until the end of 1963. It should be noted that the European School has about 600 pupils whose parents are working at Ispra.

In December 1962, the first halls destined for conferences and scientific seminars were opened, which has made it possible to discard the temporary expedients resorted to until that date.

16. The large number of visitors arriving to exchange views with their fellow-scientists has included a group headed by Professor Mössbauer which is now engaged in the United States on work in the field of low-energy physics. This particular visit was connected with the discussions which have been held concerning the possible undertaking of work on basic physics at Ispra.

The Centre has also played host to numerous journalists from te Community countries (64 in 1962) and 47 batches of visitors.

b) *Activities*

17. As in the previous years, the establishment's activities have been to a large extent centred on work connected with the ORGEL project, in which the reactor physics department, together with the sections dealing with metallurgy, technology, heat transfer, physical chemistry, and chemistry, have played a major part.

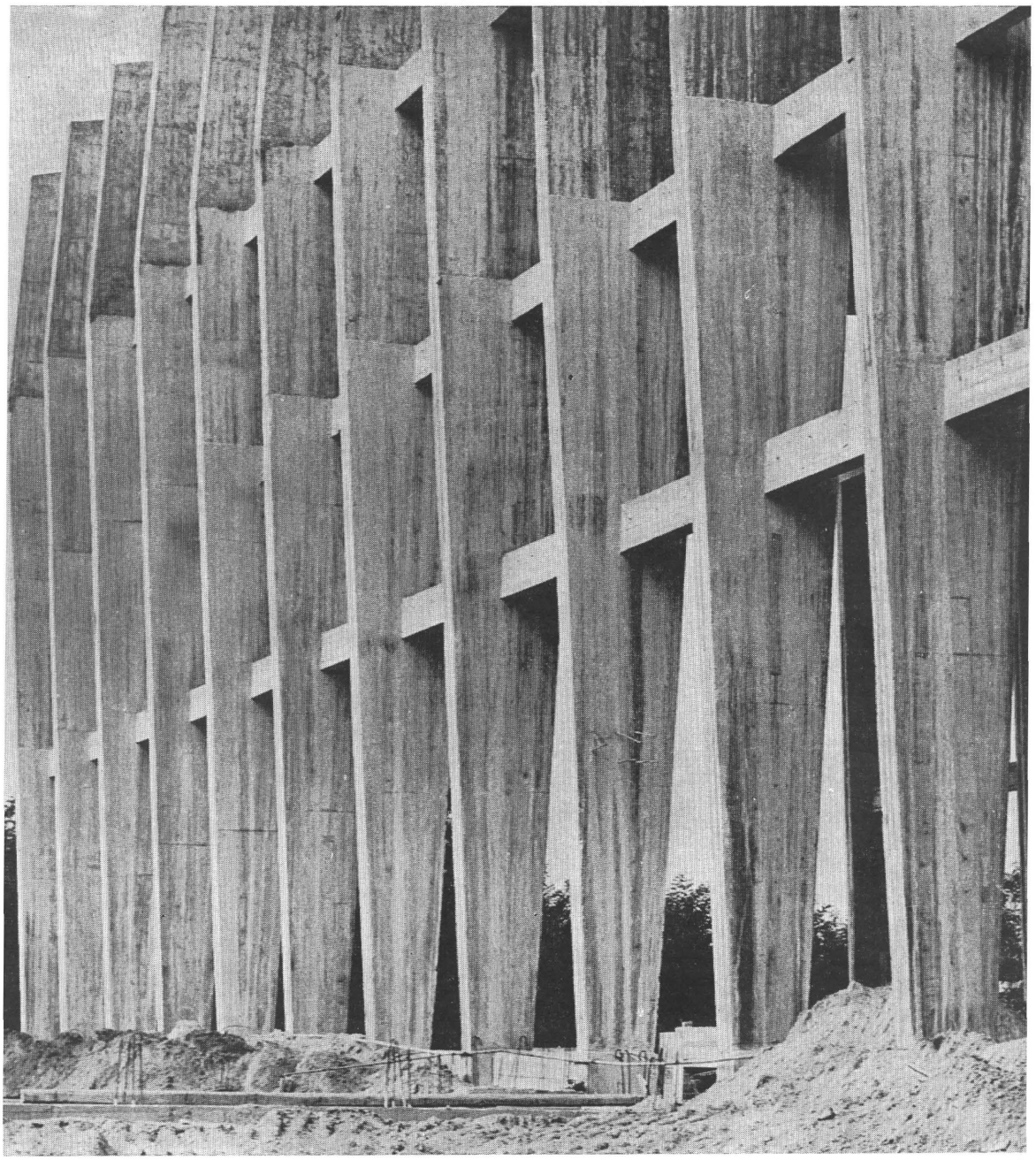
The construction of the *ORGEL critical experiment (ECO),* the first reactor built at Ispra by the Community, has been actively pursued and it is scheduled to come into operation at the beginning of 1964. The preliminary work for the construction of the *ESSOR test reactor* has also been commenced. The details on these two projects are given under points 48 to 60, devoted to ORGEL.

Other research carried out at Ispra is described under the following points:

Computation and automatic documentation	114 to 118
Nuclear physics	119
Mineralogy and geochemistry	121 to 124
Direct conversion	130 and 131
Magnetic resonance	132

In 1962, the results obtained with these projects were covered in a number of *reports*—about 30 a month on average—published sometimes as Euratom reports and sometimes in journals or in the proceedings of scientific congresses. Scientific meetings of one kind or another (congresses and symposia) were attended by 234 members of the Staff in Europe, and by 24 outside Europe, mainly in the United States and Canada.

The stepped-up pace of activities and the new laboratories available have made it possible for the Ispra Centre to play an



Another construction project in progress at Ispra : the technology building erected under the agreement for the setting up of this Joint Centre establishment. The Italian authorities provided Euratom with the land, the existing buildings and an appropriation of 9 million EMA u.a. for new buildings.

(Euratom photograph)

important part in the *training and instruction programme* pursued by the Commission for the last few years. Under this scheme, 153 visitors were received in 1962, 109 being students and 44 being visiting scientists ([1]).

2) *Petten*

18. The *agreement with the Dutch Government* on the setting up at Petten of an establishment of the Joint Centre was ratified by the Dutch Parliament on 25 July 1962. On fulfilment of the various conditions stipulated, the agreement came into force on 1 November 1962. On the same date, the high flux reactor (HFR) and a 60 acre site were handed over to the Community, which also has an option on a 50 acre intermediate site.

Under the agreement, the Reactor Centrum Nederland (RCN) is to remain in charge of the reactor's operation for a four-year transition period. A contract concluded between this body and the Commission establishes the rights and obligations of each party with regard to the management and operation of the reactor, at the same time laying down the manner in which the Community establishment is to make use of certain general services belonging to the Dutch centre in order to avoid duplication of effort.

19. A *construction programme* has been launched under which the ground was broken in 1963 for several important buildings.

Two prefabricated buildings intended to house the first research teams and administrative officials have been ordered and it is hoped they will be available by September. At the same time, work will be started on the construction of a large technology shed which should be completed sometime in the second half of 1964. Finally, design studies relating to a cold laboratory and a medium-activity laboratory will be initiated in the course of the first half of 1963, construction work being scheduled to start at the beginning of 1964.

([1]) Cf. paras. 133 to 136 for information on trainee schemes and instruction.

The establishment's infrastructure will be rounded off by a road network providing easy access to the various buildings.

To facilitate operation of the HFR reactor, it proved necessary to equip one of the swimming-pools with a dismantling cell, which has already been designed and ordered and which is expected to be ready for use at the beginning of 1964. This cell will be fitted out with the equipment necessary for the dismantling of irradiated experiments.

Lead cells for post-irradiation studies, as well as two loops, one for molten salts and another for hydraulic studies, will also be installed.

20. Although the new establishment will be primarily concerned with the operation of the HFR reactor ([1]), a certain number of *research projects* have already been launched. In order to get this work under wat as soon as possible, agreements for cooperation have been concluded with experienced teams at Ispra, the CEN (Grenoble), the CEA (Saclay) and Oak Ridge. Discussions are in progress with a view to making a similar arrangement with the University of Delft.

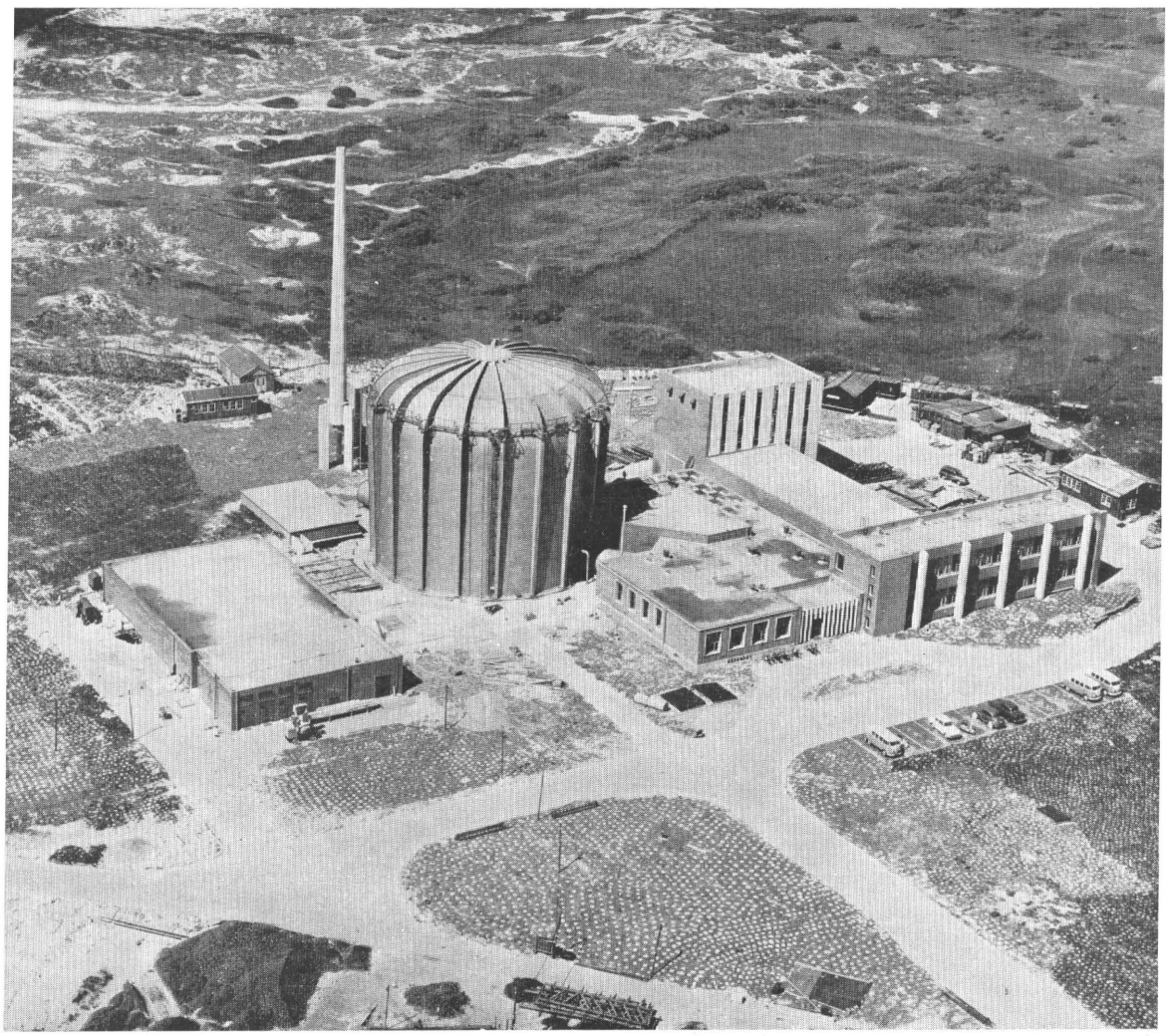
The areas of research in which work has already started deal mainly with the development of molten-salt fuels, the maintenance of active circuits and the hydraulic problems bound up with the irradiation experiments performed in the HFR reactor.

It proved necessary to pay particular attention to *staffing* problems, the most vital point being concerned with recruitment, housing and the setting up of a European School.

3) *Karlsruhe (European Transuranium Institute)* ([2]).

21. As pointed out in the previous annual report, the *Institute building* was designed in 1961 on the basis of a framework

([1]) See para. 84 for data on HFR reactor.
([2]) See paras. 85 et seq. for information concerning research on plutonium and the transplutonium elements.



In November 1962 the high flux reactor (HFR) at Petten (located on the sea about 30 miles NW of Amsterdam) was officially handed over to the Community. This represents an important contribution on the part of the Netherlands to the launching of the new Euratom establishment. Aerial view of reactor and its auxiliary laboratories.

(Photograph by Aero Camera – Amsterdam)

programme approved by the Commission after a favourable opinion had been obtained from the Scientific and Technical Committee and the Euratom/Gesellschaft für Kernforschung planning group. The application for permission to build was filed with the German authorities, which recently signified their approval.

The building will consist of six wings: basic studies laboratory, high-activity alpha and gamma laboratory, cold laboratories, technology shed, technology laboratories and administration block. The construction schedule consists of two phases which will be started at an interval of about six months. The rough work connected with the first phase—administration block, changing rooms and basic studies laboratory—was commenced in November 1962 by a group of French and German firms selected after the issue of a Community-wide call for tenders. This will be followed up, in April 1963, by a second phase for the erection of the cold laboratory and a technology shed. Barring unforeseen contingencies, the first teams will be set up at Karlsruhe before mid-1964, and the whole complex should be completed in 1965.

22. Since the end of 1962, orders have been placed in the Community for certain items of *equipment* entailing long delivery dates. In view of the time necessary for the construction of the laboratories, the placing of orders has lagged behind, but the rate will speed up considerably towards the end of 1963.

23. Considerable efforts have been made in connection with the *recruitment* of research staff, and it has been possible to fill all the high or medium-rank permanent slots provided for in the budget. Pending completion of the laboratories, most of the engineers are attending advanced training courses at national centres in the Community as well as at the American centre in Hanford. A small team is working at Karlsruhe on problems connected with laboratory construction.

4) *Geel (Central Nuclear Measurements Bureau)* (1)

24. The Bureau has been expanded in line with the programme laid down by the Commission in 1960 and 1961 after examination by the Scientific and Technical Committee.

The buildings destined to house the *Van de Graaff accelerator* and the auxiliary laboratories were completed in May 1962. The delivery of the accelerator itself, the first machine of this type which the vendor has built in the Community, was unfortunately delayed by six months owing to a technical mishap in the factory. It was therefore impossible to start installing the machine before December.

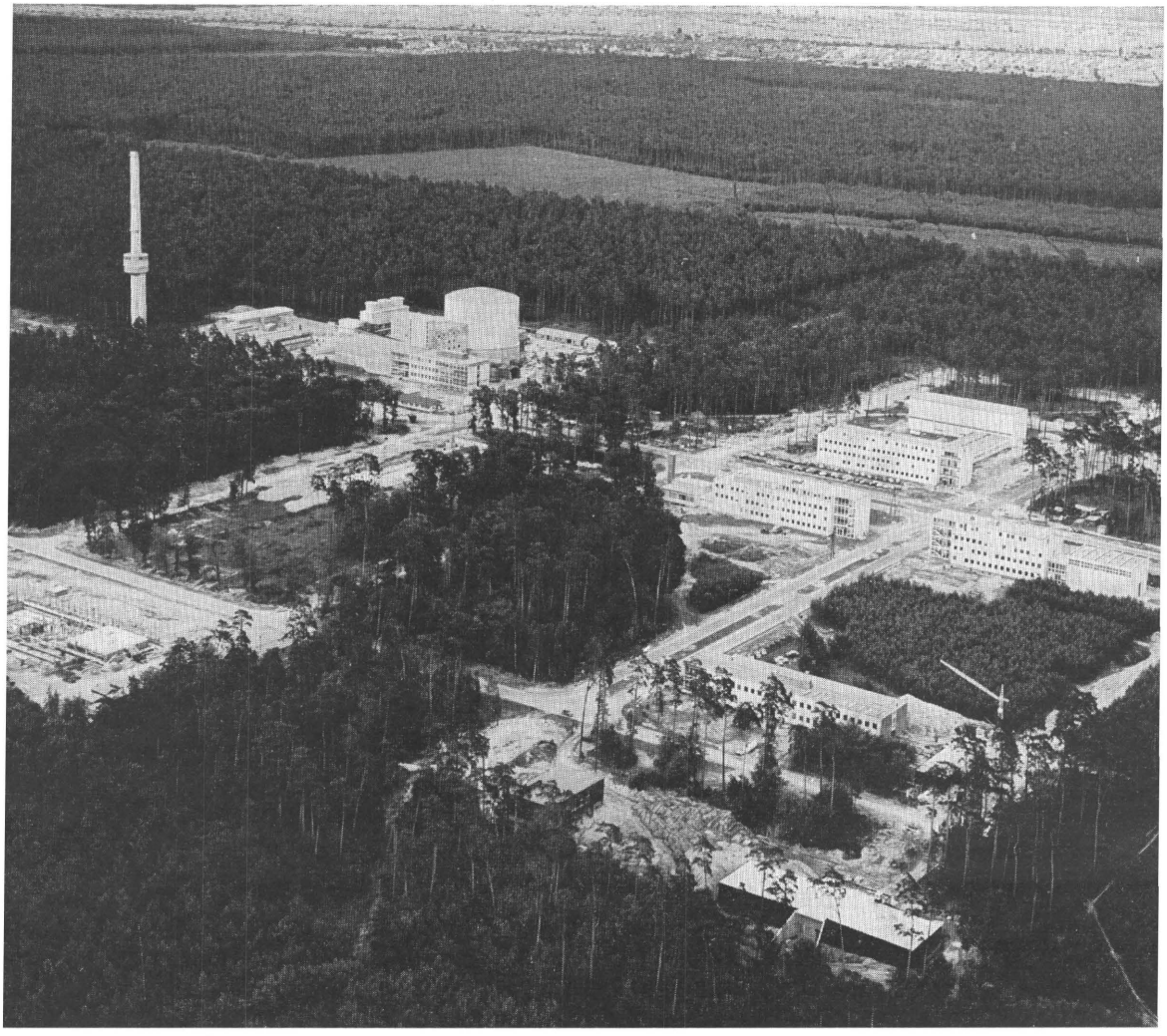
In October work was started on the site for the *linear accelerator building.* At the same time, six neutron time-of-flight measurement paths were built and fitted out. The linear accelerator, which was ordered in 1961, should come into operation by the end of 1963.

Work was also started in October on the construction of a building for mass spectrometry and the sample preparation laboratory (the first stage of its development).

25. The *fitting out of the laboratories* has been continued in a regular manner. Special mention should be made of the installation of a new mass spectrometer intended for use in the examination of alpha-active substances, as well as of electron bombardment vacuum evaporation apparatus. Other equipment, including a beta spectrometer has been ordered. With the exception of the neutron group and the sample preparation laboratory, the departments are now considered to be adequately equipped.

26. The material resources are thus already available, or at least they should be in the very near future. As far as *personnel* is concerned, on the other hand, requirements are more difficult to satisfy. In order to bolster up its limited staff, the Commission

(1) Cf. points 92-96 for information on work in the field of nuclear measurements.



In 1962 the ground was broken at Karlsruhe for the construction of the European Transuranium Institute building. The photograph shows the German nuclear research centre near which the Euratom establishment is to be built.
(Photograph by Kernreaktor Bau- und Betriebsgesellschaft – Karlsruhe)

would like to arrange for the secondment of experts from the Member States.

B. *Associations and contracts*

27. While the Joint Centre was being developed, the Commission has continued to ensure that national bodies, both public and private, remain closely associated with the carrying out of the programme.

In order to do this, it has followed the three-pronged plan of campaign which will be examined below: contracts of association, research or study contracts and supply and service contracts.

1) *Contracts of Association*

28. The so-called contract of association represents the most original and at the same time the most important type of contract concluded by the Community. The Community's efforts are thus linked up with those exerted by national enterprises in fields which call for both sustained and large-scale operations. The Commission assists by supplying the additional resources necessary to ensure that the work is carried out on the appropriate scale. These contracts are administered by a Management Committee, on which both parties are represented, and which fixes the detailed budget and supervises the execution of the work, guiding it in certain directions in line with the objective aimed at and keeping track of the manner in which it is executed by means of teams which, under the direction of a project chief appointed by the Committee, comprise, besides the staff provided by the other party in the contract, a considerable proportion of research workers recruited by the Commission throughout the Community.

This means that, quite apart from the financial arrangements, even the day-to-day work reflects the Community-wide character of the enterprise. This method makes it possible, furthermore, to carry out a concerted action without setting up

a new institution in the legal sense of the term, thus keeping administrative requirements pared down to a minimum.

29. Among the *fields covered by such contracts of association* attention may be drawn to:

— *thermonuclear phenomena* (1). In this field, the research carried out under the Community's atoms-for-peace programme are all covered under the contracts of association;

— *fast reactors* (2). The reorganization of Community activities is being continued so that the Community will soon be in a fairly strong position for the purpose of collaborating in a useful way, and on favourable terms, with the United States and Great Britain;

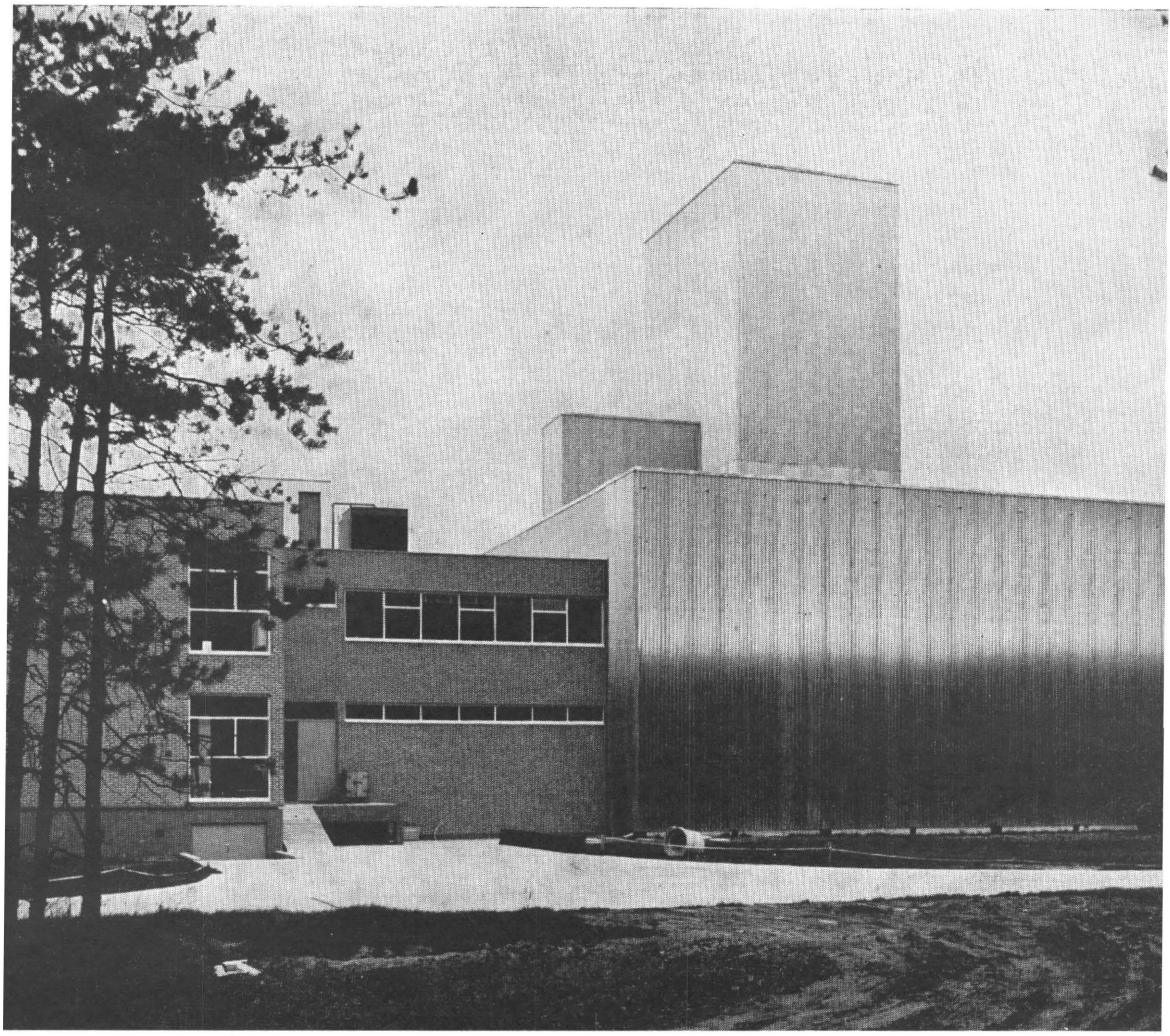
— *high flux reactors* (3). The most modern high flux reactor in Europe (BR 2) is being operated at Mol under an association between Euratom and the CEN;

— *homogeneous reactors* (4). Certain sectors of *nuclear physics, radiobiology* as applied to agriculture and animal physiology, and *isotope* geology.

The following table gives a list of the new contracts of association concluded in the course of the budgetary year 1962.

Contracts of association		
Field	Number	Total amount to be borne by the Commission for the entire duration of the contract (in EMA u.a.)
Biology	1	900 000
Controlled thermonuclear reactions	4	16 213 000
Fast reactors	1	32 373 000
	6	49 486 000

(1) cf. paras. 97-104
(2) cf. paras. 34-39
(3) cf. paras. 81-83
(4) cf. para. 77



A view of the Geel establishment (CNMB). The building housing the Van de Graaff accelerator is on the right.

(Euratom photograph)

2) *Research Contracts*

30. The Commission also charges various bodies in the Community and, in exceptional cases, in countries outside the Community, with the carrying out of research or of studies less extensive in scope, and of shorter duration. These contracts, as well as providing a source of fresh knowledge to the Community, enable the industries to increase their technological potential. The Commission concluded 133 contracts of this type in 1962, the breakdown being given in the table below:

Research Contracts

Field	Number	Total amount to be borne by the Commission for the entire duration of the contract
Research and development programme under US/Euratom Agreement	28	4 296 000
ORGEL project	25	2 247 000
Fast reactors	2	82 000
Gas reactors	1	500 000
Homogeneous reactors (SUSPOP)	2	91 000
Biology and health and safety	7	467 000
Transplutonium elements	2	1 643 000
Scientific data processing	9	177 000
Marked molecules	21	265 000
Fission products	2	1 822 000
Radioisotopes	16	377 000
Technical and economic studies	10	232 000
Miscellaneous research	8	414 000
	133	12 613 000

Furthermore, certain contracts concluded in previous years have been followed up by supplementary financial clauses for a total amount of 1 900 000 EMA u.a.

A detailed list of all contracts concluded in 1962 is attached as Annex V to this report.

3) *Other Contracts*

31. Under this heading, sizable supply and service contracts have been concluded in connection with the new constructions at Ispra and Karlsruhe, for which, in 1962, the Commission awarded contracts to the tune of a total amount of about 3 million EMA u.a. Apart from the costs of buildings and various supplies, this figure also covers transactions relating to the performance of work of an incidental character such as tests, analyses, the provision of certain services, etc.

***

32. The Commission has decided to proceed henceforth by *publishing in the Journal Officiel* invitations addressed to the bodies concerned to take part in its programme. This is intended to enable such bodies to submit information on their abilities and experience and to put forward suggestions so that the Commission will be in position to establish the procedure for the carrying out of its research programme on the basis of a thorough knowledge of the various possibilities available in the Member States.

The first invitation, published on 1 December 1962, elicited nearly 400 replies by 1 March.

III. Carrying out of programme

33. After the previous paragraphs, one of which was devoted to the preparation of the programme and the other to Euratom's resources (Joint Centre establishments and contracts), the fol-

lowing pages contain a detailed description of the execution of the research programme. The exposition will be made in the following order:

A. *Development of reactor strings*
   1. *Fast reactors* (paras. 34 to 39)
   2. *Advanced gas reactors* (DRAGON project, high temperature thorium reactor) (paras. 40 to 45)
   3. *Reactors fuelled by natural or slightly enriched uranium* (ORGEL — Halden — water reactors — research and development programme under US/Euratom Agreement) (paras. 46 to 76)
   4. *New reactor types* (homogeneous reactors and reactors cooled by water-steam mixtures) (paras. 77 and 78)

B. *Allied studies*
   1. Waste processing (para. 79)
   2. Reprocessing of irradiated fuels by dry method (para. 80)

C. *Materials testing reactors*
   1. BR 2 (Mol) (paras. 81 to 83)
   2. MTR (Petten) (para. 84)

D. *Research on plutonium and transplutonium elements*
   1. Programme of Karlsruhe Institute (para. 85)
   2. Plutonium recycling (paras. 85 a) tot 88)
   3. Research on transplutonium elements (paras. 88 to 91)

E. *Nuclear measurements*
   1. Neutrons (para. 92)
   2. Stable or long-lived isotopes (para. 93)
   3. Absolute counting of radioisotopes (para. 94)
   4. Sample preparation laboratory (para. 95)
   5. Contacts with national and international bodies (para 96)

F. *Controlled thermonuclear reactions*

1. Coordination of activities and creation of new associations (paras. 98, 99)
2. Research programme carried out under contracts of association in the field of fission (paras. 100 to 104)

G. *Biology*

1. Study of the harmful effects of radiations on living organisms (paras. 105 to 108)
2. Application of nuclear techniques in agriculture (para 109)
3. Application of nuclear techniques in medicine (para. 110)

H. *Radioisotopes and marked molecules* (points 111 to 113)

I. *Scientific information* (CETIS) (points 114 to 118)

J. *Other research*

1. Nuclear physics (paras. 118a. to 120)
2. Mineralogy and geochemistry (paras. 121 to 124)
3. Isotope geology (paras. 125 to 129)
4. Direct conversion (paras. 130 and 131)
5. Magnetic resonance (para. 132)

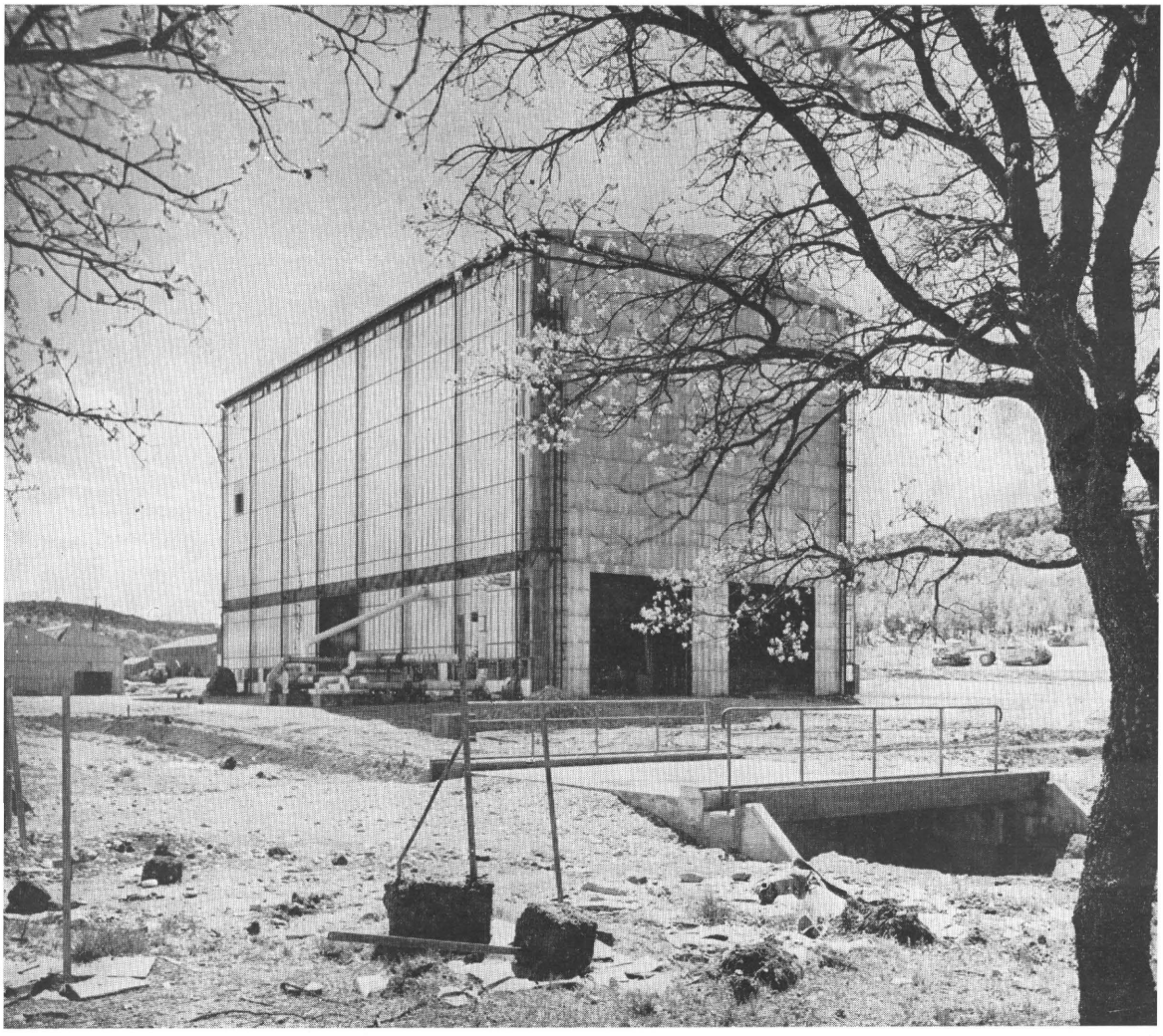
***

A. *Development of reactor strings*

(Fast reactors — advanced gas reactors — natural or slightly enriched uranium reactors — research and development programme under US/Euratom Agreement)

1) *Fast Reactors*

34. As far back as 1957, the Commission was contemplating, in the field of fast reactors, an extensive programme embodying



In July 1962 the Commission signed a contract of association with the French Atomic Energy Commission (CEA) for the design, construction and operation of the 20 MWth fast neutron experimental reactor RAPSODIE. *The photograph depicts the mechanical and technical test building.* RAPSODIE *is located near Aix-en-Provence at Cadarache.*

(Photograph by Jean Biaugeaud, Arcueil/Seine)

all projects undertaken or envisaged in the Community. This type of reactor is destined to play, by the 1980's, an important part in the production of nuclear electricity. It affords the following advantages:

— it is able to produce, from a fertile material, more fissile material than it uses. This "breeding" makes it possible to use a much larger proportion of the energy potential possessed by uranium and thorium for the production of power;

— it permits the optimum nuclear utilization of plutonium, rich in the higher isotopes, which is produced in large quantities by thermal reactors, particularly by those of the natural-uranium-graphite-moderated-gas-cooled type;

— the first studies performed holt out the hope that it would be possible to cut the investment costs per kilowatt and thus to produce energy at attractive prices.

The credits allocated to this string in the first five-year programme were sufficient for an effort of limited scope bearing fundamentally on design and preparation.

As a result of this preparation work, the Council of Ministers, after discussions within the Scientific and Technical Committee and the Consultative Committee for Nuclear Research, decided to appropriate for fast neutron reactors a credit of 73 million EMA u.a. under the second five-year programme. This sum, which represents about 35% of the total programme, underscores the desire of all the parties concerned to act with vigour and to place the subject of fast reactor design high on the list of the Community's priorities.

The report presented by the USAEC to the President of the United States in September 1962 shows that American efforts are following the same trend.

The points below set out, on the one hand, the development of a coordinated programme (with the CEA, Karlsruhe and the CNEN) and on the other hand the activities of the Joint Research Centre.

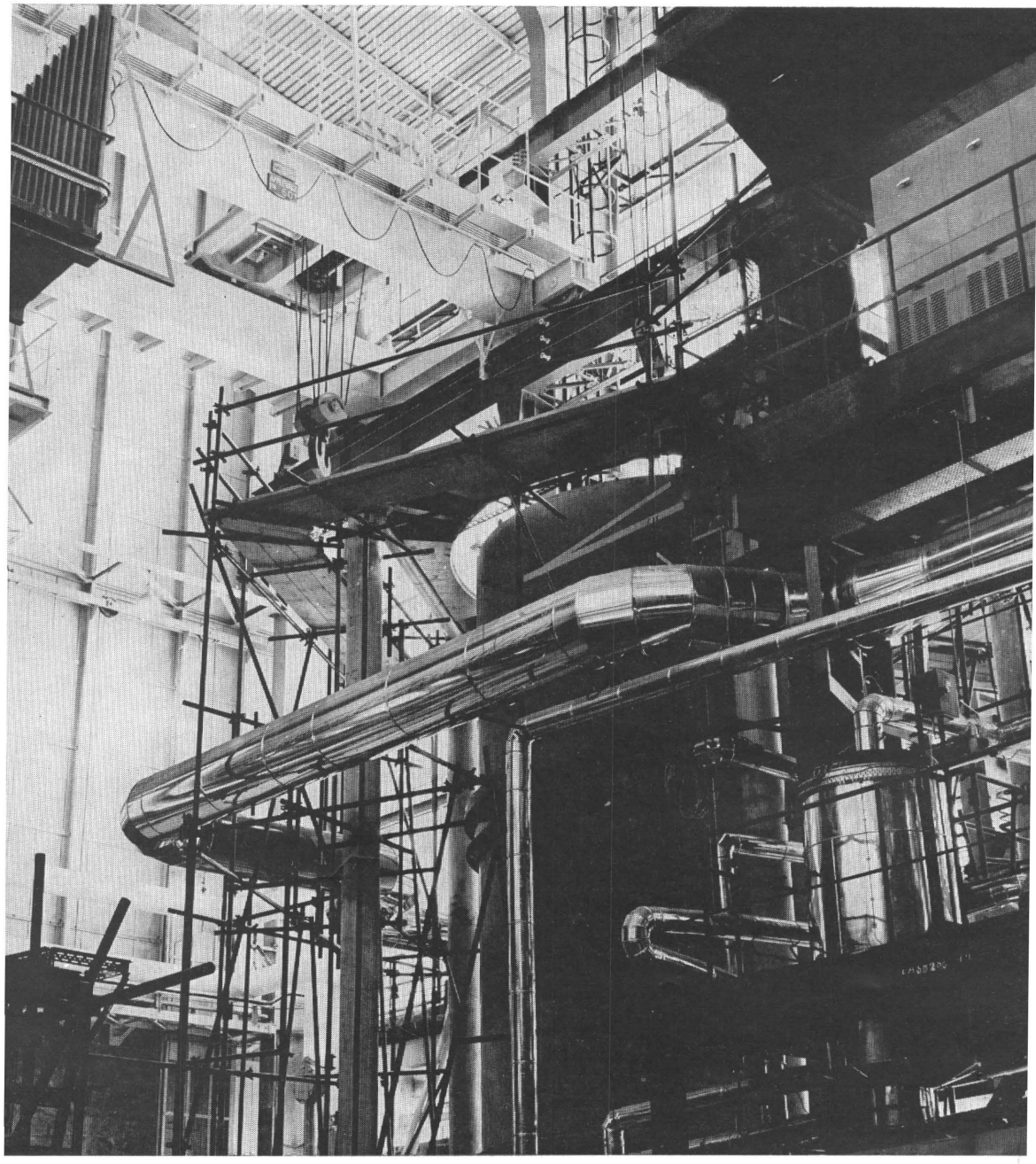
a) *Development of Coordinated Programme*

35. The negotiations with the French Atomic Energy Commission (CEA) embarked upon in 1961, resulted in July 1962 in the signing of a contract of association bearing on the design, construction and operation of the experimental reactor RAPSODIE (20 MWth) and of a high-flexibility critical fast neutron mock-up. A standard source reactor, to become critical in 1964, will round off this group, while the other reactors are scheduled for criticality in 1965. The plutonium supply for the first RAPSODIE core will be provided by the UKAEA, which will be delivering a first instalment of 45 kg at the beginning of 1964. The supplying of the critical assembly is linked with that of the Karlsruhe assembly, which will be dealt with later.

This first contract with the CEA will shortly be followed up by a second, at present being negotiated, concerning design, research and development work connected with the fast reactor string, and particularly of a prototype reactor with a power of about 100 MWe, the construction of which, not covered by the contract, would be able to start by the beginning of 1967. The association with the CEA will bear above all on the string of sodium-cooled fast reactors in which the slightly-enriched fuel will make possible a very high burnup owing to the breeding of fissile materials within the core.

36. At the same time, talks have been held with the German authorities with a view to integrating the Karlsruhe Nuclear Centre ([1]) in the Community's programme. Those negotiations will make it possible, in the very near future, to form an association encompassing the entirety of the activities carried out at Karlsruhe. Up to 1965, these studies will be concerned with the assessment, from technical and economic angles, of an important range of fast plutonium reactors employing different cooling systems. By this time it will be possible to select the most promising concept for the development of a detailed design for

([1]) Cf. points 21 to 23.



Fast neutron critical mock-up in the test hall of the experimental reactor RAPSODIE at Cadarache. Fast reactor studies are in the forefront of the Community's activities, approximately 18 % of the second five year programme's budget being appropriated under this head. This amount accounts for over 35 % of the total sum devoted to fast reactors within the Community.

(Photograph by Jean Biaugeaud, Arcueil/Seine)

a plant with a power of about 100 MWe, the construction of which not covered by the association, would be able to start in 1967.

The programme will have a heavy bias in favour of neutron studies; particular provision will be made at Karlsruhe for the construction of a fast-neutron critical assembly of a type similar to that dealt with under the Euratom/CEA association. These two assemblies will, under a common programme, share a stock of 300 kg of plutonium as well as large quantities of uranium 235.

The programme will, furthermore, involve the use of the *ARGONAUT reactor* at Karlsruhe for combined rapid-thermal type experiments (sub-critical core with fast neutrons surrounded by a sub-critical blanket with thermal neutrons, the whole becoming critical when the two sections are juxtaposed). There is also a certain interest in the American experiments aimed at determining the Doppler effect by power excursion in an experimental reactor to be built for the purpose. Negotiations are in progress with the USAEC and with American firms engaged on these experiments.

37. The talks initiated with the Italian Atomic Energy Commission (CNEN) at the beginning of 1963 should lead soon to the signing of a third association, the programme of which will embody the research initiated recently by the CNEN on the application of the uranium 233-thorium cycle in sodium-cooled fast reactors as well as on the use of paste-type fuels consisting of uranium oxide particles swimming in sodium. The first few years will be devoted to experimental studies on the fabrication and irradiation of these pastes, the fabrication of experimental fuel elements and the assessment from the neutronic angle of uranium 233 reactors.

38. In order to facilitate the exchange of experience and information, all the necessary steps must be taken to ensure that the work carried out within the Community is *well coordinated.*

This is already made possible to a large extent by the presence of Commission representatives on the Management Committees. Apart from this, however, the contracts provide for the setting up of an inter-association liaison group made up not only of representatives of the Commission and each of its partners but also of several experts not belonging to the associations. This group will be created as soon as all the contracts have entered into force.

Meanwhile, a working meeting serving to adumbrate the future liaison group was held in December 1962 with a view to defining the common objectives of a scheme for collaboration with the AEC pursuant to the overtures made to a group of European experts on the occasion of a recent visit to the States. This scheme, on which talks have been in progress since the end of 1962, may give rise to the establishment, both in the Community and in the United States, of experts' groups on fast neutron physics, sodium technology and fuels which may be considered for use in fast reactors. It would be the task of these groups to organize the exchange of personnel and information between the European centres themselves and between these centres and the American centres with which such a scheme might be instituted.

b) *Activities of the Joint Centre*

39. In line with the policy recommended by the Commission and approved by the Council, the Commission's activities in the field of fast reactors are covered mainly by contracts of association.

The JRC at Ispra may, however, make a significant contribution to this programme. It was with this objective in view that the work being carried out at Ispra, dealing mainly with reactor physics, fuel reprocessing and sodium studies, was continued in 1962. These programmes will be gradually dovetailed with those in progress under the associations. The theoretical

studies programme carried out by the Reactor Physics Department at Ispra already meshes with that carried out under the contracts of association with the CEA and Karlsruhe. The sodium programme has been focussed on the study of boiling liquid metals, which is vital from the standpoint of reactor safety studies.

2) *Advanced Gas Reactors* (DRAGON—hig-temperature thorium reactor)

40. The proven-type gas-cooled reactors can be considerably improved by boosting the power density, which leads to a reduction in the investment cost. The Commission's efforts are based on concepts which, owing to their good neutron economy, give reason to expect a cheap fuel cycle.

Furthermore, the high temperature which can be attained by using helium as the coolant give rise to an advantageous thermodynamic efficiency which should have a beneficial influence on both the investment costs and the fuel cycle cost.

The DRAGON reactor and the HTTR projects outlined below therefore represent two significant variations on the advanced gas reactor theme.

Although the DRAGON project will in all likelihood make it possible to obtain higher power densities, with a more conventional fuel element geometry and better heat transfer conditions, the HTTR project offers a solution which, as well a being more original from the mechanical standpoint, should in principle allow of a more homogeneous total irradiation of the pebble-type fuel elements and might lead to particularly economical fuel cycles.

a) *DRAGON Project* [1]

41. This project, carried out by the European Nuclear Energy Agency as a joint OECD enterprise, is aimed at the construction

[1] Cf. also para. 249 of Chapter IV: External Relations.

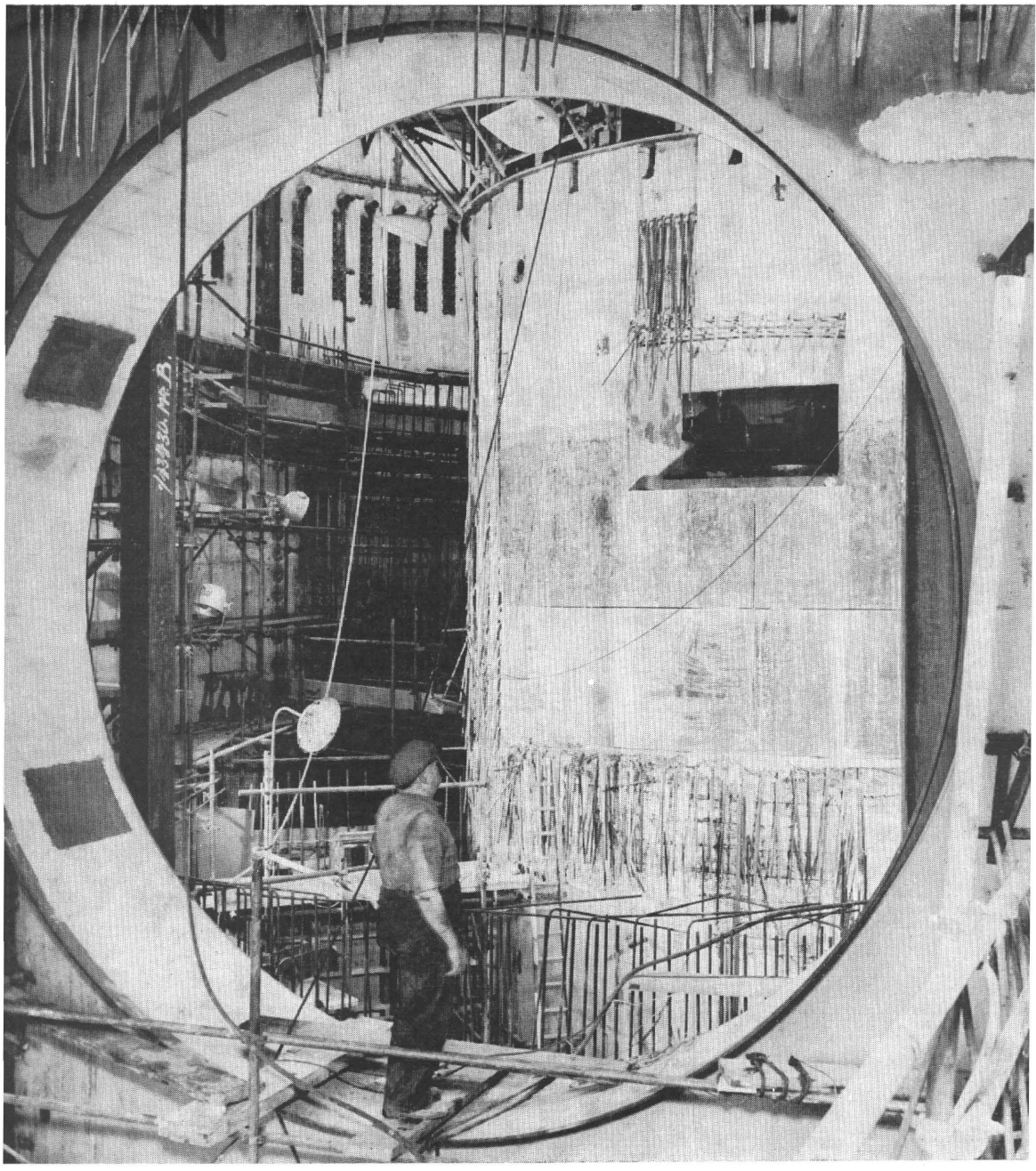
and operation at Winfrith Heath (United Kingdom) of a reactor experiment which can be used to appraise the technical and economic future of the high-temperature-graphite-moderated gas-cooled reactor string.

The construction work progressed satisfactorily in 1962 so that, barring accidents, the reactor will be completed by the end of 1963. The awarding of supply contracts and conclusion of deals necessary to the construction work has been carried out as scheduled. At the same time, the research and development programme has proceeded with the collaboration of industry and of the research bodies of the signatory countries. The stress has been placed on the development of fuel elements and on structural materials for the core.

In this way the bulk of the research effort has borne on the development of fuel elements capable of the complete retention of fission products and has led to the elaboration of the "coated particle" technique. This technique has already put within striking distance the possibility of obviating the need for fission product elimination from inside the fuel elements.

42. At the request of the Project Management Committee, a working group drafted at the beginning of 1962 a programme for *a possible extension of the original agreement,* which is due to expire in March 1964. The conclusions arrived at by this group have enabled the Management Committee to determine the technical content of a revised agreement involving the extension of the project up to March 1967.

In order to ensure that this prolongation was effected in satisfactory conditions, it was necessary to induce the UKAEA to waive the clause conferring on it ownership of the reactor at the expiry of the first agreement. Furthermore, to preclude duplication of effort and to ensure maximum efficiency in the distribution of the knowledge gained, it proved advisable to incorporate in the project's programme the research which had been carried out independently up to that date by the British teams at Harwell.



Euratom is taking part in the DRAGON project which, carried out by the European Nuclear Energy Agency as a joint OECD enterprise, covers the construction and operation at Winfrith Heath (United Kingdom) of a reactor experiment to be used for assessing the technical and economic outlook for the high-temperature graphite-moderated gas-cooled reactor string. In November 1962, Euratom signed a new agreement extending the project until March 1967. The total expenditure has been raised to 70 million EMA u.a., Euratom's share being 32.2 million, i.e. 46 %.

The photograph depicts a stage in the construction of the core containment for the DRAGON reactor.

(Photograph by UKAEA)

The negotiations embarked upon within the framework of the European Nuclear Energy Agency have enabled the Commission to achieve this twofold aim. Under the new agreement, the reactor remains the joint property of the parties, which will dispose of it, when the work is finished, on the basis of its residual value. In exchange, the 10.8 million EMA u.a. allocated to the project by the UKAEA over and above its share are accounted to the general budget. The UKAEA's share rises from 22.3 to 28.5 million EMA u.a. (including the value of the reactor on the expiry of the first agreement), while that of the Commission is stepped up from 12.2 to 32.2 million EMA u.a., and the UKAEA merges its previously independent research programme with that of the DRAGON Project. This pooling of effort, while widening the range of the DRAGON Project, has at the same time opened up a very comprehensive field of activity which will enable the signatories to gain, assuming that the work is brought to a positive conclusion, all the information necessary for the construction and operation of power reactors of the type studied at Winfrith Heath.

The new agreement, having received the fiat of the Project Management Committee on 30 October 1962, was signed by the Commission on 18 November 1962 after approval by the Council of Ministers.

43. As usual, the Community countries have been linked with the Project's activities through the agency of their technical correspondents, whose assistance has made it possible to ensure the effective dissemination of the data stemming from the project, to facilitate the participation of enterprises and laboratories of the Community in the research and other work sub-contracted by DRAGON, and to provide the Commission with advice throughout the negotiations on the extension of the agreement.

b) *HTTR Project* (high temperature thorium reactor)

44. The Commission has already pointed out, in the previous Annual Report, that its efforts tending towards the association

of the Community with a German research and development programme on pebble-bed reactors had been favourably received and that the first discussions were already in progress with the promoters of the project.

The German authorities have since given fresh confirmation of their desire to establish close links with Euratom. The negotiations started with the German Federal Government and the BBC/Krupp group have resulted in an agreement in principle on a programme for the joint operation of the AVR Reactor Experiment under construction at Jülich, the execution of a research and development programme in various fields concerning pebble-bed reactors (particularly the study of fuel elements and materials) and the design of an experimental high temperature thorium reactor (HTTR) with a power of about 400-500 MWth. This programme will be carried out under a contract of association which is expected to be concluded in the next few months. For the time being, the project will not cover the work relating to the construction of the experimental reactor. Nevertheless, the Council's decision laying down the second five-year programme makes explicit provision for the possibility of an extension to cover this aspect, after a special decision of the Council of Ministers, which shall act by unanimous vote on a proposal from the Commission. Construction work would be able to start before the end of the second programme.

45. At the same time, contacts have been established between the German Federal Ministry for Atomic Energy, the Commission and the USAEC to canvass the possibilities of an agreement for cooperation and exchange of information between the HTTR project and the *American high-temperature gas reactor projects.* Negotiations are likewise in progress to bring about a better coordination with the work carried out at *Winfrith Heath.* The institution of a scheme for intimate cooperation between all the high temperature gas reactor projects throughout the world, which has been one of the foremost ambitions of the Commission for some time, can thus be virtually considered as a fait accompli.

3) *Natural or Slightly-enriched Uranium Reactors*
ORGEL — Halden — water reactors)

a) *ORGEL project*

The paragraphs below contain information on the following fields:

i) overall concept of the project, features of technical and economic interest (para. 46)

ii) design study contract (para. 47)

iii) research and development programme (paras. 48-58)

iv) studies and constructions (paras 59 and 60)

v) Euratom/Canada Agreement and three-concerned collaboration with Canada and United States (para. 61).

i) *Overall concept of the project, features of technical and economic interest*

46. In the previous report, the Commission listed the reasons motivating its decision in 1959 to carry out a thorough investigation of the heavy-water-moderated-organic-liquid-cooled reactor string and to centre the activities of the Ispra establishment on this research.

The Council of Ministers, in signifying its approval of the second five-year programme, confirmed this decision of the Commission which, moreover, is based on a international division of labour in which the heavy water/heavy water and heavy water/gas variants are simultaneously explored by other countries, such as Canada, France and Germany. The technical and economic considerations referred to below give reason to think that the ORGEL string may well be capable, in the medium term, of providing a satisfactory solution to Europe's power supply problem. In fact:

— in the present circumstances, only natural uranium reactors can guarantee the independence of the Community with regard to fuel supplies;

— an ORGEL-type reactor, as far as its economy is concerned, would appear to compare favourably with the other reactor types. In particular the fuel cycle cost is very low, not being affected by the unknowns such as the plutonium buy-back price and the reprocessing costs, which affect the costs of the enriched uranium fuel cycle;

— the investment costs for an ORGEL power plant are fairly low: on the one hand, the string makes it possible to make extensive use of proven techniques and of fairly cheap structural materials while, on the other hand, the investment is limited by the low vessel pressure;

— the high outlet temperature of the coolant holds out the hope of a fairly good electrical efficiency, provided that a suitable steam circuit is adopted.

ii) *Economic study of the string*

47. In order to arrive at a better assessment of the economic value of the ORGEL string, the Commission awarded to a group of industrial designers a contract which has made it possible to determine the various items involved in the construction of the power reactor in this string, and to establish the price functions. This contract culminated in 1962 in the submission of a report describing a reference solution for a 250 MWe ORGEL power reactor.

The conclusions arrived at in the report do not raise any major difficulties which might constitute a stumbling-block in the economic future of this string. The main problems encountered, with particular reference to the structural materials, the fuel, and the behaviour and maintenance of the organic coolant, were examined, and the results have enabled the Commission to ensure that its present research programme is in a position to provide solutions in good time.

One of the aims of the contract was to determine, on the basis of a price survey carried out among Community suppliers, the direct investment costs for an electricity producing nuclear

power plant installed on standard conditions. Extensive enquiries have yielded a finding of 170 EMA u.a. per installed kW; this price includes 10% for contingencies, the site and roads, but provides neither for heavy water nor for fuel.

iii) *Research and development programme*

48. The research and development programme, mentioned in the Fourth General Report and developed in the Fifth, was pursued in 1962.

The Joint Centre establishment at Ispra has made a large contribution to all the fields covered under the programme, while at the same time collaboration with the research centres, either public or private, in the Member States, has been expanded. In 1962, 25 new contracts were concluded in addition to those being executed as a result of previous commitments. They are being carried out in conjunction with the appropriate departments at Ispra. Paragraphs 49-58 describe the advances which have been made under this programme in the following areas: chemistry, physical chemistry, neutron physics, heat transfer, fouling, and fuel element technology and metallurgy.

(1) *Chemistry* (polyphenyls, analytical methods, new coolants)

49. The study of the *behaviour of polyphenyls* under the effect of irradiation and heat has been continued. The in-pile loop which had been working since 1960 in the MELUSINE reactor of the Nuclear Studies Centre at Grenoble has been demounted and moved to Ispra, where it is now being used as a test assembly. A new loop was installed to replace it in the spring of 1962. These two loops have been used for irradiation series on polyphenyls and oil derivatives alternately. When these tests were carried out, the organic substances were brought in bulk to temperatures of 380, 400 and 420°C. The results indicated that polyphenyl decomposition does not become appreciable until a temperature of over 400°C has been reached. Furthermore, these

tests have made it possible to obtain decomposition products under irradiation which have been sent to Ispra for examination and analysis. A new and very advanced loop was set up in MELUSINE at the end of 1962 pending its installation in the SILOE, the power of which will be considerably higher.

50. Since 1960, large-scale operations have been carried out under contact with a view to the elaboration of *analytical methods.* This work was continued at Ispra in 1962. Canadian reports have stressed the important position occupied by the Ispra Centre on the international plane in this vital field. The water content and the main mineral impurities can now be detected with a high level of accuracy in organic substances; in the same way, through the use of synthetic substances prepared under contract, we are enabled to identify tetraphenyls and a part of the penta- and hexaphenyls in heavy radiolytic and pyrolitic decomposition products, which marks a considerable advance on the methods which were previously in use.

51. The research carried out on *new coolants* derived from oil "cuts" has yielded valuable results which, however, are still not exhaustive enough to allow of a definitive appraisal of the potential: the methyl naphthalenes, which have a vapour pressure similar to that of diphenyls, i.e. too high, are not suitable for the purpose of cooling an ORGEL reactor but constitute, under the name of "THERMIP", a valuable thermal fluid, since it contains no oxigen bonded in the molecule. The alkyl phenarthrenes, which have a vapour pressure similar to that of the terphenyls, possess a comparable radiolytic stability and a lower thermal stability. Attempts are being made to remedy this by studies on preparation methods.

(2) *Physical Chemistry*

52. Basic research following several lines closely connected with ORGEL has been undertaken. Particular mention may be made of a study of the mechanisms governing the deposit of particles on fuel element cladding, the study of internal friction in sintered

aluminium under stress, the return of fission gases into uranium carbide and the study of graphite behaviour in an organic medium. The study of magnesium corrosion by organic liquids has been abandoned, since this material proved in fact to be unusable. On the other hand, a considerable effort is being made to check whether zirconium (or certain of its alloys) can be used and in what conditions.

(3) *Neutron Physics*

53. The buckling measurements carried out in the AQUILON 2 reactor at Saclay on oxide lattices immersed in organic liquid have been completed, sifted, interpreted and compared with corresponding work performed in Canada, Denmark and France. These results have made it possible to adjust the neutron formulae, which were fairly unequivocally pessimistic. The reactivity reserve which is at present available in a medium sized reactor (250 MWe) is sufficient to bring about an average burnup of 8000 MWd/ton, which permits very advantageous fuel cycle costs. For the time being, no provision is made for any new experiment of this type, and it is planned to carry out the next tests on the ECO reactor (see point 59 below) as soon as it is commissioned. The primary aim of these tests will be to investigate uranium carbide lattices. The carbide required was ordered at the end of 1962 and will be delivered at the Ispra Centre in the course of 1963. It should be noted that the quantity to be delivered (7.5 tons) represents one of the biggest orders for this material ever placed.

(4) *Heat Transfer*

54. Three *heat transfer loops* are at present being operated by Euratom contractors. Work undertaken on one of these loops has made it possible to establish for the flow of OM 2 type terphenyls in a cylindrical configuration a relation checked to an accuracy of 1% between three characteristic functions of the liquids [1].

[1] This relation between the non-dimensional Musselt, Prandtl and Reynolds numbers is as follows:

$$Nu = 0.0133\ Re^{0.740}\ Pr^{0.468}$$

Another installation is intended for burn-out flux measurements. Several hundred points have already been measured, and a general law to supersede the very old and imprecise one used up till now for organic reactor calculations is being evolved. Another installation, entirely automatic, is intended for the study of pyrolytic fouling on the heating walls. The results so far obtained in this field are very promising (1).

55. The development of *methods and apparatus for the measurement of the physical constants* of the polyphenyls at high temperature has been pursued both at Ispra and under contract, and it is now possible to use industrial equipment for the measurement of the thermal conductivity to within ± 1.5% up to 450°C, specific heat to within ± 0.5% up to 450°C viscosity to within ± 1.2% up to 480°C, the vapour pressure to within better than 1% and density to within 1/100 up to 500°C. A laboratory apparatus is also being used to measure surface tension.

(5) *Fouling*

56. The ORGEL project is tackling this problem from a number of angles:

— from the basic standpoint, the physical chemistry section is studying phenomena which may cause the adhesion or detachment of mineral or organic particles or on from the walls. These studies constitute an attempt to elucidate the mechanisms which may be involved and to provide solutions. Some very interesting, albeit fragmentary results have been obtained;

— from the more general standpoint of wall fouling by organic liquids, tests are in progress in the heat transfer section and in in-pile loops (cf. point 54). So far, no fouling has been observed;

(1) A test for 1000 hours with a very low liquid flow rate (3m/sec), a wall temperature of 480°C and a bulk liquid temperature of 380°C did not reveal the slightest degree of fouling.

— from the purification standpoint, studies are being carried out on a number of different devices. It can already be stated however that a combined use of argillaceous absorber beds, fine-mesh sintered stainless steel filters and distillation is capable of eliminating fouling phenomena in the existing installations. An instance of this is provided by the highly satisfactory operation of the OMRE (1).

57. (6) *Technology*

Exploration of this field constitutes a full-time task for the *Ispra Centre Technology Section,* which is likewise responsible for the administration of a number of contracts. The year 1962 was marked by the commissioning of several important installations at Ispra:

— a pneumatic test bench intended particularly for the testing of SAP (2) pressure tubes;

— a test bench for pumps, valves and measuring apparatus placed in an organic medium at 400°C;

— an out-of-pile loop for the testing of a full size ORGEL channel. Up to 1964 this loop will be used for the study of the channel provided for ESSOR: study of vibrations, flow, stresses, various joints, etc.

Numerous other studies habe been developed relating particularly to heat insulators, reaming, SAP/steel joints, with which good results have been obtained, and the hydraulic study of the ORGEL channel, for which a plexiglass mock-up has been installed. Explosion tests carried out on pressure tubes in heavy water represent an important feature of the safety assessment of ORGEL—type reactors. Several experimental assemblies have been constructed, one of which has shown that, in principle, the bursting of a tube containing organic liquid did not lead to combustion in air or to any special difficulties in water. A large-

(1) OMRE: Organic Moderated Reactor Experiment: Idaho Falls, US.
(2) SAP: Sintered Aluminium Powder.

scale mock-up will be constructed to study the ESSOR case in detail.

(7) *Metallurgy and Fuel Elements*

58. The bulk if this programme is carried out by the Metallurgy Section at the Ispra Centre, which, as well as devoting 90% of its energies to the programme, is also responsible for the administration of numerous contracts. The study of *sintered aluminium* with a view to its use as a cladding and structural material has been continued. The material which was initially at our disposal has been improved to a large degree by the introduction of various processes at certain stages in the fabrication (vacuum degassing of the pellets, for example). A number of processes have been brought in to overcome the problems connected with *welding.* The studies on *uranium carbide* have likewise been followed up. An order for 7.5 tons of natural stoichiometric carbide was placed at the end of the year with two Community suppliers with the intention of manufacturing replacement charges for the study, on ECO, of the neutron properties of carbide lattices; an irradiation experiment has been performed in the Canadian NRX reactor (cf. point 61). At the end of the experiment, a rodlet break occurred on a level with a detector wire: no reaction took place between the carbide and the hot organic coolant, and the activity spread in the circuit was minimal, a fact which provides a further argument for the attractiveness of the carbide-fuelled ORGEL reactor. The study of nickel and vanadium as *diffusion barriers* between metallic uranium and an aluminium cladding was finalized: nickel proved unsuitable at the temperatures specified, whereas vanadium was more satisfactory. The study of *irradiation devices* in the ISPRA 1 reactor was continued. This study will make it possible, at the beginning of 1964, to proceed with various tests on carbide rodlets. Attention should likewise be drawn to the supply for the Ispra Centre of aluminium-clad natural uranium fuel intended as the *reference charge for the ECO reactor.* The fuel consists of 241 bundles, each comprising 19 uranium metal rodlets with a diameter of 12 mm and a length of 2 m 90.

iv) *Studies and Constructions*

ECO (Experience Critique ORGEL = ORGEL critical experiment)

59. In 1962, the building, the reactor shielding and the reflector graphite were completed, while the pressure vessel and the heavy water circuits will be installed at the beginning of 1963. The commissioning is scheduled for the end of 1963.

ESSOR (ESSais ORgel)

60. The contract for the drawing up of a detailed draft design was finished in July 1962. At the same time, the study of the alternative solution involving the replacement of ESSOR by loops installed in the high flux reactors in the Community has been completed. The conclusions arrived at are unequivocal: this solution provides no advantage either in time or in money and, in addition, involves certain important technical drawbacks. In the light of these findings, the Commission decided in September 1962 to go ahead with the construction of the ESSOR reactor and its ancillary buildings. This specific testing reactor for heavy-water-moderated pressure-tube reactors is destined, in the first stage, to test the ORGEL channel in environmental conditions which are representative of heavy water reactors. There will be facilities for the installation of five experimental circuits, three of which, intended for the heavy water-organic-liquid string, will be mounted as soon as the reactor is started up. One of these three circuits is made up of a bundle of eight channels in parallel. The final period of 1962 was devoted to the inception of the construction schedule for the reactor, which is expected to go critical at the end of 1966.

v) *Euratom/Canada Agreement and Three-cornered Collaboration between Euratom, Canada and the United States*

61. The year 1962 was marked by the continuance of the collaboration scheme with Canada and the proliferation of technical contacts with the Americans.

The meeting of the tripartite Committee instituted under the terms of the expanded Euratom/Canada Agreement was held in the United States in 1962, subsequent to a one-week technical meeting attended by Americans, Canadians and Euratom officials.

As a result of these meetings, the USAEC invited the Commission to appoint a permanent member to the Organic Standards Committee as well as four members to the Organic Working Group. The Euratom Commission accepted these proposals, and a complete scheme of coordination is now in existence between the three main organic programmes under way throughout twe world, thus avoiding duplication of effort and preventing loss of time and money for all concerned.

b) *Halden Reactor* [1]

62. The reactor operated at Halden under a joint OECD enterprise is a boiling-heavy-water-cooled and -moderated reactor installed in a pressure vessel. The present core is made up of slightly-enriched uranium oxide fuel elements. Evaluation studies carried out in the United States have demonstrated that the cooling of a heavy-water-moderated reactor by boiling heavy water, equipped possibly with a direct steam circuit obviating the necessity for heat-exchangers, is an economically promising proposition.

The Halden reactor was constructed with the primary objective of providing an opportunity for a thorough study of power stability problems linked with the questions raised in this field in the light water piles.

After the introduction of modifications occasioned by difficulties revealed by tests on the first core, the Halden reactor went critical with its second core of uranium oxide fuel elements on 23 March 1962. Low power static and dynamic tests conducted at temperatures of up to 230°C were carried out up to September 1962 to determine the characteristics of the new core.

(1) Cf. also para. 250 of Chapter VI: External Relations.

In October, the power was stepped up to 15 MW at 230°C. The high power dynamic test programme, which has been commenced, has revealed power instabilities. During these tests fuel elements equipped with measuring instruments were inserted in the core.

63. The technical difficulties, with particular regard to corrosion, encountered in the 1960-61 tests on the first core caused some delay in the project. It was therefore reasonable to provide for an extension of the agreement beyond its normal term (31 December 1962), at least in order to finish off the tests under the current programme. Moreover, the project's management had proposed to the signatory countries a programme extension centred on a general study of the stability of boiling reactors involving the use of a two-zone core.

64. The Commission, while not accepting the proposal to participate in this extension, decided, in agreement with the Council, to make available a maximum amount of 300,000 EMA u.a. for a prolongation of the agreement under which the work in progress on the dynamics of the reactor with the present core could be brought to a conclusion. Euratom's participation in the project will therefore end when the tests have been completed and the results analyzed.

c) *Research and General Studies on Water Reactors: Research and Development Programme under Euratom/United States Agreement*

65. The importance of the light-water-moderated reactor string was dramatically emphasized in the course of 1962 by the results gained from the operation of the American power plants Dresden (180 MWe boiling water reactor) and Yankee (142 MWe pressurized water reactor). The interest displayed by the Community in this string is confirmed by the fact that several power plants are being constructed in various Community countries. The Joint Research and Development Programme is aimed at

widening our scientific and technological knowledge of these types of reactor ([1]).

i) *Carrying out of research programme under the Euratom/ United States Agreement*

66. In the course of the period under review, the above programme was able to expand its scope to encompass operations relating to boiling water and pressurized water power plants.

67. The Joint Board authorized the negotiation of ten new contracts and sixteen extensions in the Community and of ten new contracts and eleven extensions in the United States. The financial commitments arising out of all the contracts concluded in the Community and the United States amount at present to a total of about 27 million EMA u.a., 17 million EMA u.a. for the Community and 10 million for the USAEC. It has not yet been possible to bring about a complete accounting balance in the breakdown of contributions, owing mainly to the fact that the elaboration of the development programme directly linked with the power plants under construction has proceeded more slowly than was anticipated. The financial contribution of the USAEC to this research will be particularly large.

68. The main *objectives pursued by the Joint Board* have not varied since the launching of the programme: development of ceramic fuels (particularly uranium oxide), and fuel element fabrication techniques; plutonium recycling; study of behaviour of steels for reactor vessels and elaboration of welding techniques for thick plates; thermodynamic and hydrodynamic studies designed to improve the heat extraction conditions in light-water-cooled reactors.

These predominant objectives are accompanied by others which, although more limited in scope, are no less important,

([1]) See Chapter on Industry and Economy, paras. 166 et seq.

and which are covered under research contracts dealing with, for example, studies on the development of circulation pumps and the devising of new control systems.

69. The research projects authorized in the Community are in the first place calculated to widen our basic knowledge and in the second place to supply the industry of the Member Countries with the experience and the resources they require to assume the entire responsibility for the design and construction of power reactors and their components. The highly effective system of collaboration established with the USAEC is of considerable assistance in this task.

Three working meetings, on ceramic fuels, plutonium recycling and biphase flow cooling respectively, attended by European and American specialists, provided an arena for very comprehensive exchanges of views on the subjects at issue, without there being at any time any question of restricting the scope of the discussion to the object of the Joint Programme contracts.

The exchange of information could be further underpinned by enabling more Euratom officials and workers assigned by Community enterprises to participate in projects carried out under contract in American laboratories.

70. The "Joint Research and Development Programme Quaterly Digest", a journal designed to point up the trend of new contracts and to describe progress made, has continued to appear every quarter. This publication contains a detailed list of the reports submitted on the basis of contract work, which may be obtained on request.

ii) *Main research work carried out under the agreement*

The points mentioned below relate to nuclear fuels and materials, the thermodynamics and hydrodynamics of liquids as well as to miscellaneous research.

(1) *Nuclear Fuels and Materials*

71. Uranium oxide still holds pride of place among the fuels on which preparation and shaping studies have been performed. The projects bearing on the *extrusion* and the *sintering* of powders have provided a thorough mastery of these techniques and now permit the fabrication of oxide rods endowed with extremely satisfactory properties.

Alongside this work, the study of the *physical properties* of the oxide before and after irradiation has been continued. A material which is excellent for study purposes has been placed at the disposal of the laboratories in the Community and the United States which are engaged in investigations of the structure and behaviour of uranium oxide: in fact, an easily reproducible technique has been applied to the preparation of uranium oxide monocrystals more than 1 cm long on which basic research and irradiation tests are being conducted.

Work on the *diffusion of fission gases* through fuel and cladding has provided a better understanding of the conditions to be observed in fuel element fabrication.

The *uranium monocarbide,* prepared by a solid phase reaction, has been subjected to hydrolysis and irradiation tests. Other fuel materials, such as uranium nitride, the interstitial U-C-O compounds, and uranium oxide- and thorium oxide-based mixed fuels, are still in the process of examination.

The overall planning of this programme is designed to enable the European industries to undertake, with the minimum delay, the fabrication of fuel charges for certain of the power reactors at present under construction in the Community.

72. The development work on low capture *cladding materials* resistant to water and steam at high temperatures has also been continued. The alloy ZrNb3Sn1 (1) seems to fulfil its original promise by displaying a very good resistance to mechanical

(1) Zirconium - Niobium 3 and tin 1

stresses coupled with a highly satisfactory corrosion behaviour. Furthermore, a coordinated research programme has been launched to study the *corrosion* mechanism in aqueous media of nuclear-grade metals.

73. A batch of contracts entailing the participation of a large number of Community industries concerns the development of fabrication methods for thick steel *reactor vessels* and the examination of the effects on these steels of irradiation and thermal cycling. The particular purpose is to demonstrate the embrittlement factors and to provide a remedy for this material deterioration.

(2) *Plutonium Recycling*

74. The preparation of plutonium-containing ceramic fuels, the study of their physical properties and the preparation of irradiation experiments making it possible to examine their in-pile behaviour have been the main items of interest under this heading. This will be discussed in greater detail under points 86-88.

(3) *Thermodynamics and Hydrodynamics of Liquids*

75. The research work in this field has been continued and extended to the study of biphase flow in reactors cooled by a steamwater mixture. The details are given in point 78.

With particular regard to the thermal features and dynamics of biphase flows, the apparent advantage of setting up vortical movements in the heat transfer liquid in order to ensure a more efficient extraction of the heat released has been corroborated. Furthermore, this research is making a contribution to our knowledge of phenomena bound up with heat transfer, such as burn-out, hydrodynamic instabilities and fuel element vibrations.

(4) *Miscellaneous Research.*

76. Studies on the development of neutron detectors, the statistical calculation of the resonance integral of U238 and the

electro-analysis of nuclear-grade metals are also covered by the programme. Attention should also be drawn in this connection to an evaluation study on a fuel cycle adapted to the SENN reactor and a survey on the problems involved in the transportation of irradiated fuels from the SENN and SENA reactors.

4) *Studies on New Reactor Types*

These studies bear at the moment on homogeneous reactors and mixed steam-water reactors.

a) *Homogeneous Reactors*

77. Studies on homogeneous suspension reactors, in progress since 1959 with the firm KEMA (N.V. tot Keuring van Electrotechnische Materialen) at Arnhem, have been continued and have yielded fresh results on the irradiation behaviour of suspensions of the proposed fuels.

In particular, the conditions governing the stability under irradiation of aqueous suspensions have been more accurately defined. In spite of the results obtained, it is not yet possible to decide with certainly whether the development of a completely satisfactory fuel is technically feasible.

A critical experiment set up at Arnhem has continued to yield valuable results on the neutronic stability of suspended fuel circulation systems. The reactivity coefficients versus temperature were measured over long periods.

The technological studies and the development of instrumentation have been carried on and have provided a definition of certain important specifications for the construction of the ancillary circuits of a small test reactor contemplated by KEMA. New examinations have been carried out on problems connected with the shielding and installation of the various systems.

Negotiations have been embarked upon with a view to ensuring the continuance of the work beyond 31 December 1962, when the current contract of association expires. As it proved

impossible to bring these negotiations to a conclusion before the above date, the first contract has been provisionally extended for three months.

b) *Reactors cooled by steam-water mixtures*

78. The work covered by the US/Euratom agreement and carried out simultaneously under contract in the Community and the United States continues to reveal the possibilities afforded by water-steam mixtures as reactor coolants. A three-pronged approach is adopted in this work:

— improvement of heat transfer;

— elaboration of the parameters governing the hydrodynamics;

— determination of the corrosive properties of biphase flows.

This programme has been rapidly expanded an a result of the interest evoked by the initial theoretical and practical results concerned, on the one hand, with technical possibilities of creating and circulating the mixture as well as of separating the steam at the loop outlet and, on the other hand, the measurement of the burn-out flux and the heat transfer coefficients for various geometries. It has also been found that the corrosion caused by the mixture is not in excess of that met with in reactors of the boiling water type. This finding is borne out by the fact that the Canadians and the Americans have introduced similar projects in their own programmes. An out-of-pile loop for large-scale flow and heat transfer studies and a in-pile loop installed in the swimming-pool of the Avogadro RS 1 reactor belonging to Sorin in Italy for corrosion studies under irradiation were brought into operation at the beginning of the year.

B. *Allied Studies*

Section A above was concerned mainly with fast reactors, advanced gas reactors and reactors running on natural or slightly enriched uranium. At this juncture, mention should be made of certain allied projects bearing on the vital issues of radioactive waste disposal and irradiated fuel reprocessing.

1) *Radioactive Waste Disposal*

79. Research is in progress under the US/Euratom Agreement on methods if disposing of slightly active solid wastes. An incinerator has been built by the CEN at Mol in order to reduce to a minimum the volume of waste for storage. This plant is now being used for tests on the burning of radioactive materials. The ash and evaporated concentrates will be rendered insoluble by a method developed simultaneously in Europe and the United States consisting in the binding of these materials in bitumen. The aggregates formed in this way have been subjected to long-term solubility tests with satisfactory results. Finally, the hydro-geological study of the water-bearing layer and of the migration of radioactive ions in the soil of preselected sites has helped to define the conditions in which subterranean storage should be effected.

The programme is at the moment passing through a transitional stage: the 1963 budget amounts in fact to only 10% of the 5 million EMA u.a. allocated to these activities under the second five-year programme. A detailed balance sheet of requirements and progress made, to be drawn up in 1963, will make it possible to widen the scope of activities from 1964 onwards.

2) *Dry Reprocessing of Irradiated Fuels*

80. Research on the purification by volatilization of irradiated uranium-bearing fuels, started in 1960, has been continued and amplified in line with the results obtained. The work is being carried out by contract.

The method evolved in the laboratory and selected as a basis for further development consists in using a fluidized bed to subject uranium ceramics to successive oxidation, reduction, hydrofluorination and fluorination in order to produce gaseous uranium hexafluoride. By means of various processes which are now being perfected, the fission products entrained are then eliminated from the gas. Progress already achieved has made it

possible to undertake the construction of a pilot plant which will come into operation shortly and which will be used to handle fuel charges in the order of 3-4 kg. Work has likewise gone ahead with studies of a more basic character designed to clarify the mechanism of the reactions involved.

This work, carried out within the framework of the US/Euratom Joint Programme, has also benefited from a comprehensive exchange of information with the American laboratories at Argonne, Brookhaven and Oak Ridge, which have been engaged for several years past on the same subject. The work will be continued in 1963 on the laboratory pilot plant scale. It would then be logical to adapt it for the processing of fuels actividad by irradiation and containing varying quantities of plutonium. This research will be accompanied by the development of effective methods of decontamination, uranium-plutonium separation and conversion of gaseous compounds into solid fuels in the form of either uranium oxide or mixed uranium and plutonium oxides.

C. *Materials testing reactors*

The study of the modifications induced in nuclear materials and fuels together with the appropriate tests constitutes a vital aspect of the development of new reactors.

These tests are carried out in materials testing reactors in which material samples or reactor components are subjected to an intense neutron flux for purposes of studying the irradiation behaviour.

For its own requirements as well as for those stemming from the programmes conducted by the Member States or by non-Community states, the Commission administers, either directly or by association, the two tests reactors BR 2 at Mol and HFR at Petten and endeavours to equip them with the necessary facilities for the preparation of experiments and for the post-irradiation examinations.

1) *BR 2 Test Reactor*

81. The BR 2 went critical in July 1961. This event was ensued by a period of blank tests with the completely equipped reactor. Subsequently, in July 1962, a new criticality experiment was performed with a core capable of accommodating the first irradiation experiments.

The power run-up and constant power operation, without experiments, will continue up to the end of 1962. Since the tests and physical measurements yielded satisfactory results, the Commission officially certified the smooth running of the reactor and declared it suitable for bringing into joint operation.

The first irradiation experiments which were inserted in the reactor in January 1963, are made up on the one hand of a loop constructed by the BR 2 team on behalf of the DRAGON Project ([1]), in order to study the effect on graphite, under irradiation, of very low impurity contents in helium at high temperatures, and on the other hand of instrumented capsules supplied by the UKAEA establishment at Harwell and the Saclay centre of the French Atomic Energy Commission (CEA).

82. The setting up of laboratories and equipment has been continued and the apparatus necessary for the post-irradiation handling of experiments is complete.

The *hot medium activity laboratory* has been completed and 27 hot cells with their necessary scientific installations are in the process of manufacture. The design of the very *high activity laboratory* has been entrusted to Community industry; the earth works could be started by mid-1963.

The design and construction of the *irradiation loops* are being carried out by technicians of the BR 2 group or by the users in conjunction with industry. As was explained above, the first experiments were inserted in the reactor in January, while

([1]) Cf. paras. 41-43.

about 100 others are in the process of preparation. The time for preparation (excluding both irradiation and post-irradiation checks) amounts to from 2-3 years for big experiments and their cost may total as much as 1 million EMA u.a.

83. The BR 2 reactor is at the disposal of any organization of the Community or of any non-Community country which happens to be interested, including the two partners to the convention between the Euratom Commission and the Belgian Nuclear Studies Centre (CEN). The results of the irradiation tests are conveyed only to the user in order to prevent any distribution of data without his agreement. The users pay the cost of irradiation tests on a standard basis.

The high neutron flux in BR 2, particularly the high fast neutron flux, make this reactor particularly valuable for irradiation behaviour tests on materials intended for use in the construction of future nuclear power plants.

2) *High Flux Reactor (HFR) at Petten*

84. The main feature of the agreement concluded in July 1961 with the Dutch Governement for the setting up at Petten of the Joint Research Centre establishment (1) is the provision for the transfer to the Community of the HFR reactor on its completion by the Reactor Centrum Nederland. In line with the terms of the agreement, the *transfer* of this reactor took place officially on 1 November 1962, after acceptance by the Commission.

The reactor reached its rated power of 20 MWth for the first time on 25 May. The acceptance and safety checks carried out since that date have been fully satisfactory and have made it possible for the pilot team to get acquainted with the reactor's behaviour and to make their preparations for operating it. Normal operation started at the end of 1962.

Under the agreement, the experiments covered by the Dutch programme have priority throughout a transition period

(1) For information on the Petten establishment cf. paras. 18-20

of four years dating from reactor start-up. The first Dutch experimental devices were installed, as scheduled, in 1962. For its part, the Commission has initiated the preparation of a series of experiments due for irradiation in the next few months.

D. *Research on plutonium and transplutonium elements*

The programmes to be carried out both at the European Transuranium Institute at Karlsruhe and unter contract are based on the attractiveness of plutonium as a fuel for fast neutron reactors and on the possibilities open for its use in thermal neutron reactors.

1) *Plutonium Programme of Karlsruhe Institute* ([1])

85. The development of the Institute's programme, sketched out in 1961, has been continued after discussions within the Scientific and Technical Committee and the Consultative Committee for Nuclear Research.

The research carried out at the Karlsruhe Institute will be focussed on problems connected with the use of plutonium as fuel in nuclear reactors from the angle of technical and economic feasibility.

It is clear that fast reactors come high on the list of reactors which can be fuelled by plutonium; this is why the development of fuel elements for this type of reactor will be one of the focal points of the programme. Pending the completion of the building at Karlsruhe, a small laboratory, in the process of installation, will be used to fabricate sintered-oxide-based prototype elements. This laboratory could start up by the end of 1963.

Although plutonium would appear to be an attractive choice as a fast reactor fuel, the situation is by no means clear

([1]) Cf. paras. 21-23 for information on the Karlsruhe establishment.

with regard to thermal reactors. For the time being, there is nothing to show that this is a utopian prospect, but it would certainly seem to involve considerable difficulties. Contract work under way in the United States and in Europe under the US/Euratom Agreement is designed to reduce the problem to its essentials by amplifying the knowledge available on the neutronics of reactors using plutonium. Experiments on a larger scale, however, must be carried out in medium-power reactors if we are to arrive at a reasonably reliable assessment of the advantages of plutonium. It is this consideration which will determine the equipment with which the Karlsruhe Institute is to be provided.

For both types of reactor, it will be necessary to design and to construct fuel elements which attain the maximum burnups and which lend themselves to fabrication by cheap and easy methods.

A basic research programme will be performed to provide all this work with an adequate theoretical basis and to pinpoint as accurately as possible the properties of the materials used. The work will be directed mainly at the high temperature properties of plutonium and its compounds. This will be accompanied by the chemical analysis of the irradiated material. Research in this field constitutes the foundation of a good understanding of the behaviour of fuels in both thermal and rapid reactors and will be particularly useful in the possibility which it affords of making a reliable judgment as to their profitability. At present, however, they are in an early stage of development.

The laboratory will also be equipped for the recovery of the plutonium used for laboratory work.

2) *Plutonium Recycling in Thermal Reactors*

85a. The agreement for cooperation between Euratom and the United States provides for important projects which are carried out under contract and which are intended to define the conditions in which plutonium may be used to fuel thermal reactors.

Studies on plutonium recycling yield valuable data concerning the behaviour of natural uranium fuel in graphite-gas and heavy-water-moderated reactors. A large proportion of the energy produced in piles of this type originates from the fission of plutonium atoms; these studies are important for the optimization of the fuel cycle in these reactor strings.

Moreover, the valuable possibilities offered by the re-use of plutonium in light-water-moderated reactors are by no means negligible and can offer an outlet for this fissile material pending the industrial development of fast neutron power reactors.

The current work relates to 3 importants fields: the metallurgy of plutonium-containing fuels, in-pile studies and neutron studies.

a) *Metallurgy of plutonium-containing fuels*

86. The studies performed have been concerned with plutonium oxide and carbide preparation techniques and with the shaping and study of granulates of these materials to be dispersed in a zirconiumbased metallic matrix. No difficulties arose in connection with the preparation of and forming of rods from mixed uranium-plutonium oxides and carbides.

b) *In-pile studies*

87. The studies preparatory to the in-pile examination of uranium oxide rodlets with a plutonium enrichment of 2-4% were started in 1962 with thermal simulation tests and with the theoretical determination of the irradiation conditions.

These studies will make it possible to irradiate in the BR 3 reactor at Mol a series of full-size rodlets with a plutonium enrichment of about 1% in order to check on the behaviour of the mixed UO_2-PuO_2 oxide in conditions characteristic of a pressurized water reactor and to make a comparison of various fuel element fabrication methods.

c) *Neutron studies*

88. These studies are concerned firstly with the effect caused by the substitution, in a well defined fuel, of plutonium for uranium 235, and secondly with the neutron characteristics of the fuel in various moderating media (heavy water and graphite).

The programma is aimed at the elaboration of the exact method of calculation for a core burning the fissile isotopes of uranium and plutonium simultaneously. It calls for the provision of large-scale facilities and the fabrication of several fuel charges of well-defined composition. This phase is at present well under way and measurement series are in progress in the critical assemblies AQUILON, MINERVE and MARIUS sited at Saclay, Fontenay-aux-Roses and Marcoule respectively.

3) *Research on the Transplutonium Elements*

89. Only about 10% of Karlsruhe's overall activities will deal with this research. The work concerned relates to basic research which would by no means benefit from being centralized and which, apart from the actual fabrication of the elements themselves, requires very little in the shape of other facilities. It is, however, necessary that the practical applications which might be devised as a result of work carried out under contract (such as the use of transplutonium elements as fuel in reactors for space satellite drives) should be developed at Karlsruhe.

90. The contracts concluded in 1961 with various laboratories and research centres in the Community are focussed in the first place on the production of several transplutonium elements and in the second place on the chemical study of these elements as well as separation and purification processes. This work, which covers virtually all the activities in this field which are in progress in the Community, was carried on in 1962. Special attention should be drawn to an irradiation contract with the Euratom-CEN association under which quantities of transplutonium elements of the order of a microgram will be produced in the high-flux test reactor BR 2.

91. The strengthening, in 1962, of the bonds linking together the various activities in progress in the Community has made it possible to establish a tightly-knit coordination of the different programmes resulting in a uniform and well-balanced overall pattern.

Contacts have been established with certain extra-Community countries with a view to future collaboration aimed primarily at the avoidance of duplication of effort. Collaboration with the American laboratories and the USAEC has likewise continued in a highly satisfactory manner.

E. *Nuclear measurements*

The work under this heading, which is in the hands of the Central Nuclear Measurements Bureau ([1]), acting in liaison with the national and international organizations concerned, bears mainly on neutron measurements, research on isotope standards, radioisotope counting and the manufacture of samples necessary for the measurement of nuclear constants.

1) *Neutrons*

92. Preliminary Pu 239 effective fission cross-section measurements for thermal and epithermal neutrons have been made at Saclay in collaboration with CEA physicists. The final high precision measurements will be carried out at the beginning of 1963.

Pending the installation of the CNMB's Van de Graaff accelerator, a measurements' programme has been prepared for this apparatus. The programme relates in particular to measurements of effective elastic and inelastic diffusion cross sections of materials: these measurements are of the utmost importance for assessing the neutronics of nuclear reactors. Measurements

([1]) Cf. paras. 24-26.

of the effective cross-sections of threshold reactions will likewise be undertaken. Two critical compendia of the data known on these reactions have been published. The equipment necessary for the Van de Graaff accelerator measurement programme has been designed and constructed.

The installation of the linear accelerator has been prepared by CNMB experts for whom a course was held at Saclay to enable them to follow the various stages in the construction of this apparatus. Collaboration with the group responsible for the operation of the linear accelerator at Saclay has, moreover, been extended to other fields. Work has been started on the preparations for a measurement programme for the linear accelerator.

2) *Stable or Long-lived Isotopes*

93. The study of mass discrimination in spectrometers has led to the publication of an initial series of results which will be added to in the near future.

In view of their importance from the standpoint of reactor design, work has started on the manufacture of isotope standards of stable and fissile elements (boron, uranium, plutonium, heavy water) after preliminary studies. Through the agency of the European-American Nuclear Data Committee, contacts have been established with other laboratories in order to bring about collaboration on this point and to effect a distribution of labour.

A thorough examination of the standard boron stocks used in the main western laboratories has revealed an appreciable divergence between two groups of laboratories.

A large number of analyses have been made for outside laboratories.

3) *Absolute Radioisotope Counting*

94. The latest comparisons carried out on a international plane, including those drawn between low-energy beta emitters, bear

out the high degree of accuracy attained in the absolute counting of radioisotopes. Considerable advances have been made in gas counting, liquid scintillator counting and in tritium counting.

The CNMB has carried out the preparation and distribution of solid cobalt 60 sources with a view to making a world-wide comparison under the auspices of the International Bureau of Weights and Measures.

The CNMB distributes cobalt detectors and cobalt 60 standard sources for the calibration of counting systems, a service which was organized pursuant to the recommendations of the dosimetry working group (cf. point 4).

A theoretical and experimental study has been performed on the neutron flux depression caused by cobalt detectors. Some of the results have already been published.

4) *Sample Preparation Laboratory*

95. In compliance with a resolution of the European-American Nuclear Data Committee, the Commission decided in 1961 to set up at the CNMB a central laboratory for the fabrication, calibration, analysis and distribution of samples required in the measurement of nuclear constants.

This laboratory, which started up in 1962, is engaged mainly on the preparation and precise chemical and physical analysis of samples while at the same time taking steps to bring about improvements in the methods employed.

The facilities at present at the disposal of the CNMB are insufficient for this work to be performed on the necessary scale. The service is organized by coordinating the activities of groups already in existence and by making available the appropriate metallurgical resources. Its activities are practically confined to stable elements and compounds and to alpha emitters (fissile isotopes). The usefulness of the laboratory was rapidly substantiated by the continual influx of requests for samples sent

in from laboratories in countries both in and outside the Community. These applications are far in excess of the present capacities of the Bureau, particularly with regard to personnel.

5) *Contacts with National and International Bodies*

96. In certain sectors it has been possible to bring about a certain degree of coordination as a result of regular contacts with standards bureau in the Community and elsewhere, while exchanges of staff and samples are also envisaged.

The CNMB is continuing to take part in the work of the International Bureau of Weights and Measures, and particularly of its Consultative Committee on Ionizing Radiations. It is playing an active part in the comparisons between samples and radioisotopes which are being made on the international level under the auspices of the IBWM.

Participation in the work of the European-American Nuclear Data Committee has continued to yield results both for the CNMB and for the other Community laboratories. The Committee has concentrated its attention on the problems involved in separating adequate quantities of high-purity isotopes intended for neutron measurements.

F. *Controlled thermal nuclear reactions*

97. The overall picture in the field of controlled fusion remained disappointingly static in 1962. The data available on the properties of plasmas are still insufficient for the construction of installations foreshadowing a reactor to be contemplated.

Whereas the possibilities for other applications, in the short or medium term, are taking shape, controlled fusion continues to be the main item of plasma studies. In this field, the Commission has pursued its activities along the lines indicated in the previous general report.

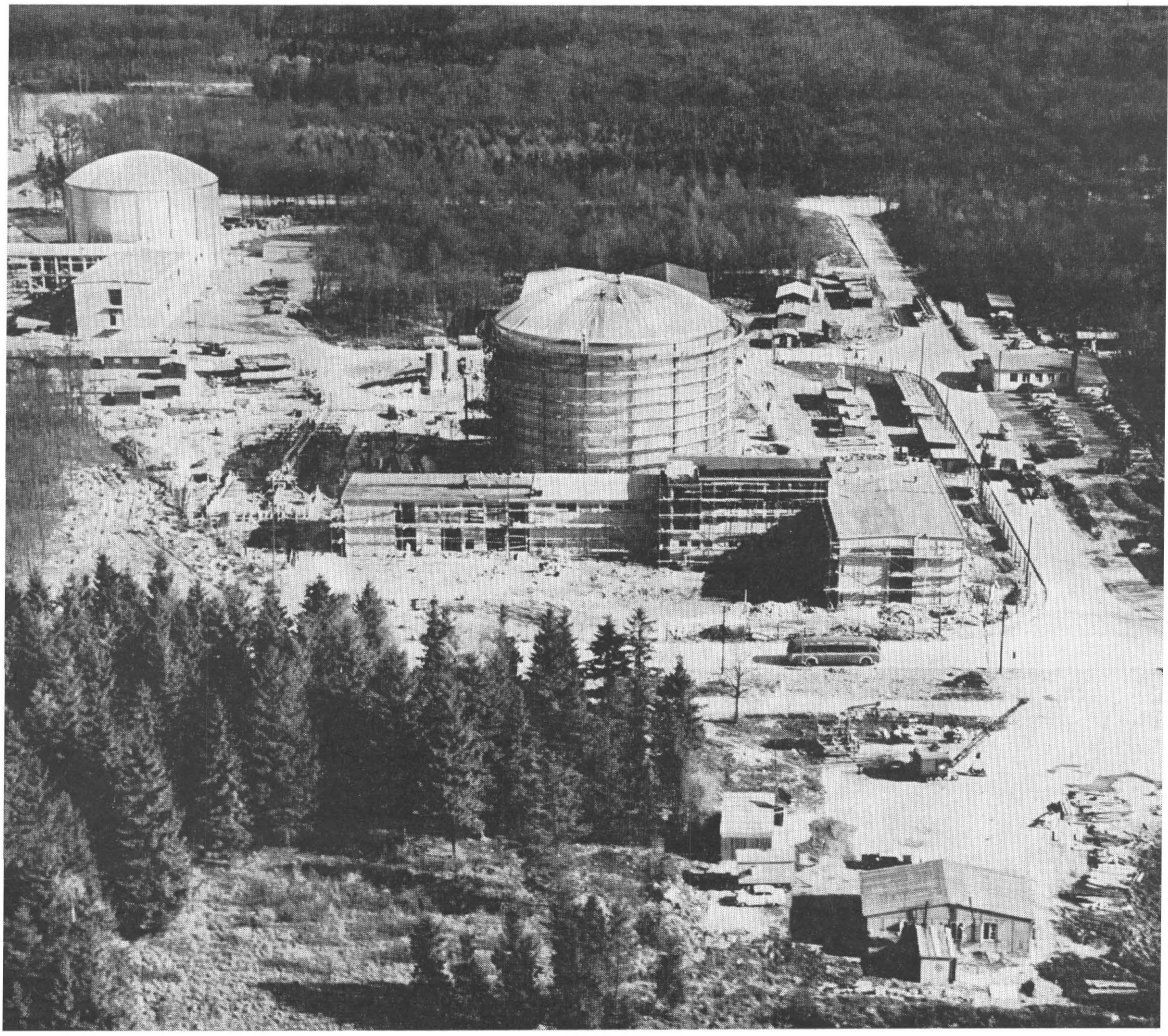
1) *Coordination of Activities and Conclusion of New Contracts of Association*

98. The contracts of association of the CEA (Fontenay-aux-Roses) and the CNEN (Frascati) have each been renewed for a period of three years, while the work undertaken at Garching is proceeding. Two new associations have also been concluded: one on 1 July 1962 with the "Stichting Fondamenteel Onderzoek van de Materie" at Jutphaas in the Netherlands and the other on 1 October 1962 with the "Kernforschungsanstalt des Landes Nordrhein-Westfalen" at Jülich (Germany).

These two contracts have been concluded for a period of three years and are renewable. They round off the network of association contracts on controlled fusion by ensuring Euratom's participation in all research undertaken in the Community. The Commission is thus enabled, with the collaboration of its associates, to coordinate the work in an entire sector of research by allocating programmes, arranging for exchanges of personnel and information and eradicating duplication of effort.

99. A *liaison group* made up of the physicists in charge of each of the associated laboratories and of representatives of the Commission was set up in 1962, holding its first meeting on 27 February 1963. This group was established in response to the wish both of the Commission and of its associates to bring about more intimate cooperation by periodical exchanges of information and by a wide-ranging discussion on the trends to be followed in the future. Later, a number of representatives of the Scientific and Technical Committee will join the group. The Commission is also preparing to arrange for small seminars on highly specific subjects to be attended by experts from the various laboratories.

A contract of association must permit comparisons between methods and habits of thought by the setting up of teams consisting of research workers of different origin and training. This aim has been achieved, as well as could be done with the available resources, in the first associations, which have yielded excellent



In the field of controlled thermonuclear reactions, Euratom has signed or renewed contracts of association with the most important laboratories in existence in the Community, i.e. at Fontenay-aux-Roses, Frascati, Garching (Munich), Jutphaas and Jülich. The photograph depicts an overall view of the Jülich plant (in the German Federal Republic near Aachen) where the research carried out is centred on the study of theta-pinch with rapid plasma confinement.

(Photograph by Rheinland Flugdienst – Düsseldorf)

results. As far as the new contracts are concerned, the limited numbers of staff will make it necessary to have recourse to scientists seconded by national bodies.

2) *Research Programme Under Contracts of Association*

a) *Theoretical research*

100. Theoretical work, which has been carried on under all the contracts, has borne mainly on the conditions governing plasma stability in toroidal and magnetic mirror devices, magnetic pinch discharges, resistive instabilities and plasma-induced shock waves. The study of these shock waves al well as of their interaction with radiations has yielded valuable results.

The theoretical groups have worked hand-in-hand with those engaged on experimental work. The Garching group has obtained a substantial addition to its facilities by the recent installation of an IBM 7090 computer.

b) *Experimental work*

This work relates mainly to pinch, magnetic bottles and continuous mirrors.

i) *Pinch*

101. At *Garching,* the study os plasma instabilities and the hard X-rays which are emitted are being continued on linear pinch devices. Using a confinement apparatus in which the magnetic field is maintained in rotation to obviate instabilities, the group set up recently at Jutphaas has studied the penetration of the magnetic field into the plasma. An improved device is under construction. The so called theta pinch devices, which can be used to obtain a shortlived plasma of high density and temperature are in current use in plasma physics research. Three devices of this type are operating at Garching and have been used to check the calculations of the theoretical group. A larger device is being prepared.

At *Frascati,* work has continued on the setting up of the CHARYBDIS experiment, a medium-scale device for the study of orthogonal pinch. The slow capacitor bank employed for the production of the initial magnetic field, as well as the two tiers of the fast bank, have been put into operation, while at the same time the study of the electric field and its effect on the initial phase of the discharge has been continued.

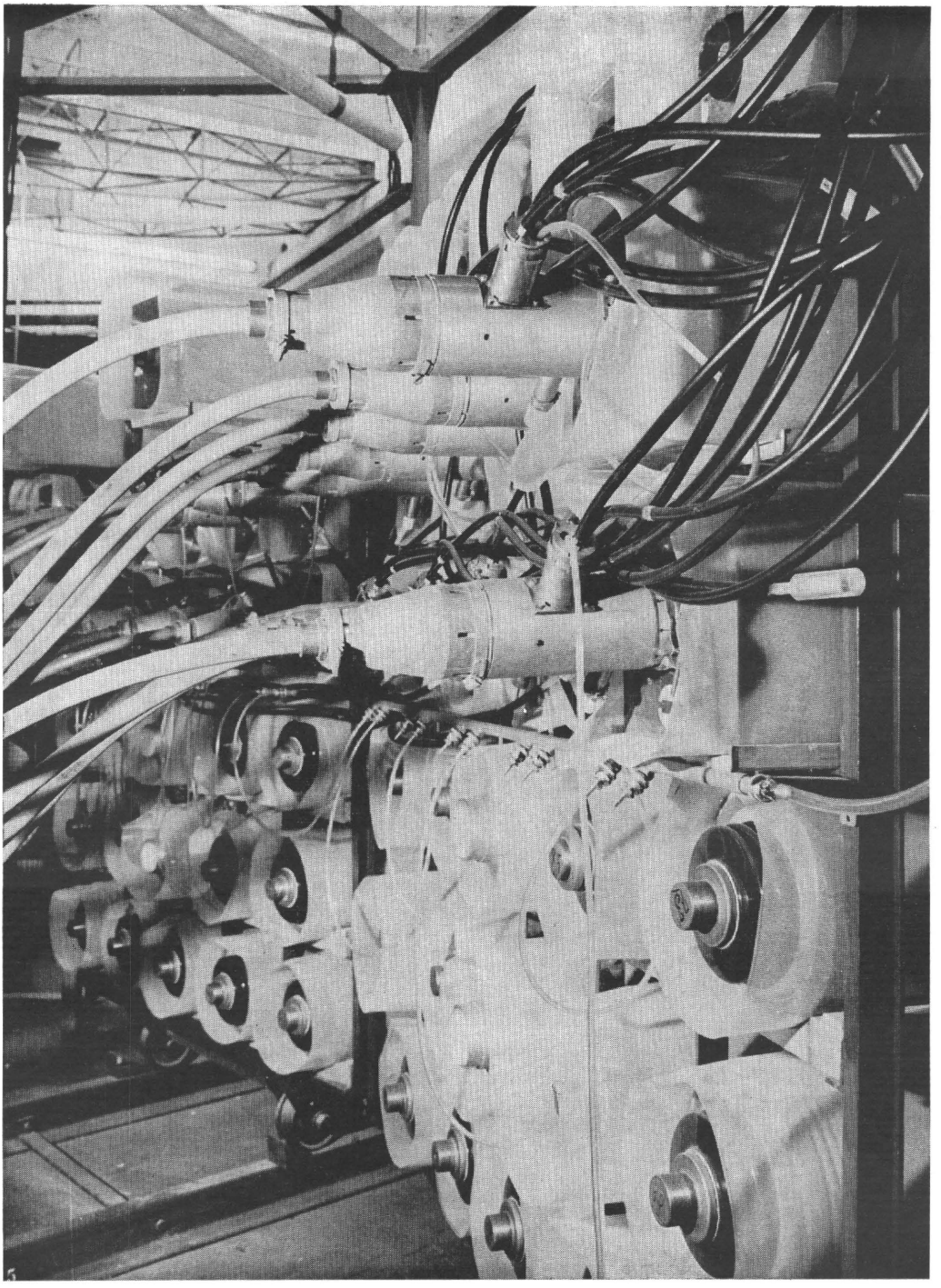
The programme covered under the new contract of association with the Kernforschungsanstalt des Landes Nordrhein-Westfalen at *Jülich* is centred on the study of theta pinch with rapid plasma confinement. This work has been carried out by means of various small-scale devices which will be supplemented shortly by a 0.6 MJ theta pinch device.

A fast tubular pinch device has been used at *Garching* for shock wave studies, while a second device of this type in operation at *Fontenay-aux-Roses* has brought about improvements in the stability conditions of a dense plasma. A larger-scale version is under construction.

The research carried out at *Frascati* on dense very high temperature plasmas has given rise to a study of methods which can be employed for the production and implosion of plasma layers. Very intense magnetic fields have been produced by implosion.

ii) *Magnetic bottles*

102. The preliminary experiments carried out at *Fontenay-aux-Roses* on the collision of two plasmas using magnetic bottles would appear to point to the existence of instabilities. In a DECA device (Dispositif Expérimental Compression Adiabatique = Experimental Adiabatic Compression Device), a considerable electron heating generated by magnetic compression has yielded results similar to those forecast by the theoretical calculations. Studies were carried out on the characteristics of plasma before compression pending the bringing into operation of a second device, which is at the moment on the point of



Euratom has signed a contract of association with the Italian Atomic Energy Commission (CNEN) for research on controlled fusion, the main item being plasma study. The photograph shows the capacitor bank of the fast theta-pinch device "Cariddi" in the ionizing gas laboratory at Frascati (near Rome).

(Photograph by CNEN)

completion. The study of the propagation of the plasma in a longitudinal or transverse magnetic field has been continued.

iii) *Continuous mirrors*

103. At *Fontenay-aux-Roses,* the first tests on the injection of fast ions in a continuous mirror device have been conducted and new methods have been investigated, while work has progressed on the study of the ion sources and the arc used for ion capture in the device.

At *Jutphaas,* measurements have been made on a plasma held in rotation by interlocked electric and magnetic fields.

Two experiments on high frequency confinement are in progress. A cusp magnetic field confinement device, now being assembled, will serve to check whether the theorists are right in thinking that stability may be possible. This work is accompanied by further activities connected with the development of a radial plasma gun.

iv) *Other research*

104. The experiments carried out by the *Fontenay* group on the interaction of ion beams with the plasma have revealed the existence of new phenomena which may lend themselves to practical uses. The basic effective cross-section measurements have been continued. At *Frascati,* the study undertaken on transition layers around the plasma has been carried on, yielding results which may be applied in practice.

The study of oscillations and the diffusion, in a magnetic field, of stationary plasma columns has also been further pursued. A new device for studying the interaction of the stationary plasma and of fast ions is being assembled at *Garching.* With regard to the production of a dense plasma, heating has been brought about by means of a second electric arc and confinement by magnetic fields. The study of shock waves set up during plasma confinement has also been continued at Garching.

G. *Biology*

The Commission's efforts under this heading have been followed up and amplified over the past year, particular stress being laid on the study of the harmful effects of radiations, without neglecting the uses to which nuclear techniques can be put in agriculture and medicine. These three fields are discussed below.

1) *Study of the Harmful Effects of Radiations on Living Beings*

105. The ultime aim is to gain a more thorough knowledge of radiation effects on living beings, with a particular view to facilitating diagnosis and to improving preventive measures and therapy for radiation injuries.

It is well known that the bone narrow, and the *heamatopoietic system in general,* play a major rôle with regard both to the acute reactions involved in irradiation sickness and to the delayed appearance of leukemia. It was therefore natural that particular attention should be paid to its study. It is for this reason that the Commission has supplemented the studies in progress on the monkey, the rat and the mouse by a systematic examination of the bone marrow pathology of these animals as well as the grafting possibilities.

The *pharmacological treatment of radionecroses* is dealt with under a research contract signed in October 1962 with the University of Strasbourg. The impulse for this work was provided by a remarkable piece of clinical detective work for which we have to thank the Medical Service of Euratom.

The *interaction of radiations with living matter* occurs in the first place on the molecular level, after which, following an inexorable chronological sequence, it appears on the biochemical level, then at the cell stage before the clinical symptoms become apparent. An overall programme for the study of radiation effects and their prevention at all levels has therefore been undertaken in association with a number of laboratories.

Special consideration is being given to *radioprotective substances and decontamination agents.* At the same time, a study has been undertaken, at various levels, of radioactive contamination itself: in man, animals, soils, plants, foodstuffs, etc.

106. The *genetic alterations* in the human species which are liable to be caused by radiations raise a problem of paramount importance. This has prompted the Commission to conclude with the Naples Institute of Genetics and Biophysics, a contract of association of considerable scope on the study of human genetics. Furthermore, the study of the mutagenesis process has been continued and amplified.

107. Recent research work has made it possible to carry out direct observations in man of *morphological chromosome alterations* which may, as is common knowledge, be triggered off by radiations. The introduction of these new techniques has unveiled a hitherto unsuspected risk by demonstrating that these alterations were bound up with a large number of fairly common disorders in human pathology. This induced the Commission to take an active interest in the problems of human cytogenetics, a field in which it has been able to enlist the services of a outstanding expert who will head a research group now being set up.

108. By reason of its inevitably fatal character, *leukemia* is one of the most awesome delayed effects induced by radiations. This phenomenon is being investigated under several experimental research projects undertaken by the Universities of Turin and Brussels in collaboration with the Commission.

2) *Uses of Nuclear Techniques in Agriculture*

109. Work under the Euratom/ITAL association has continued along the lines of the programme fixed in 1961 which, it will be remembered, was focussed on the study of isotope movements in soils, plants and animals, the use of radiations or other nuclear techniques for the improvement of crops, the conservation of foodstuffs and the elaboration of analysis methods.

The programme for the improvement of cultivated species was given concrete expression by the setting up, on the initiative of the Euratom/ITAL association, of a "Joint Mutation Breeding Group" which, headquartered at the Dutch Centre for Agronomical Research at Wageningen, incorporates the main institutes working in this field. The studies on the migration of radioactive ions in various types of soil have been continued from the experimental and theoretical angles. Work has started on the development of new types of miniature beta and gamma detectors using semi-conductors. These instruments make it possible to obtain quasi-punctual measurements, and are therefore of considerable interest to biologists. The research group took over new laboratories in January 1962.

3) *Medical Uses of Nuclear Techniques*

110. The limited credits allocated to biology under the second five-year programme restrict the resources at Euratom's disposal for the study of the uses of nuclear techniques in medicine. Such applications, however, open up a number of promising vistas in all fields of medicine, with particular reference to cancer. The Commission therefore expresses the hope that the Member States themselves will forge ahead with research projects of their own in these vital areas.

H. *Radioisotopes with Marked Molecules*

1) *Preparation and supply of Marked Molecules*

111. The programme launched in 1961 for the preparation and making available to users of rare marked molecules and for the improvement of the conservation processes employed was pursued in 1962. Altogether, 33 research and supply contracts relating to over 100 new molecules have been concluded or are being drafted. The Commission thus enables laboratories already engaged in the preparation of certain non-commercial molecules to improve their techniques and to produce a quantity in excess of their own requirements which is then put at the disposal of any user.

As the preparation of these molecules progresses, the potential users are kept informed of the new molecules available and the terms on which they may be obtained by means of notices in the Journal Officiel of the Communities as well as by circulars.

Arrangements are being made for a colloquium on the preparation and storage of marked molecules, which might be held in 1963.

2) *Isotope Production*

112. At the present time, the radioisotopes prepared in the Community are still so few in number that requirements have to be met by imports. The Commission has therefore been prompted to conclude or negociate three contracts bearing on the elaboration of original preparation techniques or on the improvement of existing methods to permit laboratories within the Community to set about the production of certain particularly important isotopes. Further studies have, moreover, been made on new applications of a number of radioelements and on certain problems of intense radiation chemistry and physics. These studies will be continued in 1963. A survey is now under way in the Community on the current possibilities for the use of intense sources. The conclusions arrived at will serve as the basis for a possible contribution by the Commission to the development of these uses.

113. It is well known that the irradiated fuels unloaded from a reactor contain numerous highly active fission products, some of which may be recovered for uses in medicine, industry of research. To bring about the development of economical recovery methods, two research contracts, each relating to caesium 137 and strontium 90 extraction, have been concluded with specialized laboratories within the Community. The Commission's two partners, which will attempt to arrive at the same goal along different avenues of approach, form part of a liaison group set up on the initiative of the Commission to smooth the way for the coordination of research and the exchange of information.

Finally, contact has been made with the British centre at Amersham with a view to coordinating the Commission's activities with those projected by the UKAEA. It is planned to arrange for regular contacts between those in charge of the two programmes.

⁂

Activities dealing with the *industrial applications* of radioisotopes and radiations are described under paras. 191-194 of the chapter on Industry and Economy.

I. *Scientific Information (CETIS)*

1) *General Considerations*

114. In 1962, the activities and abilities of CETIS were realigned in order to give top priority to the task of meeting the concrete requirements which the Community will make in the near future :

The satisfaction of these needs as well as calling for

— *specifically nuclear requirements* stemming from various Euratom teams as well as from other bodies and Member States in the Community.
The satisfaction of these needs as well as calling for the services of the majority of the available staff, has increased the use of machines, which several teams are now operating. Although its fundamental purpose is production, CETIS is nevertheless still engaged on important research activities bearing mainly on computation methods and the optimum use of computers. The coupling of analog and digital computers, a technique developed at Ispra, has now been taken over by numerous centres in Europe, the US and Australia;

— the *other requirements* stemming from the automation of the work of various groups in the European Institutions. This relates, in particular, to the conventional fields of

automated management procedures (stores, personnel, budget, contracts, etc.). It concerns also the machine-processing of ever-increasing quantities of printed matter (scientific, legal, administrative, etc.) in various languages. A final item under this heading is the handling of statistical data connected with all aspects of economic and social life, which information is vital to the Community's directing bodies.

2) *Equipment of CETIS*

115. To satisfy all these demands, CETIS has at its disposal a large-scale complex of computing equipment made up as follows:

a) analog equipment comprising three PACE 231 R type computers controlled by an ADIOS installation and an IBM 026 together with its auxiliaries (recording gear, repair outfit, etc.);

b) digital equipment comprising an IBM 7090 provided with 16 magnetic tape units, an IBM 1401 and an IBM 1620.

This is supplemented by a complete standard outfit of punched-card and punched-tape equipment, two magnetic disc units and an IBM 1401, which are on hire.

3) *Computation and Computer Utilization*

116. The increased use of Ispra's computers in 1962 has called for the acquisition of more equipment, so that extra magnetic tape units, a new IBM 1401 and an additional PACE 231 R analog computer have been installed. Trials habe been carried out with a data transmission hookup between Ispra and Brussels with a view to linking up the CETIS computers with an IBM 1401, which has been ordered for Brussels in agreement with the Euratom Information and Documentation Centre [1] and the Joint Statistics Office. The increased demand has made it necessary for an extra half-shift to be worked as from 15 September 1962.

[1] Cf. Chapter II, paras. 138 to 147.

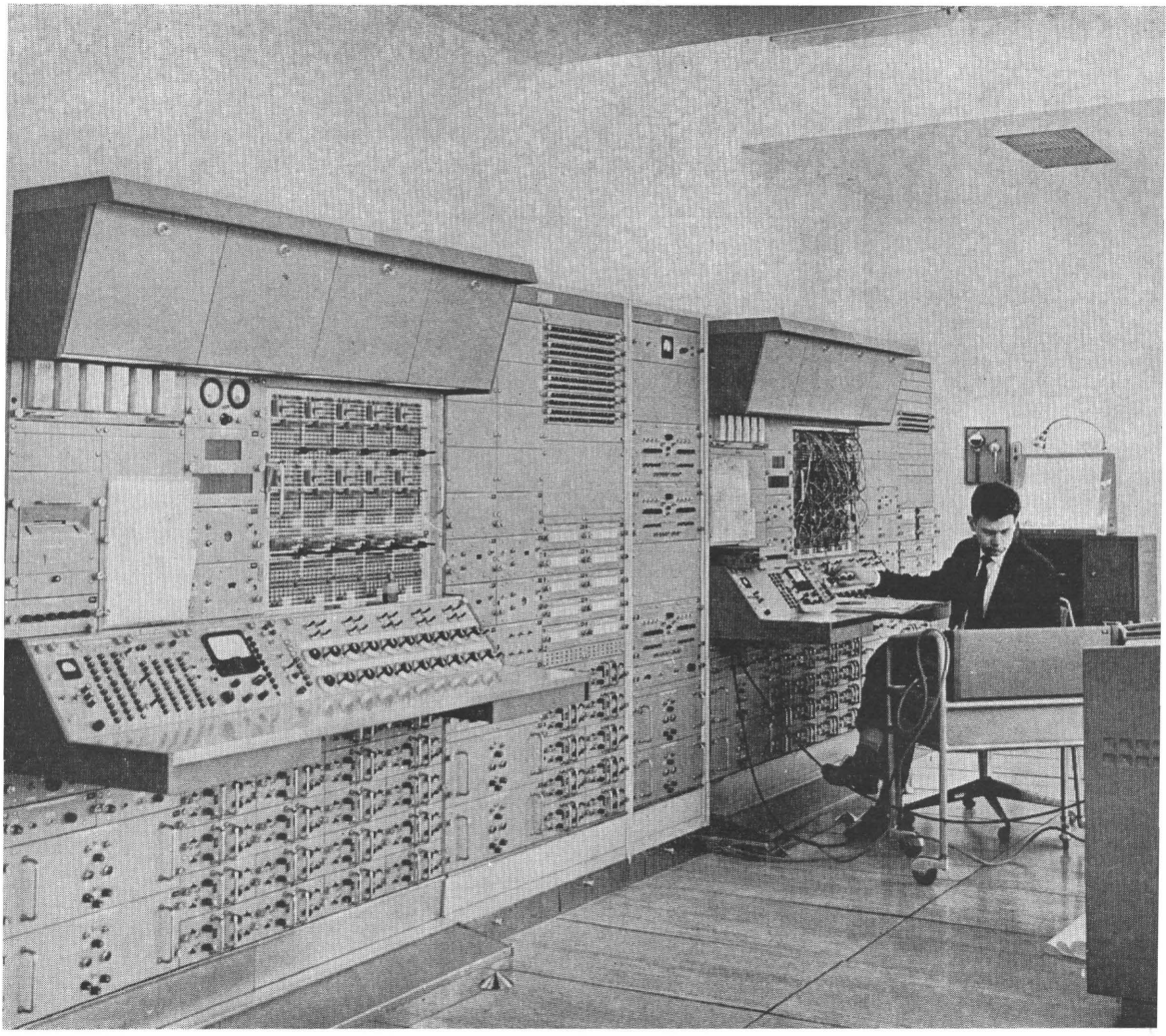
As a result of proposals which the Commission put before the OECD's European Nuclear Energy Agency, the idea of setting up a European Nuclear Programme catalogue at Ispra has been explored. CETIS is taking part, on Euratom's behalf, in the work of the panel of experts which is to submit concrete proposals to the Agency by 1 June 1963.

4) *More Specific Activities*

117. The main task is to satisfy the demands of a more specifically nuclear nature mentioned above (para. 114) by work which relates fundamentally to reactor calculations and which consists in setting up the programmes and performing the calculations on analog and digital computers. Mention should likewise be made of various numerical analyses and economic evaluations as well as the automatic interpretation of experimental data.

In the field of *language research,* CETIS has pruned its theoretical activities in order to concentrate on French-German translation and on the exploitation of the Russian-English programme evolved by the American team at Georgetown University. Furthermore, at the request of the terminology bureaux of the three European Communities, extensive studies have been carried out on the question of providing mechanical aids to translators.

In the field of *automatic documentation,* the trend followed by most of the studies has hinged on the immediate requirements, on the one hand, of the Euratom Information and Documentation Centre and the library of the Ispra Centre, and on the other hand, of various departments of the other Communities. In particular, considerable efforts have been expended on the practical level in the conversion of the various information aids resorted to by documentalists and librarians (punched tapes and cards). As a result of the wide experience which it has gained in this field, CETIS was invited by the International Documentation Federation to organize a colloquium on the subject at Ispra.



Any nuclear installation requires electronic equipment. Euratom's Scientific Data Processing Centre at Ispra now has at its disposal a considerable complex of equipment for both analog and digital computation. The photograph shows a CETIS mathematician next to an analog computer.

(Euratom photograph)

5) *Other Research on Scientific Information*

118. Major projects have been devoted to computer and computability theory on the basis, firstly, of the new possibilities which seem to be opening up for numerical analysis and, secondly, of the requirements of analog-digital coupling, the static version of which (APACHE code) is now being distributed and used in numerous computer centres in Europe and the USA and as far afield as Australia.

J. *Other research*

The research activities discussed below cover nuclear physics, mineralogy and geochemistry, isotope geology, direct conversion and magnetic resonance.

1) *Nuclear Physics*

118bis The projects already launched in this field have been carried on both at Ispra and in the Italian laboratory affiliated to the Istituto nazionale di Fisica nucleare (INFN). It will be recalled that the work undertaken by these laboratories on low-energy nuclear physics is covered under a contract of association concluded in 1960 between the Commission and the Italian Atomic Energy Commission (CNEN) aimed at the coordination of the research carried out by the INFN.

a) *Studies carried out at Joint Centre*

119. The projects pursued at Ispra have been mainly concerned with the study of polarized neutrons. An experimental device capable of producing an intense polarized thermal neutron beam has been developed and set up in a channel of the ISPRA 1 reactor. This device can be used to polarize neutrons by critical reflection on a cobalt alloy mirror placed in the air gap of an electromagnet. It will be used for a series of experiments on the electromagnetic transitions of the nuclei produced by neutron capture and for the study of other types of nuclear interactions.

After the installation of this device, preliminary experiments were performed to measure the intensity of the reflected beam as a function of the magnetic field. This spadework will permit the various departments concerned to set about their experimental programme in the coming months. A complete outline of the work was given at the conference held at Padua last September on direct interactions and the mechanism of nuclear reactions.

Furthermore, the experiments performed by the Nuclear Chemistry Department for the study of the Be^7 (n, gamma) He^4 reaction have been completed and the results are to be published shortly.

b) *Contract studies*

120. The Italian laboratories affiliated to the INFN have continued their work along the lines of the programme delineated in the last general report. The Milan and Florence groups have studied certain effective cross-section fluctuations forecast by theoretical calculations, while effective cross-section measurements have been carried out at Milan and Catania of reactions triggered off by neutrons of different energies. The Catania group has, moreover, studied several reactions produced by protons and deutons.

Extensive research projects on nuclear spectroscopy have been pursued at Naples, Bologna and Padua.

Several experimental techniques developed at Padua and Trieste have made it possible to study on helium the elastic diffusion of neutrons with energies ranging from 3 tot 15 MeV and the polarization effects produced by these particles. Photonuclear reactions have been covered under extensive studies carried out by the Genoa and Catania groups.

Finally, a considerable effort has been directed at the finalization of the experimental plant at the scientists' disposal. The main items of equipment are an electrosynchrotron, betatron, five Van de Graaff accelerators, eight small accelerators for the

production of neutrons and a small research reactor. This reactor, which is located at Palermo, is fitted out with an oscillator constructed at Ispra by Euratom personnel.

2) *Mineralogy and Geochemistry*

121. The mineralogy and geochemistry at Ispra has continued to make satisfactory progress. The main programmes in 1962 comprised, on the one hand, the study of the alkaline carbonatite massif of the Kaiserstuhl in Germany and, on the other hand, prospecting for beryllium and the study of beryllium geochemistry in Norway. Pursuant to the decisions of the Council of Ministers this group will in future direct its attention at research on the materials involved in the second five-year programme.

a) *Kaiserstuhl study*

122. The first of these programmes has embarked upon phase II involving the laboratory study of samples obtained in the course of prospecting work undertaken in 1961. The results of this prospecting and the use of modern analytical techniques should make an important and original contribution to the data available on the geochemistry of the rocks studied and on the mechanism governing the concentration of elements such as niobium, the rare earths, uranium, thorium and strontium.

The salient items of this programme include a detailed mineral-petrographical study on the silicate and carbon tite rocks of the Kaiserstuhl area, the study of the geochemical distribution of a large number of elements by means of techniques such as X-ray fluorescence, optical spectrography and gamma spectrometry, together with a statistical study of the geochemical data and correlations.

A publication will later be put out dealing with all these projects, including the results of the on-site surveys.

b) *Prospecting and the study of beryllium geochemistry*

123. The second programme, devoted to beryllium prospecting and geochemistry studies, was undertaken as the result of an

official request by the Norwegian government. After the development of laboratory beryllium analysis methods, a preliminary survey carried out in the Oslo region yielded, in spite of its limited duration (one month), a number of interesting results. At a depth of a few metres, contact deposit type mineralization was discovered by combined magnetic and geochemical measurements. Furthermore, a preliminary geochemical survey over an area of 6000 km^2 made it possible to demarcate the most favourable zones, which will be prospected in detail later.

c) *Other work*

124. The Lake Maggiore sedimentation study has been continued in conjunction with the Ispra Centre's radioactive waste processing group.

Recent technical improvements introduced in both methods and equipment have given rise to several patent applications, the most important of which concerns an X-ray fluorescence analysis self discrimination system.

3) *Isotope geology*

a) *Overall organisation of work*

125. The Commission's activities in this field have been carried out under a *research contract* concluded in February 1962 with the Bundesanstalt für Bodenforschung, Hannover, and a *contract of association* involving the participation of the Community, the free University of Brussels and the Italian Atomic Energy Commission (CNEN).

These two contracts, each concluded for a duration of three years, were terminated by the Commission in January 1963, since the second five-year programme contained no credit appropriation for geological research.

The space of time which elapsed between the signing and the cancellation of the contract sufficed only for the Bundesanstalt für Bodenforschung to prepare the ground for the launching of the programme envisaged. With regard to the above-mentioned

three-cornered contract of association, the main effort has been focussed on the building up of both personnel and equipment in order to create favourable conditions for the inception of the jointly agreed programme and to ensure the immediate implementation of the facilities already available. As far as the first point is concerned, both the staff and the equipment have been virtually doubled so that by the end of 1962 a complex of apparatus unique in Europe was available ([1]).

Such good progress had been made with the setting up of the scientific and technical team provided for in the contract that by the end of 1962 the personnel had doubled as against the previous year's figure. When the contract was cancelled, the staff amounted to 54 persons: 25 university-trained scientists; 24 qualified technicians; 5 administrative employees.

b) *Research results obtained in 1962*

i) *Geological age measurements*

126. Several hundred samples dated by radioactive techniques have shed considerable light on the geological problems tackled (rocks from the Hoggar — Lower Congo — East Antarctica).

A large number of original and often unexpected results have been obtained on the granite massifs of the Alps and the Himalayas.

ii) *Studies on atmospheric natural and background radioactivity*

127. A large scale measurement and calculation programme has been carried out on the results gained from the Belgian Antarctic expeditions of 1958 and 1960. These studies have

([1]) i.e.:
- 7 mass spectrometers of various types to deal with the entire range of requirements in isotope geology;
- several very low-level radioactive counting installations, one of which is used for natural carbon 14 and tritium measurements and
- the highly specialized chemistry and radiochemistry laboratories attached to these installations.

been mainly concerned with the distribution of fission products and natural radioactive elements (radon, thoron and radium) in those parts of the globe where natural background radioactivity is at its nadia: the Antarctic Ocean and Continent.

iii) *Antarctic Programme*

128. Studies have been continued on the samples obtained in January 1960 at the time of the CNEN/Euratom drilling operation and the 1958-1960 Belgian Antarctic expeditions.

A continuous profile reaching down to a depth of 16 metres below the snow has now been exhaustively studied and the following measurements have been carried out:

— variations in oxygen and hydrogen isotope composition;
— mineral salt contents;
— distribution of fission products stemming from nuclear explosions.

Various studies have been initiated on suspended matter and extra-terrestrial particles.

iv) *Natural variations in the stable isotopes of oxygen*

129. The variations in the isotope make-up of natural waters (precipitations, surface waters and waters deep below the surface) have been covered by systematic studies. With the particular object of obtaining data on the climatic and geographical conditions of the Mesozoic, an advanced study has been carried out on the problem of measuring paleotemperatures using the technique based on the oxygen isotopes contained in calcareous shells. The premises underlying this method were reexamined in the course of a study concerning variations in the isotope composition in current species obtained from the Banks of Newfoundland and living in clearly determined climatic conditions.

4) *Direct Conversion*

The direct conversion section at Ispra has proceeded with the study of methods for the direct conversion of heat of nuclear

origin into electricity. The main activities have consisted in preparing the ground for experiments connected with the design of thermionic converters. Only theoretical work has been carried out in connection with the magnetohydrodynamic generator.

a) *Thermionic converters*

130. The installation of the design and construction laboratories for thermionic converters has been more or less completed and two research programmes are in progress.

The in-pile test programme covers the construction of nuclear-heated caesium cells, the study of the operation of these cells in a vertical channel of the ISPRA 1 reactor and their post-irradiation examination. The first cell, having a mixture of highly enriched uranium carbide and of zirconium carbide as an emitter, is under construction.

In the out-of-pile test programme, caesium cells are being constructed for the study of the physical properties of thermionic converters. The nuclear heat source will be simulated by electron bombardment.

b) *Magnetohydrodynamic generator (MHD)*

131. Theoretical work has been carried out to see whether the principle of the MHD generator is applicable to a reactor of the DRAGON type [1] running, however, at a higher temperature.

Normally, a gas temperature of over 2000°C is necessary to obtain sufficient ionization. The first result gained from the theoretical studies, however, shows that in certain special conditions adequate ionization can be obtained with a reactor outlet gas temperature ranging from 1200-1500°C. The same results were arrived at independently in the United States at exactly the same time. The Commission does not, however, have at its disposal enough personnel or funds at the present time to check these results experimentally.

[1] Cf. paras. 41-43.

5) *Magnetic Resonance*

132. This group, set up at Ispra at the end of 1961, now contains three teams which deal with electronic resonance, nuclear magnetic resonance and impulse methods respectively.

In conjunction with the chemistry department, the first team has studied the radical ions of the ortho-, meta- and para-terphenyls. The hyperfine structure of the spectra has been completely resolved and has yielded detailed data on the structure of the radicals.

In the field of nuclear magnetic resonance, a study has been launched on the molecular structure of terphenyl fragments.

The impulse methods team has studied proton relaxation phenomena in radical solutions as a function of concentration and temperature with a view to subsequent application of the dynamic polarization of the nucleus for amplifying signals in high-resolution nuclear resonance. This work has been focussed on the improvement of the technical measuring possibilities.

Now that the group has moved into a part of the building which it will occupy finally, it has been possible to bring three spectrometers into temporary operation. Two other spectrometers and a helium liquefying plant cannot be installed until the completion, anticipated for the beginning of 1963, of the whole building and of a laboratory intended for constant temperature studies.

IV. Training and Instruction

In 1962, the Commission's activities have been carried on along different lines all aimed at the creation of the scientific cadres vital to the development of the Community's nuclear industries and research centres. In the first place, Euratom organizes and finances training schemes and courses for student trainees and visiting scientists desirous of rounding off their previous training either at Euratom or at centres belonging to

the Member States. In the second place, the Commission is making plans for a standardization of the diplomas awarded to nuclear technicians. Finally, the French Government recently put forward a proposal concerning the setting up of a technical and scientific training centre.

1) *Student Trainees*

133. The organization of university-level and technical training courses has been continued. Although, as in previous years, the majority of the trainees have been absorbed by public and private research centres in the Member States, the consolidation of the establishments at Ispra and Geel has enabled the Commission to double the number of posts available in its own establishments in relation to the preceding year.

The training courses held under the auspices of Euratom cover an extremely comprehensive range of specialities : mathematics, scientific and automatic documentation, physics, chemistry, biology and all branches of engineering. The year 1962 was marked by one innovation in that trainees interested in the problems of power reactors were enabled to work on the sites of power plants constructed in Italy within the framework of contracts of participation under the US/Euratom agreement.

In 1962, 319 applications were received and 250 courses organized.

The student trainee schemes are primarily intended for nationals of the Member States. Under agreements for cooperation concluded with several non-member states, however, or even beyond the framework of any particular agreement, the Commission has agreed to take a small number of nationals of non-Community states such as the United Kingdom, Austria, Norway, etc.

The work performed by the trainees has in general been highly satisfactory and has justified the Commission in awarding to the majority of them a bonus in addition to their lump-sum monthly allowance.

2) *Visiting Scientists (Stagiaires qualifiés)*

134. These courses, which are designed to enable research scientists who have already completed their training to acquire practical experience during a stay in a Joint Centre establishment or by working together with a scientific team of one of the Commission's contractors, have been amplified. The courses held in 1962 related to the equivalent of 80 trainees for a full year.

Apart from their intrinsic value, these courses have enabled various Euratom departments, in many cases, to play host to eminent visitors for substantial lengths of time.

The Commission will, however, be compelled to make serious cuts in this programme as a result of the very stringent budgetary limitations imposed for 1963.

3) *Standardization of Diplomas*

135. The Commission has carried on with its task of standardizing nuclear training programmes for engineers and technicians. These programmes relate, in the first stage, to radiation hygiene, radiochemistry, isotope technology and, in the near future, nuclear instrumentation and regulation as well as reactor technology and operation.

If the training institutes in the Six undertake of apply these programmes in line with hard-and-fast procedures (uniform time-tables and curricula), it will be possible to harmonize nuclear training on the technical level. An information pamphlet will be distributed to existing technical institutes in order to put this first stage into concrete shape.

4) *Training of Experts*

136. The French Government recently submitted to the Commission a proposal for the creation, within the framework of the Joint Research Centre, of a European Institute of Nuclear Science and Technology which would be responsible for providing specialized training in the fields referred to in Article 9 para-

graph 1 of the Treaty. For this purpose the French Government has offered to put at Euratom's disposal, to serve as a basis, a considerable proportion of the resources and facilities possessed by the Institut National des Sciences et Techniques Nucléaires (INSTN), which has been in existence at Saclay since 1956. This Institute possesses a wide range of equipment for specialized scientific training the most important items of which are the 100 kW reactor "ULYSSE", the subcritical assembly "URANIC", a reactor simulator and a SAMES-type particle accelerator. The existence of the INSTN at the Saclay centre makes for the smoother operation of the Centre at the same time as providing a stimulus for its students.

The Commission is now in the process of examining this proposal.

***

The European University

137. At the meeting held in Berlin in November 1962, the Parliamentary Commission on Research and Culture reaffirmed the value of the scheme for setting up a European University, which has been dealt with at greater length in the Commission's previous General Report.

CHAPTER II

DISSEMINATION OF INFORMATION

CONSOLIDATION OF THE INFORMATION AND DOCUMENTATION CENTRE (IDC) — DEVELOPMENT OF SEMI-AUTOMATIC DOCUMENTATION PROGRAMME — STEPPED UP TEMPO OF PUBLICATION AND INITIAL RELEASE OF INFORMATION — DISSEMINATION OF INFORMATION POLICY — INCREASE IN THE NUMBER OF PATENTS FILED ON BEHALF OF EURATOM — INITIAL WORKING LICENCES — BASIC PATENTS AND KNOW-HOW — UNIFICATION OF INDUSTRIAL PROPERTY RIGHTS IN THE COMMUNITY

I. Activities of the Information and Documentation Centre (IDC)

138. The Information and Documentation Centre (IDC), which was up in 1961, is responsible for activities relating to documentation, publications and libraries. During 1962, it was able to introduce a scheme of organization more in line with its requirement and its structure was modified accordingly. Suitable candidates were able to be recruited for all the news positions created for 1962, and thus the scheduled ceiling of 88 employees was reached. The most noteworthy increase was in the Documentation Section, for which several experienced scientific and technical information officers were engaged at the beginning of 1962, in particular, as additions to the team of analysts engaged on the "memory-storage" of information.

139. The *Consultative Committee on Information and Documentation,* composed of experts from the six Member States who have been appointed in a personal capacity on account of their knowledge

of documentation and information problems, confirmed the appointment of Professor E. Pietsch as Chairman and Professors Balbis and Boutry as Vice-Chairmen.

Encouraging decisions were taken by the Committee concerning the IDC's work schedule, special backing being given to the project for the construction of an electronic memory for the storage of information and the use of this information in accordance with methods to be elaborated in conjunction with the European Scientific Data Processing Centre (CETIS), operating at Ispra (1).

Two meetings were held of the *working group of the heads of documentation services of the national nuclear centres,* set up in 1961 on the recommendation of the Consultative Committee.

The particular importance of this Working Group stems from the fact that its collaboration has resulted in a rational distribution of the work between the IDC and the national centres. Thus in the longer term, the services supplied to users in the Community will be able to be constantly improved by striving for maximum efficiency from the available resources.

Such a programme requires above all a thorough understanding by each party of the others' working conditions. Here the specialized nuclear libraries of the Community, each of which has its own specific tasks to fulfil in order to satisfy the needs of its users, have a major contribution to make. In an effort to bring about closer cooperation between them, the head librarians met for the first time to discuss common problems and consider possible solutions.

140. In the field of international relations, cooperation with the documentation departments of the USAEC continued. Details of the current programme for the memory-storage of information were supplied to both the USAEC and the UKAEA in view of its possible interest to these two institutions, which have not as yet engaged in any similar activity.

(1) See Chapter I, nos 114 to 118, and no 147 of the present Chapter.

The Euratom Commission followed the example of the two other European Communities and became a member of the International Federation of Documentation.

It has also, for the purposes of linking up with the international loan network, applied for membership to the International Federation of Library Associations.

With regard to the Transatom Bulletin (a monthly bulletin providing information on the availability of translations of documents relating to the nuclear field which are published in languages with which the Western reader is largely unfamiliar), collaboration with the European Translation Centre at Delft was intensified and the possibility of a link-up brought nearer.

Finally, the Commission was invited to participate in "International Cooperation in Information Retrieval among Examining Patent Offices" (ICIREPAT) in view of the special interest shown by the member countries of this organization in matters relating to the electronic storage of data.

A. *Documentation*

141. The work of the Documentation Section was stepped up considerably in 1962. To the two existing groups, Bibliographical Information and Documentary Analysis, was added a third, Documentary Sources, whose function is to establish contacts with the national documentation centres which do not specialize in the nuclear field but are able to provide additional information essential in many cases overlapping this field.

1) *Bibliographical Information Service*

142. The Bibliographical Information Service, set up in 1960, continued its activities, while at the same time branching out into new fields. A total of 204 documentary research operations were carried out in 1962.

Since the IDC does not yet possess modern equipment such as the electronic unit discussed below, the research must be conducted by traditional methods which are less rapid. In the meantime, therefore, it has been necessary, for this service, to confine itself to meeting requests from the Joint Research Centre, other departments of the Commission and contract-holders.

The Bibliographical Information Service has taken steps to increase its own resources, in particular by the purchase of card-index systems systematically covering all the literature in fields of major interest.

There are, however, numerous fields which, although only slightly related to nuclear technology, are of interest in special cases. An inventory of the appropriate information centres has been drawn up in order to make the literature available in these fields easily accessible. It is further planned to incorporate this inventory in the electronic memory.

2) *Documentary Analysis and Programming of the Electronic Memory*

143. The great handicap in documentary research carried out manually is slowness and this drawback can only be mitigated by the use of automatic or semi-automatic methods.

In view of the wealth of existing information and the rapidity with which further information is being accumulated, the Commission has decided to make use of an electronic memory and to order the necessary equipment.

This equipment, which will be available around the end of 1963, will be operated jointly with CETIS (European Scientific Date Processing Centre). The time-saving thus afforded will enable the IDC to supply information of use not only to the Commission itself, but also to the national centres and private industries in the Community countries. It is this last consideration which constitutes the main justification for the substantial outlay entailed by this project.

At the time of writing, it is difficult to assess the possible output in terms of exact figures, but work divided up among the national documentation centres having no electronic equipment to assist them would probably require much higher expenditure and far more skilled manpower.

In order to be able to use electronic equipment, a system must be worked out by means of which each item of information can be labelled both succinctly and accurately. Such a system, based on a restricted number of keywords, has been devised. The main effort, therefore, is now being concentrated on the "translation" into keywords of the considerable amount of existing information, which can then be stored in the electronic memory when required.

This apparatus will replace some of the punched-card equipment now in operation at the IDC. It will be used not only for scientific and technical documentation, but also for overcoming various administrative problems and for processing numerical data for the Joint Statistics Service of the European Community.

B. *Publications*

1) *The principles underlying the Dissemination of Information derived from the Community's Research Programme*

144. The discussions with the competent bodies of the Council on the elaboration of a policy for the dissemination of information obtained from the Research Programme have been concluded. A final statement will be issued by the Commission in April 1963.

This policy is based on the following principles :

The Commission must maintain a balance between its desire to allow the information it obtains to be released rapidly and in full and its anxiety not to compromise the smooth progress of its research work by divulging results prematurely.

Before the result of a particular piece of research can be made public, its reliability must be ascertained in order to avoid

damaging the reputation of the research worker concerned or the standing of the Commission itself and it must be sufficiently accurate and complete to obviate errors on the part of anybody who may use it. It is also advisable to ensure that premature disclosure of such results does not allow "outsiders" to exploit them solely for their own profit, before the Commission, can do so with the result that the Community is denied the final results.

As regards publications, the Commission complies with the procedure followed in the large national centres. It publishes with as little delay as possible basic scientific information and information of humanitarian interest such as that obtained in the field of medicine and biology. Publication takes various forms, such as Euratom reports, articles in periodicals issued by the Commission or in scientific journals, papers read at congresses, conferences, symposia, etc.

On the other hand, information of possible industrial use can only be published if this is not liable to affect Community's nuclear industries to priority of use.

Accordingly, a procedure has had to be introduced for communicating such industrial information (detailed reactor projects, fabrication processes, plans, technical designs, etc.) to Member States and to persons and enterprises in the Community in conformity with the spirit of Article 13 of the Treaty.

This information is distributed to persons and enterprises in the Community who have a legitimate interest in acquiring it and undertake to treat it as confidential material. The decision as to what is a legitimate interest lies with the Commission, which for the distribution of such information calls upon the services of national correspondents. In addition to the issue of documents and the organization of technical meetings, colloquies and exchanges of personnel, contacts between research and industrial workers, etc., are arranged specially and solely for Member States and for persons and enterprises in the Community.

Information of an industrial nature is only communicated to non-Member-States or institutions in non-Member-States if this

is in the general interest of the Community in that it falls within the scheme of exchanges of mutual benefit.

2) *Non-Periodical Publications and "Communications" (Article 13 of the Treaty)*

145. A total of 106 reports were published by the Commission during the period from 1 January 1962 to 28 February 1963. A list of these reports is given in Annex IV to the present Report and forms a supplement to the list in appendix to the Fifth General Report, which recapitulated all the publications dating back to 1958.

Since the Commission's final statement to the Council on policy governing dissemination of information is not due until April 1963, the first "Communications" (Article 13 of the Treaty) were made in line with a provisional procedure, with the representatives of the Members States acting as intermediary, pending the appointment of national correspondents. By means of this provisional procedure, as many as 66 "Communications" had been issued up to 28 February 1963.

3) *Periodical Publications*

146. The Transatom Bulletin, the Quarterly Digest and the Euratom Bulletin all continued to meet with a favourable reception.

It will be recalled that the Transatom Bulletin, which appears monthly, lists translations, either existing or in the course of preparation, of scientific and technical documents published in Slavonic and Oriental languages and provides information as to how copies can be obtained. Publication of this periodical was considerably rationalized in 1962 by the introduction of a punched-card and punched-tape system. As a result, recapitulative indexes can now be compiled at extremely short notice and are thus of infinitely greater practical value. Altogether, H 6032 references were published in the Bulletin in 1962.

The *Quarterly Digest,* a review of the reference type which traces the progress of the Euratom/US Joint Research and Devel-

opment Programme, is now in its second year. It is, however, likely to cease publication as an independent journal, and will be incorporated in the two-monthly periodical Euratom Information mentioned below.

The Euratom Bulletin, a quarterly review covering certain aspects of the peaceful uses of nuclear energy and the activities of the Commission in a form designed for the non-specialized reader, has successfully entered its second year of publication.

The impressions of these three periodicals are 1200, 1750 and 7600 copies respectively.

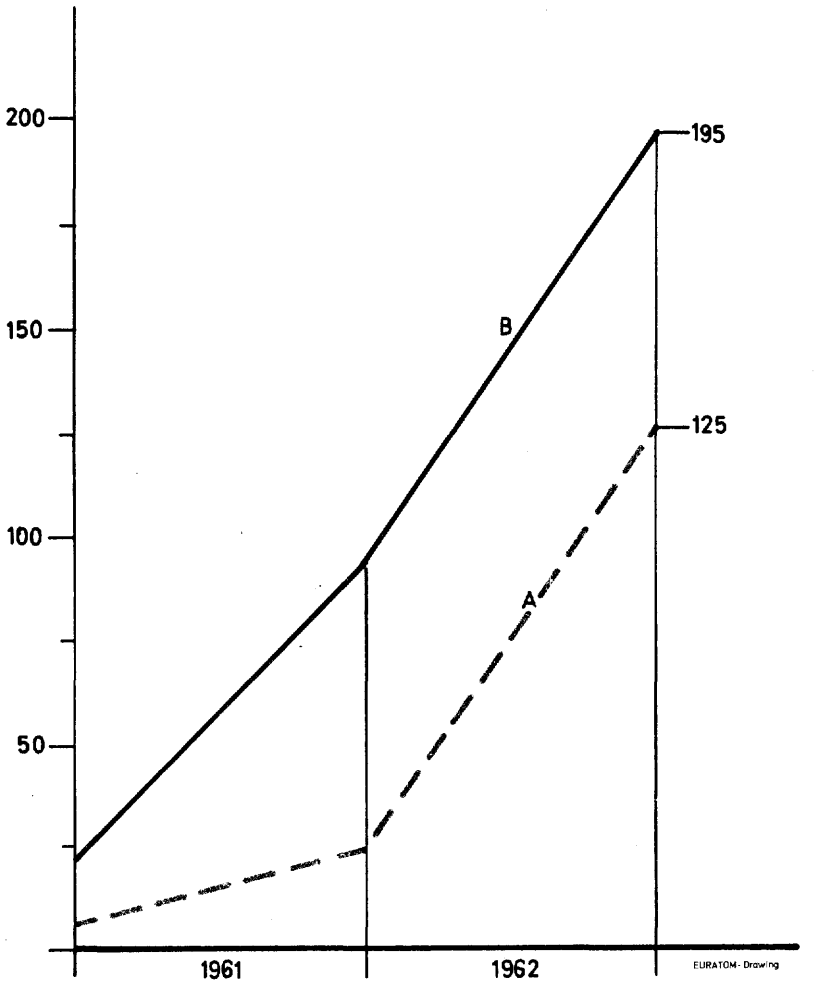
It has also proved necessary, in view of the growing number of scientific and technical publications put out by the Commission, to issue a two-monthly periodical, *Euratom Information,* for the benefit of the specialized public. The first number is due to appear in April 1963. This review will set out the broad lines of the research programme, the subjects of contracts and particulars of non-periodical publications and patents stemming from the programme, furnishing the reader with summaries of these documents and the customary references.

C. *Libraries*

147. Libraries constitute an important medium for promoting the internal dissemination of information throughout the various departments and establishments of the Commission, whose constant concern is the ensure their smooth operation.

Since 1961, the IDC has had on its staff a specialist with responsibility for coordinating the activities of the libraries.

Several steps aimed at coordination have already been taken, and in particular a unified catalogue has been created for reviews and reports. A programme has also been developed for the use of punched-card type-writers, which will facilitate the compilation of catalogues and—in the longer term—make it



Scientific and technical reports (A) published by Euratom and (B) patent applications filed by Euratom (1961 and 1962).

possible to rationalize the placing of orders and to see that they are executed more satisfactorily.

The library in Brussels, which had already been entrusted with the task of organizing the Central Nuclear Measurements Bureau's library, is now engaged on collecting the works and periodicals required to set up libraries at Karlsruhe and Petten.

Finally, analytical studies have been embarked upon with a view to coordinating and dovetailing the acquisition procedures at the libraries of the nuclear documentation centres run by the Member States.

II. Industrial property

148. The year 1962 saw an increased rate of expansion in the number of patents filed in the Community. More precise clauses concerning non-patentable information were added to the patent rules laid down by the Commission in January 1961.

A. *Communications of patent applications* (Article 16)

149. Notifications of patent applications as provided in Article 16 of the Treaty were submitted in a regular manner and within the time-limits laid down.

By 31 December 1962, the Commission had received details of 8785 patent applications, 1242 of which were notified in 1962. A total number of inventions covered by these patent applications is 6317.

B. *Filing of patents by the community and holders of its contracts*

150. At the end of 1962, the Commission's Patent Office had dealt with 248 inventions stemming from the research programme.

Of this number, 117 had been examined in 1962, as against 131 in the course of the two preceding years.

Between the date of the Treaty's coming into force and the end of 1962, theses inventions had been the subject of 195 premiers dépôts filed on behalf of either the Community or the holders of its contracts, 106 of them being filed in 1962.

The total number of requests for the extension of patent rights to other countries had reached 490 by the end of last year.

Five of the patent applications submitted in countries where a preliminary examination is required have already been granted, none having been rejected. In those countries where there is no examination, 136 patents have been granted.

The inventions for which patents had been filed up to the end of 1962 break as follows:

ORGEL, ECO and ESSOR	49
Controlled Thermonuclear Fusion	23
BR2	18
Dragon	54
Miscellaneous	51

The breakdown of these inventions by origin was follows:

Joint Research Centre	57
Contracts of Association	50
Other Contracts	32
Dragon	54
Miscellaneous	2

A list of the patent applications filed during the period from 1 April 1962 to 28 February 1963 is given in Annex VI to the present General Report.

C. *Working of patents held in portfolio*

151. It would be premature at this stage to consider the industrial working of the majority of patents protecting the inventions arising out of the research programme.

Even so, several of these inventions are now being used in laboratories. Others are to be employed in the construction of the ECO and ESSOR reactors.

It should also be noted that a licence has been granted in respect of a patent deriving from a contract of association in the field of fusion and that an agreement has been concluded between a contract-holder and two firms associated with him on the working of two inventions held by the former.

An invention by a Euratom employee was the subject matter of a permit for the fabrication of a limited number of sample-carriers for electronic probes. A more far-reaching licence contract is now being negotiated concerning another invention by a Euratom employee, which consists of a window for the observation of experimental chambers under radioactive radiation.

D. *Rules governing know-how and patents in research contracts*

152. The patent system applicable to research contracts which was approved by the Commission in January 1963 has not been subjected to any modifications.

It has been supplemented by more specific rules covering non-patentable information, and in particular "know-how". The main principles underlying these rules are as follows:

a) The Commission has the right to communicate to Member States, and to persons and enterprises in the Community, in accordance with Article 13 of the Treaty, any information arising from the execution of the programme as laid down in the technical annex to the contract.

b) When any such knowledge cannot be put to any use in the nuclear field, its dissemination is subject to the agreement of the contract-holder, unless the information in question forms one of the specific subjects of the contract.

c) The contract-holder may not prevent communication of the results obtained from the contract to Member States, or to

persons or enterprises in the Community as required by the Treaty. The contract-holder may, however, oppose wider dissemination in the form of publication, stating his reasons for so doing.

d) Under its obligations and as part of its policy of exchanges with non-Member States, the Commission may communicate the information referred to in (a) to non-Member States or to persons or enterprises outside the Community.

The contract-holder, however, is entitled:

(i) to be informed, at the time the contract is signed, about these obligations and this policy and in this case no modification of these obligations or this policy can be invoked against him;

(ii) to put forward any reasons why the information should not be communicated, the Commission being obliged to refrain from transmitting the information if it considers these reasons compatible with the interests of the Community;

(iii) to be allowed to participate in the exchange of information if this is likely to result in industrial application outside the Community.

(e) The know-how required for the practical utilization of the information referred to in (a) remains the property of the contractor, who has the right to draw up agreements with third parties—e.g., for technical assistance—on this point but on condition that he allows the Member States and persons and enterprises in the Community to have priority as regards the benefits of such information. If, on the other hand, it is the acquisition of the know-how which forms the subjects of the contract, it is subject to the rules on information as set out in (a) to (d) above.

153. A solution was found to the problem of "basic" patents after consultation with the parties concerned.

The problem was to prevent the contract-holder from invalidating the rights which he had accorded the Community concerning information and patents arising from the contract, by invoking a patent (basic patent) acquired outside the contract and upon which utilization of the information and patents originating from the contract is conditional.

If, for example, the contractor holds a patent for a novel organic liquid and the purpose of the contract is to adapt this liquid to use as a moderator in a reactor, possession of the basic contract would enable the contract-holder to prohibit the Commission and third parties from availing themselves of the results of the Community-financed research.

It is henceforth laid down that the Commission and the contract-holder shall determine, prior to signing the contract, whether basic patents relating to a technical field which has been defined or has been designated by name require undertakings to be given by the contract-holder.

These undertakings will include an obligation to supply and, if called for, an obligation to grant licences on commercial conditions. The utilization of knowledge and patents arising from the contract will therefore no longer encounter any bar arising from the basic patents.

E. *Standardization of industrial property rights within the Community*

154. Both the Euratom and the EEC Commission have participated in the work undertaken by the six Community Countries with a view to the establishment of European industrial property rights.

This work has progressed extremely satisfactorily. The Working Group on Patents has completed the most important phase of its work and the preliminary draft of a European Patent Convention drawn up by this group was published in

November 1962 with a view to eliciting comments from the quarters concerned.

The purpose of this draft is to create a patent to be issued by a European patent office, which is valid throughout the territory of all the contracting states. The grant of a patent would be dependent on the result of a non-compulsory patentability examination held at any time during the first five years of its live. The European patent system would exist side by side with that covering national patents, the applicant being allowed to choose between the protection afforded by the one system or the other.

CHAPTER III

INDUSTRY AND ECONOMY

PRESENT SITUATION AND PROSPECTS FOR THE DEVELOPMENT OF NUCLEAR ENERGY-ACTIVITY IN THE FIELD OF POWER PLANT CONSTRUCTION — IMPLEMENTATION OF THE UNITED STATES/EURATOM AGREEMENT — THE NUCLEAR COMMON MARKET — THIRD PARTY LIABILITY AND NUCLEAR INSURANCE — NUCLEAR MARINE PROPULSION — DEVELOPMENT OF INDUSTRIAL APPLICATIONS FOR RADIO-ISOTOPES — SUPPLY AGENCY — PROSPECTS FOR THE SUPPLY OF ORES, NATURAL URANIUM AND SPECIAL FISSILE MATERIALS — REPROCESSING AND TRANSPORT OF IRRADIATED FUEL — RELATIONS WITH EMPLOYERS' ASSOCIATIONS AND TRADE UNIONS

155. The Commission's activities in the economic and industrial sectors form an integral part of its overall task, which consists in promoting the development of nuclear industries and fostering exchanges in the nuclear field within the Community.

The various activities outlined in this chapter therefore come under the general heading of present trends in the development of nuclear energy in the Community, especially as regards electricity production.

The prospect studies were continued during 1962 both within Euratom and externally under various contracts. They were carried out in close consultation with the other two Communities, whose forecasts, up to 1975 in particular, constitute an essential element in drawing up the general framework for the role of nuclear energy in the economy as a whole.

Although it is not intended to summarize the situation in this respect, a brief survey of some of the short- and longer-term

projects may contribute towards an understanding of the Commission's activity in the industrial sphere.

In the first place, it is appropriate to review the nuclear power plants, both under construction and planned, which in the next few years will take their place beside the existing plants; the Euratom Commission is closely associated in one way or another with most of these industrial achievements.

Secondly, it is necessary to sketch out the foreseeable development quite apart from the projects currently in hand. This forecast, which will be the subject of intensive studies in 1963, is in fact essential, since it will enable all interested parties to plan their activities according to the most likely trend.

I. Development of nuclear energy : present situation and future prospects

A. *Present situation and development in the next few years*

156. Since 1957, nuclear electricity production in the Community has followed the pattern shown below (in kWh millions):

1957	1958	1959	1960	1961	1962
1	4	41	130	266	500

This production comes from small nuclear power plants whose total installed capacity on 31 December 1962 was some 174 MWe, of which France accounts for 149 MWe (the three reactors at Marcoule and the EDF 1 plant), Germany for 15 MWe (Kahl) and Belgium for 10 MWe (Mol BR 2).

157. For the rest, the power plants whose construction is provided for under the national programmes of the Community countries are as follows:

Germany: besides the low-power reactor already operating at Kahl, work has been proceeding since January 1961 on the construction at Jülich of the 15 MWe high-temperature gas-cooled reactor of Arbeitsgemeinschaft Versuchsreaktor GmbH (AVR). Mention must also be made of the construction work on the 50 MWe multi-purpose research reactor at Karlsruhe, which is equipped with a pressure vessel and will be fuelled with enriched uranium.

In addition, in the course of the past year Kernkraftwerk RWE Bayernwerk mbH (KRB) decided to go ahead with the construction of a 237 MWe power plant at Gundremmingen near Günzburg, Bavaria. This plant, which is equipped with a boiling-water reactor, will go critical at the end of 1965 and will be commissioned in the course of 1966.

Finally, an organic-moderated reactor project is at present being studied by Kernkraftwerk Baden-Württemberg Planungsgesellschaft mbH (KBWP) of Stuttgart.

Belgium: the 10.5 MWe boiling-water reactor BR 3 at Mol is now in operation. Belgian enterprises are also participating in the Société d'énergie nucléaire franco-belge des Ardennes (SENA) which will operate the power plant at Chooz, in which a pressurized-water reactor is to be installed.

France: further progress has been made with the implementation of the programme comprising the string of three gas-graphite reactors at Chinon (EDF 1, EDF 2 and EDF 3) to which a fourth reactor (EDF 4) of the same type was recently added; this reactor, which will have a capacity of 500 mWe is scheduled for commissioning in 1967. The EDF plant went critical in 1962 and EDF 2 will do so in 1963. Finally, a heavy-water reactor, EL-4, is to be built in the Mont d'Arrée, Brittany, while the above-mentioned SENA power plant at Chooz will reach criticality towards the end of 1965.

Italy: three nuclear power plants are under construction, viz: the 150 boiling-water reactor plant of Società Elettronucleare Nazionale (SENN), located at the mouth of the Garigliano River;

the 200 MWe gas-graphite reactor plant of Società Italiana Meridionale Energia Atomica (SIMEA), at Latina; and the 257 MWe plant of Società Elettronucleare Italiana (SELNI) at Trino Vercellese, running on a pressurized-water reactor. Of these, the first two will be commissioned in 1963 and the third in 1964.

Holland: Samenwerkende Electriciteits-Productiebedrijven (SEP) are continuing in their efforts with a view to the construction of a 50 MWe power reactor.

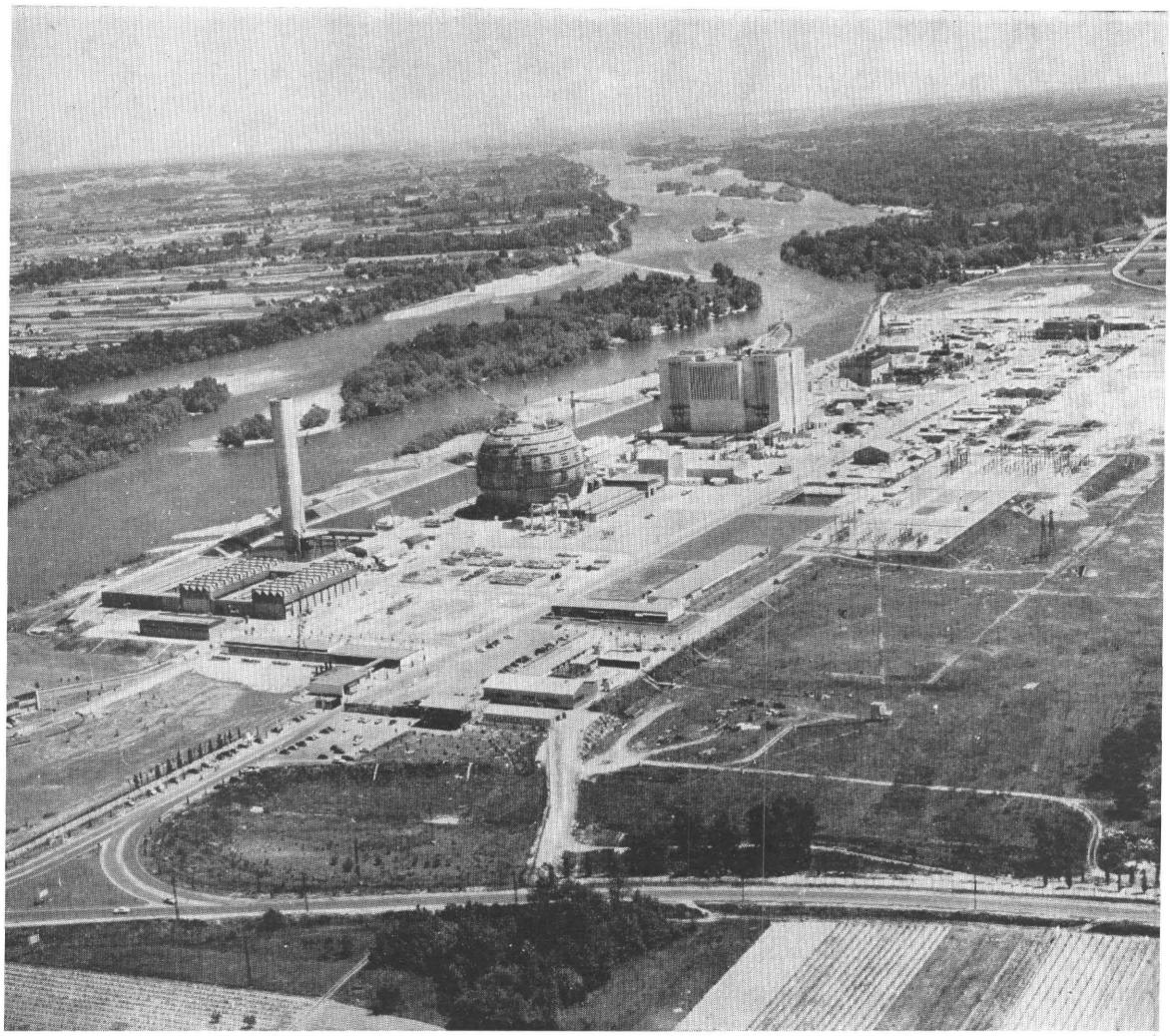
According to the present outlook, the timing for the commissioning of nuclear power plants will be as follows (installed capacity in MWe):

Installed capacity	Germany	France	Italy	Belgium	Holland	Total
1961	15	80				95
1962		70		10		80
1963	15	170	350			535
1964		80	257			337
1965	287	600*		121*		1,008
1966						
1967	150	500			50	700
Total:	467	1,500	607	131	50	2,755

(*) The Chooz power plant, which is a Franco-Belgian joint enterprise, in which French and Belgian participation is on a 50/50 basis

It can be seen from this table that the nuclear generating capacity in operation at the end of 1963 will amount to 710 MWe and that on the strength of the current projects some 2,760 nuclear MWe will be available in the Community by the end of 1967; of this total, 1,580 MWe will be generated from natural uranium and 1,170 MWe from slightly enriched uranium.

This installed capacity will enable some 17,000 million kWh of nuclear electricity to be produced in 1967, i.e. about 3% of the Community's total estimated production, as against only just over 0.1% in 1962.



As of 1 January 1963, the construction of nineteen nuclear power plants had been decided on in the Community countries and some 2,500 to 2,800 nuclear MWe are expected to be commissioned by the end of 1967. Nuclear electricity production amounted to five hundred MWe in 1962. The above photograph is an aerial view of Chinon, on the Loire, the biggest nuclear site in Europe, where the three nuclear power plants (EDF 1, 2 and 3) under construction represent an installed power of over six hundred MWe.

(Photograph by EDF)

ERRATUM

Page 119, § 158, 3rd. para., last line : read « ... (in *thousands of millions* of kWh) : »

In caption of photograph on page 118, line 4, read : *« 500 million kWh »* instead of « 500 MWe »

B. *Prospects*

158. Apart from the projects now under way, it is still difficult to foresee how nuclear energy for electricity production will develop after 1963.

The studies undertaken by the three Communities, however, enabled the national authorities to form certain hypotheses which, taken as a whole, indicate that the growth of installed nuclear capacity might follow the trend shown below (figures in MWe):

1963	1964	1968	1970	1975
700	1,000	2,700	3,500 to 4,000	10,000 to 16,000

In these conditions, the probable development of nuclear electricity production in the Community between 1965 and 1975 is likely to be as shown below (in kWh milliard):

1965	1969	1970	1975
6	15	20 to 25	60 to 100

A reasonable extrapolation from these figures up to 1980, based on the assumption that the nuclear capacity will double every three years, therefore leads to estimates which show a very good measure of agreement with the tentative figure of 40,000 nuclear MWe for 1980 quoted by the Commission in its Third General Report. Obviously, however, such forecasts are not yet sufficiently firm or accurate to constitute a basis for a programme of definite commitments.

159. Several important advances were made in the course of 1962 in the direction of obtaining a more general picture of future developments. In conjunction with the work of the Inter-Executive Group on Energy, the Euratom Commission's participation in the drafting of the report entitled "Study on the long-Term Energy Prospects in the European Community" has made

it possible to estimate the contribution of nuclear energy to the development of power production up to 1975. The results of this work confirm that the trends in nuclear energy in the next twelve or thirteen years will take shape against a background of economic expansion and of greatly increasing energy requirements the fulfilment of which will necessitate recourse to all economically exploitable sources of energy. From this it follows that during the period in question nuclear energy will constitute an indispensable complement to the production and importation of conventional energy rather than a source of structural modifications to these activities.

This study has also shown that the generation of electricity in nuclear plants will fulfil the two principal conditions stated in the "Memorandum on Energy Policy" which was submitted on 25 June 1962 to the Special Council of Ministers of the European Coal and Steel Community by the three European Executives, namely reduction of the price of energy and increased reliability of supplies.

Obviously, the first of these objectives, and also to some extent the second, can only be attained insofar as nuclear energy can compete with conventional energy; indeed, only adequate competitiveness can provide a firm basis for the growth of nuclear energy and permit its development under the stimulus of purely economic criteria. It is therefore on this crucial point that the prospect studies have hitherto been centred.

160. During the November 1962 session of the European Parliament Mr. P. De Groote, member of the Euratom Commission, announced that recent information confirmed the previously adopted view that in various parts of Europe nuclear energy had very good prospects of becoming truly competitive before 1970. This outlook is likewise confirmed by the statements of various experts, notably the director of atomic reactors of the French

Atomic Energy Commission (CEA) and the officer responsible for the reactors of the United Kingdom Atomic Energy Authority.

161. At the 24th session of the Economic and Social Committee, held on 30 October 1962, Mr. E.M.J.A. Sassen, member of the Euratom Commission, stated that the information available on each of the proven reactor types (1), which had been obtained chiefly from the operators themselves, both within the Community and in Britain and the United States, enabled a detailed comparison to be made between the kWh cost of conventional and nuclear electricity.

One of the conclusions of this study was that large-scale nuclear power plants which may be commissioned in three or four years' time and which have long annual utilization periods could become competitive in areas where coal costs between 12 and 16 EMA u.a. per ton. Towards the end of the present decade the production cost at these plants would be in line with that at conventional installations using coal at 10 - 12 EMA u.a. per ton. The reason for giving an upper and a lower limit instead of a single figure is that it is necessary to take account of differences between the Community countries as regards interest rates on invested capital and taxation rates.

Mr. Sassen also compared these data with the cost of conventional sources of energy, namely coal and oil. Coal of European origin currently costs between 14 and 15 EMA u.a. per ton. American coal is cheaper and can be reckoned to cost 12.5 EMA u.a. per ton delivered to a European port. For oil, reckoned as tons of coal equivalent, the cost varies from 10.5 to 12 EMA u.a.

(1) At the present time, the types of power reactor which have proved themselves on the industrial scale are as follows :
— natural-uranium-fuelled, graphite-moderated, gas-cooled reactors (EDF and SIMEA, for example);
— slightly-enriched- uranium-fuelled, boiling- or pressurized-water- moderated- and cooled-reactors (e.g. SENN, SELNI, KRB, SENA).

According to the memorandum of the Inter-Executive Group on Energy, these prices cannot be expected to decrease appreciably in the future. Consequently the conclusion is justified that it will not be long before nuclear energy becomes competitive. Moreover, when the time comes it will constitute a real turning point in a trend which will thenceforth be accelerated by purely economic necessities.

162. The foregoing statements are amplified by a recent study by the three Communities entitled "Study on Long-Term Energy Prospects", in which a chapter on nuclear energy is incorporated.

This study discusses in detail the cost factors in the production of nuclear electricity by proven-type large-scale plants designed in accordance with present-day technology which could become operational in the period 1965-1967. Moreover, in the light of cautious estimates as regards technological developments up to 1968-1970, forecasts have likewise been arrived at for this more distant period. On this basis, the study arrives at the figures quoted in the table below. In view of the divergent interest rates and depreciation-periods counted on by the various reactor operators, the production cost per kWh has been calculated according to three assumptions determined by the rate of annual fixed charges on invested capital, this rate being taken respectively as 8.6% (France and Holland), 10% (Southern Italy [1]) and representative average for the Community as a whole) and 13% (Germany, Belgium and Northern Italy). These figures are based on a probable life of 20 years for nuclear power plants, which corresponds to the universally accepted minimum. Finally, they involve two assumptions with regard to the annual use time of the plants, i.e. 6,000 and 7,000 hrs.

---

(1) Cf. Previous references to the setting up of ENEL (Ente Nazionale per l'Energia Elettrica).

Estimated Production Costs of Nuclear Energy

(in mills, or thousandths of an EMA u.a. per kWh)

Date of Commissioning	Annual fixed charges on invested capital, in %					
	8.6 %		10 %		13 %	
	6 000 hrs/yr	7 000 hrs/yr	6 000 hrs/yr	7 000 hrs/yr	6 000 hrs/yr	7 000 hrs/yr
1962/1963						
enriched uranium	9.1	8.3	9.8	8.9	11.3	10.2
natural uranium	8.7	7.8	9.5	8.5	11.3	10.0
1965/1967						
enriched uranium	6.8	6.2	7.4	6.7	8.7	7.8
natural uranium	6.7	6.1	7.4	6.7	8.8	7.9
1968/1970	5.5	5.0	6.0	5.4	7.0	6.3

At the same time it is necessary to ascertain the probable trend in the cost of producing electricity by conventional means. Indeed, technological progress is likewise being made in the field of conventional thermal generating stations, as a result of which lower construction costs and greater efficiency are being achieved. By making certain assumptions and proceeding on the basis of the above table, it is possible to estimate the progress of nuclear energy towards competitiveness. The following table expresses this progress in terms of conventional fuel prices (coal and fuel oil).

163. Fuel prices ensuring break-even between a conventional thermal generating station and a nuclear power plant at various

dates and under various conditions (in EMA u.a. per ton coal equivalent at 7000 kcal/kg).

Operating Period	Annual fixed charges on invested capital, in %					
	8.6 %		10 %		13 %	
	6 000 hrs/yr	7 000 hrs/yr	6 000 hrs/yr	7 000 hrs/yr	6 000 hrs/yr	7 000 hrs/yr
Date of commissioning						
1962/1963						
enriched U	18.8	17.6	19.4	18.1	21.6	20.0
natural U	17.4	16.0	18.4	16.8	21.4	19.4
1965/1967						
enriched U	13.1	12.3	13.5	12.6	15.2	14.1
natural U	12.9	12.1	13.5	12.6	15.8	14.5
1968/1970	10.7	10.1	10.8	10.2	12.1	11.3

The figures in this table obviously involve a margin of uncertainty; nevertheless, they provide a sufficiently reliable indication of the rate at which production costs in nuclear power plants are likely to drop. These evaluations, which have been drawn up with the necessary caution, moreover, assume that there will be no radical technological innovations. Today, in particular, it seems that a service life of 20 years for a nuclear power plant may be a slight underestimate. Under these conditions and on the basis of the existing and probable future prices of fossil fuels, it would appear that nuclear power plants will already be reasonably competitive in several regions of the Community between 1965 and 1967, and will be so in the Community as a whole around 1968 or 1970, for annual operating periods of 6,000 hours or more. Furthermore, since production costs will continue to fall in the later years, nuclear power plants can become

competitive even for lower annual operating periods, in consequence of which their use will become more widespread.

164. From 1970 onwards, therefore, the production cost of nuclear energy will no longer act as a brake on its increased use, but expansion may well be limited by the difficulty for nuclear industries of maintaining an economically desirable rate of capacity installation. Those entitled to speak with authority in fact consider that for a number of technical and industrial reasons it would be difficult to exceed a growth rate amounting to a doubling of the annual installed capacity every three years. Studies are in hand with the object of analyzing this problem and detecting the possible bottlenecks.

In this respect the Euratom Commission is playing a vital part within the framework of the Treaty, under which it is entrusted with the task of laying the foundations for a rapid rise of nuclear energy in the years to come.

The transition from the prototype to the industrial stage will henceforth take place regardless of the magnitude of the future problem. Indeed, the second-generation nuclear power plants (KRB, SENA and EDF 3) now under construction are very nearly competitive and give every reason to anticipate that the third generation will confirm the profitability of nuclear energy. This does not, however, rule out the uncertainties that can still attach to the operation of the projected power plants, notably in view of the amount of investment they involve.

This is why it is so important that the public authorities should continue to provide financial and technical assistance to all the sectors concerned and should ensure—insofar as they are competent to do so—that all efforts on development and industrial application remain carefully coordinated in the interests of maximum efficiency.

This assistance should aim above all at concentration on full-scale plants, as a result of which it will be possible to acquire the technical experience which is indispensable if such plants are

to be built and operated economically. As far as the Commission is concerned, apart from the research and development activities it carries out itself, this assistance takes three principal forms, namely the implementation of the programme for participation in power-reactor construction, the continued application of the Agreement for Co-operation with the United States on the development of reactor strings tested out in America, and its financial contribution to the development of reactor components and fuel elements.

II. The Commission's activity in the field of nuclear power plant construction

A. *Community participation*

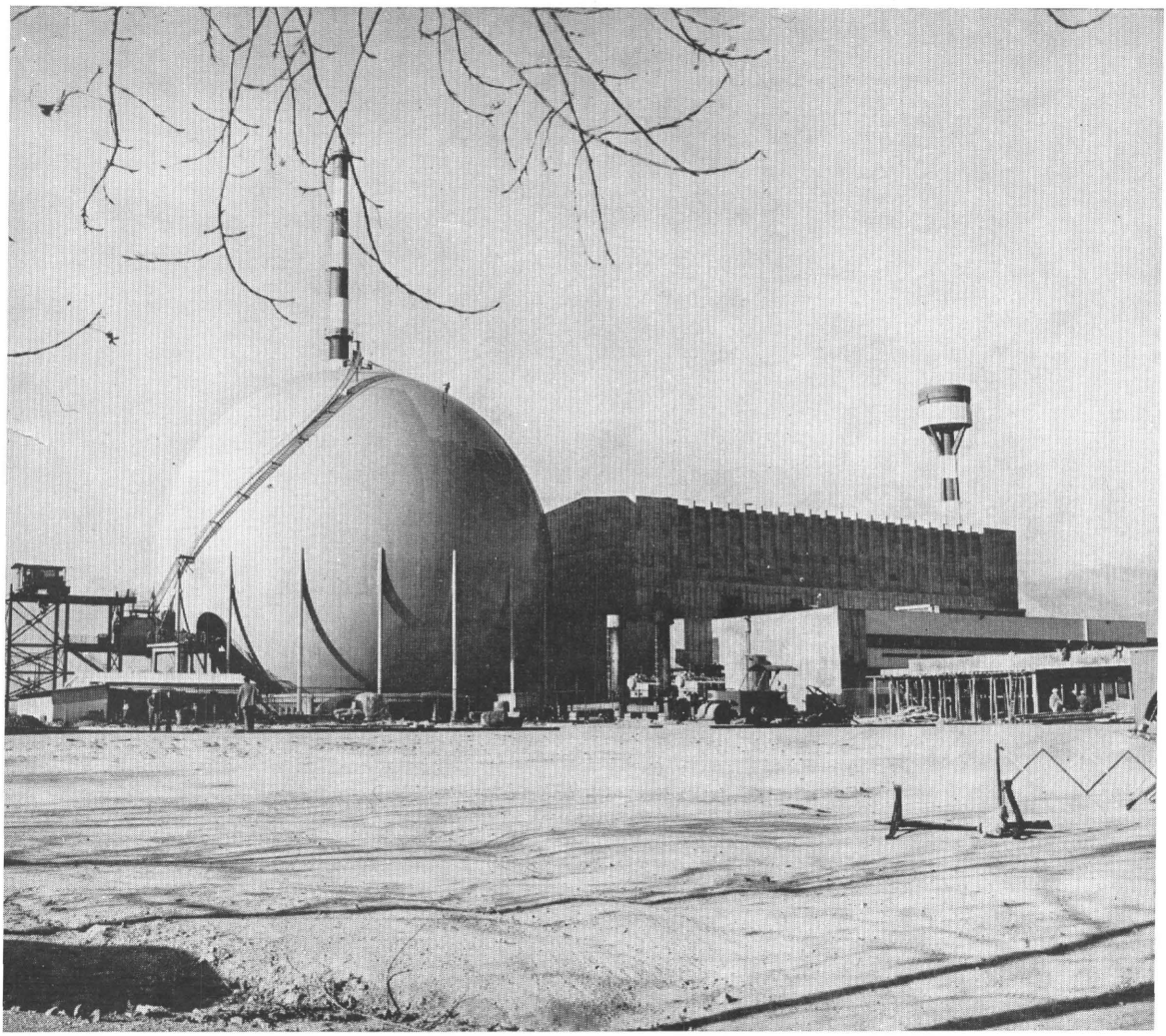
165. Among the powerful media now available to the Commission for the fulfilment of its task of promoting industrial development is the programme for participation in power reactor projects.

This programme enables the Community to participate to the extent of 32 million EMA u.a. in the construction of power reactors. Its object is to stimulate the building of nuclear power plants on an industrial scale by pinpointing the technological problems involved in their true magnitude and perspective and by disseminating throughout the Community the knowledge and information acquired. In addition, this programme will contribute to the creation of a European nuclear industry, particularly that branch of it engaged in the fabrication of fuel elements.

1) *Contracts of Participation*

166. Three firms have so far put forward proposals which have led to the signing of contracts of participation. The companies in question are:

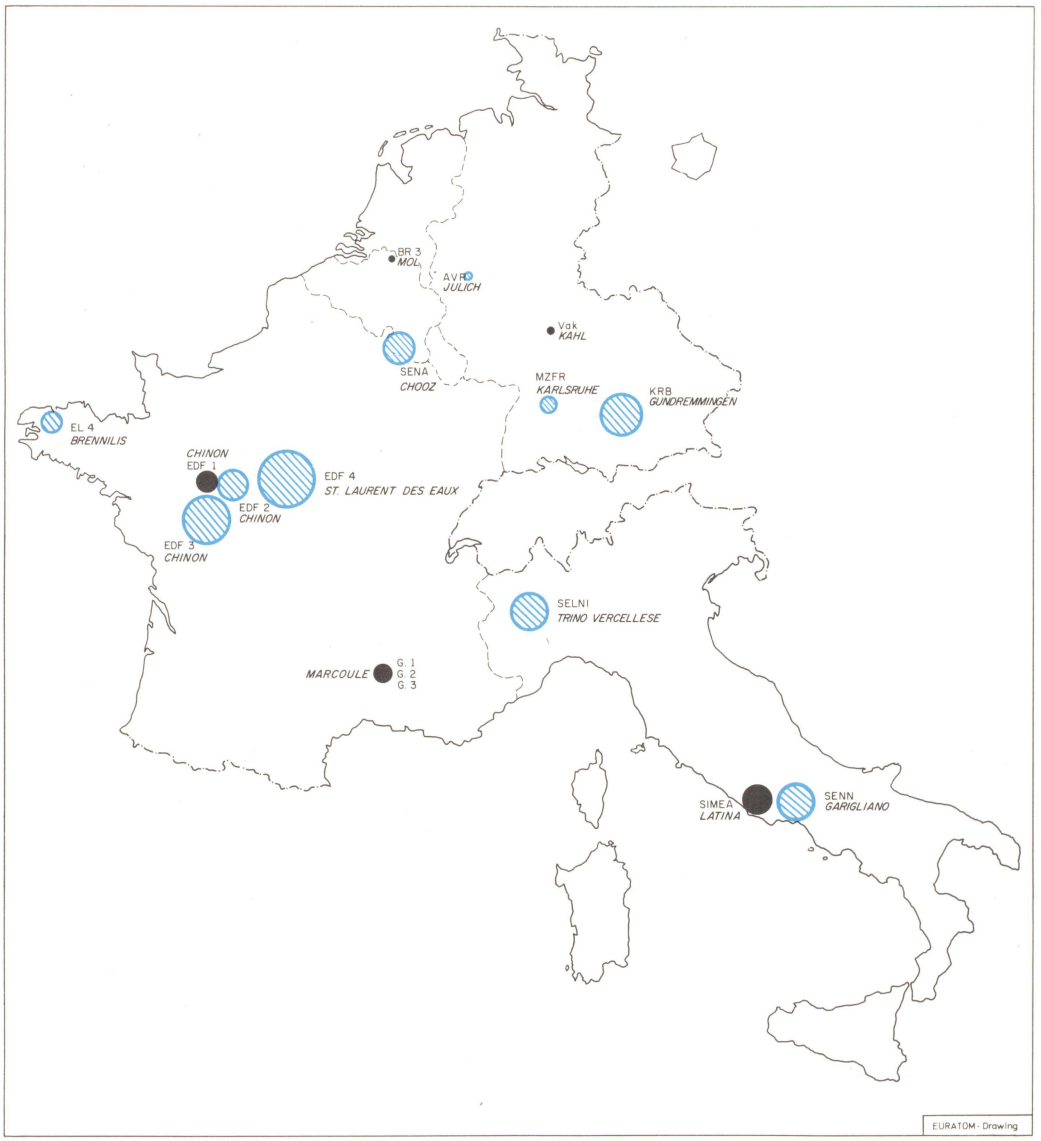
a) Società Elettronucleare Nazionale (SENN), who have just completed a power plant of 150 MWe net capacity equipped with a dual-cycle boiling-water reactor;



One of the most important means now at Euratom's disposal for the pursuance of its industrial promotion policy is the programme for participation in nuclear power plant construction projects. Three contracts have been signed to date: with SENN (Italy), SIMEA (Italy) and SENA (France and Belgium). Furthermore, the Commission has decided to share in the construction of two other reactors: RWE-BW (Germany) and SEP (Netherlands).

The photograph shows the 150 MWe net SENN power plant (located at the mouth of the Garigliano near Naples). The plant is equipped with a dual-cycle boiling-water reactor, the construction of which has just been completed.

(Photograph by SENN)



Power reactors in the Six (surface areas marked proportional to power) :

— *black : reactors in operation ;*

— *blue : reactors either projected or already under construction (to be completed before 1967).*

b) Società Italiana Meridionale Energia Atomica (SIMEA), who recently finished the construction of a power plant with a net capacity of 200 MWe and equipped with a reactor of the natural uranium-graphite-carbon dioxide type;

c) Société d'energie nucléaire franco-belge des Ardennes (SENA), who have undertaken the construction of a power plant equipped with a pressurized-water reactor, the installed capacity of which is 210 MWe (capable of being stepped up to over 242 MWe). Furthermore, the Commission is giving favourable consideration to two other applications for participation in power reactor construction. These applications, which were submitted by the Kernkraftwerk Rheinisch-Westfälische Electrizitätswerke - Bayernwerk (RWE - BW) syndicate and by Samenwerkende Elektriciteitsproductiebedrijven N.V. (SEP), relate respectively to a 237 MWe boiling-water reactor and a 50 MWe boiling-water reactor with natural circulation.

2) *Ways and Means of Participation*

167. As regards the SENN power plant, it will be recalled that Euratom is participating in the additional start-up expenditure and in the cost of fuel-element fabrication inside the Community. The amount of this participation is 7 million EMA u.a.

Euratom is also participating to the tune of 4 million EMA u.a. in the cost of fuel-element fabrication for the SIMEA reactor.

168. Euratom participation in the *SENA* power plant may total 8 million EMA u.a., this figure being broken down as follows:

a) Participation up to a maximum of 2 million EMA u.a., in additional start-up expenditure;

b) participation, up to a maximum of 6 million EMA u.a., in the cost of fabricating fuel elements (slightly enriched uranium-oxide pellets, stainless-steel cladding) inside the Community.

3) *Implementation of the Contracts of Participation with SENN, SIMEA and SENA*

169. The implementation of the above-mentioned contracts is well under way and the Commission has held information meetings which were attended by representatives of about sixty firms and organizations as well as by members of the Permanent Delegations of the six Member States.

During these meetings the Commission expounded the possibilities which the contracts offer to the Community's industry with respect to:

— the dissemination of information contained in the documents sent in by the contracting parties;

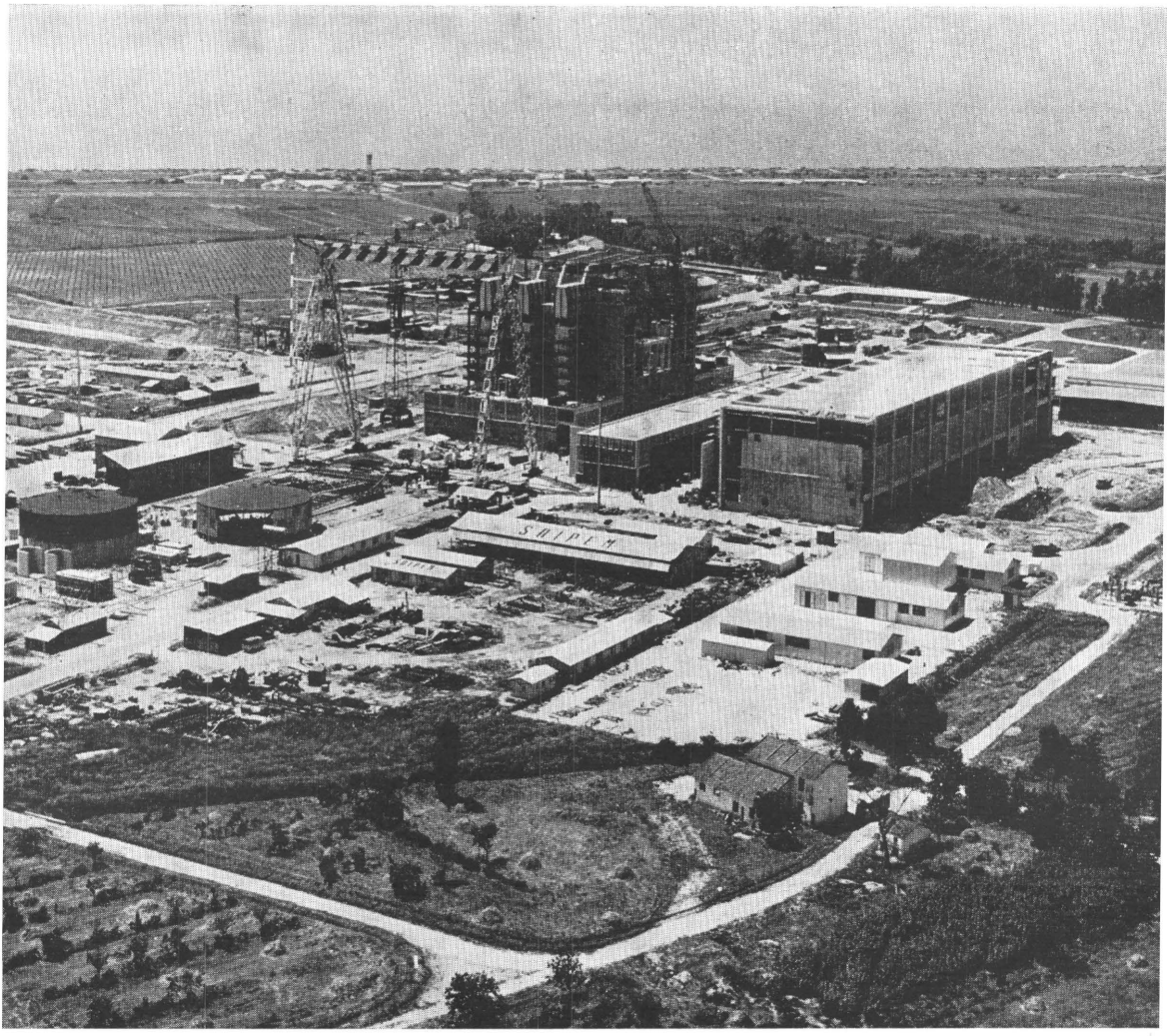
— the assignment of personnel to the plants to take part in pre-operational trials and power run-up tests;

— the fabrication of proven-type fuel elements for replenishment purposes.

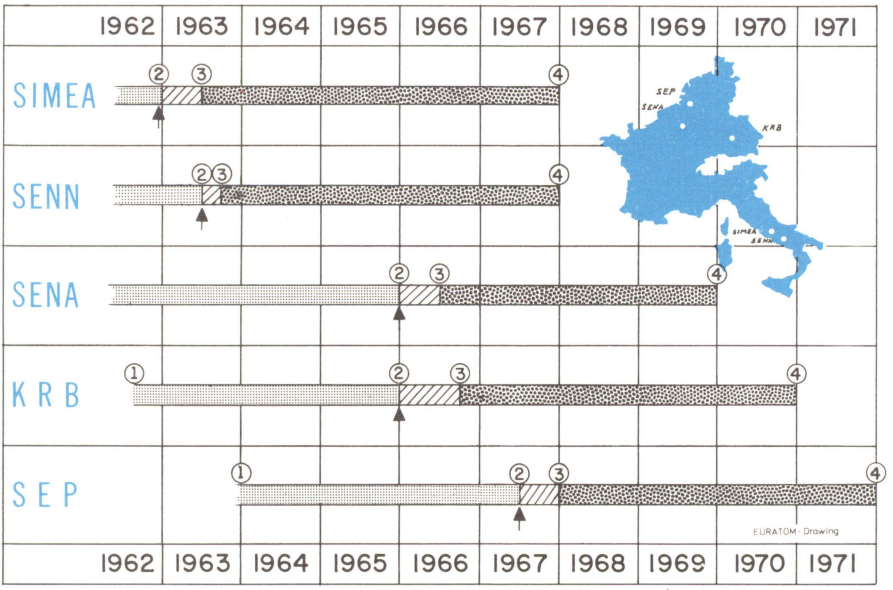
170. At regular intervals the contractors furnish the documents stipulated in the contracts. Extracts from these documents are sent to the Member States, who in turn forward them to the firms and organizations concerned in each country; the latter may consult, or request copies of, any document that is of interest to them. From May 1963 onwards, certain reports of special interest, such as annual reports, final construction reports, reports on the transport of fuel elements, etc., will be published.

171. The contracts provide for the assignment of personnel, whether or not they are employed by the Commission, to the contractors in order to observe the activities relating to the design, construction and operation of the plants.

Under this arrangement Euratom employees have been permanently attached to SIMEA (since April 1962), to SENN (since May 1962) and to SENA (since October 1962). They see to the proper execution of the contracts, take part in the work of the contractors' teams, pay visits to the principal suppliers, coor-



A view of the SIMEA plant, the construction of which has just been completed. This 200 MWe net power plant, built under a contract of participation with Euratom, is situated at Latina (Rome). It is equipped with a natural uranium-fuelled reactor moderated by graphite and cooled by carbon dioxide gas.
(Photograph by Publiphoto, Rome)



Euratom's programme for participation in power reactors built in the Six :

1) *Start of construction work ;*
2) *Criticality ;*
3) *Full power ;*
4) *Expiry of participation contract.*

dinate the activities of seconded personnel and assist in the drafting of the contractors' quarterly, annual and other reports.

Moreover, 28 firms and organizations in the Community have requested permission to assign 61 of their employees to take part in the pre-operational criticality and start-up trials of the SENN, and SIMEA plants, which are scheduled to take place between November 1962 and July 1963, the date by which it is planned to have both plants operating at full power. Apart from Euratom staff, 29 persons have been or still are on the site. Finally, several university students from various countries have spent some time at the plants for training purposes.

B. *Implementation of the United States/Euratom Agreement*

1) *Proposals received*

172. In agreement with the United States Atomic Energy Commission (USAEC), the Euratom Commission has postponed from 31 May to 31 July 1962 the closing date for the submission of proposals under the invitation for proposals for nuclear power plants to be constructed in the Community by 31 December 1965. In accordance with the Agreement for Cooperation [1], this invitation provided that two reactors, to be commissioned by 31 December 1965, were to be chosen under the second phase of this Agreement.

Four proposals were received by the Joint Reactor Board of the United States/Euratom Agreement for Cooperation. On the strength of the recommendations drawn up by this Board, two projects were accepted jointly by the Euratom Commission and the United States Atomic Energy Commission. One of these was the power plant of Société d'énergie nucléaire franco-belge des Ardennes (SENA) which will have a pressurized-water reactor with a net capacity of 210 MWe capable of being stepped

[1] Agreement for Cooperation: cf. Chapter VI, External Relations Nos. 238 et seq.

up to 242 MWe. The other plant, owned by Kernkraftwerk RWE - Bayernwerk GmbH (KRB), will be equipped with a boiling-water reactor of 237 MWe net capacity.

2) *Ways and Means of Implementation*

173. For the financing of these two power plants Euratom is to grant SENA and KRB loans of 16.25 million and 20 million EMA u.a. respectively, which amounts will be set off against the line of credit opened by the Import - Export Bank under the United States/Euratom Agreement for Cooperation.

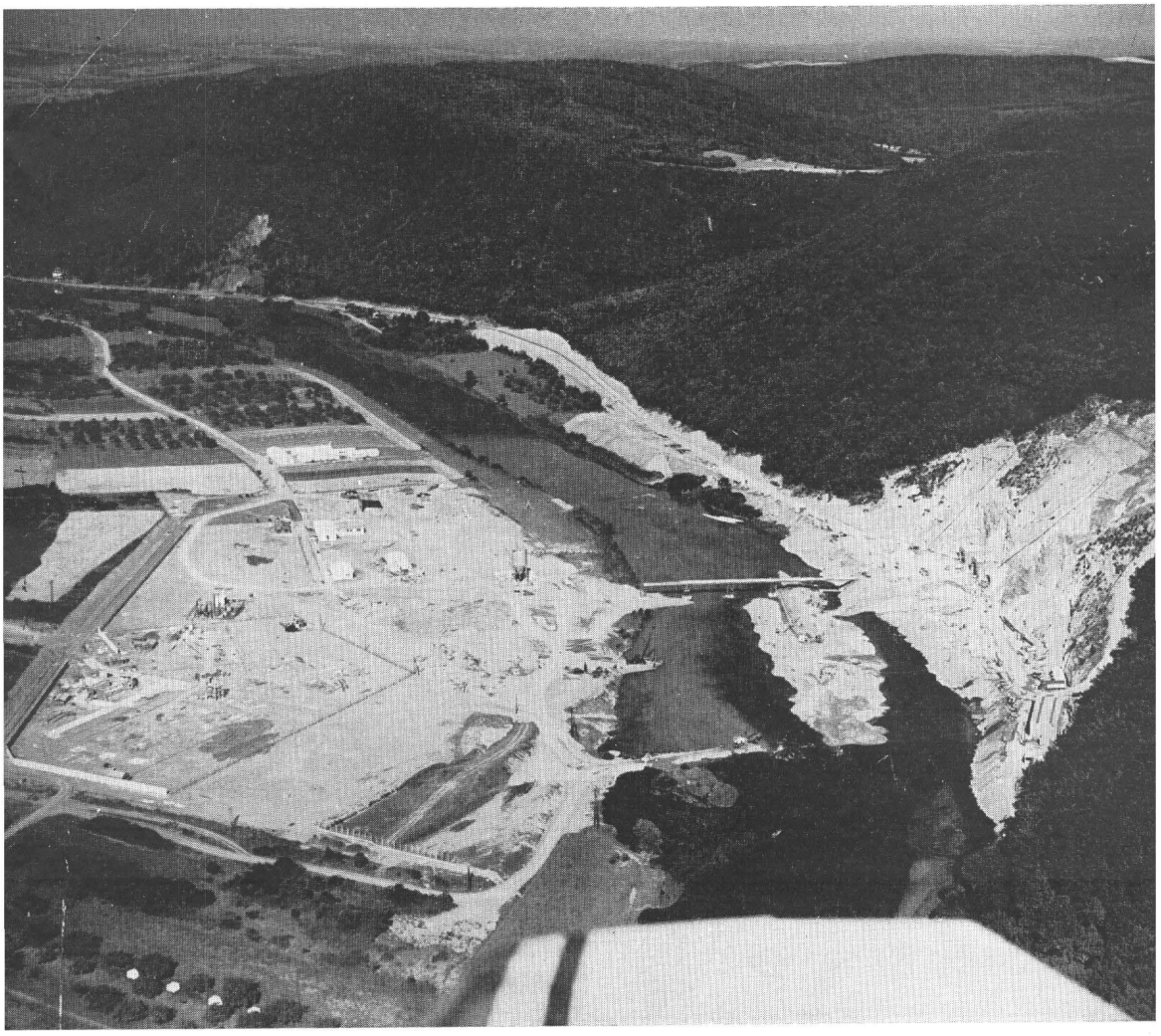
These plants are scheduled for commissioning at the end of 1965, while the Garigliano (SENN) Plant, which represents stage one of the joint programme, is due to come into operation this year.

Also under the terms of the United States/Euratom Agreement for Cooperation, on 25 July 1961 SENN concluded with Euratom the basic contract governing the ways and means of their participation in the joint programme. On 25 November 1962 SENN likewise concluded the fuel supply contract with the Supply Agency; the relevant purchasing and sales contracts between the Supply Agency and the USAEC were signed at the same time.

In collaboration with the departments of the Italian Atomic Energy Commission (CNEN) responsible for the safety of nuclear installations, the operational safety aspects of the SENN project were studied on the basis of the definitive technical features of the plant.

C. *Development of power reactors of proven types*

174. The work carried out in 1962 related chiefly to the influence of the steam characteristics on the conventional parts of nuclear power stations, the study of uranium-rich ternary alloys, the irradiation behaviour of uranium-alloy fuel elements and the development of techniques for their fabrication, investigation of the



Aerial view of the site intended for the construction of the SENA power plant (Centrale Franco-Belge des Ardennes) under a contract of participation with Euratom. The site is near Givet on the Franco-Belgian frontier. The entrance to the galleries which will give access to the two caverns housing the reactors can be seen on the right bank of the Meuse. The ancillary buildings will be constructed on the left bank.

(Photograph by M. Arsène – Mézières)

heat-resistance of concretes intended for the construction of pre-stressed concrete pressurized containments, the technical and economic comparison of a 250 MWe power plant using a single-cycle boiling-water reactor with a dual-cycle plant of the same capacity, and finally the parametric study of the differing physical properties of fuels for graphite reactors and water reactors. This work is to be continued in the course of the second five-year programme, during which the emphasis will be on gas-cooled reactors. It is to relate primarily to the points enumerated below.

a) *Improvement of fuel performance*

Attempts will be made to improve the factors determining the core performance and the fuel cost per kWh produced. In particular, studies will be carried out on the improvement of fuel behaviour under operating conditions, the reduction of fabrication costs, the heat-resistance of the fuel and the cladding and the improvement of their geometry.

This research should lead to the finalization of fuel elements for industrial use and to their testing in power reactors.

b) *Improvement of reactor performance*

With a view to reducing investment costs and improving operating conditions, there is a need for development work in certain reactor components which are expensive or have a limited performance. The accent here will be placed mainly on the loading and unloading gear and pressure vessel construction methods. These studies relate in principle to the "integral"-type reactor with a pre-stressed concrete pressurized vessel and will be applied to the case of power plants running on 500-1000 MWe reactors.

c) *Power plant operation*

The object here is to acquire a better knowledge of the phenomena encountered in the operation of nuclear power plants and to benefit from the operating experience gained with existing plants with a view to improving the performance of future ones.

D. *Development of fuel elements*

175. The considerations set out in the Fifth General Report on the development of fuel elements still hold good.

It must be stressed that in the case of elements for the graphite/gas reactor string, France has developed a technique of its own as regards the alloying of natural uranium and the material and form of the cladding, which is machined in one piece. This technique, which was adopted for the EDF 2 and EDF 3 power plants at Chinon, can readily be adapted to other plants of the same string.

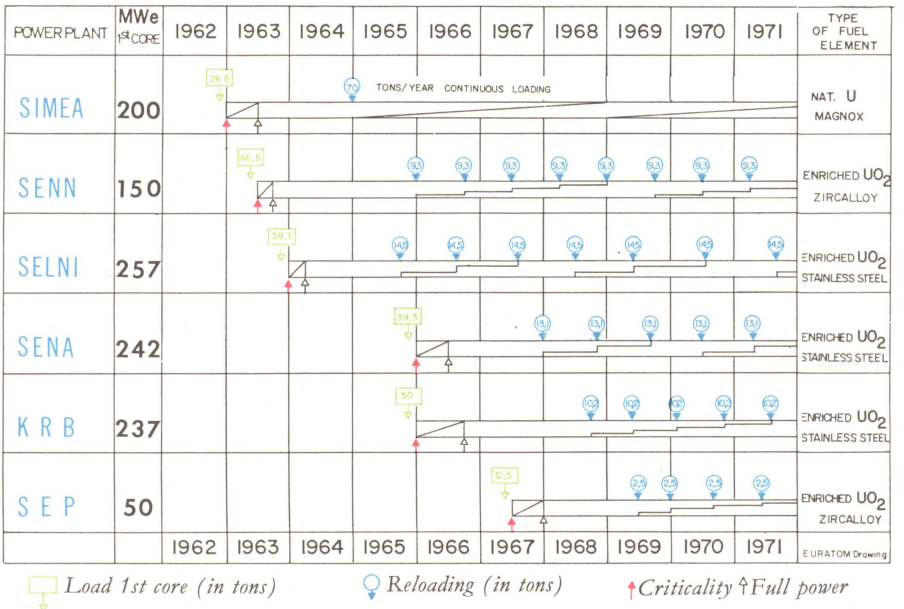
For the whole range of power reactors, the demand for fuel elements is expected to reach a level corresponding to an annual turnover—excluding the value of the fuel—of 8 million EMA u.a. in 1967, 24 million in 1970 and 80 million in 1973.

Nevertheless, for various reasons fuel-element manufacturers in the Community must avoid dissipating their efforts and must devise means of cooperation. That is why the Commission has provided for contracts of participation in order to contribute —with funds totalling 17 - 20 million EMA u.a.—to the cost of fuel-element fabrication. Its activity will be rounded off by a research and development programme, the details of which are given in the chapter on Research. The Commission expects shortly to receive proposals for studies, tests and irradiations provided for in the 1963 budget.

III. The nuclear common market

A. *Free trade in nuclear products Common External Tariff*

176. The almost total abolition of customs duties and import quotas on nuclear products has facilitated commercial transactions, which have again increased in the course of this year, both



Reloading of power reactors covered by Euratom participation programme. The ringed figures indicate amounts – in tons of fuel elements – of the annual loads.

between Member States of the Community and with outside countries.

After next year interested parties in the Community will be able to follow the trend of transactions in nuclear products more closely as a result of the harmonization of foreign-trade statistics now being carried out, involving a more detailed breakdown by product and country of origin.

The Customs Cooperation Council has suggested a number of changes in the nomenclature for nuclear products, which entail certain amendments to the common external tariff. These proposals were examined in collaboration with the EEC Commission at various meetings of experts, and consultations on this subject have not yet been concluded. It was agreed that experts of the Member States should put a proposal before the Council of Ministers for the creation of two new sub-heading viz:

28.50 F active fuel slugs 0%

81.04 M uranium depleted in U-235 . . . . . 7%

The possibility of granting natural radioactive isotopes the same exemption from customs duty as is applied to artificial radioisotopes in the Nuclear Common Market is also being explored. In addition, consideration is being given to the inclusion in the Nuclear Common Market of uranium depleted in U-235, in view of its use as a fertile material and its importance as a cost-factor in nuclear energy production.

B. *Third-party liability and insurance against nuclear risks*

1) *Supplementary Convention*

177. As indicated in the preceding General Reports, it has been understood from the start of the negotiations that every signatory State to the Paris Convention of 29 July 1960 on third-party liability in the field of nuclear energy would be eligible for membership of the Supplementary Convention. Since negotiations on the Supplementary Convention were in an advanced stage, the

Member States of the Community invited the signatory States to the Paris Convention and the European Nuclear Energy Agency to an information conference which was held on 20 December 1961. The Agency and most of these States were represented at this conference. The preparatory work on the Convention continued at experts' level until July 1962 with the participation of the following countries: Austria, Britain, Denmark, Greece, Norway, Spain, Sweden, Switzerland, Turkey; the Agency was present at the negotiations in the capacity of observer. The Commission took an active part. The principal amendments made during the final stage of the negotiations to the text of the Convention, an analysis of which was given in the last General Report, relate to its field of application.

178. In the summer of 1962 the text of the draft Convention was transmitted to the governments of the States who had expressed a desire to become signatories thereto. The final text was drawn up in the course of a diplomatic conference called by the Belgian Government on 28 - 31 January 1963. The Convention was signed by the representatives of thirteen countries, namely Austria, Belgium, Denmark, France, the German Federal Republic, Holland, Italy, Luxembourg, Norway, Spain, Sweden, Switzerland, the United Kingdom.

It seems that the Paris Convention and the Supplementary Convention will have to be ratified simultaneously. This should enable the complete system of third-party liability and insurance cover provided by the two Conventions together to take effect at an early date, and should expedite the enactment om implemental measures by the contracting States. An end will thus be put to the uncertainty that besets on the one hand the nuclear industry as regards the costs it may incur as a result of major nuclear accidents, and on the other hand the victims of such accidents as regards adequate compensation. It is imperative that these conventions should take effect without delay.

Indeed, several reactors in the Community which are operated by industrial concerns have already reached criticality

or will do so very shortly. Moreover, the first irradiated fuels to be discharged from research reactors in various Community countries will be dispatched to reprocessing plants before mid-1963, and in many cases this will mean journeys of considerable length.

179. Application of the Supplementary Convention to Euratom's Own Installations. The installations which will be operated by the Community within the meaning of the Paris Convention, that is to say primarily those of the Joint Research Centre, are not covered by any special arrangements in respect of third-party liability. Like the others, therefore, they are subject to the provisions of the Paris Convention and the Supplementary Convention.

2) *Practical Problems of Nuclear Insurance*

180. Within the scope of the tasks entrusted to it under Article 98, the Commission has long been concerned with the practical problems of assurance against nuclear risks. In the preceding General Report it was stated that the foundations for wider activity in this sector had been laid during a colloquium held in October 1961 between representatives of the Commission and leading authorities in the world of nuclear insurance. As the outcome of these discussions, a working group composed of representatives of the Commission and of the nuclear insurers was set up to study the practical problems of insurance against nuclear hazards. The group's meetings in 1962 were devoted to what is considered the most urgent problem, i.e. insurance cover for the carriage of radioactive materials. As regards third-party liability incurred during the transport of radioactive substances, the work of this group has brought about a streamlining of methods and conditions to forestall the adoption of practices which diverge from country to country. The Commission supplied a great deal of technical information and in particular provided concrete instances of the transport of irradiated enriched-uranium fuels, which are the most problematic substances from the safety angle,

since they are both fissile and highly radioactive. After consultation with the Commission the insurers drew up, on their own responsibility, the following documents:

a) a standard questionnaire to be completed by the insured, as a result of which the risk can be satisfactorily defined without any need for prolonged discussions;

b) standard policies which will serve as a basis for the policies of the various nuclear pools;

c) principles for the fixing of insurance rates.

The Commission and the insurers took advantage of a second colloquium held on 13 and 14 December 1962 to map out the broad outline of further work bearing mainly on insurance against the risks involved in the use of radioisotopes.

181. Parallel to the activities of the working group on "practical insurance questions" and in order to obtain an overall picture of the maritime insurance markets throughout the world, the Commission has engaged a large insurance broker to carry out under contract a detailed study on insurance for the transport of nuclear fuels by sea.

3) *Brussels Convention on the Liability of Nuclear Ship Operators*

182. The Commission took part in the diplomatic conference on maritime law held at Brussels from 14 to 25 May 1962, which culminated in the adoption of a convention on the liability of nuclear ship operators. The Convention, which has been signed by twelve countries, none of which at present possesses a nuclear-powered vessel, is unlikely to enter into force immediately, but in several respects it is serving as a bosis for the bilateral agreements concluded or being negotiated between the United States and the countries—amongst which are several Member States—called upon to admit the American passenger-freighter NS "SAVANNAH" to their ports. The provisions of the Convention are very similar to those of the Paris Convention.

C. *Free access to qualified employment in the nuclear field (Article 96 of the Treaty)*

183. The directive proposed by the Commission and adopted by the Council of Ministers on 5 March 1962, after consultation with the Economic and Social Committee and the European Parliament, was published in the Journal Officiel of the European Communities dated 9 July 1962 after the Member States had been notified.

It will be recalled that this text sets out by defining the posts envisaged in Article 96 of the Treaty and then imposes on Member States the obligation to take all necessary measures for the automatic granting of the permits required for the exercise of such employment. In this respect it lays down the principle that the conditions for the granting of these permits shall in no case be less liberal than those established for "offres nominatives" (notifications of vacancies specifying by name the person appointed) by the provisions enacted pursuant to Articles 48 and 49 of the EEC Treaty governing mobility of labour.

Finally, the directive expressly provides that in matters which it does not cover (rights of employees' families, balancing supply and demand on the labour market, restriction of labour mobility, e.g. for reasons of public order, public safety or public health), the Member States shall apply the provisions of the EEC Treaty governing the free movement of workers.

With the coming into force of this directive, free access to qualified employment in the nuclear field, on which there are in fact scarcely any restrictions, will henceforth be guaranteed by law.

IV. Marine propulsion

A. *Contracts of association*

Activities directed at the development of nuclear propulsion for merchant ships were continued in line with the programmes

agreed in 1961 under the Commission's four contracts of association. Part of the experimental work has suffered some delay owing to the difficulty of procuring and erecting the experimental installations within the specified deadlines.

1) *Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffahrt mbH (GKSS), Hamburg, and Internationale Atomreaktorbau GmbH (INTERATOM), Cologne/Bensberg*

184. In November 1962 the construction drawings for the ship's hull were sufficiently advanced for GKSS to place a construction order, outside their contract with the Commission, with Kieler Howaldswerke AG. No decisions have yet been taken on the execution of the nuclear part of the project.

2) *Reactor Centrum Nederland (RCN)*

185. The programme of experimental work in hand, which aims at the development of an advanced marine reactor of the pressurized-water type, was rounded off by tests relating principally to a sub-critical assembly, heat extraction from the core and means of reducing the effects of corrosion. The greater part of the experimental equipment is about to be procured and installed.

3) *Fiat/Ansaldo*

186. In accordance with the terms of the contract, the Italian companies Fiat of Turin and Ansaldo of Genoa carried out in 1962 a comparative study on the respective advantages for marine propulsion of pressurized-water reactors with forced or natural circulation and direct- or indirect-cycle boiling-water reactors. These four reactor types were compared chiefly in respect of safety, controllability, weight, bulk and profitability.

4) *Gesellschaft für Kernenergieverwertung in Schiffbau and Schiffahrt mbH (GKSS), Hamburg*

187. The second contract of association with GKSS relates on the one hand to the development of means of shielding against ionizing radiations and on the other hand to the performance of mechanical and thermal tests on components of nuclear reactors for mercantile marine use. These projects, which are open to the participation of Euratom's other contractors engaged in work on marine propulsion, have led to the achievement of a good measure of coordination in this field.

B. *Technical and economic studies*

188. A study on the maximum acceptable construction and operating costs for nuclear-powered ships under present conditions was carried out by two of the Community's experts, whose report is on the verge of completion.

This study has shown the necessity of pressing ahead with research, development and testing before nuclear drives become competitive with conventional marine propulsion.

C. *Legal aspects of nuclear marine propulsion*

189. In connection with the proposed visit of the American passenger-cargo vessel NS "SAVANNAH" to European ports, the Commission has endeavoured to facilitate the necessary exchange of views between the appropriate authorities of the Member States on all the problems raised by the arrival of a ship of this novel type in Community ports, as well as the adaptation of the relevant administrative and technical regulations in force in the Member States. To this end, evaluations of the safety features of the NS "SAVANNAH" were carried out jointly in conjunction with two shipping classification societies in the Community, namely Bureau Veritas and Germanischer Lloyd.

D. *Coordination of activities*

190. All activities relating to nuclear marine propulsion in which the Commission participates were the subject of exchanges of views at three meetings of a liaison group held during 1962. This group, which is composed of government delegates and representatives of the contractors, was of valuable assistance to the Commission in its task of keeping interested parties informed and coordinating the work in hand.

V. Activity as regards industrial applications of radioisotopes and radiations

The Bureau Eurisotop, which was set up at the end of 1961 for the purpose of promoting and publicizing the use of isotopes and radiations, has now become active in all the fields assigned to it. The Bureau is assisted by a Consultative Committee comprising independent experts selected from the Community countries.

The Bureau's activities embrace the undermentioned fields:

1) *Development of applicational methods and apparatus*

191. In collaboration with national laboratories and industrial concerns, the Bureau is developing methods and apparatus for the use of isotopes through contracts with the laboratories. The twenty development projects already launched relate exclusively to the methods and apparatus required for the industrial applications of isotopes, notably in the mining and metallurgical industries, in metallography and materials-testing, in the town-gas supply and glass industries, in hydrology and transport, in plant laboratories and certain industrial activities which are carried out under exceptional conditions.

2) *Information and documentation*

192. The Bureau is compiling a bibliography with the aid of existing publications and other documents and data relating to the use of isotopes and radiations. A comprehensive statistical report has been drawn up on the production and utilization of isotopes.

An information and consultation service of which frequent use is made is at the disposal of all organizations, firms and individuals in the Community.

In collaboration with experts in the Community, the Bureau also publishes directories in which the information is classified by subject, method and principle of application. Several such directories are at present being compiled.

3) *Coordination within the Community*

193. For the purpose of coordinating, in the interests of greater efficiency, the numerous efforts exerted within the Community in the field of isotope application, the Bureau Eurisotop has started to organize working sessions with isotope users on certain clearly defined subjects. These sessions are devoted to the examination of problems concerning the division of labour, the drawing-up of a research and development programme and the distribution of information on the possible uses.

The Eurisotop Bureau cooperates closely with the competent authorities and industrial bodies in the Community countries. Joint meetings were accordingly held with the respective isotope groups of the ATEN (Association Technique pour l'Energie Nucléaire) and CONFINDUSTRIA (Confederazione Generale dell'Industria Italiana), with the Arbeitskreis Kernenergieverwertung in Wirtschaft and Verkehr, various chambers of commerce in the Federal Republic of Germany and the Coordination Committee for the Textile Industries of the European Economic Community.

4) *Legal and Economic Questions*

194. In order that full benefit may be derived from the economic advantages afforded by the use of isotopes it is necessary to set up a legal and economic framework which is adapted to the requirements of their application. The Bureau Eurisotop examines the problems arising in this sphere by entrusting research projects, among other things, to specialists within the Community.

VI. Supply

A. *Supply Agency*

195. The Supply Agency's third year of existence was marked by a strengthening of the already close ties between the Agency and its Consultative Committee, which, it will be recalled, is composed of users' and producers' representatives together with qualified experts, and has been presided over since 1961 by Mr. Jacques Mabile, Head of the Production Division of the French Atomic Energy Commission. This collaboration between the Agency and parties concerned with supply problems took the form of general studies and concrete activity carried out within working groups of the Consultative Committee.

In these working groups members of the Consultative Committee and experts selected by that body meet to discuss specific subjects with a view to advising the Agency in its activity and working out jointly with it a series of measures for the Community's benefit.

Thus one working group has undertaken, in conjunction with the Agency, the re-arrangement and rationalization of orders for special fissile materials in all cases where such measures can make it possible to cut the cost of the necessary conversions and may permit the maximum utilization of the facilities already existing in the Community or, finally, the earliest possible use of recovered materials the value of which renders failure to make use of them particularly expensive.

Another working group of the Agency's Consultative Committee has embarked upon a detailed study of the supply position which will arise in the Community when nuclear energy attains a competitive footing with conventional power sources.

Furthermore, on the Commission's instructions and with the approval of the Consultative Committee, the Agency has undertaken a second market survey with the object of ascertaining the trends likely to appear in the nuclear materials market in the period from 1963 to 1967. As in 1961, the data collected within the Community, together with an indication of the market prospects in other countries, will be transmitted to interested parties in the Community.

B. *Transactions*

1) *Natural Uranium and Thorium*

196. Apart from its work of a more general nature described above, the Agency's activity in the commercial sphere has undergone a considerable expansion. The validity of the quotas fixed by the Commission under the regulations laid down at the end of 1961 for movements involving small quantities, was substantiated by the numerous minor transactions negotiated directly between producers and users under this procedure and the small number of major transactions arranged by the Agency itself.

2) *Special fissile materials*

a) *United States/Euratom joint programme*

The first supply contracts under the joint power reactor programme were signed by the United States Atomic Energy Commission and the Euratom Supply Agency on 27 November 1962.

Under the first of these contracts the USAEC will provide the Agency with sufficient nuclear fuel for 20 years' operation of the SENN power reactor.

The contract provides, inter alia, for a system of deferred payment, spread over a ten-year period, for the operating charge of this reactor.

The second contract covers on the one hand the return to the USAEC of the unconsumed U-235 contained in the fuel supplied by the United States and irradiated in the SENN reactor, as well as the use of the credits opened by the USAEC in return, and on the other hand the purchase by the USAEC of the plutonium produced over a period of ten years, should that quantity exceed the Community's requirements.

This contract system devised by the USAEC and the Agency has the advantage of ensuring reactor fuel supplies while at the same time giving the operators, as far as possible, a free hand to choose the most economic sources of supply.

Since the Agency acts as an intermediary in these transactions, it can be of further benefit by serving as a clearing-house for the financial operations involved.

Under the same joint programme, the Agency obtained delivery from the USAEC of 834 kg (1) of U-235 contained in enriched uranium and of 4.8 kg of plutonium intended for use by Community enterprises under research contracts concluded with Euratom.

b) *Application of the amendments to the United States/ Euratom Agreement for Cooperation*

198. In July 1962 the Agency and the USAEC signed a blanket contract for the hire of enriched uranium to enterprises engaged in research programmes of their own.

In execution of this contract the Agency supplied on hire to national research centres a total of 52 kg of U-235 contained in 90% enriched uranium.

(1) The statement of contracts was fixed on 15 December 1962. Subsequent contracts will be announced by the Agency up to the final date chosen.

Power reactors in the Community which do not form part of the United States/Euratom joint programme can likewise be supplied with fuel under the Agreement for Cooperation in its amended form. Società Elettronucleare Italiana (SELNI) have therefore requested the Agency to arrange for the supply, on the most reliable basis, and most economic terms, of the enriched uranium required for the operation of their reactor.

c) *Implementation of the United Kingdom/Euratom Agreement*

199. Apart from various small consignments for use in the Commission's research programmes, in the course of the past year a contract was concluded between the Agency and the United Kingdom Atomic Energy Authority covering the supply of enriched uranium for the experimental programme of an industrial group in the Community. Negotiations are in hand with the UKAEA for the supply of the plutonium required for the initial charge of the French Atomic Energy Commission's "Rapsodie" fast reactor, which is managed in association with Euratom.

C. *Prices*

200. As in the past, the Commission continues to concern itself with the prices ruling on the world market for nuclear fuels. During the period under review the prices obtaining for natural uranium maintained the downward trend which began several years ago. Not only did isolated small transactions continue to be effected at very low prices of down to $ 3.65 per lb of U_3O_8, but important deals too were concluded at relatively low prices. In fact, the UKAEA signed a contract with Canada for 9,000 metric tons of contained uranium metal for delivery in instalments by 1970 at an average price of $ 5.03 per lb. of U_3O_8. In the United States, the USAEC recently announced its intention of allowing delivery periods in the case of contracts expiring in 1966 to be extended to the end of 1968. Furthermore, during the period 1968-1970 it is prepared to purchase quantities equivalent

to those covered by this extension, but at a maximum price of $ 6.70 per lb. of U_3O_8.

This development seems to indicate that up to 1970, when most of the contracts now in force or notified will have expired, it will be possible to purchase natural uranium at low prices based on the existence of mining installations or ore-processing plants which will already have been depreciated under contracts previously concluded at high prices.

D. *Prospects*

1) *Long-term Prospects*

201. The long-term supply problem was examined from different angles both by the Inter-Executive Group on "Energy" and by a working group of the Supply Agency's Consultative Committee.

It became apparent, in the course of these activities, that it would be advisable not only to compile an inventory of the proven reserves, but also to compare these with the Community's future requirements, taking account of the available production capacity in the free world.

From the energy point of view, it was found that the present known reserves in the free world which can be extracted at a price of $ 8 - 10 per lb. of U_3O_8 in the form of concentrates amount to some 600,000 metric tons of contained uranium metal. Geographically, these reserves are favourably distributed, being located mainly in three continents, viz: North America (Canada and the USA), South Africa and, to some extent, Australia. Together with any other reserves that may yet be discovered these are sufficient to ensure fuel supplies for an extensive reactor programme.

It also emerged that the incidence of the price of uranium concentrate on the kWh production cost of nuclear electricity is low, as a result of which it may in future be possible to exploit larger reserves at a higher price without entailing more than a moderate increase of the kWh cost.

A comparative study was made of the storage costs at conventional and nuclear power plants, allowance being made for the specific costs incurred by various types of plant. On the assumption that stocks sufficient for one year's operation are set up, it is concluded that the storage costs for nuclear generating plants are less than one-third of those necessary in order to stock a coal- or oil-fired power plant for the same period.

The foregoing considerations, coupled with the relatively long useful life of a reactor charge and the ease with which nuclear fuel can be transported, constitute advantages in favour of nuclear power plants as compared with conventional generating stations.

Finally, mention should be made of the efforts aiming at the recycling of plutonium, and its use in fast reactors with a view to breeding, which will permit the exploitation of much larger known reserves of fertile materials, thus leading to a great increase in the potential energy content.

2) *Ore Prospects*

202. The Commission received the reports on ore exploration for 1961 drawn up by the Member States pursuant to Article 70. These reports were transmitted to the Council of Ministers, but the Commission is refraining from any expression of opinion on prospecting in the Community until such time as it is able to apprise the Council of all the problems that could arise in connection with the long-term supply of nuclear fuels to the Community.

VII. Reprocessing and transport of irradiated fuels

A. *Highly enriched fuels*

203. During 1962 the Commission brought the bulk of its energies to bear on the problem of reprocessing highly enriched fuels, with particular reference to MTR-type elements (an alloy of aluminium and enriched uranium).

Euratom is directly responsible for, or participates in the management of, several research reactors already in operation or under construction (HFR at Petten, BR-2 at Mol, ISPRA 1 and ESSOR at Ispra). Various operators of other research reactors in the Community are awaiting the outcome of Euratom studies on the reprocessing of MTR fuel elements so that they can plan their own activities accordingly.

Since the storage capacity for irradiated fuel elements at several research reactors is nearing saturation point, it is essential that a solution be found; this may be either reprocessing or storage at another site. Furthermore, the development of the fast-reactor programme raises the problem of the reprocessing of enriched-uranium and plutonium-based fuels.

204. At the end of 1962 three possible solutions for the reprocessing of highly enriched fuels were being examined as to their respective merits. These are:

a) Revamping of Société Eurochemic's plant at Mol for the reprocessing of MTR elements. The draft design for this revamp provides for a daily capacity of 9.7 kg of 90-93% enriched uranium.

b) The Italian EUREX plant. The final design, now nearing completion, provides for a daily capacity of 16 kg of uranium-aluminium alloy. This plant, which will be in a position to carry out reprocessing operations early in 1965, will nevertheless be equipped with a storage tank during the second half of 1963.

c) The CEA study on a plant capable of handling both fast-reactor fuel and MTR elements. The envisaged daily capacity of the plant is 5 kg of fissile material.

The progress made with this investigation during 1962 was such that some preliminary conclusions can be expected very shortly. The Commission also looked into the possibility of reprocessing MTR fuels in the United Kingdom.

B. *Transport*

205. Concomitantly with the study of the various reprocessing possibilities outlined above, special attention was paid to the problems involved in the transportation of irradiated fuels between the reactor sites and each of the envisaged reprocessing plants.

In order to avoid the adoption of different solutions to all these new problems in the various Community countries, the Commission proposed appropriate measures which were discussed in the Coordination Group for the Transport of Radioactive Materials working under the auspices of the Council of Ministers. The main outcome of these measures was that in addition to the invitation to tender for the carriage of consignments from BR-2 at Mol, HFR at Petten and ISPRA I, to be effected by the end of 1963, the Commission was induced to issue simultaneously two enquiries relating on the one hand to consignments from FEM at Münich and FRH at Hamburg and on the other hand to those from Mélusine and Siloé at Grenoble, Triton at Fontenay and Pégase at Cadarache.

The Coordination Group were in fact of the opinion that if the enterprises concerned were invited to submit proposals for the simultaneous transport of as many irradiated-fuel consignments as possible, they would be in a better position to make the necessary arrangements as regards both special equipment and the training of qualified personnel. Furthermore, the centralization of transport activities to which this should normally give rise will make it necessary to devise a rational policy on dispatch and will thus improve the overall economy of transport operations in the best interests of the reactor operators.

With due allowance for the time that the enterprises must be allowed in order to adapt themselves to the technical or legal difficulties involved in these transport operations, it is to be hoped that the proposals they submit will enable the necessary decisions to be taken by about mid-1963. These decisions will be based both on the result of the studies relating to each of the solutions

envisaged for chemical reprocessing and on the proposals concerning fuel transportation.

VIII. Relations with employers' associations and trade unions

A. *Employers' associations*

206. The past year has been marked by a strengthening of the links forged with the electricity producers' and industrial equipment manufacturers' associations; this applies particularly to bonds with the Union of European Community Industries (UNICE), the International Union of Producers and Distributors of Electrical Energy (UNIPEDE) and the International Federation of Industrial Producers of Electricity for Captive Consumption (FIPACE).

Relations with UNICE were consolidated during the period under review by exchanges of views relating mainly to isotopes, insurance and transport.

In April 1962 the Commission participated in a colloquium at Amsterdam with representatives of FIPACE. The exchanges of views which took place on this occasion were followed up by discussions between experts.

Finally, the Commission has further reinforced its ties with the chambers of commerce in the Community.

At the invitation of the Euratom Commission a discussion was held in March 1962 with the Secretaries-General of the National Forums of the Member States. The discussion sparked off profitable exchanges of opinions with circles concerned in the development of nuclear energy in the Community. These meetings will be continued at irregular intervals. The Commission also played an active part in the first FORATOM Congress, held in September 1962.

With the steady progress of nuclear development towards the technical and economic stage, more and more tasks relating

to the harmonious evolution of the Community's nuclear industries are devolving upon the Euratom Commission. For this reason relations with industrial federations and enterprises in the Community will have to undergo considerable further consolidation in the course of the next few years.

Following the publication of the official proceedings of the conference on "Technical Progress and the Common Market" which they had jointly sponsored in December 1960, the three European Executives adopted the conclusions and recommendations formulated at that Conference. They plan to organize successive round-table meetings with independent experts, the employers' organizations and trade unions, and the government representatives, in order to study means of implementing the conclusions of the 1960 conference. These meetings will enable the three Executives to draw up a working programme based on a list of priorities. A preliminary exchange of views with the independent experts took place at Brussels on 26 and 27 November 1962.

B. *Trade Unions*

207. The Commission continued its information policy vis-à-vis trade-union circles both through the Economic and Social Committee and by means of meetings held at various levels; among the latter mention must be made of the interview given by President CHATENET and Vice-President MEDI to the Executive Committee of the International Confederation of Free Trade Unions (ICFTU) for the six Member States on 4 October 1962.

With the assistance of the "Trade Unions" section of the Joint Press and Information Service, the Commission organized several information visits specially designed for trade-union delegates, among which was a visit to the Ispra establishment of the Joint Research Centre.

Euratom's second five-year programme, which was tabled for discussion on several occasions, gave rise to exchanges of

views between the representatives of the Commission and those of trade-union organizations.

Subjects of direct interest to the trade-union organizations, such as the economic outlook for nuclear energy and the question of employment in the nuclear sector, were tackled.

C. *List of nuclear installations*

208. In view of the interest shown by numerous organizations and enterprises concerned with nuclear development, and in response to the wish expressed by the European Parliament, the Commission has compiled a second edition of the list of nuclear installations in existence, under construction or planned in the Community.

Fixed on 1 January 1953, this document testifies to the definite progress achieved during the last 18 months in the nuclear equipment of the Community countries.

IX. Communications relating to investment projects

(Articles 41 - 44 - Regulations nos. 4 and 5)

208a. The application of Articles 41 - 44 of the Treaty, which have been supplemented by Regulations 4 and 5 governing investments, has proved comparatively difficult, mainly owing to the changeable nature of the projects.

The Commission is examining procedures calculated to improve and to facilitate the application of these provisions.

For this purpose, the Commission is to publish an information brochure destined for Community enterprises, which will expound the spirit and letter of the legal provisions relating to investment projects.

CHAPTER IV

HEALTH AND SAFETY

APPLICATION OF THE BASIC STANDARDS AND UNIFORMITY BETWEEN LAWS ENACTED BY THE MEMBER STATES — REVISION OF THE BASIC STANDARDS — BACKGROUND RADIOACTIVITY MONITORING — IMPROVEMENT AND COORDINATION OF MEASURING METHODS — TECHNICAL STUDIES — BACKGROUND RADIOACTIVITY COUNTS — CONTROL OF RADIOACTIVE WASTE DISPOSAL PROJECTS — NUCLEAR PLANT SAFETY — HYGIENE AND MEDICINE — SOCIAL QUESTIONS AND PUBLICITY

I. Basic standards and legislative uniformity

A. *Application of the basic standards and uniformity between laws enacted by the Member States*

209. In 1962 the Commission made several approaches to Member States with a view to ensuring the satisfactory application of the directives establishing the Basic Standards and succeeded in obtaining a number of positive results. The situation has, in fact, undergone a marked change for the better, as will be apparent from the following comments on the advances made by the Member States.

Germany

As a result of the Atom Law of 23 December 1959 relating to the peaceful uses of nuclear energy and safeguards against the dangers involved and the first decree relating to radiological protection, which came into force on 1 December 1960, the German Federal Republic became the first Member State to

adopt a specific set of rules in line with the Basic Standards. Rules relating to medical applications still remain to be adopted.

Belgium

On 11 April 1962 the Belgian Government officially submitted to the Commission the draft "general regulations on the protection of the general public and workers against the hazards of ionizing radiations" and a preliminary draft of a "Royal Decree amending the general regulations on the protection of workers".

After making a thorough examination of these drafts, the Commission made a certain number of recommendations on specific questions in its letter of 11 July 1962.

It should be noted that, in compliance with the Basic Standards and after obtaining the Commission's approval, Belgium had already passed the law of 29 March 1958 relating to the protection of the general public against the hazards of ionizing radiations, in line with the Basic Standards, the Royal Decree of 12 April 1960 relating to the possession and use of radioactive substances for medical purposes, and the ministerial order of 6 May 1960 providing for the implementation of the said Royal Decree.

France

On 12 June 1962 the Commission received from the French Government a draft "decree relating to the regulations governing basic nuclear installations" and a draft "instruction on the establishment of a plan of defence against radioactive irradiation and contamination".

In its letter of 19 July 1962 the Commission expressed the opinion that these provisions were adequate to ensure compliance with part of the Basic Standards, the decree relating to the regulation of basic nuclear installations implementing in particular Articles 3 and 17, para. 3 of the Basic Standards, and the Instruction on the establishment of a plan of defence against radioactive irradiation and contamination being especially designed

to put into practice Article 17, para. 5 of the Basic Standards. The Commission also voiced the opinion that no recommendation would be necessary under Article 33 of the Treaty. In any case, the Commission holds the view that the Basic Standards must be complied with whatever the nature of the establishment concerned.

Italy

After the Senate had signified its consent, the Chamber of Deputies followed suit by approving, on 20 December 1962, a draft nuclear energy law submitted by the Government. The main feature of this text, which relates to the use of nuclear energy in Italy, is that it empowers the Government to take any action with regard to administrative measures or the establishment of regulations required in the field of health and safety.

During the past year the Inter-Ministerial Committee continued with its task of drafting a set of specific regulations. The appropriate national authorities have kept in touch with the appropriate departments of the Commission so that the progress made could be duly noted. The Italian Government submitted to the Commission an extremely detailed report on the text on 14 November 1962.

It would seem likely that the promulgation of the nuclear energy law will soon be followed up by the establishment of the final regulations governing its implementation.

Luxembourg

A law on the protection of the general public, the draft of which was accorded the sanction of the Commission in 1958, has just been approved by the Luxembourg Parliament. Work has begun on the drafting of a text designed to give effect to that part of the Basic Standards which relates to the safeguarding of the general public. This text will be the subject of a Grand-Ducal decree based on the law relating to the protection of the general public.

Netherlands

It will be recalled that on 5 February 1960 the Dutch Government conveyed to the Commission a draft nuclear energy law on which the latter gave a favourable opinion. This draft was recently approved by the Lower Chamber of the States-General and is now before the Upper Chamber for discussion in the near future.

The draft decree for the adaptation to the Euratom Basic Standards of the "Decree on Protection Against Ionizing Radiations" of 20 March 1957, submitted to the Commission by the Dutch Government, was approved by the Commission on 8 February 1962.

Finally, a new draft "Decree on Radioactive Substances" was referred to the Commission on 4 June 1962. Exchanges of views held with the Dutch authorities while the draft was being scrutinized have resulted in agreement on the introduction of certain amendments to the text, on which the Commission issued a favourable opinion on 20 July 1962.

210. It can therefore be asserted that on the entry into force of the measures which have been examined in draft form by the Commission, most of the Member States will have a basic framework of standards in harmony with the fundamental safety regulations, at least in sectors where they are most urgently required. Nevertheless, the Commission must continue to stress the importance which it attaches to the Member States' persistence in their efforts to ensure that the Basic Standards are implemented by domestic legislation in order to bring about their complete observance throughout the Community.

The Commission's policy of keeping abreast of the various stages in the drafting of the texts implementing the Standards from the very outset has proved extremely successful and relationships with the national administrations are on an excellent footing of cooperation and mutual understanding. The discussions held during the numerous meetings between Euratom departments

● *Sampling posts*

★ *Measuring posts,*
in contact with Euratom, for the monitoring of artificial radioactivity in the atmosphere at ground level.

and their opposite numbers in the Member Countries have on many occasions made it possible to arrive at agreement on the necessary modifications before the texts were officially transmitted and, what is more, any recommendations which appeared to be required were favourably received by the State concerned.

B. *Revision of the Basic Standards*

211. It will be recalled that the revision of Annexes 1 and 3 of the Basic Standards, undertaken on the proposal of the Commission, resulted in a decision by the Council on 5 March 1962. The directive revising these annexes was published in the "Journal Officiel" of 9 July 1962.

At the same time, pursuant to a request submitted by the Federal German Government in 1960 for the revision of Articles 9 and 10 of the Standards, the Commission found it necessary to examine the entire problem of emergency irradiations. Particular attention was paid to this study having regard to the importance of the subject and the development of certain concepts on this question on an international level, especially in the International Commission on Radio-logical Protection whose most recent meetings were held in September 1962.

As a result of this study, and after consulting the group of experts referred to in Article 31 of the Treaty, the Commission drafted a proposal for the emendation of the Standards so that in particular the dose received in emergency irradiation can be split up and recovery is obligatory from the effects of each fractional dose, the period, pattern and conditions of recovery being determined.

Transport of Radioactive Materials

212. In connection with the Basic Standards and the harmonization of national legislations, reference should be made to the problems created by the transport of radioactive materials and the provisions applicable thereto in each Member State.

The work undertaken in this field is outlined in para. 205 of the chapter on Industry and Economy, particularly as regards the activities of the coordination group for the "Transport of radioactive materials" which comes under the Council; although the terms of reference of this group do not directly cover questions of health and safety, such issues are in fact very often brought up owing to the fact that they overlap with the various problems created by methods of transport.

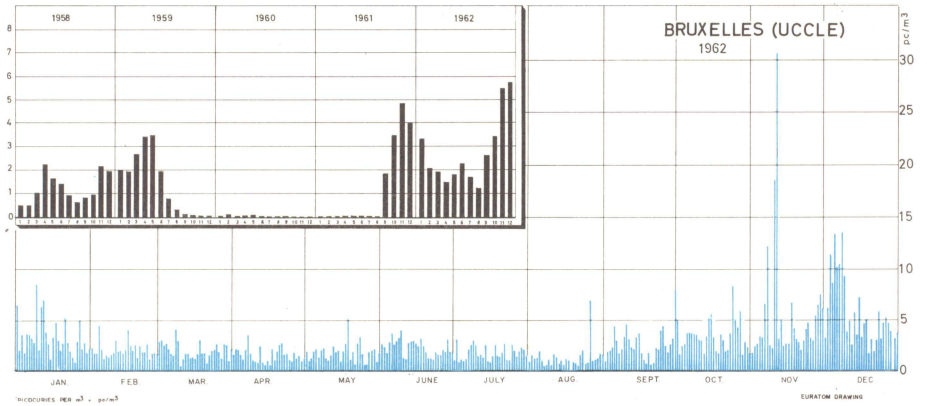
II. Background radioactivity monitoring

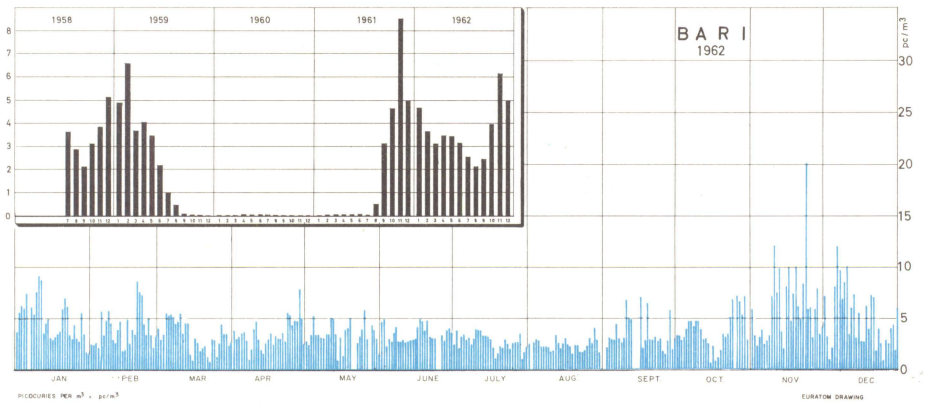
A. *Control set-up*

213. In 1961 the Commission described a general monitoring network consisting of 88 sampling posts and 79 measuring posts for air and 98 sampling posts and 54 measuring posts for the monitoring of radioactivity due to fall-out and precipitation, all linked up with Euratom. There was a further substantial improvement in this situation during 1962, with both a considerable increase in the number of sampling posts and increased centralization of the measuring posts.

As a result there are now nearly 150 sampling posts for the measurement of atmospheric radioactivity and about the same number of sampling posts for the measurement of fall-out and precipitation. This network covers the entire territory of the Community in a chequerwork pattern of squares with sides of less than 100 km and constitutes a very effective form of general supervision. On the other hand greater centralization of the measuring posts (at present there are only 60 posts for the measurement of atmospheric radioactivity and 32 for the measurement of fall-out and precipitation) has made for the greater completeness, accuracy and speed of transmission of the data supplied to the Commission.

The 5 sampling posts and the measuring post at Ispra have enabled several spectrometric analyses of the dusts to be made in 1962 and the radioactivity of various foodstuffs to be determined.





Two examples of air radioactivity measurements carried out in 1962 and from 1958 to 1962 at Brussels and Bari.

The Commission is also preparing a general card-index system giving technical data on each of the sampling and atmospheric radioactivity measuring posts. This card index system will be distributed among the specialized scientific and technical centres of the Member States. The Commission intends to keep the system up-to-date and to supplement it as soon as possible with data on the posts used for sampling and measuring the radioactivity of surface waters.

B. *Coordination of measuring methods*

214. In addition to its efforts at centralizing the measuring posts, Euratom has continued its work of coordinating the measuring methods so as to ensure optimum comparability of the results obtained.

As in previous years, experts from the Member States collaborated very closely in the study of certain problems connected with the application of Articles 35 and 36 of the Treaty, and during 1962 the Commission brought together several study groups who examined the organization for monitoring radioactivity in milk and water sampling.

A complete account of the work will be published in a document which will provide the monitoring authorities with a useful guide to the control of background radioactivity.

Finally, Euratom organized a number of seminars at Saclay in April 1962. This work, which was mainly concerned with the comparison of apparatus for the measurement of atmospheric radioactivity, provided the impulse for two activities to be started which the Commission is following with great interest. A centre has been established in the Saclay area where apparatus will be subjected to comparative tests, while research on the statistical interpretation of the results is also in progress in Belgium and Holland.

C. *Technical studies*

215. In addition to organizing the monitoring network and coordinating radioactivity measuring methods, the Commission has made a series of technical studies.

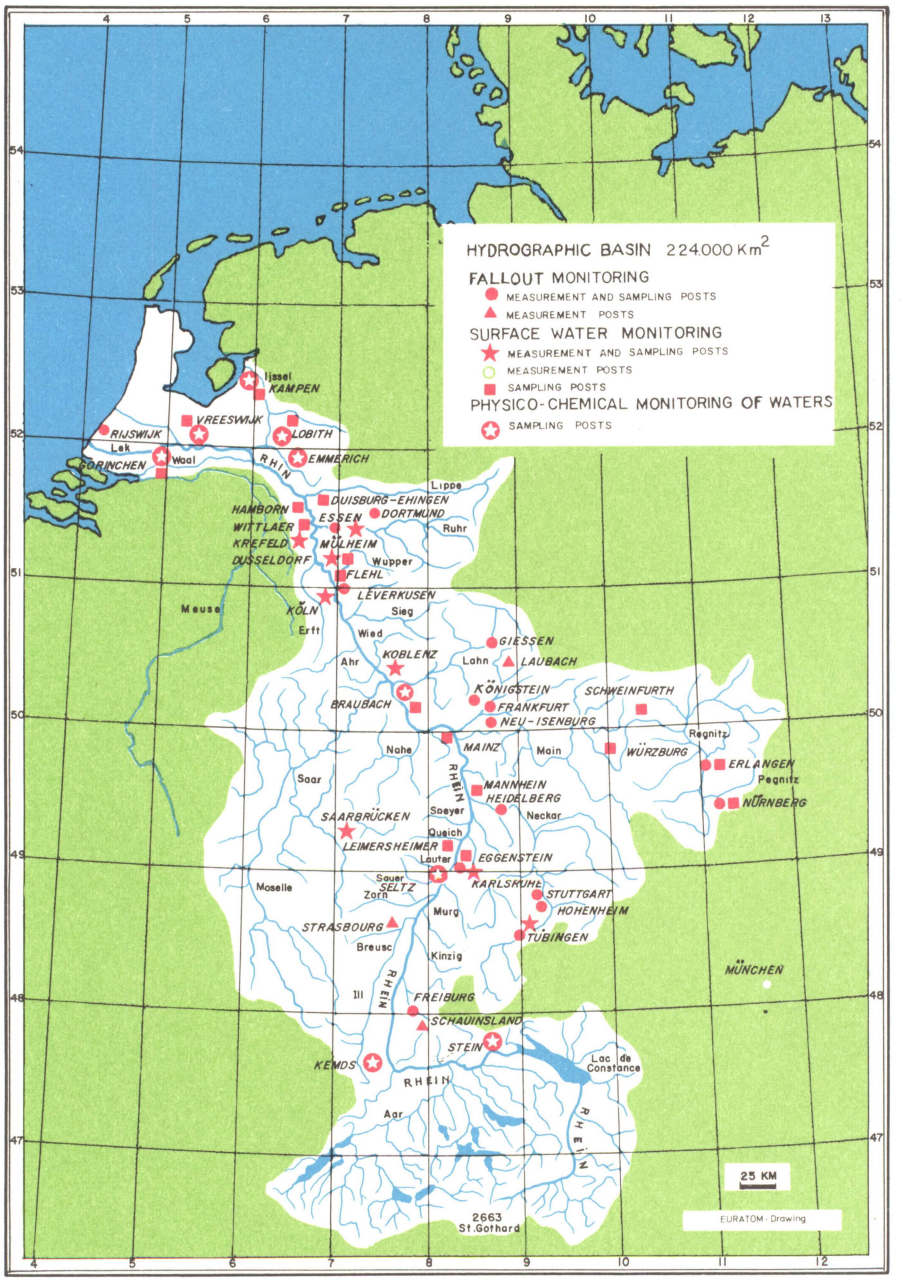
For example, a contract was concluded with a German scientific institute for the purpose of studying the *sampling filters* used in Europe for atmospheric radioactivity measurements. This study will make it possible to compare the efficiency of these filters and to establish the optimum operating zone for each.

216. Studies were also made of the *radioactivity in the Rhine Basin* in conjunction with representatives of the appropriate authorities of the countries concerned and in close contact with the International Commission for the Protection of the Rhine.

At present this study includes an overall list of geographical, geological, hydrological and demographic data on the Rhine Basin and a survey of the radioactivity of the waters, suspended materials and sediments measured by the same methods and means in the national laboratories. The study will be continued in 1963 and 1964 for the purpose of assembling the most accurate information on the temporal and spatial trend of the natural and man-made radioactivity of the Rhine and its main tributaries.

217. External dosimetry, the crucial item of the control system for nuclear workers, is a question to which the Commission attaches primary importance.

While continuing its study of problems relating to the coordination of means and methods employed in the Community for individual external irradiation dosimetry, the Commission has also begun investigating measures designed to bring about improvements. The chief nuclear installations in the Community have taken an active part in this work, which is particularly important in view of the progress now being made in dosimetry.



Radioactivity monitoring network in the Rhine Basin

D. *Development of background radioactivity*

218. Background radioactivity decreased during the summer of 1962 but rose again in September. At the present moment the levels reached are higher than in any previous year. This rise was followed with a great deal of attention by the Commission's departments and the health authorities of the Member States.

Research and monitoring work was assisted by the weekly bulletins published since 1961 for the benefit of the authorities referred to in Article 36 of the Treaty. These bulletins provide the various Member States with a continuous picture of the chronological trend of radioactivity throughout the Community area.

As in the previous years, a comprehensive document will shortly be issued, combining the measurement results of artificial background radioactivity in the six countries. It gives all the values, monitored by the competent authorities of the Member States, for the radioactivity of dusts suspended in the air, fall-out and precipitation and surface waters, and also, for the first time, information concerning measurements of the radioactivity due to iodine-131 in milk. This information is particularly valuable in view of its direct connection with food-chain contamination resulting from fall-out and precipitation.

III. Nuclear plant safety

A. *Examination of radioactive waste disposal projects*

219. In the course of 1962 six projects were studied by the Commission pursuant to Article 37 of the Treaty (1 Dutch project, 2 Belgian projects and 3 German projects).

In arriving at its opinions, the Commission had to take into account several factors affecting the distribution of radioactive wastes around an installation; furthermore, there are substantial divergences between nuclear installations. It is therefore impossible to establish exact, universal criteria which

can be applied in all cases. Each project has to be examined on its individual merits, a task which calls for a combined effort on the part of specialists representing a wide variety of scientific fields.

In some cases it might be possible to apply Article 37 in a more satisfactory manner. The Commission has made some comments to this effect in the opinions submitted, stressing the fact that certain Member States should make a special effort to ensure more adequate compliance with the recommendation published in the "Journal Officiel" of 21 December 1960.

Some of the most vital items of information required deal with the mean and maximum waste concentrations allowed for during normal operation and in the event of an accident, and although it is not always easy to assess such values correctly, these particulars must be known if the objectives outlined in the Treaty are to be attained.

B. *Opinions on operational safety*

220. Opinions have likewise been given on installations and laboratories in Joint Research Centre establishments, particularly the laboratories of the Central Nuclear Measurements Bureau, the Van de Graaff accelerator which is due to start operating in the near future at Geel, and the chemical laboratory of the University of Liege, which is engaged on work connected with a research contract relating to transplutonium chemistry.

Opinions were also expressed on the health and safety of workers and the general public in the course of studies of projects concerning the SENA reactor at Chooz and the KRB reactor at Gundremmingen, submitted in pursuance of Article 41 of the Treaty and the Euratom/US Agreement.

A second evaluation of the SENN project is now in progress together with an assessment of the safety features of the EUROCHEMIC installation, the study of which is proceeding in close cooperation with the Belgian authorities.

IV. Nuclear hygiene and medicine

A. *General safety provisions*

221. General safety provisions to safeguard against the hazards of ionizing radiations were adopted by the Commission in respect of the Joint Research Centre Establishment at Ispra. They stem from the Directives laying down the Basic Standards and are intended to put into practice the general health and safety principles embodied in the directives.

In line with the rules set out in these general safety provisions, it has been decided to draft similar texts for the other Joint Research Centre Establishments, taking into account the national regulations to which each establishment is subject.

B. *Munich symposium*

222. One of the problems now arising in connection with the protection of workers is that of radioactive contamination, which raises specific difficulties with respect to control, prevention, protection and organization in the event of accidents.

These were the four keynotes of the Munich Symposium organized by the Commission in October 1962, which was attended by nearly 300 delegates from the Member States and other countries, as well as from the international organizations concerned.

The official conference proceedings will be published in the course of 1963.

C. *Food chain contamination*

223. The year 1962 saw the coming into effect of the contract of association between the Commission and the French Atomic Energy Commission (CEA) relating to a study of the radioactive contamination levels in the environment and the food chain. A study group has been formed consisting of representatives of a number of different scientific fields.

A number of reports were drafted, chiefly dealing with the definition of the standard man, the radionuclides to be taken into consideration in order to achieve the aims of the contract, the sources of radioactive pollution, and the elimination of radionuclides by dairy cattle.

Surveys of the dietary pattern followed in the six Community countries are now being planned.

All the studies are being undertaken in close collaboration with the national authorities. For this purpose the Commission is also keeping in close touch with the FAO.

D. *Decontamination techniques*

224. A Dutch institute has been approached with a view to making a joint study of the problems entailed in the decontamination of surface waters polluted with radioactive substances. These are matters meriting particular attention owing to their bearing on public health, particularly in countries or areas where water supplies are drawn from rivers.

E. *Supervision of workers exposed to radiations*

225. The Commission is particularly concerned with ensuring the safety of workers exposed to ionizing radiations and one of its constant preoccupations is to bring the system adopted for the medical supervision of such workers to the highest possible pitch of perfection. In particular, the Commission is endeavouring to bring into line the pre-employment criteria and control procedures.

The very valuable contributions made by the Stresa and Munich conferences in this sphere by the Stresa and Munich conferences will take practical shape in 1963 when closer collaboration is established between the authorities operating large-scale nuclear installations.

F. *Research and documentation*

226. The Commission's research programme includes such subjects as haematological, cytological and cytogenetic studies of exposed groups of the population, particularly nuclear workers.

New techniques are being developed and their application has already brought the Commission into close contact with several nuclear plant managers who are anxious to introduce these techniques in their system of radiological protection for nuclear staff.

Furthermore, copious documentary material has been gathered on the general problems of health and safety, which is a fertile field of scientific theory. The collection of up-to-date material enables the Commission to carry out its promoting and coordinating activities in every realm of research having a bearing on health and safety.

V. Social problems

227. While exercising meticulous supervision over nuclear workers, the Commission is also anxious to come to grips with the social problems arising out of nuclear hazards.

The EEC Commission, the High Authority of the European Coal and Steel Community and the Euratom Commission organized at Brussels in December a joint "European Social Security Conference" at which the Commission submitted a report on "the occupational hazard of ionizing radiations and social security" in which the present situation was described and proposals were put forward on the possibilities, methods and limits of coordination between the Member States.

Injuries caused by ionizing radiations obviously entitle the injured person to compensation when such injuries are regarded as industrial accidents or occupational diseases. But the

studies undertaken by the Commission together with the other two Communities have revealed a number of disparities between the systems in force in the six Member States, especially as regards the benefits, terms, qualifying periods for acceptance of liability, and the problems created by the assumptions made as to the radiological origin of the injury. These systems should be brought into line with the latest scientific knowledge so that adequate compensation can be paid out for delayed effects. The Commission's comparative study of the existing indemnification procedures has shown coordination to be possible. The methods of achieving this should be investigated in close cooperation with the other two Communities and the national nuclear energy authorities.

The Commission has also proceeded with its studies on the statistics of industrial accidents and diseases due to occupational radiation hazards, as well as the number of nuclear sectors and workers subject to exposure.

It has also renewed the present contract relating to industrial psychology in nuclear enterprises.

Finally, a detailed programme has been drawn up, with the assistance of Community experts, on training in radiation hygiene. This programme has been accepted by the national authorities and may serve as a basis for the coordination of specialized training schemes, in the field of radiological protection.

VI. General publicity

228. In addition to the comprehensive document referred to above on man-made background radioactivity in the six Community countries ([1]) mention should be made of articles which have appeared in the non-specialist press as well as in scientific and technical reviews.

([1]) Cf. para. 218

A number of lectures were given on health and safety problems to audiences of laymen; especially journalists and other groups of visitors invited to the Headquarters of the Commission by the Official Spokesman's Group or the Communities' joint information service.

Euratom has also taken part in radio and television features, particularly in connection with the survey on radioactivity in the Rhine.

CHAPTER V

SAFEGUARDS AND CONTROLS

METHODS AND PROCEDURES ADOPTED BY THE COMMISSION — PROGRESS MADE IN SURVEILLANCE OF NUCLEAR ACTIVITIES — IMPLEMENTATION OF REGULATIONS 7 AND 8 — INSPECTION OF RESEARCH INSTALLATIONS AND INDUSTRIAL BODIES

I. Methods and procedures adopted by the Commission

229. During 1962 the control system set up by Euratom continued to operate in line with the following procedures, adopted and applied as long ago as 1959 and 1960:

a) Regulation 7, defining the basic technical characteristics of each plant of which declaration is to be made to the Commission (Article 78 of the Treaty);

b) Regulation 8 governing the statements to be submitted to the Commission periodically by the various enterprises concerning stocks and movements of materials on Community territory (Article 79 of the Treaty);

c) The inspections provided for in Article 81 of the Treaty, during which the declarations submitted by enterprises pursuant to Regulations 7 and 8 are verified on the spot.

The reason for these procedures is laid down by the Treaty itself, which requires on the one hand that the Commission shall ensure that the materials are used solely for the purposes stated by the users and on the other hand that it shall ensure compliance

with the regulations concerning supplies as well as commitments undertaken by the Community towards non-member states.

230. The number of cases in which these procedures were applied continued to show a steady increase as a result of the progressive extension and diversification of nuclear activities.

Furthermore, the regulations in force concerning supplies were supplemented by Regulation 10 which defined the extent of the transactions exempt from the simplified procedure laid down for the conclusion of contracts by the Supply Agency.

Finally, outside commitments were involved in the supply to Community enterprises, under the Euratom/US Agreement, of substantial quantities of fissile material and equipment for a power plant. The supplementary clauses to this Agreement, signed in 1962, have considerably improved the Community's sources of supply for special fissile materials, which may now be used for projects other than those covered by the joint research programme. Furthermore, it is now becoming possible to reprocess in the Community and under guarantees supplied by the Community the irradiated fuels obtained under the bilateral agreements concluded by the Member States.

Since it was acknowledged in the Euratom/US Agreement that the responsibility for these imports devolved upon the Community and not upon the supplier, the control procedures with respect to outside commitments have thus risen to considerable proportions and these activities are bound to assume even greater dimensions.

The manner in which this control system is organized and operated offers the two-fold advantage of facilitating the position with regard to supplies from the US and placing these supplies under a purely European surveillance.

231. In 1962 the Community's activities seemed to be on the verge of a new phase marked by the commissioning of new power plants and the inception of construction work on installations intended for the reprocessing of irradiated materials.

One important development in this period was that three reprocessing plant projects were submitted to the Commission; they are now being studied. These projects require the Commission's approval in line with Article 78, Para. 2, a provision which has so far not had to be applied. An internal procedure was therefore recently established by means of which the Commission can carry out periodical inspections as work progresses, in an effort to arrive at a compromise between the safeguarding of investments and the fact that the conditions required for the granting of approval under Article 78 did not all obtain until construction had been completed.

232. The table below shows the gradual increase in the control operations carried out by Euratom in the two fields listed above, i.e. those covered by Regulations 7 and 8:

	1961	1962	1963
Regulation nº 7	72	83	97
Regulation nº 8	111	127	134

It should be noted that the increase in the number of installations coming under Regulation 8 was greater during the period 1962/63 than the figures would indicate, for declarations concerning 25 new plants were submitted for the first time in 1962/63, as required by Regulation 8, but at the same time 17 mines were closed and one research reactor ceased to be covered by territorial jurisdiction of the Treaty.

II. Application of regulation 7

233. The installations of which the basic technical characteristics were communicated to the Commission up to 28 February 1963 break down, according to the branch of industry, as follows:

	Germany	Belgium	France	Italy	Netherlands	Community
Manufacture of concentrates	1	1	4	1	—	7
Fuel fabrication	1	1	5	—	—	7
Fuel element fabrication	1	3 *d*)	3	—	—	7
Reactors *a*)	13	6 *c*)	18	14	5	56
Irradiated fuel reprocessing	—	—	1	—	—	1
Laboratories *b*)	4	4	5	6	—	19
	20	15	36	21	5	97

a) The term « reactors » covers power and research reactors as well as sub-critical assemblies.
b) Physical and chemical laboratories using source materials or special fissile materials for research purposes. A separate statement is submitted for each reactor possessed by a research centre.
c) One of which is now outside the Community.
d) Two closed down.

III. Application of Regulation 8

234. The following data illustrate the situation regarding the application of Regulation 8 at the end of February 1963.

a) *Stocks and movements within the Community:*

— Ores: 10 enterprises submit quarterly statements to the Commission relating to the production and stocks of 29 mines;

— Source materials and special fissile materials: 52 enterprises submit to the Commission the balances and inventories for 105 installations.

b) *Exports to and imports from non-member countries:* A total of 260 declarations relating to import and export transactions with non-member countries were submitted to the Commission by 17 enterprises, the breakdown being as follows:

	Imports	Exports
Natural uranium	45	27
Depleted uranium	14	—
Thorium	23	82
Special fissile materials	62	7
	144	116

Thirteen of these imports and three of the exports related to materials covered by the Community's guarantee.

The following breakdown shows the geographical distribution within the Community of the enterprises, establishments and installations governed by Regulation 8:

	Germany	Belgium	France	Italy	Netherlands	Community
– *Enterprises*	17	7	15	13	7	59
– *Establishments*	20	7	49	19	8	103
– *Installations*						
Mines	2	—	26	1	—	29
Manufacture of concentrates	1	—	4	1	—	6
Fuel fabrication	1	1	6	—	—	8
Fuel element fabrication	1	1	3	—	—	5
Reactors	13	5	16	13	6	53
Irradiated fuel reprocessing	—	—	1	—	—	1
Laboratories	6	4	8	8	6	32
	24	11	64	23	12	134

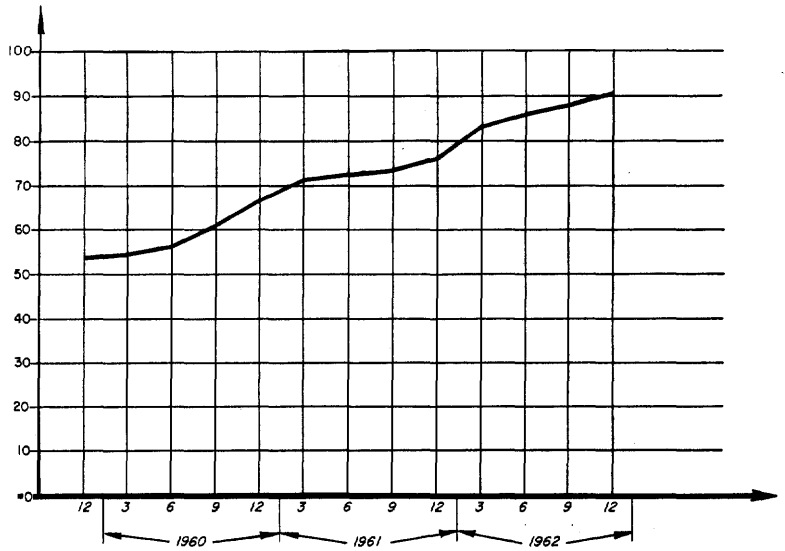
235. The question of controls was of course raised, in connection with the negotiations with the United Kingdom, with respect to Great Britain's defence programme. When the talks were opened President Chatenet made the following statement on the Commission's behalf:

"The Treaty of Rome, which from the very outset was conceived as being applicable to states having a military programme as well as to those having none, has instituted a system which, while in principle covering all the nuclear activities of the Member States, contains special provisions regarding military applications and designed to provide effective safeguards for the defence interests of these states. The Commission holds the view that an intelligent application of the Treaty will make it possible to solve any problem that may arise in this connection, while at the same time respecting Euratom's avowedly peaceful purposes and avoiding any distinction liable to discriminate against the States which have no military programme or to those which have".

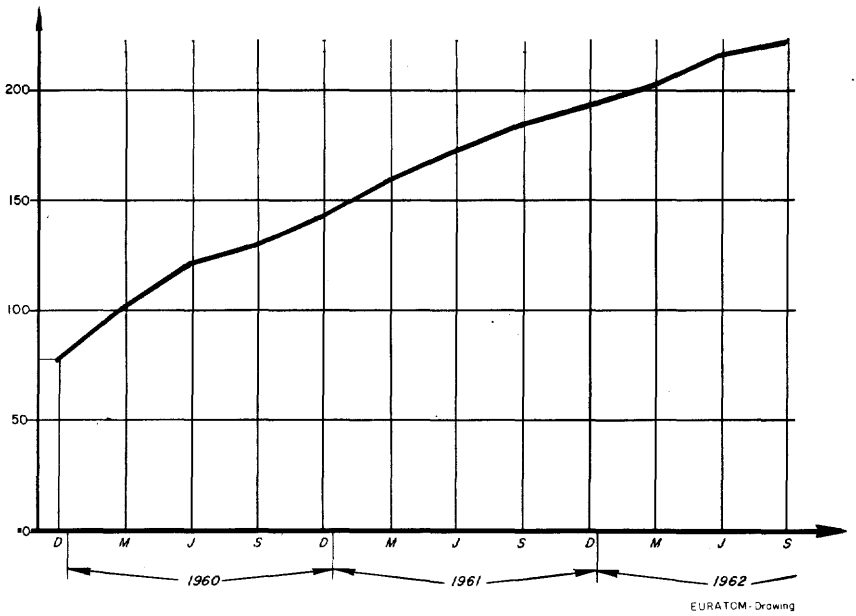
The subject was therefore broached during the negotiations, but the talks were broken off before the matter could be pursued any further. The question will therefore have to be taken up again, this time in line with the procedure described in paragraph 177 of last year's General Report.

IV. Inspections

236. The implementation of control procedures progressed satisfactorily in 1962. As in previous years, the process was facilitated in several cases by the assistance provided by the national authorities. The inspectors took advantage of their visits to installations by requesting, whenever appropriate, further particulars to clarify the declarations submitted pursuant to Regulations 7 and 8. The carrying out of checks to ensure observance of the provisions governing supply were to a certain extent promoted and assisted by the coming into force of Regulation 10,



Total number of installations which have submitted declarations in line with Regulation n° 7.



Materials' statements transmitted to Euratom by persons and enterprises in the Community (total figures).

defining the small quantities which, in line with Article 74 of the Treaty, may be transferred without any need to call upon the Supply Agency.

A total of 34 inspections had been carried out by the end of 1962, 20 of them in research installations and 14 in industrial plants, the following establishments being visited:

1 ore concentration plant;
7 installations for the chemical reprocessing and refinement of uranium and thorium concentrates;
1 fuel preparation installation;
4 fuel element fabrication plants;
1 irradiated fuel reprocessing plant;
3 power reactors;
12 research laboratories;
13 research reactors.

CHAPTER VI

EXTERNAL RELATIONS

DEVELOPMENT OF AGREEMENTS FOR COOPERATION WITH THE UNITED STATES, THE UNITED KINGDOM AND CANADA — SIGNATURE OF AGREEMENT FOR COOPERATION WITH ARGENTINA — DEVELOPMENT OF EXISTING RELATIONS WITH OTHER NON-MEMBER STATES — RELATIONS WITH THE EMERGING COUNTRIES — COLLABORATION BETWEEN THE COMMUNITY AND OTHER INTERNATIONAL ORGANIZATIONS

237. The Council of Ministers recently expressed its desire to have a discussion with the Commission on the subject of the Community's external relations. This proposal was readily accepted by the Commission, which also considers the time ripe for a clarification of all the problems arising out of the application of Chapter X of the Treaty (External Relations).

As a cerellary to the ever-increasing extent of cooperation within the Community in all the major fields of nuclear research, the fulfilment of the initial programme and, what is more, the prospects opened up by the second five-year programme, Euratom's own activities are coming to be more and more intimitely meshed with those of the Member States. The question therefore arises whether this trend will not effect relations between the Community and non-Member countries. The latter are evincing, and will continue to evince, a growing interest in the Community's achievements in the field of nuclear research—wich suggests that the attraction exerted by the Community on these countries will carry on growing. A further consequence of the same trend is that it is becoming increasingly difficult to distinguish between information of which each

Member State may freely avail itself and information which has now become the property of the Community as a whole.

It is accordingly the Commission's wish that the discussions initiated with the Council may bring out the need for harmonization in the field of the Community's external relations—a field which, in the Commission's view, also embraces action open to Member States, the limits to such action and the conditions in which it might be undertaken by those States. Such a harmonization would take due account of both the letter and spirit of the Treaty and of the practical situations which have arisen, and which will recur, in the context of the development of the coordinated efforts of the Community and its Member States in the field of nuclear technology.

The Commission considers that it is its duty to draw the attention of the European Parliament to the importance of this problem, the solution of which will undoubtedly have its repercussions on the whole of the Community's external relations in the atoms-for-peace field. At the appropriate time it would be pleased to have a discussion with the Political Commission of the European Parliament on the various aspects of the Community's external relations.

I. Relations with non-member states

A. *Countries with which Euratom has concluded Agreements for Cooperation*

a) *The United States*

238. The amendments to the Agreement for Cooperation between EURATOM and the United States concluded in 1958 and to the 1960 supplementary Agreement were signed on 21 and 22 May 1962.

Their entry into force on 9 July last year constituted a new and significant milestone in the development of United States/ Euratom relations.

It is worth while to recall the principal object of these amendments and to underline the spirit in forming them, namely to bring about a greater degree of flexibility in the supply and use of the special fissile materials made available to Euratom under the original agreement and its first supplement.

The texts which came into force in the summer of 1962 provide for not only the purchase but also the hiring of the special fissile materials needed to fuel the power reactors to be built under the Joint Euratom/US Programme ([1]).

A further relaxation enables the Community to draw on the 30 tons of U-235 laid down in the 1958 Agreement for Cooperation certain quantities of material required either for research undertaken in the Community outside the framework of the Joint Euratom/US Research Programme or for persons and enterprises in the Community desirous of constructing reactors outside the joint power reactor programme.

Another provision in the amended texts permits fissile materials to be imported into the Community from the United States for processing into fuel elements for subsequent re-exportation. The new texts also provide for the chemical processing in the Community of fuel elements imported from the United States. The two new clauses have imparted to the agreements a flexibility which is proving extremely beneficial to the Community's industries.

At a time when the Commission has just decided to devote a major part of its credits under the second five-year programme to the development of fast reactors, there is considerable significance in the insertion in our agreement with the United States of a clause permitting the USAEC, subject to the approval of the American legislative and executive authorities, to sell or lease for peaceful purposes other than those laid down in the agreements any quantities of U-233 and plutonium which may be agreed upon.

([1]) See also Chapter III (Industry and Economy), nos. 172 et seq.

In conclusion, it should be stressed that the strengthened collaboration between the Community and the United States is one of the encouraging results of the joint efforts which the Member States have been making over the last five years through the agency of Euratom. The EAEC has, in fact, acquired sufficient experience and authority for the Atlantic partnership policy to be able to be implemented under the agreements with the United States in a field in which such a policy is eminently desirable.

b) *United Kingdom*

239. The exchanges of information and personnel in the sectors reviewed in previous years continued, together with the supplying of small quantities of special fissile materials to the research centres of the six countries, to be the kingpin of the system of cooperation envisaged by the framework agreement of 1959.

The continuing Committee for Euratom/United Kingdom Cooperation met in April 1962 to take stock of results thus obtained. It became evident at this meeting that the existing cooperation could be further strengthened in certain fields, such as fusion, irradiated fuel reprocessing, fast reactors and delivery to the Community of larger quantities of special fissile materials.

Moreover, the negotiations which started in July 1962 on Britain's admission to Euratom illustrated even more graphically the importance of the mutual aid which—in the technical sphere—British membership would make possible and the advantages to both sides of closer cooperation between the Community and the United Kingdom.

It is the Commission's view that the breaking off of the negotiations with the United Kingdom should not compromise the possibilities outlined above, and it hopes that the positive factors which emerged in the course of these talks will help to strengthen the fruitful cooperation which has grown up between the United Kingdom and the Community since 1959.

c) *Canada*

240. Technical cooperation between Euratom and Atomic Energy of Canada Ltd. (AECL) progressed satisfactorily over the past year. In particular, the relations between the two partners on the one hand and the USAEC on the other assumed more definite shape, especially as regards the study of organic liquids.

d) *Brazil*

241. Implementation of the Cooperation Agreement with Brazil began in 1962, more particularly in the field of training of specialists.

e) *Argentina*

242. The Agreement for Cooperation previously negotiated between Euratom and Argentina was signed in Buenos Aires on 4 September 1962.

On the same occasion, a Commission delegation visited the Argentine Atomic Energy Commission's installations at Buenos Aires and Bariloche.

In February 1963, Admiral Oscar A. Quihillalt, the Chairman of the Argentine Atomic Energy Commission, paid an official visit to the Euratom Commission for the purpose of a joint examination of the ways and means of applying the Cooperation Agreement.

It was agreed that the primary aim should be to promote the exchange of research workers and technicians and that the discussions on the programmes of both parties should be continued with a view to furthering in every possible way the cooperation thus embarked upon.

B. *Other countries*

a) *Japan*

243. Following its visit to Japan in 1961, the Commission received from the Japanese authorities an initial set of proposals

for cooperation, mainly with regard to exchanges of information, which were discussed by the Council and the Commission in October and November 1962.

In November of last year two members of the Japanese Atomic Energy Commission, Messrs. Ishikawa and Komacata, were the guests of the Commission and paid a visit to the Euratom installations at Geel/Mol and Ispra. Preliminary exchanges of views on the same occasion enabled the Commission to obtain some further details on the Japanese proposals.

b) *Sweden*

244. In June 1962, the Commission paid an official visit to Sweden at the invitation of the Swedish Government, being received by Premier T. Erlander and Ministers P. Lange and R. Hermannsen. The Commission was thus afforded the opportunity of going over certain scientific and industrial installations at Stockholm, Västeräs, Agesta and Studsvik.

c) *Greece*

245. Finally, on 10 and 11 January 1963, the Commission received a Greek delegation, headed by Admiral A.G. Spanides, Chairman of the Greek Atomic Energy Commission.

The Greek delegation was given detailed information concerning Euratom's activities and programmes and acquainted the Commission with the efforts undertaken by Greece in the atoms-for-peace field.

Having regard to the association relationship between Greece and the EEC, the importance of such exchanges of views, notwithstanding their wholly general and preliminary nature, needs no emphasizing.

C. *Missions accredited to Euratom*

246. The Ivory Coast, Portugal, Spain, Australia and Greece have now accredited missions to the Community, thereby

increasing to sixteen the number of non-Member States maintaining diplomatic relations with Euratom. In addition, Brazil, Argentina, Upper Volta and the Republic of Ireland have set in train the necessary formalities for the accrediting of diplomatic missions.

D. *Relations with emerging countries*

247. The new implementing convention on association between the EEC and the Associated African States and Madagascar (EAMA), initialled in December 1962, also encompasses exchanges of nuclear products in line with the combined provisions of the two Treaties of Rome.

In the spring of 1962, the Ivory Coast Republic applied to the Commission for the loan of Euratom specialists to assist in the investigation of the possible uses of radioisotopes.

To that part of the request which concerned agricultural and medical research in particular the Commission was able to give the Ivory Coast Government broadly favourable reply.

It is the Commission's view that the granting of such technical assistance to the Ivory Coast fits logically into the scheme of cooperation between the Six and the emerging African States and of the contracts already established by the Commission with some of these countries, and also with the Afro-Malagazy Organization for Economic Cooperation (OAMCE).

II. Relations with international organizations

A. *Organization for Economic Cooperation and Development* (OECD)

248. In accordance with Supplementary Protocol N° 1 to the Convention relating to the Organization for Economic Cooperation and Development, which came into force on 30 September 1961, the European Atomic Energy Community is represented in the

OECE and takes part in its activities. As stipulated in the new Article 21 of the Statute of the European Nuclear Energy Agency (ENEA), the provisions of the above-mentioned protocol apply both to Euratom representation in the Agency and its Steering Committee and to the Euratom Commission's participation in the work carried out by the Agency and its Steering Committee. This collaboration has been very active during the past twelve months.

249. International cooperation under the Dragon Project Agreement, for example, has been successfully continued. The technical details are given in the chapter on Research. Although the agreement signed in Paris on 23 March 1959 is not due to expire until 30 March 1964, it was deemed necessary for all the signatories to ensure that the work already commenced was continued beyond the originally fixed date of expiry. A new agreement was accordingly concluded in November 1962 covering the period from 1 April 1959 to 30 March 1967. A new five-year (1 April 1962 to March 1967) research programme has as its main aim the supplying of the signatories with the necessary information for the development of a high-temperature gas-cooled carbon-moderated power reactor capable of economic operation on land. The extension of the agreement will increase the total budget for the project to 70 million EMA u.a. of which 32,200,000 (or 46%) will be borne by Euratom.

250. In addition, the Halden Agreement has been extended to 30 June 1964, with the proviso that Euratom's further participation will be limited to what is required for ensuring the completion of the experiments and work commenced under the preceding programme.

The main subjects of the extension are the reactor dynamics programme on the second core charge, the final evaluation of the tests and the publication of the results of the theoretical and experimental work.

Euratom's financial contribution under this extension will not be in excess of 300,000 EMA u.a.

251. By the terms of an amending clause to the Annex to the Agreement for Cooperation between the Euratom Commission and the US Government, special nuclear materials imported from the United States can now be chemically processed in the Community.

The Commission, the European Nuclear Energy Agency and the American authorities have taken the necessary measures, particularly with regard to Euratom's control of materials and equipment, for the processing of fuels of US origin by EUROCHEMIC.

Finally, the competent departments of the Euratom Commission have taken an active part in the work of the OECD, Public Health Sub-Committee in connection with the establishment of basic standards for protection against radiation; the revision of these standards was approved by the OECD Council on 18 December 1962.

B. *International Atomic Energy Agency (IAEA)*

252. The contacts between the various Euratom departments and the Secretariat of the Agency were continued during the past year. At the invitation of the Board of Governors, the Commission was represented by an observer at the Agency's Sixth General Conferences, held in Vienna from 16 to 26 September 1962.

C. *International Labour Organization (ILO) and World Health Organization (WHO)*

253. Through the links forged with the ILO and WHO, representatives of the Commission were able to keep abreast of the work of these organizations and to contribute to it in the various sectors of health and safety.

Euratom's world-wide activities in the field of radiological protection were outlined for the first time at the International Radiology Conference held at Montreal in September 1962.

The Commission took an active part in the European Conference on Public Health Aspects of Protection Against Ionizing Radiations which was organized at Düsseldorf in June 1962 by the WHO.

Representatives of Euratom also shared in the work carried out by groups of experts, in particular on the disposal of radioactive wastes, reactor safety and hazards' evaluation, the migration of radioactive ions in the soil, filtration of the atmosphere, contamination of surface water and dosimetry.

D. *Council of Europe*

254. Cooperation between the Euratom Commission and the Council of Europe has continued along wholly satisfactory lines. Relations with the Consultative Assembly were given concrete expression by a joint session with the European Parliament in September 1962. On this occasion, Mr. Sassen, on behalf of the Euratom Commission, delivered an address in which he outlined Euratom's attitude to the political problem facing the three Communities. In addition, the Assembly of the Council of Europe adopted, at its last session (15 January 1963), on the basis of a report submitted by its Economic Commission, a resolution on Euratom's Fifth General Report.

III. Other activities in the field of the Community's external relations and coordination of such activities

255. In compliance with Article 103 of the Treaty, France submitted to the Commission a draft agreement between the French and Brazilian Governments on the peaceful uses of atomic energy. The Commission was also, in accordance with the same procedure, apprised by the German Federal Republic and France of draft amendments to the bilateral agreements concluded with the US Government.

As to the agreements concluded in previous years and referred to in previous General Reports (cf. Fourth General Report, para. 163, and Fifth General Report, para. 195), the information deriving from the implementation of these agreements continues to be communicated to the Commission, which passes it on to the Member States.

CHAPTER VII

ADMINISTRATION AND PERSONNEL

SIZE OF STAFF — IMPLEMENTATION OF THE STATUTE — RECRUITMENT — SOCIAL QUESTIONS — EUROPEAN SCHOOLS

256. The gradual implementation of the Statute of Service for the Personnel and the system applicable to "other employees" together with the linking-up of the two five-year programmes, had considerable repercussions on personnel management, making 1962 a year of transition marked by the two following features:

— a continued increase in staff requirements, due to the progression of existing activities and the commencement of new ones;

— the replacement of individual employment contracts by the rights, obligations and procedures laid down by the Statute of Service, which inevitably has had its effect on the volume and rate of recruitment.

I. Size of staff

257. The total staff employed, which at 31 March 1962 was 1,966, had by 28 February 1963 risen to 2,416.

This increase of 22.8% on 1962 has mainly affected the research and investment budget, a breakdown of the relative personnel being given in Annex IV to the present report.

258. The total staff covered by the working budget is now 576, which represents an increase of 17 employees, or 3% on 1962.

The Commission continued to adhere resolutely to its policy of limiting recruitment in the administrative field. However, this could only be done by calling for increased efforts on the part of the existing staff in order to cope with the heavier work due both to the modifications brought about by the coming into force of the Statute of Service and to the development of the research programme, which is having a direct effect on many sectors of the working budget (in particular administration, finance and industry).

For this reason, the Commission was constrained to take various steps for the rationalization of methods and the development of its punched-card and punched-tape multicopying equipment. With regard to methods, a number of problems relating to working procedure were examined and useful contacts were set up with the departments responsible for organization and methods in the other two Communities, in the nuclear research bodies of several Member or non-Member countries and in various intergovernmental agencies.

Finally, attention should be drawn to the fact that, geographically speaking, the Euratom staff is very widely scattered. There are at the moment 40 different places where Euratom personnel are employed (24 in the Community [1]) and 16 in non-Member States [2]), which has the inevitable effect of making the administrative work more complex and difficult.

II. Statute of service for personnel

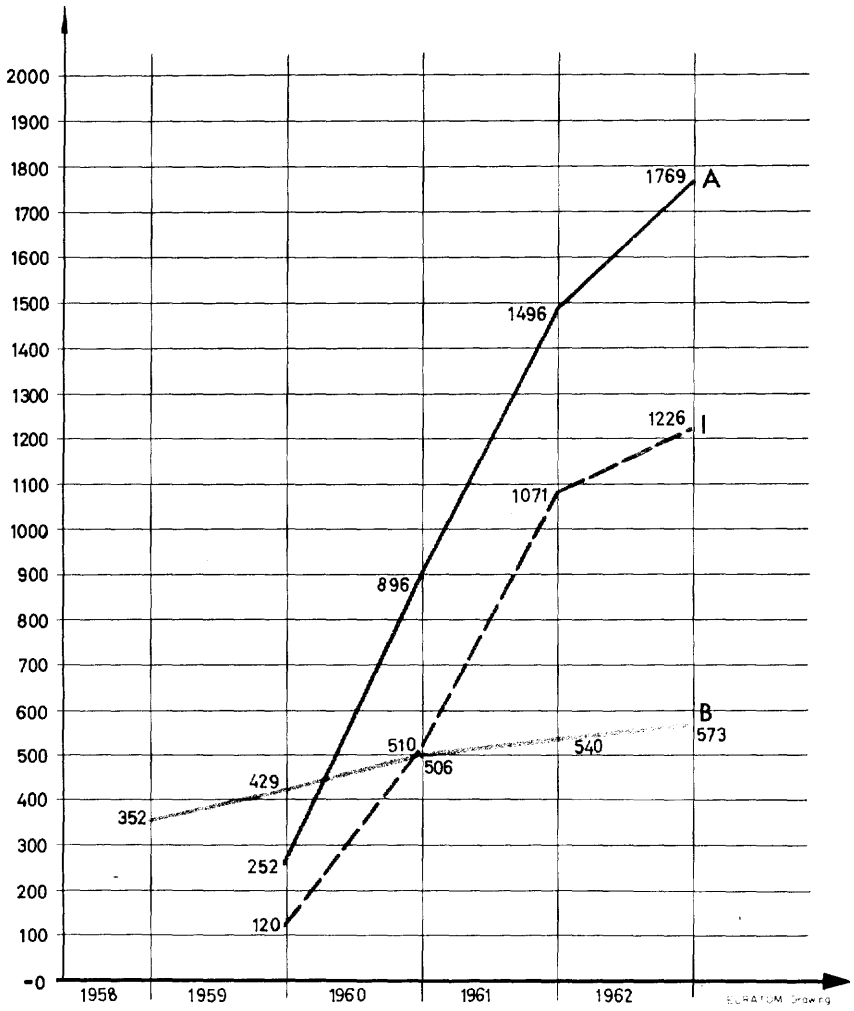
259. The gradual implementation of

— the Statute of Service for Personnel;

— the system applicable to "other employees";

(1) Brussels, Ispra, Geel, Karlsruhe, Petten, Liège, Mol, Munich, Cadarache, Fontenay-aux-Roses, Grenoble, Saclay, Versailles, Bologne, Frascati, Milan, Naples, Padoue, Pavie, Rome, Turin, Arnhem, Rijswijck, Wageningen.

(2) 13 places of employment in the United States and 3 in Great Britain.



Research budget staff (A) including those of the Ispra establishment (I) and operating budget (B).

— and the Community tax scheme

has entailed a considerable amount of fresh work, some of which is not yet entirely finished.

Up to 1 January 1962, all employees engaged were given contracts of limited duration, as provided by Article 214, para. 3, of the Treaty. The first step was to redistribute the entire staff amongst the various categories of employees laid down by the Statute, such as permanent officials, temporary staff, establishment employees and auxiliary staff, depending on the nature of the function performed at the institution. Criteria also had to be established for distributing staff between the scientific and technical teams on the one hand and the administrative division on the other.

While the Statute contains special regulations which to a certain extent accommodate the specific requirements of the research section and take account of the traditions of the industrial enterprises with which Euratom is variously connected, it is none the less a fact that the application of the provisions of the Statute to the staffs of various establishments is posing major problems.

The increase in the Joint Centre establishment's manpower necessitated the rapid drafting of special regulations for "establishment employees", who are governed by separate regulations determined on the basis of local practice. The regulations concerning the establishment staff employed in Italy and Belgium are to be submitted to the Council in the course of 1963.

260. Furthermore, the Commission set up an "integration board" to express, prior to classification as an employee covered by the Statute, individual opinions on the professional capabilities of each employee occupying a permanent position at the time the Statute came into force. This work was completed by the end of March 1963, but other allied procedures and formalities must be fulfilled before certificates of appointment can be issued to employees. This phase may be expected to be concluded by 1 April 1963.

As an aid to the objective implementation of the rules relating to integration, the Commission also compiled two job-description tables as required by the Statute, one for posts covered by the working budget and the other for those coming under the research budget.

261. The Statute provisions concerning personnel, which were adopted by the Councils in December 1962, are applied in all the Institutions of the European Atomic Energy Community, the EEC and the ECSC, which thus calls for a certain harmonization of the policies of the various Institutions. With this aim in view, numerous contacts have taken place between the heads of administration of the eight Institutions ([1]) and the Statute Committee.

The regulations enacted in 1962 concern in particular:

— annual leave
— public holidays
— the school fees allowance
— social security for auxiliary employees in line with the terms of Regulations 3 and 4 concerning social security for migrant workers
— Community tax, etc.

By means of these contacts certain progress has been made towards dovetailing the interpretation and implementation of certain provisions concerning personnel. While fully appreciating the desirability of unifying the provisions of the various Statutes, the Commission is sometimes confronted with difficulties due to the specific nature of the Institution, whose work is in numerous respects similar to that of a large enterprise.

262. A final noteworthy development in connection with the implementation of the Statute concerns the provisions on the

([1]) Commission of the EAEC, Commission of the EEC, High Authority of the ECSC, Court of Justice, European Parliament, Secretariat to the Councils, Economic and Social Committee, European Investment Bank.

periodical review of the salary scales, which have been modified in the light of the increase in the cost of living, wage trends in the public and private sectors and recruiting difficulties.

It was with this in mind that the Councils assented to an increase in salaries as from 1 January 1963. The primary effect of this increase was to bring the Brussels Communities' salaries into line with those of the ECSC.

Furthermore, pursuant to Article 64 of the Statute, adjusting coefficients, dating from 1 January 1962, were worked out to enable the Commission to assure its entire staff of the same purchasing power in whatever place they may be employed, taking into account the differences in living costs in the various JRC establishments.

In conclusion, mention should be made of the Council's adoption of certain provisions before the Statute came into force. These provisions apply among other things to:

— the field of application of Article 15 of the Protocol on Privileges and Immunities;

— determination of the categories of employees subject to Community tax and the list of family allowances and social security benefits deductible from the assessable amount.

III. Recruitment

263. The main feature of the new recruiting procedure introduced by the Statute is the holding of general selection tests, aimed at ensuring not only that the selection is made from among the largest possible number of candidates but also that it is carried out with the maximum objectivity. Inevitably, however, this new procedure will entail a certain slowing-down in the recruitment of the 450 employees that the Commission hopes to engage before the end of 1963.

So far, 16 general selection tests have been held, 14 for scientific or technical staff of grades A, B and C and two for the administrative side.

The following conclusions can already be drawn:

— the tests are difficult to organize, mainly owing to the problem of comparing educational levels and diplomas in different countries and their various scientific training institutions. In addition, experience has shown that it is necessary to define the lines of demarcation between the numerous specializations required at the Headquarters and the various establishments.

— There is usually a very large number of applicants, but many research workers, although considerably attracted by Euratom's activities, cannot be engaged because of slowness of the procedure and the inadequacy of certain of the salary scales which can be offered them.

These two points should be stressed, for they find concrete expression in the fact that nearly 30% of all offers of employment sent to applicants having a grade A scientific training in 1962 were declined.

In a field where skilled manpower is at a premium, the Commission is meeting with ever-increasing competition from private industry in the various countries. Apart from the relatively low level of some starting salaries and the rigid structure of the pay scale, there is in some cases a lack of flexibility in the provisions of the Statute which imposes a trammel on possible promotion. All these factors are serious obstacles to recruitment.

IV. Social Questions

264. The period covered by the Report saw the development of staff representation, more particularly in the form of the Provisional Staff Committee, which acts as a spokesman for all

employees, including those at the research centres and other establishments.

Provisional Joint Committees were set up at the Headquarters and at the Ispra establishment, the former being at the present stage responsible for all establishments other than Ispra.

The Commission wishes to underline the fact that its contacts with the representatives of the staff are always marked by an atmosphere and true mutual understanding.

265. Two sets of regulations relating to *social security* were worked out in 1962 in collaboration with the other Institutions, one on the joint health insurance system and the other on coverage of accidents and occupational diseases as laid down in Articles 72 and 73 of the Statute respectively. There has been similar liaison activity in the setting-up of uniform procedures for the superannuation and social security schemes.

266. In addition, a *social scheme* was elaborated in 1962 to facilitate contact between the establishment employees, who are frequently housed at a considerable distance from one another, and to promote amenities for leisure and cultural activities. This work was undertaken on a joint basis with the Ispra staff in particular, and the Council has voted the necessary credits for 1963 to enable this establishment to set up a recreation centre which will be laid out primarily in accordance with the needs of the employees' families.

267. As regards housing, it will be noted with satisfaction that a first instalment of 400 permanent dwellings is being put up at Ispra by the Italian Government. While this problem is gradually being overcome at Ispra, there is reason to fear that this is not the case at Petten and Karlsruhe, for, despite the respective efforts of the Dutch and German authorities on the one hand and the Commission on the other, it is clear that, owing to the shortage of accommodation in both the Netherlands and Germany, this problem will not be solved quickly without a

special effort on the Commission's part. Since housing is an important factor in successful recruiting, the Commission is redoubling its endeavours to arrive at solutions in this matter.

268. The *Medical Service's* staff has been increased both at the Headquarters and at the Ispra establishment, in order to step up the medical surveillance of the employees who, as Euratom's activities become more and more extensive, are particularly exposed to the hazards inherent in all nuclear research activities.

Furthermore, the Medical Service has continued its work of maintaining medical and medical-social supervision of the entire staff, has carried out numerous recruitment and pre-employment and screening examinations and has also lent assistance in the running of the health-insurance scheme.

In the scientific field, the Medical Service instituted a system for the treatment of radiation injuries which was found to be effective in several cases and formed the subject of an official report published by the Commission. The Medical Service has established contacts with university clinics and hospitals throughout the Community countries with a view to the application of this treatment. Favourable results have already been achieved, and in order to study the specific action of the product used in the treatment, a research contract was concluded jointly with Professor Mandel, of the Strasbourg Faculty of Medicine, and the firm of Bayer. Finally, studies on pathology due to ionizing radiations are now being conducted in collaboration with the Ispra section of the Medical Service. The results of this work can be put to immediate practical use.

European Schools

269. There are at present five European Schools in the Community, three of which (Mol, Varese and Karlsruhe) have been set up for the express purpose of satisfying needs arising out of the creation of Euratom establishments in the areas concerned.

Five European schools are at present in existence in the Community : at Luxembourg, Brussels, Mol, Ispra-Varese and Karlsruhe. The latter three were set up to serve Euratom establishments at which employees from the six Community countries are working side by side. The above picture shows part of the European school at Ispra-Varese, which already has a total of 614 pupils.

(Photograph by Euratom)

The attendance breakdown at 1 February 1963 was as follows:

Luxembourg	1,306
Brussels	1,385
Mol	487
Varese	614
Karlsruhe	24

The European School in *Brussels* continues to flourish. The number of pupils and teachers is constantly increasing and more new buildings have now been added.

Since the beginning of the school year 1962, the school at *Mol* has had a new provisional building, which is illustrative of its expansion. The foundation stone of the permanent building, however, was laid in the spring of 1962 and construction work is now in progress.

Part of the *Varese* school is already housed in permanent buildings. The last stage of the construction work is in progress and should be completed towards the end of 1963. The Varese school is expanding rapidly, keeping pace with the growth of the Ispra establishment of the JRC.

The *Karlsruhe* school, the setting-up of which was resolved upon by the High Council on 13 April 1962, opened at the start of the 1962 school year in a temporary building.

Finally, in April 1962 the High Council for the European Schools gave its assent to the creation of a school in the Petten area. Negotiations on the project are under way and are progressing well.

The Commission records its satisfaction at the creation and expansion of the European Schools, which would not have been possible without the support and financial backing of the Member States on whose territory they have been set up.

CHAPTER VIII

FINANCE

RESEARCH BUDGET — WORKING BUDGET — MEMBER STATES' CONTRIBUTIONS — OWN RESOURCES — FISCAL AND CUSTOMS AFFAIRS — BUDGETARY ORGANIZATION

I. Research and investment budget

The year 1962 marks the end of the first five-year programme. It is therefore possible, after examining the implementation of the research and investment budget for the past financial year, to obtain an overall picture of what has been accomplished under this initial programme.

A. *Implementation of 1962 Budget*

270. The total volume of credits available to the Commission in the form of budgetary commitments in 1962 was 87,510,000 EMA u.a. This amount was made up of the *budgetary commitments* under the 1962 budget—namely 71,443,000 EMA u.a.— plus the credits outstanding from previous financial years (pursuant to Article 4, §1 (b), para. 3 of the financial regulations on the establishment and implementation of the research budget), aggregating 16,067,000 EMA u.a.

Commitments entered in the books at 31 December 1962 amounted to 60,540,000 EMA u.a., broken down as follows:

	Figures rounded off to nearest '000 EMA u.a.	*% actually utilized*
— Personnel expenditure (Heading I)	11,147	100%
— Working expenditure (Heading II)	3,418	97%
— Equipment and real property investments in the Joint Research Centre Establishments (Heading III)	10,220	62%
— Reactor construction and development (Heading IV)	22,030	55%
— Other scientific and technical activities (Heading V)	13,725	86%
	60,540	69%

These amounts, and in particular those opposite Headings I and II in the table above, are not definitive; at its meeting on 17 and 18 December 1962, the Council granted a supplementary period of three months for effecting the necessary adjustments, more especially those occasioned by the application of the Statute of Service for officials and employees of the Community as from 1 January 1962. It will therefore only be at the end of this supplementary period that the precise results for the financial year 1962 will be known.

Thus the commitments contracted represent approximately 69% of the total budgetary commitments available, the apportionment of which by sections is shown in the table in Annex I to the present Report. However, if account is taken of two large contracts totalling 13 million EMA u.a., relating to the Commission's participation in the development of two power reactors, which were scheduled for signature in 1963 and which are to be concluded right at the beginning of 1963, the percentage of credits actually used may be set at 81.3%.

271. *Payment authorizations* under the 1962 budget amounted to 56,781,000 EMA u.a. As payments up to and including 31 December 1962 totalled 35,187,000 EMA u.a., the proportion of these authorizations actually taken up was 62%.

The difference in relation to the estimates must be attributed mainly to the nature of the operations concerned, i.e. orders for heavy and special equipment involving lengthy delivery dates and, to a large extent, contracts in respect of which it is not easy to fix a time-table for payments.

Furthermore, many payments have still to be effected against the 1962 credits during the supplementary period.

Payment authorizations brought forward from 1961 to 1962, totalling 19,424,000 EMA u.a., were utilized as to 16,498,000 EMA u.a. i.e. 85%.

Finally, it should be mentioned that three transfers from one item to another were authorized by the Council. The first, 300,000 EMA u.a., enabled the Community to make good its contribution to the Halden Project. The purpose of the other two was to adjust certain credits under Heading II (working expenditure).

272. In view of the fact that all the sums voted for personnel and working expenditure relate to the Commission's own activities, disregarding, that is, the proportion of these credits— a small one, moreover—assigned to the settlement of the salaries of personnel working with contractors and the corresponding administrative expenditure, the credits available in 1962 for the Commission's own activities amounted to about 42,000,000 EMA u.a., or 48% of the total. Of this amount, 76% was utilized, as compared with 62% in the case of credits allotted to meet expenditure under contracts, leaving aside, however, the credits earmarked for participation in power reactors for the reasons already given, the latter proportion comes to 88%.

This ratio between the Community's own activities and activities under contracts is an accurate reflector of the policy

pursued by the Commission in this field, which finds particularly marked expression in the operations scheduled under the second programme.

B. *Implementation of first programme*

273. The table below illustrates the position as regards fixed appropriations made under the research and investment budgets for the five financial years covered by the first five-year programme and also as regards commitments contracted over the same period.

Budgetary year	Amounts definitively adopted in Budgets	Cancellations already known	Probable cancellations under 1962 Budget	Commitments at 31 March 1963 (1)	Credits outstanding in 1963
	(1)	(2)	(3)	(4)	(5)
1958	449,000				
1959	2,759,000				
1960	34,833,000			164,191,794	26,887,382
1961	85,050,000	1,455,024			
1962	71,443,200		2,000,000		
Total :	194,534,200	1,455,024	2,000,000	164,191,794	26,887,382

(1) These commitments have been contracted on the assumption that following the supplementary period there will be a cancellation of 2,000,000 EMA u.a. under Headings I and II.

There is accordingly a surplus of approximately 24,000,000 EMA u.a. from the first five-year programme, which will have to be added to the amount available under the second programme.

The difference between the 215,000,000 EMA u.a. estimates for the first programme and the fixed appropriations actually

used up to the end of the financial year 1962 (i.e. 164,000,000 EMA u.a.) comes to 51,000,000 EMA u.a., made up as follows:

— 27 million EMA u.a. — outstanding credits to be appropriated to their respective budgetary headings;

— 20.5 million EMA u.a. — already assigned to the various items at the time of drawing up the second five-year programme;

— 3.5 million EMA u.a. — additional surplus to be appropriated afresh.

Payments effected over the 5 years of the first programme up to 31 December 1962 are shown in the following table:

Budgetary Year	*Payments Effected*
1958	449,000
1959	2,759,000
1960	12,535,000
1961	37,617,461
1962 (up to 31 Dec. 62)	51,684,415
	105,044,876

Payments still due under the first programme after 1 January total about 110 million EMA u.a.

Part of these payments will have been made during the supplementary period and another part against the credits brought forward from the 1962 budget. As the exact amounts of these payments will not be known until after 31 March, it will doubtless suffice to show the additional expenditure in which they will involve the Member States. The latter's contributions have totalled 129,117,000 EMA u.a. for the five years covered by the first programme, the balance will accordingly be about 85 million EMA u.a.

Annex II to the present Report contains a table recapitulating in terms of budgetary commitments the implementation of the financial part of the first five-year programme.

II. Working budget

274. The Community's working budget for the financial year 1962 was finally adopted by the Council of Ministers on 31 January 1962.

It provides for a total expenditure of 10,181,597 EMA u.a.. the credits appropriated to Section III (Commission) amounting to 6,720,880 EMA u.a., not including the credits of 388,539,48 EMA u.a. brought forward from the previous financial year. The number of the Commission's employees paid under the working budget was fixed at 599.

Two supplementary working budgets were adopted during the financial year 1962.

The first, which was approved by the Council on 2 July 1962, added 564,650 EMA u.a. to the initial budget. However, no credits or manpower increases in favour of the Commission were authorized.

Furthermore, the coming into force of the system of remuneration of Members of the Commissions and the Statute of Service for the employees necessitated an adjustment of the 1962 credits, which as a result of the introduction of a second supplementary budget, approved on 17 and 18 December 1962, were increased to 11,025,441 EMA u.a., of which 6,936,198 EMA u.a. were for the Commission's provisional estimates. There was, however, no increase in the Member States' contributions, the extra credits having been duly compensated, in particular by the collection of the proceeds of the tax now paid on the salaries of the Community's officials and employees in accordance with the provisions of their Statute of Service.

In order to facilitate the implementation of the supplementary budget and to make possible the budgetary operations resulting from the integration of employees in accordance with the methods and procedure laid down in the Statute of Service, the Council decided that the period for the implementation of the budget for the financial year 1962 should be extended by three months, i.e. to 31 March 1963, a measure corresponding to that enacted for the purposes of the research budget.

As regards the Commission, commitments under the working budget for the financial year 1962 totalled 6,839,187.39 EMA u.a. at 31 December 1962. Payments effected up to that date amounted to 5,159,552.05 EMA u.a.

Amendments will be made to these figures at 31 March 1963, when the supplementary period ends, in the light of the actual expenditure resulting from the application of the Statute of Service and which must be assigned to the financial year 1962.

III. Other financial questions

Financial contributions from Member States

275. The 1962 budgetary resources were made up almost entirely of financial contributions from the Member States.

The financial regulations governing the methods and procedure for making such contributions available to the Commission came into force on 1 April 1962.

These regulations lay down in the case of the research budget that contributions shall be paid to the Member States' Treasuries as to seven-twelfths of the annual contribution for each Member State before 20 January of the year to which it relates and as to five-twelfths not later than 1 June of that year. The Commission may therefore draw upon these accounts in proportion to the payments to be made in the course of a quarter. However, concerned as the Commission was to gear calls on

contributions as far as possible to the rate of expenditure and having regard to the availabilities at the start of the financial year, the seven-twelfths call was postponed from the beginning of January to the beginning of June, while the remaining five-twelfths was not required until September.

As regards the research budget, it should be noted that of the 54,674,000 EMA u.a. due in financial contributions for the financial year 1962 a sum of 49,624,000 EMA u.a. had been paid by 31 December 1962, the difference representing the share of a Member State which had not yet discharged its obligations. In the case of the working budget, for which contributions totalling 10,547,000 EMA u.a. had been fixed, 10,507,000 had been paid by 31 December 1962, the difference consisting in the balance of a Member State's contribution.

Contributions under the head of the research budget were paid on the dates stipulated in the financial regulations effective from 1 April 1961 which lay down that payments shall be made by Member States in the proportion of seven-twelfths before 20 January and five-twelfths by 1 July to accounts opened for the Commission with the various national Treasuries. The Commission for its part may avail itself of such accounts to the extent of as many twelfths as there are whole months which have elapsed in the year, plus two.

Other revenue totalled 269,000 EMA u.a. The greater part of this amount, more particularly 198,000 EMA u.a., was derived from the remuneration of services rendered under Article 10 of the Treaty, which had, in fact, been estimated in the budget at 300,000 EMA u.a.

Own resources

276. Studies have been continued in the field covered by Article 173 of the Treaty, which states that all or part of the Member States' financial contributions may be replaced by levies collected in the Member States by the Community. These studies are being conducted in cooperation with the Commission of the EEC,

whose Treaty contains similar provisions (Article 201) which are still more precise, since among the Community's possible resources reference is made to revenue accruing from the common customs tariff when finally introduced. This problem the importance of which has been emphasized on a number of occasions by the European Parliament, is being accorded unremitting attention by the Commission, which will explore every possible way of submitting to the Council concrete proposals aimed at translating this Treaty provision into terms of practical realization.

Borrowings

277. In the financial field, the Treaty makes provision for the Commission to contract loans, on terms laid down by the Council, to finance research and investment. Pursuant to this provision, the Commission entered into an agreement in 1959 with the Export-Import Bank in Washington, under the United States/Euratom Agreement for Cooperation, for the opening of a line of credit of 135 million dollars for financing power plant construction.

Under this agreement, the Export-Import Bank, upon request by the Commission, allocated Euratom a sum of 16,250,000 EMA u.a. so as to enable it to participate in the financing of the Franco-Belgian project SENA. Thus the application submitted by SENA to Euratom for financial assistance will be able to be granted.

A second application was recently submitted by Kernkraftwerk RWE Bayernwerk GmbH, which is desirous of obtaining a credit of 20 million EMA u.a. The discussions on the relative contract have entered their final phase.

Fiscal and customs affairs

278. The Commission has persisted with its efforts to obtain satisfactory application to the Community's research activities of Articles 3 and 4 of the Protocol on Privileges and Immunities which in the field of exemption from customs duties and taxes

embody principles which must be translated into implementing measures. With the extension of the Joint Research Centre establishments and the development of activities carried out in the form of research contracts and contracts of association, the fiscal and customs problems arising out of such activities are assuming ever-increasing importance.

This being so, the Commission has actively continued, together with the governments of the Member States, the elaboration of the methods and procedure for implementing the Protocol, and in spite of difficulties, notably those stemming from the diversity of the six countries' fiscal laws, it hopes to secure a coherent system throughout the Community in the near future.

The Commission has also been called upon, when dealing with concrete cases encountered through its policy of participating in the development of power reactors, to raise and solve problems involved in certain fiscal exemptions available to firms enjoying joint-enterprise status within the meaning of the Treaty.

Finally, the Commission is in constant touch with the EEC Commission on the subject of customs problems relating to the nuclear common market and also concerning general fiscal problems liable to have repercussions on the nuclear sector.

Budgetary organization

279. The financial regulations on the establishment and implementation of the research and investment budget came into force on 1 January 1962, the corresponding regulations for the working budget having been in operation since 1 January 1961.

On 18 June 1962, the EAEC Council of Ministers extended for the financial year 1962 the financial regulations laying down the methods and procedure for the rendering and auditing of accounts. These regulations had been adopted on 14 August 1959 and were applicable in the financial years 1958, 1959 and 1960.

Similarly, the Councils of the EEC and the EAEC, together with the Commission of Presidents of the ECSC have extended for the financial year 1962 the financial regulations applicable in this field to the joint institutions and the Councils. These regulations had been adopted on 20 October 1959 and were applicable to the financial years 1958, 1959 and 1960.

The Statute of the Supply Agency—which operates in accordance with normal commercial practice—fixes the broad lines of the procedure for drawing up the special revenue and expenditure statement referred to in Article 171, para. 2, of the Treaty. Draft financial regulations laying down the conditions for estimating, implementing and auditing such revenue and expenditure are in course of preparation.

Thus as from 1962, the Community will have, with the exception of those relating to the Supply Agency, the whole of the financial regulations provided for in Article 183 of the Treaty.

This set of texts forms a sound basis for both the activities of the Community and the work of the Committee of Control. The latter's report for the financial year 1960, drawn up in November 1961, was passed to the Parliament and the Council, together with the Institution's replies, in July 1962; the report relating to the financial year 1961, drawn up in July last year, was completed by the Commission's observations in September and passed to the Parliament and the Council in one language in October and in the three other Community languages in January 1963. The delays inevitable in the early stages are thus being gradually eliminated.

The financial and administrative machinery provided for in the Treaty has thus been introduced at the same time as the first five-year programme is being completed. With the launching of the second five-year programme, the Commission will now endeavour, on the basis of experience already acquired and within the institutional framework laid down in the Treaty, to study and prepare the ground for the adaptation of this machinery in

such a way that it will, where necessary, be more appropriate to the more specifically industrial and technical tasks of the Community and will also take account of the geographical distribution of Euratom's own activities.

CHAPTER IX

THE INSTITUTIONS OF THE COMMUNITY AND INTER-EXECUTIVE CO-OPERATION

EUROPEAN PARLIAMENT — COUNCIL OF MINISTERS — COURT OF JUSTICE — SCIENTIFIC AND TECHNICAL COMMITTEE — ECONOMIC AND SOCIAL COMMITTEE — JOINT SERVICES — ENERGY POLICY

I. Institutional activity

The European Parliament

During the period under review, the European Parliament held six plenary sessions, as well as a joint session with the Consultative Assembly of the Council of Europe.

280. At its *constituent session in March 1962,* the European Parliament elected M. Gaetano MARTINO as President to replace M. Hans FURLER, whose term of office had expired. The session was also marked by a ceremony commemorating the fifth anniversary of the signing of the Treaties of Rome, Mr. COUVE de MURVILLE's submission of a report on the activities of the Councils, and the Assembly's choice of the name "European Parliament", which is already in use in Germany and the Netherlands.

281. The *May session* was devoted to a political debate, at the end of which the Parliament adopted two resolutions, one referring to its recommendations of December 1961 on the subject of political union and calling for a resumption of negotiations

between the Member States, the other expressing its point of view on the negotiations for the admission of the United Kingdom to the European Communities.

282. At the June session, the Parliament heard a statement by President CHATENET on the second five-year research and training programme, which was adopted by the Council on 19 June 1962.

The Parliament also passed a resolution on draft supplementary budgets for the financial year 1962 and approved the draft supplementary research and investment budget. As to the working budget, it requested the Council to follow the same policy with regard to the credits proposed by the Commission as that adopted in connection with its own provisional estimates.

In a resolution adopting the recommendations of the Permanent Euro-African Joint Committee on the new implementing convention on association between the African states and Madagascar on the one hand and the EEC on the other, the Parliament once again affirmed the unitary character of the three Communities.

283. In *September,* the Parliament held the traditional *joint session* with the Council of Europe's Consultative Assembly. As in the previous year, the debate was dominated by the problems posed by the admission of the United Kingdom and the association of neutral states. Reference was made to Euratom's main achievements over the past few years, and also to the broad outlines of its second five-year research and training programme, its general philosophy and the implications of this philosophy on the economic and political planes.

284. A feature of the *October session* was the discussion on Euratom's Fifth General Report, preceded by Mr. BRUNHES's

report. The Parliament wound up this debate by unanimously passing a resolution in which it

— congratulated the Commission on the excellent work performed at all levels, especially at the Joint Research Centre;

— stressed the importance it attaches to the Commission's being provided with the means required of attaining the objects set out in the Treaty;

— encouraged the Commission to continue its present policy with regard to instruction, occupational training and dissemination of information;

— reaffirmed its conviction that the European University should be one of the keystones of this policy;

— underlined the increasing part which the nuclear industry is being called upon to play in the Community, and

— reiterated that, having regard to its future development, nuclear energy should forthwith be accorded its rightful place in the context of the economic outlook as an increasingly important factor in energy policy;

— approved the steps taken by Euratom to promote the construction of power reactors and the development of the nuclear facilities industry;

— emphasized Euratom's special responsibilities in the vital fields of health and safety, and protection of nuclear workers and also towards the general public in the Community countries;

— expressed the hope that the current negotiations for the regulation of nuclear liability insurance would soon be concluded;

— noted with satisfaction the Commission's insistence on the application of Regulations 7, 8 and 9 relating to safeguards and controls;

— expressed its desire that a solution should be found for the problem of reconciling the Member States' national defence obligations with their Treaty commitments, and

— in conclusion expressed the hope that the Executives of the three Communities would continue their active cooperation.

285. The November Session was marked by the annual colloquy with the Councils of Ministers, dealing with the pattern of growth of the Community institutions, their cooperation in the face of the Community's increasing responsibilities and the aims of the Community during the phase corresponding to the second stage of the Common Market transitional period.

The Parliament also examined the draft budgets for the financial year 1963, a proposed amendment to Article 66 of the Statute or Service and the Communities' information policy.

With regard to the first point the Parliament emphasized the fact that henceforward budget estimates would have to accord with a policy previously determined by the Councils in cooperation with the Executives and the European Parliament.

In its resolution on Article 66 of the Statute of Service, the Parliament approved the Commission's proposals.

In its resolution on the information policy, the Parliament asked that the manpower and credits made available to the Executives for their information work should be commensurate with the real information needs inside and outside the Community, having regard to its rapid development.

The Parliament also approved the Permanent Euro-African Joint Committee's recommendation of 5 October 1962 on the new implementing convention on association with African States and Madagascar, at the same time expressing its concern at the lack of any precise information on the subject of the institutional problems.

286. The main focus of attention at the *February 1963 session* was a full-scale political debate on the state of negotiations between the United Kingdom and the six Community countries, at the end of which two resolutions were passed. In the first of

these, the European Parliament requested the European Commission to report to it on the state of the negotiations; in the second, it expressed its concern at the unilateral breaking-off of the negotiations, restated its sympathetic attitude towards the United Kingdom's membership and emphasized the fact that the final goal of European integration was the creation of a United States of Europe.

The Parliament also adopted a recommendation on the proposed amendment to Articles 108 and 109 of the Statute of Service, as well as a resolution on the management accounts and balance-sheets of the EEC, and Euratom Commissions and on the reports of the Committee of Control concerning the accounts for the 1960 and 1961 financial years, in which it recommended the Council to discharge the Committee.

The Council of Ministers

287. The activities of the Council of Ministers have been closely linked with those of the European Commission and during the year 1962/1963 there was still greater cooperation in formulating the decisions taken. The most important of these related to the adoption of the second five-year programme of research and training. The Council discussions and the decisions adopted are referred to in the relevant chapters of the present Report.

288. 49th Session (2 - 4 April 1962)

The Council met under the presidency of Mr. GORSE, the French Secretary of State for Foreign Affairs.

It approved the financial regulations, as drafted in the Community languages, relating to the method and procedure for making available to the Commission the Member States' contributions referred to in Article 172, para. 2 of the Treaty.

289. 50th Session (14 - 15 May, 1962)

The Council met under the presidency of Mr. COUVE de MURVILLE, the French Foreign Minister.

It appointed Professors Josef WENGLER and Nestore CACCIAPUOTI as members of the Scientific and Technical Committee to succeed Professors K. WINNACKER and Edoardo AMALDI

290. 52nd Session (18 - 20 June 1962)

The Council met under the presidency of Mr. PALEWSKI, French Minister of State for Scientific Research, Atomic Energy and Space Research, and Mr. GORSE, Minister for Cooperation.

It adopted the texts of the financial regulations governing the rendering and auditing of the 1962 accounts.

In joint session with the EEC Council, it laid down the preliminary draft EEC and EAEC supplementary budgets (Section II - Councils) for 1962, which were afterwards passed to the European Parliament for an opinion.

On the basis of the preliminary draft submitted by the Commission it also laid down the draft supplementary research and investment budget for the financial year 1962, which it then passed to the European Parliament.

The most important matter dealt with by the Council during this session was the second research and training programme.

291. 53rd Session (2 - 4 July 1962)

The Council met under the presidency of Mr. Emilio COLOMBO, Italian Minister of Industry and Commerce.

During this session it laid down the supplementary EEC-EAEC budget (Section II - Councils) for 1962, as well as the supplementary research and investment budget for 1962.

Overriding the favourable opinion expressed by the European Parliament on the preliminary draft supplementary working budget for 1962 submitted by the Commission, the Council decided not to lay down the supplementary working budget, thereby con-

firming the decision to the same effect which it had taken during the 52nd session.

292. 54th Session (23 - 24 July 1962)

The Council met under the presidency of Mr. Emilio COLOMBO, Italian Minister of Industry and Commerce.

It formally adopted the text of the second five-year research programme.

It also took due note of the Commission's recommendation concerning reports submitted by the Member States on the development of prospecting and production, the probable reserves, and mining investments to be made in or planned for their territories.

293. 56th Session (22 - 23 October 1962)

The Council met under the presidency of Mr. Emilio COLOMBO.

It held its first exchange of views with the Commission on the possible extension of the agreements covering the Halden and Dragon projects.

It then appointed Mr. Luciano ORSINI to succeed the late Mr. Claudio CASTELLANI, member of the Consultative Committee of the Supply Agency.

The Council also adopted the draft working and research budgets for the financial year 1963, which were then passed to the European Parliament for an opinion.

294. 57th Session (13 - 14 November 1962)

The Council met under the presidency of Mr. Carlo RUSSO, Italian Under-Secretary of State for Foreign Affairs.

During this session, it approved the text relating to the extension of the Dragon project and authorized the Commission to sign the corresponding agreement.

295. 59th Session (17 - 18 December 1962)

The Council met under the presidency of Mr. Emilio COLOMBO.

After taking due note of a statement by the Commission supporting the recommendations made by the European Parliament at its November 1962 session the Council again debated afresh the draft research budget for the financial year 1963.

The Council considered that it should disregard the Parliament's recommendations and the wishes expressed by the Commission and adopted the 1963 budget without making any amendments to the draft laid down at its 22 October 1962 session.

The Council also laid down the working budget for the financial year 1963 and established the directives for the Commission's negotiations on the Halden Agreement extension.

To enable the Brussels Institutions to give full effect to the new Statute of Service as from 1 January 1962, the Council amended a number of articles in the financial regulations so as to allow the Institutions a further period of three months for the implementation of the 1962 budgets.

The regulations amending these financial provisions were passed to the Parliament for an opinion.

296. 60th Session (14 January 1963)

The Council met under the presidency of Mr. Eugène SCHAUS, Foreign Minister of the Grand Duchy of Luxembourg.

It also elected a new Consultative Committee for the Supply Agency.

297. 61st Session (25 - 26 February 1963)

The Council met under the presidency of Mr. Eugène SCHAUS, Foreign Minister of the Grand Duchy of Luxembourg.

During this session, it authorized the Commission to extend for a period of six months, from 15 March to 15 September 1963,

the insurance contract covering the nuclear hazards involved in the Ispra I reactor.

At the same time it unblocked the credits appropriated for the financing of this type of insurance under Item 414 of Heading II of the Community's research and investment budget for the financial year 1963.

The Council next gave its approval to the text of the agreement, previously signed by the Commission ad referendum, on the extension of the Halden Agreement.

Finally, the Council discussed the two new contracts of participation which the Commission planned to conclude with "Kernkraftwerk RWE - Bayernwerk GmbH (KRB)" and "Samenwerkende Electriciteits-Productiebedrijven N.V. (SEP)" under its programme for participation in power reactor construction.

Other activities of the Council

298. The Council also examined the following questions relating to problems common to the Euratom and EEC Commissions.

During its *49th session* (2 - 4 April 1962), an exchange of views took place on the Dutch Government's proposal for revising the Rome Treaties by adopting a Convention which would institute a single Council for the European Communities and a single "European High Commission".

The Council agreed to pass this proposal to the European Parliament and the EEC and EAEC Commissions for advice.

During this session, it also elected a new Economic and Social Committee.

During its *50th session* (14 - 15 May 1962), the Council discussed the European Parliament's proposed amendments to its rules of procedure.

During the *53rd, 55th and 56th sessions* (2 - 4 July, 24 - 25 September and 22 - 23 October 1962), the Council elected a number of new members to the Economic and Social Committee.

During its *57th session* (13 - 14 November 1962), the Council adopted a draft amendment to Article 66 of the Statute of Service for the personnel of the Brussels Communities, which it then passed to the European Parliament and the Court of Justice for an opinion.

It exchanged views with the Commission on the subject of the colloquy with the European Parliament to be held on 20-21 November 1962.

During its *59th session* (17 - 18 December 1962), the Council established for 1962 the adjusting coefficients provided for in Article 64 of the Statute of Service.

To enable the Commission to apply the Statute as from the beginning of the financial year 1962, the Council decided to extend for a term running from 1 January 1963 to 1 April 1963 the periods laid down in Articles 108 and 109 of the Statute.

During its *61st session* (25 - 26 February 1963), the Council formally approved the Regulation determining the adjusting coefficients (Article 64 of the Statute) and the Regulation amending Article 66 of the Statute.

It approved a second reading of the Regulation extending the periods laid down in Articles 108 and 109 of the Statute, taking into account the amendment suggested by the Parliament which would

1) extend to 1 July 1963 the period laid down in Article 108;
2) bring the terms of office of Interim Committees to an end on that date, whatever the circumstances.

The Council also took a number of other decisions relating to the application of the Statute of Service.

Finally, the Council expressed the desire to receive from the Commissions in the near future proposals for amending the Statute of Service for the personnel of the Brussels Communities so as to bring it into line with that applicable to personnel of the ECSC.

The Court of Justice

299. The Commission's activities have not yet given rise to any legal proceedings at the Court of Justice.

At their conference on 15 May 1962 the representatives of the Member Governments appointed Mr. Robert LECOURT, Court Judge, to succeed Mr. Jacques RUEFF.

At the meeting of 27 January 1963 the representatives of the Governments of the Member States appointed Mr. Walter STRAUSS, Court Judge, in succession to Mr. Otto RIESE.

Scientific and Technical Committee

300. By the terms of Article 134 of the Treaty, the members of the Scientific and Technical Committee are appointed in their personal capacity for a period of five years.

The Committee was formally established in March 1958 by a decision of the Council. Thus the term of office of its members will end in March 1963.

In 1962 the Committee held five meetings under the presidency of Mr. GIBRAT, viz. on 9 January, 13 March, 15 May, 18 September and 4 December. The 15 May meeting, held at Ispra, was preceded by a visit to the laboratories, which enabled Committee members to form an idea of this establishment's achievements and its growth problems. The Committee's last meeting was held at Brussels on 5 March 1963.

301. In accordance with the policy followed since 1958, the Commission has consulted the Scientific and Technical Committee on all major problems created by the launching and implementation of its scientific and industrial programmes. Foremost among the problems studied in 1962-1963 were those relating to the construction at Ispra of the critical experiment designated ORGEL and the ESSOR reactor, participation in power reactors, activities in the field of fast reactors and advanced-type gas reactors, and the creation and development of the European Transuranium

Institute. In connection with this last matter, fruitful discussions were held on the outlook for the use of plutonium as a fuel in both fast and thermal reactors. The Committee was also consulted on the 1963 research programme and gave its opinion on the corresponding expenditure estimates. Finally, it gave its full support to the Commission's project for developing fundamental research work at Ispra.

302. The Committee was represented by two of its members (Messrs. CACCIAPUOTI and DEKEYSER) in the Consultative Group set up by the Committee to examine general and organizational problems involved in nuclear documentation within the Community.

The Committee's study group on training continued its work, particularly as regards the student trainee courses and diploma equivalence.

During its 4 December meeting, the Committee decided to appoint six new experts so as to enlarge the group responsible under Article 37 of the Treaty for the examination of projects relating to radioactive waste disposal in the Community. This expansion takes account of the need to call on numerous specializations and to organize meetings limited as to numbers in order to deal with specific problems.

In 1962 two Committee members, Professors AMALDI and WINNACKER, resigned from the Council. After consulting the Commission, the Council appointed Professors CACCIAPUOTI and WENGLER as their successors for the period of the mandate. In addition, Professor AUGER, who had given notice of his resignation in 1961, was replaced in 1962 by Professor BUGNARD.

The Economic and Social Committee

303. The valuable cooperation between the Commission and the Economic and Social Committee which had been developed in the course of previous years continued during the period covered

by the present Report. A noteworthy event in 1962 was the election of a new Economic an Social Committee, whose members were appointed for a period of four years commencing 25 April 1962.

During its constituent sessions of 4 and 28 May 1962, the Committee elected its officers, consisting of 15 members under the chairmanship of Mr. E. ROCHE, and set up its specialized nuclear sections, one covering social and health and safety problems and the other economic problems.

304. At the 16 and 17 July session, President CHATENET and Vice-President MEDI outlined the second five-year research and training programme.

After these surveys, the two specialized nuclear sections drafted a background report designed to furnish the Commission with some useful data on the annual programmes and the particular choice involved. This report was approved by the Committee at its plenary session in October.

305. On the subject of coordination of energy policies, the Committee heard during its 30 October 1962 session a statement by Mr. SASSEN on the nuclear aspects of the "Memorandum on Energy Policy" drafted by the inter-executive group on energy and submitted to the Special Council of Ministers of the ECSC.

Following this session, a working group was formed by the specialized section on economic problems with the object of studying the Memorandum and preparing a draft report on this subject.

II. Inter-executive cooperation

The following paragraphs deal firstly with the activities of the three joint services and secondly with other fields of inter-executive cooperation.

The Joint Legal Service

305bis Under the 1960 agreement between the three Executives on the organization of the Joint Services, the Legal Service has been directed by the Steering Board, while for its administrative purposes it comes under the appropriate departments of the Euratom Commission. Consequently, the Administrative Board of the Legal Service was responsible, as in the past, for matters relating to the general organization of the service, which as regards the Euratom branch underwent scarcely any structural changes during the past year.

On the functional level, the close liaison between the three branches of the Service and the practice of mutual consultation were continued and consolidated with studies of questions of common interest to several Communities, especially questions of an institutional nature and those relating to the coming into effect of the Statute of Service.

As regards the specific tasks of the EAEC Commission, the Legal Service, as in previous years, continued to be closely associated with all the Commission's activities. It was regularly consulted on all legal questions involved in the interpretation and application of the Treaty and Community acts and the formulation of the various instruments drafted by the Commission. It also participated in various working groups which met under the auspices of the Commission or the Council.

Joint Press and Information Service

306. The work of the Joint Press and Information Service was concentrated on a number of spheres which had been brought into the limelight by the resolution passed by the European Parliament on 24 November 1960.

This resolution called for, among other things:

— a scientific enquiry to be conducted by the Joint Service into public opinion in the six Member States with regard to the unification of Europe;

— a special effort in the field of visual media for training courses at institution headquarters, for the information of trade-union leaders, agricultural and educational groups and youth organisations.

On these points, the Joint Press and Information Service has responded to the call. Thus, an opinion poll was held in February 1962 in the six European Community countries by a group of specialist institutes acting under the sponsorship of "Gallup International". From the beginning of November 1962, the European Parliament has been kept informed of the chief results of this public opinion poll, a summary of which is in course of publication.

Finally, the Service decided on a second phase of the poll relating to the analysis of the changes and the study of the information channels.

Information activities in the Community during 1962 were focussed on trade-union circles, training organizations, youth movements and adult education.

Details of the activities undertaken are as follows:

Fairs and Exhibitions

307. In 1962, the Euratom Commission participated in the Salon International de la Chimie held in Paris from 25 April to 4 May. To judge by the interest aroused by the Euratom stand, this specialized exhibition was a genuine success.

This event was followed in November by the visit to Euratom of a Franco-Belgian delegation from the Société de Chimie Industrielle.

The Joint Service participated in activities varying in both nature and importance which were organized in close cooperation with the Executive Secretariat of the Commission, namely the Milan Fair (12-17 April), the Berlin Industrial Fair (22 September to 7 October) and the Levant Fair, Bari (9-24 September).

In France and Belgium, a mobile exhibition was incorporated in several local events and proved a success.

At the invitation of the American authorities and the request of the Member States, the Joint Service organized the participation of the European Communities in the 21st Century Exhibition held at Seattle (US) from 21 April to 21 October 1962. In connection with the same exhibition, the Joint Service also staged the "European Days", which greatly enhanced the prestige of the Communities. According to official estimates, this major international event attracted nearly 10 million visitors.

In addition, the reorganization of the permanent exhibition at the Atomium was continued. It is interesting to note that each year there are nearly 300,000 visitors from all over the world to this exhibition illustrating nuclear achievements in general and Euratom activities in particular.

The underlying purpose being that of instruction and popularization, it has proved worth while to arrange for the provision of demonstrators, lectures and in some cases film shows, for the benefit of groups visiting the Atomium. Over 1000 such visits are made each year.

Publications

308. Nine booklets on Euratom were published in the four Community languages and English by the Official Spokesman's Group. One of the most important of these was a special publication on the second five-year programme.

Several special issues of general or technical information reviews were edited either wholly or partly by the Official Spokesman's Group.

The six monthly bulletins published at The Hague, Paris, Rome, Bonn, London and Washington are developing on the lines of European magazines. The present circulation of each is between 30,000 and 40,000 copies a month.

Radio, Television, Cinema

309. In addition to numerous film shots and interview recordings on the occasion of important events, and the technical assistance given to the many reporting teams sent out by Member State organizations, particular mention should be made of a documentary film on Euratom activities which was produced by the Commission's departments.

Information, Visits and Lectures

310. During 1962 there was a further increase in the number of information visits organized at the Euratom headquarters and the Joint Research Centre.

Over 100 lectures were given in this connection by the Official Spokesman's Office.

Trade-Union Information

311. Several visits and special information lectures were organized at Brussels for trade-union leaders in the course of 1962. The Joint Service also took part in forty operations in the Member States and the United Kingdom. In France and Italy the network of trade-union lectures formed in 1961 continued to operate.

University Information and Educational Activities

312. In the field of university information, a number of colloquies and Seminars were organized by the Joint Service, the most important being those held at Brussels ("Applied Geography and the Communities" - March 1962), Trieste ("Information on the Communities in the Italian Universities" - May 1962) and Montpellier ("The Common Market and Problems of the Mediterranean Economy" - December 1962).

In December the Commission also organized an event of a specifically informational character at the University of Florence.

The Joint Service's activities in the field of youth and adult education related to the production of teaching aids, the training

of lecturers, and the organization of information and study visits to the headquarters of the Communities and in the six Member States.

313. Side by side with and in close relationship to these general information activities, the Official Spokesman's Office of the Euratom Commission continued its work, which in 1962 was chiefly concerned with the second five-year programme.

As a result of the press contacts, interviews and conferences, the number of articles published was greater than in previous years. It was necessary to meet the growing public interest in nuclear questions in general and the problems created by the production of nuclear energy in particular.

Finally, the Official Spokesman's Office, which is in close touch with the various departments of the Commission, maintains daily contact with all circles interested in the Commission's own activities, and in particular by means of press releases and background notes.

Statistics Office of the European Communities

314. Apart from its numerous general activities on behalf of the European Atomic Energy Community, the Statistics Office was responsible for compiling energy balances during the period covered by the present Report. These were chiefly electrical energy balances dealth with from different angles. For instance, consumption of electric current during the period 1951-1961 was broken down according to consumer categories. In addition, a monthly statement was drawn up on the consumption of fuels in thermal power plants, being broken down according to energy producers.

In the nuclear energy field, the Statistics Office compiled, in cooperation with the UNICE, a new directory of nuclear industries. It also supplied the statistical bases for the exchange and use or radioisotopes in the Community countries.

The Statistical Office of the European Communities often calls on the assistance of the CETIS Group at Ispra.

The Coordination of Energy Policies

315. As was stated in the Fifth Report (para. 229), the activities of the inter-executive Group on "Energy" have been since the beginning of 1962 devoted mainly to determining a joint energy policy. In this task the Group has received encouragement from the European Parliament, which on 20 April 1962 passed a resolution based on the substantial report submitted by its Energy Commission on 10 January. This resolution was kept very much in mind by the inter-executive Group in its subsequent work.

At its session of 23 January 1962, the Council of Ministers of the ECSC also decided to take a very active interest in the establishment of a joint energy policy.

In order to have an initial thorough-going exchange of views on this question, the Ministers decided to hold a very limited meeting to determine the main principles of a joint energy policy and the procedure required for its formulation.

316. This restricted meeting of Ministers was held at Rome on 5 April 1962. The inter-executive group was then instructed to draft at an early date a joint energy policy proposal which would be as detailed and complete as possible. On this subject the Ministers gave the following directives, which, it may be added, correspond in their broad lines with the above-mentioned resolution passed by the European Parliament:

a) The joint policy cannot be defined in terms of any one predominant source of energy but should be formulated on the basis of the optimum combination of the various sources of energy available so as to achieve the two essential objectives of an energy policy, viz. low prices and regularity of supplies.

b) The joint policy should conduce to a reduction of energy prices in general. Instead of raising the prices of cheap imported forms of energy to the level of the dearest price of domestic

energy, it will be better to aim progressively at a general alignment of prices to the level of the cheapest forms of energy obtainable under satisfactory supply conditions.

c) The joint policy should include a system of aid to the coal industry so as to prevent an unduly acute decline in its activity and to obviate the social or economic effects which would ensue for certain Community areas.

d) In the petroleum sphere, the joint policy, with a view to ensuring regularity of supplies and an optimum price level, should comprise:

— a joint supply policy characterized by diversification of import avenues, a joint purchasing policy and a joint policy on imports from the Eastern bloc;
— a joint policy on the storage of petroleum products;
— a coordination of the legislative provisions on petroleum and taxation;
— the establishment of the common market and the common external tariff.

e) The development of the nuclear energy as a new source of power should be vigorous ly pursued so that it is able within the shortest possible time to make a substantial contribution towards ensuring reliability of supply and lower prices.

317. Taking these directives as a basis, the inter-executive group drafted a "Memorandum on Energy Policy", which was submitted to the Council of Ministers of the ECSC on 25 June 1962.

Since this document has received a great deal of publicity, it only need be stated here that it constitutes the first rough outline of a true energy policy for the European Community. For each of the main sources of energy, and especially for coal and petroleum, the Memorandum sets out the method by which this policy is to be put into operation over a transitional period, to wit 1964-1970, so that by the end of the common market transition period a definitive system will have been developed

which is characterized by the free movement of energy products. The Memorandum also contains detailed proposals on imports, taxation, storage and the diversification ef external supplies, and also on the support to be given to the coal industry so as to prevent an unduly marked falling-off and inordinate dependence on imports.

As regards nuclear energy, the Memorandum stated that this new source, with production having now passed the experimental stage and continually reaping the benefits of numerous advances, will in the years ahead constitute an increasingly important factor in the solution of the problem of reliability of supplies and also contribute to the reduction of prices.

The joint energy policy must therefore be directed towards ensuring that every effort is made, both by industry and on the government or intergovernmental side, to promote rapid development of nuclear energy production.

318. The Memorandum was the subject of an initial debate during the 17 July 1962 session of the Council of Ministers of the ECSC. The Ministers were unanimous in recognizing the importance and constructive nature of the document. Nevertheless a great many comments were made and reservations expressed on both the principles and the methods of application. There were lively discussions on the problem of giving aid for the coal industry and on the amendments to be made to the Paris Treaty so as to make possible the introduction of the policy envisaged.

The representatives of the Euratom Commission gave a detailed survey of the competitive position of nuclear energy and its prospects, with special reference to imported energy.

On 17 July and again during its session of 4 October, the Council requested precise data on:

— the legal repercussions of the proposals, especially from the point of view of a possible amendment to the ECSC Treaty;

— the financial aspects of the various systems and possible levels of aid to collieries;

— the petroleum policy;

— the outlook for nuclear energy.

In response to the call for information on the legal repercussions of the proposals, the inter-executive group examined over a number of restricted-participation sessions a draft protocol which had been drawn up on the initiative of the High Authority and which is designed as the legal instrument for implementing a joint energy policy.

As regards the other questions, the reply was embodied in a document which the inter-executive group prepared and submitted to the Council of Ministers for its first 1963 session and which consists of a detailed study on the long-term energy prospects in the European Community.

The aim of this study is to determine how the growth of energy needs, the supply trend and the chief problems created by the energy balance in the longer term, i.e. up to 1975, will fit in with the anticipated development.

A contribution on nuclear energy prospects was made by the Euratom Commission. Its salient features are set out in the chapter on "Industry and Economy" in the present Report (nos. 156 to 164).

319. The preparation of these documents constitutes a technical phase in this important work of coordinating energy policies on the basis of the three Executives' Memorandum. The political phase has still to be negotiated; this will deal with the problem of final choices and possible solutions.

Other fields of interexecutive cooperation

320. With regard to the *nuclear common market,* the Euratom Commission has been closely connected with the work of the EEC Commission for bringing about the free movement of nuclear products within the Community and establishing the common external tariff.

In the *field of coordination of legislation on industrial property* in the Community countries, the Euratom Commission, together with the EEC Commission, has participated in the work of an interministerial working group for the drafting of a convention covering a European patent law.

On the question of *social policy,* a "European Conference on Social Security" was organized jointly by the three executives at Brussels in December 1962, a report being submitted by Euratom on the occupational hazard deriving from ionizing radiations and social security in the Community countries.

Pursuant to Article 173 of the Treaty, the Euratom Commission has cooperated with the EEC Commission in its efforts to arrive at concrete proposals for replacing all or part of the financial contributions of Member States by *resources of the Commissions' own.*

Finally, as regards aids and subsidies, the Commission's limited 1962 budget did not allow it a great deal of scope for such action. Nevertheless, the three Executives were able to coordinate their efforts for the establishment of a joint policy in this field. The most noteworthy activities were participation in the organization of the International Congress of the European Movement held at Munich in June 1962 and a contribution to the International Law Association for its Jubilee Conference at Brussels in August 1962.

INDEX

(The numbers refer to paragraphs of Report).

A.

B.

C.

D.

E.

F.

G.

H.

I.

J.

K.

L.

M.

N.

O.

P.

Q.

R.

S.

T.

U.

V.

W.

ANNEXES

Annex I

IMPLEMENTATION OF COMMITMENTS UNDER RESEARCH AND INVESTMENT BUDGET IN 1962

EMA units of account

Heading	Chap.	Description	Credits available under budgetary commitments in 1962	Commitments entered in the books as at 31 Dec. 1962
I		*Payments, allowances and expenses in connection with commencement and termination of employment and staff movements*		
	II	Personnel	10,347,200	10,347,200
	III	Allowances and expenses in connection with the commencement and termination of employment and staff movements	800,000	800,000
		Total unter Heading I:	11,147,200	11,147,200
II		*Real property, equipment and various operating expenses*		
	IV	Real property	761,000	753,857
	V	Movables, equipment, fixtures and fittings for administrative use: maintenance and replacements	152,900	152,574
	VI	Current operating expenses	1,031,600	1,026,549
	VII	Entertainment and reception	13,500	13,466
	VIII	Official journeys and removals	420,000	418,972
	IX	Meetings, conferences, etc.	92,000	91,972
	X	Publication and popularization	21,000	20,988
	XI	Social services	635,000	606,852
	XII	Initial outlay and equipment	247,000	227,865
	XIII	Patents and licences	81,000	60,000
	XIV	Cover for credits available and entered under Chapter 21 of the 1961 budget	45,000	45,000
		Total under Heading II:	3,500,000	3,418,095

Heading	Chap.	Description	Credits available under budgetary commitments in 1962	Commitments entered in the books as at 31 Dec. 1962
III		*Joint Nuclear Research Centre*		
	30	Apparatus and equipment	9,197,766	5,381,578
	31	Real property investments	7,332,838	4,838,742
		Total under Heading III:	16,530,604	10,220,320
IV		*Reactor development and construction*		
	40	Gas reactors	4,520,000	4,520,000
	42	Heavy-water reactors	550,736	250,736
	43	Organic reactors	7,422,107	4,805,481
	44	Homogeneous reactors	200,000	200,000
	45	Fast reactors	5,396,196	4,413,161
	47	Nuclear marine propulsion	9,459	9,459
	48	Cost of general development and research in connection with reactor construction	2,120,633	1,687,340
	48*bis*	Euratom/United States Agreement	6,750,927	5,840,143
	49	Power reactors	13,447,840	303,990
		Total under Heading IV:	40,417,898	22,030,310
V		*Other scientific and technical activities*		
	50	High-flux irradiation	2,029,186	2,029,186
	51	Fusion-plasma study	4,512,748	4,383,101
	52	Biologie	2,402,861	1,801,507
	53	Radioisotopes and miscellaneous research work	5,033,510	4,056,943
	54	General documentation	875,139	843,654
	55	Training	1,060,747	610,291
		Total under Heading V:	15,914,191	13,724,682
		Sum total:	87,509,893	60,540,607
			100 %	69 %

Annex II

FINANCIAL IMPLEMENTATION OF THE FIRST FIVE-YEAR RESEARCH AND TRAINING PROGRAMME

Budgetary Commitments

In millions of EMA units of account

Heading	Chap.	Descriptions	Portion authorized for 1958-1962	Commitments entered in the books as at 31 Dec. 1962	Credits outstanding	Cancellations
I		Payments, allowances and expenses in connection with the Commencement and termination of employment and staff movements	21,332	21,332(*)	—	(*)
II		Real property, equipment and various operating expenses	7,103	7,021(*)	—	0,082(*)
III	30	Apparatus and equipment	26,242	22,426	3,816	—
	31	Real property investments	7,333	4,839	2,494	—
		Total unter head. III:	33,575	27,265	6,310	—
IV	40	Gas reactors	12,152	12,152	—	—
	42	Heavy water reactors	1,883	1,583	0,300	—
	43	Organic reactors	17,585	14,968	2,617	—
	44	Homogeneous reactors	1,425	1,425	—	—
	45	Fast reactors	6,200	5,217	0,983	—
	47	Nuclear marine propulsion	5,966	5,966	—	—

(*) In headings I and II the budgetary commitments coincide with the payment authorizations; on account of the supplementary period the residual amounts will not be known until after 31 March 1963.

Heading	Chap.	Descriptions	Portion authorized for 1958-1962	Commitments entered in the books as at 31 Dec. 1962	Credits outstanding	Cancellations
	48 48b	Cost of general development and research in connection with reactor construction – under the Euratom programme (not under the Euratom/US Agreement) and under the Euratom/US Agreement programme	22,317	20,973	1,344	—
	49	Power reactors	32,500	19,356	13,144	—
		Total under head. IV:	100,028	81,640	18,388	—
V	50	High-flux irradiation	4,400	4,400	—	—
	51	Fusion – plasma studies	11,247	11,117	0,130	—
	52	Biology	3,613	3,012	0,601	—
	53	Radioisotopes and miscellaneous research work	8,595	7,618	0,977	—
	54	General documentation	1,582	1,551	0,031	—
	55	Training	1,604	1,154	0,450	—
		Total under head. V:	31,041	28,852	2,189	—
		Grand total:	193,079	166,110(*)	26,887	0,082

(*) As at 31 March 1963, the end of the supplementary period, the estimated cancellations under headings I and II will be approximately 2,000,000 EMA u.a.

BREAKDOWN OF RESOURCES FOR THE SECOND FIVE-YEAR PROGRAMME OF RESEARCH AND TRAINING

Heading	Credits from the first programme	Credits from the second programme	Provisional Breakdown					
			Personnel and operating expenses	Apparatus, equipment, etc.	Investments	Contracts	Personnel	
							As at 1.1.63	As at 31.12.67
	in millions of EMA units of account							
I JRC – Ispra	3	72	61	7	—	4	1,270	1,700
II – Karlsruhe	3	25	8.1	6.4	1.5	9	60	300
III – CNMB	—	11	6.9	3.5	0.6	—	120	180
IV – Petten	8.5	19	8.5	10.0	0.5	—	50	350
V « Orgel » programme	—	57	—	42	7	8	—	—
VI Fast reactors	—	73	2.0	—	—	71	25	90
VII Advanced gas reactors	6	25	2.0	—	—	23	42	60
VIII BR 2 reactors	—	12	2.3	—	—	9.7	60	70
IX Proven reactors	—	29.5	1.6	—	—	27.9	21	43
X Fuel reprocessing	—	14	1.4	—	—	39.1	20	40
XI Radioactive waste processing	—	5		—	—			
XII New reactor types	—	9		—	—			
XIII Marine propulsion	—	7.5		—	—			
XIV Radioisotopes	—	5		—	—			
XV Fusion and plasma physics	—	31	4.0	—	—	27.0	85	130
XVI Health and safety – biological studies	—	17.5	3.0	—	—	14.5	60	110
XVII Training	—	3	0.4	—	—	2.6	7	7
XVIII Dissemination of information and general documentation	—	9.5	4	3.5	—	2	90	120
Totals:	20.5	425.0	105.2	72.4	9.6	237.8	1,910	3,200

Annex IV

STAFF BREAKDOWN UNDER THE RESEARCH AND INVESTMENT BUDGET

(Posts filled as at 28 February 1963)

	A	B	C/D	Establishment personnel	Total
ISPRA	405	385	163	324	1,277
C.N.M.B.	35	31	24	16	106
Transuranium Institute (*)	28	16	10	1	55
PETTEN (*)	23	5	9	—	37
BR 2 and RHF	19	17	8	—	44
Fusion	43	20	10	1	74
Biology	25	1	7	2	35
Fast reactors	12	—	2	—	14
DRAGON/SUSPOP	26	4	2	—	32
ORGEL	16	2	7	—	25
U.S. Agreement	6	1	4	—	11

(*) Since the necessary laboratories are not yet available at Karlsruhe and Petten, personnel already recruited for these two establishments have been provisionally assigned elsewhere (cf. Chapter I, Research and Training, paras. 20 and 23).

	A	B	C/D	Establishment personnel	Total
Article 5 programmes	1	—	—	—	1
Training	2	1	2	1	6
Radioisotopes	2	—	2	—	4
Miscellaneous	4	1	—	—	5
Dissemination of information	21	18	34	14	87
Health and Safety	6	3	—	—	9
Economy and industry	15	1	2	—	18
Sum total	689	506	286	359	1,840

Annex V

RESEARCH CONTRACTS AND CONTRACTS OF ASSOCIATION AWARDED BY THE COMMISSION

I. *Research and Development Programme under the Euratom/US Agreement*

	Name of Contractor	Title
I/1	Commissariat à l'Energie Atomique (CEA) Paris	Irradiation Programme in the EL 3 reactor of steel samples at different temperatures and post-irradiation tests of these samples
I/2	Compagnie Industrielle des Combustibles Atomiques Frittés (CICAF) Corbeville p/Orsay	Study on the preparation of 4.5%-enriched UO_2 pellets containing 0.25 mol % niobium oxide and 0.25 mol % yttrium oxide for the purpose of the irradiation in the NRX reactor
I/3	BATTELLE Institute Frankfurt/Main	Microgravimetric studies of the corrosion mechanism under irradiation of reactor materials
I/4	Société Grenobloise d'Etudes et d'Applications Hydrauliques (SOGREAH)	Experimental study of the vibrations in a bundle of fuel elements immersed in a flow parallel to the axis of the bundle
I/5	Ghent University Ghent	Construction of a 6000 t tensile testing machine
I/6	Société RATEAU Paris	Secondment of an engineer from the Société RATEAU to the ALLIS-CHALMERS MANUFACTURING Co. in the US for participation in the research work being carried out under a contract between the USAEC and ALLIS-CHALMERS concerning the utilization of consumable poisons
I/7	Centre d'Etude de l'Energie Nucléaire (CEN) Brussels	Study of the influence of neutron and gamma irradiation on the corrosion of nuclear materials

	Name of Contractor	Title
I/8	Commissariat à l'Energie Atomique (CEA) Paris	Research of the in-pile behaviour of uranium carbide as a nuclear fuel
I/9	Centre d'Etude de l'Energie Nucléaire (CEN) Brussels	Studies on the swelling of uranium
I/10	Société PECHINEY Lyons	Development of a zirconium alloy displaying good mechanical properties over a wide temperature range, and corrosion studies on this alloy
I/11	Commissariat à l'Energie Atomique (CEA) Paris	Research into sintered uranium oxide, sintering techniques and the irradiation behaviour of the substance studied
I/12	Free University of Brussels Brussels	Studies on certain problems of oxidation in metals and the application of impedance measurements to the study of the corrosion resistance of these metals in an aqueous medium
I/13	Compagnie Industrielle des Combustibles Atomiques Frittés (CICAF) Corbeville p/Orsay	Studies on the reproducibility of extrusion results obtained with special CEA powders, extended to UO_2 powders of different origins
I/14	Soc. THOMSON HOUSTON Paris Société ALSTHOM, Paris Allgemeine Elektrizitätsgesellschaft (AEG) Frankfurt/Main	Improvement of the thermal characteristics of nuclear fuels by means of the Vapotron process
I/15	Société d'Etude, de Recherches et d'Applications pour l'Industrie (SERAI) Brussels	Study of the corrosion of steels in water and steam at high temperatures
I/16	NUKLEAR CHEMIE UND METALLURGIE GmbH Frankfurt/Main	Fabrication of uranium carbide and uranium-carbide-based cermets

	Name of Contractor	Title
I/17	Centre d'Etude de l'Energie Nucléaire (CEN) Brussels	Research into the effect of cristalline flows in metals on the oxidation mechanism and internal separations of gas-metal compounds
I/18	METALLGESELLSCHAFT Frankfurt/Main	Irradiation tests on the alloy ZrNb3Sn1
I/19	Centre National de la Recherche Scientifique (CNRS) Vitry-sur-Seine	Study of stainless and high-alloy steels made from high-purity metals
I/20	Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffahrt GmbH Hamburg	Irrodiation of $ZrNb_3Sn$, and Zircaloy-2
I/21	HAHN-MEITNER INSTITUT Berlin-Wannsee	Diffusion of fission gases in reactor materials
I/22	Centre d'Etude de l'Energie Nucléaire Brussels	Reprocessing of irradiated fuels
I/23	UNIVERSITE DE BOLOGNE Instituto Aug. Righi Bologna	Mechanism governing the diffusion and precipitation of hydrogen in zirconium and its alloys
I/24	Soc. BELGONUCLEAIRE/ Centre d'Etude de l'Energie Nucléaire (CEN) Brussels	Continuation of studies on the recycling of plutonium in thermal reactors
I/25	INSTITUT BATTELLE Genève	Study of the effect of irradiation on the ductility transition temperature in reactor vessel steels
I/26	INSTITUT DE SOUDURE Paris	Study of elementary cracking in the welding of thick steel plates used in reactor construction
I/27	INSTITUT BATTELLE Genève	Study of creep in reactor pressure vessel steels

	Name of Contractor	Title
I/28	Société INDATOM Paris	Secondment of an engineer to BABCOCK and WILCOX under a contract relating to the resonance integral of U_{238} within the framework of the Euratom/US programme

II. *ORGEL Project*

	Name of Contractor	Title
II/1	Société d'Etudes, de Recherches et d'Applications pour l'Industrie (SERAI) Brussels	Synthesis of organic molecules for use as controls in analytical chemistry research
II/2	Société GILBY-FODOR Rueil-Malmaison	Study of the fabrication and supply of thin stainless-steel tubes
II/3	Société d'Etudes, de Recherches et d'Applications pour l'Industrie (SERAI) Brussels	Draft design for two loops for the study of the irradiation behaviour of the different components of an ORGEL-type reactor channel
II/4	Groupement Atomique Alsacienne Atlantique (GAAA) Plessis-Robinson Société INTERATOM Bensberg/Köln	Carrying out of tests and construction of mock-ups for the development and checking of certain ESSOR components necessary for the drafting of the detailed draft design
II/5	Centre d'Etude de l'Energie Nucléaire (CEN) Brussels	Development of a fuel element type for the ECO reactor feeding cells
II/6	Siemens-Schuckertwerke A.G. Erlangen Société INDATOM Paris Société BELGONUCLEAIRE Brussels	Definition of the characteristics and drawing up of plans for a 250 MWe ORGEL reference plant

	Name of Contractor	Title
II/7	Reactor Centrum Nederland (RCN) La Haye	Initial draft design for an irradiation loop to be installed in the high-flux HFR reactor at the Petten JRC establishment
II/8	Société d'Etude de la Propulsion par Réaction (SEPR) Villejuif/Seine	Study, construction, final adjustment, delivery and installation in the Ispra establishment of: a) a prototype apparatus for measuring the thermal conductivity of solid, rigid or flexible insulators; b) a prototype apparatus for measuring heat-resistance at the point of contact between two materials
II/9	Centre d'Etude de l'Energie Nucléaire (CEN) Brussels	A draft design for two in-pile loops for the study of the irradiation behaviour of the different components of an ORGEL-type reactor channel
II/10	Société PROGIL Paris	Development of analytical methods for determining the composition of polyphenyls after pyrolysis and/or radiolysis
II/11	Commissariat à l'Energie Atomique (CEA) Paris	Study of petroleum cuts with a view to their use as substitutes for terphenyls in an ORGEL string reactor
II/12	S.A. per l'Esercizio dell'Istituto Sperimentale dei Metalli Leggeri (ISML) Milan	Study of the possibilities of reducing the impurities in a SAP powder
II/13	Reactor Centrum Nederland (RCN) La Haye	Draft design for the in-pile section of a loop to be installed in the HFR test reactor at Petten
II/14	Groupement Atomique Alsacienne Atlantique (GAAA) Plessis-Robinson Société INTERATOM Bensberg/Köln	Design, study and construction of an out-of-pile loop for tests in an organic medium and its supply to the JRC establishment at Ispra
II/15	BATTELLE INSTITUT Frankfurt/Main	Creep tests

	Name of Contractor	Title
II/16	Commissariat à l'Energie Atomique (CEA) Paris	Technological study of polyphenyls as coolants and/or moderators
II/17	BATTELLE INSTITUT Frankfurt/Main	Synthesis and production on a limited scale of C 14-, tritium- and deuterium-marked terphenyls
II/18	Société Française de Céramique Paris	Study of physical characteristics (between 20 and 500° C) of ceramic insulating materials such as porous aluminia, zirconium oxide and calcium zirconate
II/19	Société SEXTA Bagneux	Design of strain-gauges for measuring stresses under neutron flux up to a maximum temperature of 500°C
II/20	Société SODERN Suresnes	Research on the supply of special thermocouples
II/21	Société PROGIL Paris	Modification of a loop designed and constructed under a previous contract
II/22	Compagnie Industrielle de Combustibles Atomiques Frittés (CICAF) Corbeville p/Orsay	Development of process for the semi-industrial production of open-pore uranium monocarbide pellets and rods and of dense uranium monocarbide cermets
II/23	Société Anonyme DESMARQUEST Paris	Design, development and supply of heat-insulating tubes
II/24	Université de Liège Liège	Production by pyrolysis of free radicals and development of the necessary apparatus (reactor)
II/25	Centre National de la Recherche Scientifique (CNRS) Paris	Study, by a rheoelectric comparative method, of the distribution of coefficients of friction and temperature in the cladding of the straight section of an ORGEL-type channel

III. *Fast Reactors*

	Name of Contractor	Title
III/1	Centre d'Etude de l'Energie Nucléaire (CEN) Brussels	Development of nuclear spectrometry techniques for application to fast degraded-spectrum reactors
III/2	Commissariat à l'Energie Atomique (CEA) Paris	Design, construction and operation of the fast-neutron reactor "RAPSODIE"; design, construction and experimental operation of a critical mock-up
III/3	Institut Interuniversitaire des Sciences Nucléaires (IISN) Brussels Université de Liège Liège	Measurement of the angular distribution of the tritons in the reaction $^{6}Li\ (n, \alpha)\ ^{3}H$, as a function of the energy of the neutrons for values lower than 500 KeV

IV. *Gas Reactors*

	Name of Contractor	Title
IV/1	Società Nazionale Metanodotti (SNAM) Milan Comitato Nazionale per l'Energia Nucleare (CNEN) Rome	Study of uranium-enriched ternary alloys and their irradiation behaviour. Development of uranium alloy fuel element fabrication techniques

V. *Homogeneous Reactors*

	Name of Contractor	Title
V/1	Société Grenobloise d'Etudes et d'Applications Hydrauliques (SOGREAH) Grenoble	Development of apparatus for measuring stability in a single- or polyphase flow
V/2	Société Grenobloise d'Etudes et d'Applications Hydrauliques (SOGREAH) Grenoble	Hydrodynamic study of flow in the core of the KSTR homogeneous reactor (Kema Suspension Test Reactor)

VI. *Controlled Thermonuclear Reactions*

	Name of Contractor	Title
VI/1	Stichting voor Fundamenteel Onderzoek der Materie (FOM) Utrecht	Research in the field of controlled nuclear fusion
VI/2	Comitato Nazionale per l'Energia Nucleare (CNEN) Rome	Research in the field of controlled nuclear fusion
VI/3	Kernforschungsanlage Jülich des Landes Nordrhein-Westfalen (KFA) Jülich	Research in the field of controlled nuclear fusion
VI/4	Commissariat à l'Energie Atomique Paris	Research in the field of controlled nuclear fusion

VII. *Biology and Health and Safety*

	Name of Contractor	Title
VII/1	Centre d'Etude de l'Energie Nucléaire (CEN) Brussels	1) Protein alterations in the tissue of irradiated mice 2) Influence of radiations on the permeability of cells to macromolecules 3) Study of the radioprotection of rat's liver in regeneration
VII/2	Institut Nat. de la Recherche Agronomique (INRA) Paris	Comparison of the effect of chemical and physical mutagenese on higher plants
VII/3	Centre d'Etude de l'Energie Nucléaire (CEN) Brussels	Research into the absorption and concentration of strontium in plants
VII/4	Université de Turin Turin	Research into the metabolism of RNA in the leukemia cell
VII/5	Consiglio Nazionale delle Ricerche/Comitato Nazionale per l'Energia Nucleare (CNR/CNEN) (Prof. Buzzati-Traverso) Rome	Research in the field of genetics and biophysics
VII/6	Université de Strasbourg (Prof. Mandel) Strasbourg	Biochemical and histological study of certain substances for preventing and curing radiodermitis and radionecrosis
VII/7	Bundesanstalt für Gewässerkunde Koblenz	Sampling of mud from the bed of the Rhine
VII/8	Centre de Recherches psychopathologiques (Prof. Sivadon) Paris	Study of the psychological features of accident prevention and safety among nuclear workers

VIII. *Transplutonium Elements*

	Name of Contractor	Title
VIII/1	Commissariat à l'Energie Atomique (CEA) Paris	Preparation and study of transplutonium elements
VIII/2	Centre d'Etude de l'Energie Nucléaire (CEN) Brussels	Performance in the BR2 reactor at Mol of a transplutonium element irradiation programme

IX. *Scientific Data Processing*

	Name of Contractor	Title
IX/1	Centro Automazione Gallarate	Standardization of automatic and linguistic documentation by punched-card and punched-tape methods
IX/2	Centre National de la Recherche Scientifique (CNRS) Paris	Study of the advantages of a computing network over analog machines
IX/3	Université de Pise Pise	Study and development of electronic circuits and logic structures in the field of digital computers
IX/4	Université de Grenoble Grenoble	Research into automatic German/French translation by means of programmes set up on an electronic computer
IX/5	Société PRAXIS Milan	Programming of the "APACHE" project
IX/6	Société SOLARTRON Milan	Study of a system for the dynamic coupling of analog and digital computers

	Name of Contractor	Title
IX/7	Soc. GRAF ROTHKIRCH-TRACH Schloss-Hainhausen	Development of a complex of logic systems for expressing the results of research in all fields of science and technology
IX/8	Centre National de la Recherche Scientifique (CNRS) Paris	Study of the French language with a view to automatic translation into the Community languages and English
IX/9	Université de Naples Naples	Research into and design of an automatic device based on the communication of concepts and biological and neurological data

X. *Marked Molecules*

	Name of Contractor	Title
X/1	Institut G. ROUSSY Villejuif/Seine	Supply of deoxyribonucleic acid marked with tritium by biosynthesis
X/2	Centrale Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (TNO) La Haye	a) Preparation and conservation of marked molecules; b) Sale and delivery of above molecules
X/3	Institut Interuniversitaire des Sciences Nucléaires (IISN) Brussels	a) Preparation and conservation of marked molecules; b) Sale and delivery of above molecules
X/4	Universität Göttingen Göttingen	Supply of marked molecules
X/5	Istituto di Chimica Farmaceutica Rome	Improved conservation of organic compounds strongly marked with C14 and H3

	Name of Contractor	Title
X/6	Universität Freiburg Freiburg/Breisgau	a) Preparation and conservation of marked molecules; b) Sale and delivery of above molecules
X/7	Université Libre de Bruxelles (ULB) Brussels	Preparation of H3-marked polymers
X/8	Universität Heidelberg Heidelberg	a) Preparation and conservation of marked molecules; b) Sale and delivery of above molecules
X/9	Centre d'Etude de l'Energie Nucléaire (CEN) Brussels	Study of the conservation of marked-macromolecules
X/10	Faculté des Sciences de l'Université de Paris (Mlle Josien) Paris	Development of deuterium-marked organic compounds
X/11	Université de Cologne Cologne	Research into the conservation of tritium-marked amino-acids
X/12	Université de Milan (Istituto Scienze Botaniche) Milan	Preparation of C14-marked glucose and uniformly marked gibberellic acid
X/13	Freie Universität Berlin Berlin	Development of two new methods for the fabrication of tritium-marked organic compounds
X/14	Società Ricerche Impianti Nucleari (SORIN) Milan	Development of a radiocolloid of P32
X/15	Ecole supérieure de Chimie Mulhouse	Development of a method for studying the reactivity of solid surfaces with the aid of marked organic molecules
X/16	Technische Hochschule Darmstadt Darmstadt	a) Preparation and conservation of marked molecules; b) Sale and delivery of above molecules

	Name of Contractor	Title
X/17	Freie Universität Berlin Berlin	a) Preparation and conservation of marked molecules; b) Sale and delivery of above molecules
X/18	Società Ricerche Impianti Nucleari (SORIN) Milan	Development of a method for producing Mn54
X/19	Technische Hochschule München München	Research into marked molecules and the development of processes for the production of new marked molecules
X/20	Université de Liège Liège	1) Development of three tritium-marked compounds; 2) Study of a method for resolving racemics with a view to its application to tritium-marked compounds of drecalin and various amino-acids
X/21	Centrale Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (TNO) La Haye	Development of methods of synthesizing new marked molecules

XI. *Fission Products*

	Name of Contractor	Title
XI/1	Centre d'Etude de l'Energie Nucléaire (CEN) Brussels	Separation of fission products by fixation on mineral ion-exchangers in an acid medium
XI/2	Commissariat à l'Energie Atomique (CEA) Paris	Recovery of radioisotopes from solutions of fission products

XII. *Radioisotopes*

	Name of Contractor	Title
XII/1	Società Ricerche Impianti Nucleari (SORIN) Milan	Use of radioisotopes for detecting leaks in gas pipes
XII/2	Prof. Berthold Wildbad/Schwarzwald	Development of a continuous device for measuring sintered ore humidity on a conveyor belt
XII/3	Internationale Atomreaktorbau GmbH (INTERATOM) Bensberg/Köln	Development of a process and the prototype apparatus for the continuous measurement of the quantity of dust produced during steel fabrication by lime injection
XII/4	Association Belge pour le Développement Pacifique de l'Energie Atomique (ASBL) Brussels	Film on the application of radioisotopes in Belgium
XII/5	Internationale Atomreaktorbau GmbH (INTERATOM) Bensberg/Köln	Use of radiation backscattering in a remote-control coal-cutting machine
XII/6	Istituto di Ricerche Breda Milan	Development of an autoradiographic method for the quantitative evaluation of alloy component heterogeneities
XII/7	Wasserwirtschaftsamt Schleswig-Holstein	The development of methods for the production and use of radioactive sand
XII/8	Isotopenstudien-Gesellschaft Karlsruhe	Development of a method and apparatus for the analysis by fluorescence of elements having an atomic number of less than 20
XII/9	Prof. Berthold Wildbad/Schwarzwald	Method for the radiometric measurement of the height of the charge column of a blast furnace
XII/10	Prof. Berthold Wildbad/Schwarzwald	A study of the industrial effects of the use of isotopes in a number of specific cases

	Name of Contractor	Title
XII/11	Société Belgonucléaire/Usines E. Henricot Brussels	The use of radioisotopes in smelting (measurement of the wear of casting crucibles)
XII/12	Société d'Applications Industrielles de la Physique (SAIP) Paris	Development of an apparatus for measuring the metal content of an ore
XII/13	Internationale Atomreaktorbau GmbH (INTERATOM) Bensberg/Cologne	Development of an ionization chamber capable of operating at temperatures of up to 500°C
XII/14	Société l'Atome Industriel Paris	Market study of the uses of radioelements in the chemical industry
XII/15	Société Frieseke et Höpfner Erlangen	Development of a method of measuring viscosity in glass manufacturing
XII/16	Laboratoire National d'Hydraulique Paris	Development of a method of manufacturing and using radioactive sand for the study of the movements of sandbanks in rivers and basins

XIII. *Technical and Economic Studies*

	Name of Contractor	Title
XIII/1	Commissariat à l'Energie Atomique (CEA) Paris	Preliminary study consisting in assembling data liable to be of assistance later in a more thorough general survey of the safety features of nuclear power stations by listing the potential accidents, their cause and economic consequences, and by a numbered classification in terms of the costs of safety systems
XIII/2	Société Langeveldt/Devos Amsterdam	Insurance problems relating to the transportation of nuclear fuels by sea

	Name of Contractor	Title
XIII/3	Commissariat à l'Energie Atomique (CEA) Paris	Study on the variation, according to various parameters, of the physical characteristics of fuels used in water and graphite reactors
XIII/4	Bureau Courtoy Brussels	A set of calculations for determining, for several types of vessels, different combinations of speed, tonnage and distances in which nuclear propulsion could be competitive
XIII/5	Société Sogei Lebon Paris	Determining the data required for the issuance of calls for tenders for the transportation between Europe and the United States of irradiated fuels unloaded from research reactors
XIII/6	Allgemeine Elektrizitätsgesellschaft (AEG) Frankfurt/Main	Preparation and drafting of texts required for issuing calls for tenders for the transportation of irradiated fuel elements unloaded from FRH (Hamburg) and FRM Munich) research reactors
XIII/7	Commissariat à l'Energie Atomique (CEA) Paris	Study preliminary to an overall study of the economic functions connected with the materials, apparatus and assemblies involved in building up equipment components for gas-graphite-light-water-type nuclear power plants
XIII/8	Société Treuarbeit Frankfurt/Main	A comparative study of the insurance policies in force in the Community for covering hazards connected with the operation of nuclear installations
XIII/9	Société Fournier Neuilly/Seine	Analysis of the criteria to be adopted for the siting of energy-producing nuclear installations in the Community and the economic and social consequences of the choice of site

	Name of Contractor	Title
XIII/10	Allgemeine Elektrizitätsgesellschaft (AEG) Berlin Société ALSTHOM Paris	Preliminary parameter study for the purpose of comparing single and dual cycle systems used in boiling water power reactors

XIV. *Miscellaneous research work*

	Name of Contractor	Title
XIV/1	Centro Informazioni Studi Esperienze (CISE) Segrate	Time and energy measurements with semiconductors
XIV/2	Università degli Studi di Genova Genoa	A study of the thermoelectrical properties of uranium and rare earth compounds
XIV/3	INSTITUT BATTELLE Geneva	Study of the production of ceramic surfaces having great chemical inertia on contact with molten uranium
XIV/4	Université de Milan (Istituto Fisica Teorica) Milan	Physico-mathematical study by heterogeneous methods of calculation (HET-I)
XIV/5	Commissariat à l'Energie Atomique (CEA) Paris	Design and test programme, and possibly construction in the prototype stage of experimental devices for use in the HFR (Petten), BR2 (Mol), MELUSINE and SILOE (Grenoble) reactors or other CEA reactors

	Name of Contractor	Title
XIV/6	Professor Neuert Hamburg	Recasting, bringing into line with present scientific knowledge, and translation into English of the list of data drawn up under a previous contract relating to the compilation of data on effective cross-section measurement values
XIV/7	Reactor Centrum Nederland The Hague	Procedure for implementing the agreement on the setting up at Petten of an establishment of the Joint Nuclear Research Centre
XIV/8	Commissariat à l'Energie Atomique (CEA) Paris	A study of electromigration and electrochemistry in a molten salt medium

Annex VI

PATENT APPLICATIONS FILED BY THE COMMISSION AND ITS CONTRACTORS TO SAFEGUARD INVENTIONS DEVELOPED UNDER THE EURATOM RESEARCH PROGRAMME

(from 1 April 1962 to 28 February 1963)

File N°	Title of Patent	Inventors (*)	Holder	Origin
73	Improvements in or relating to welding	Sturge	Euratom	Dragon Project
81	Procédé et dispositif d'affichage semi-automatique d'un panneau d'affichage d'un calculateur analogique	Riotte (EUR) D'Hoop (EUR)	Euratom	Ispra CETIS
82	Improvements in or relating to nuclear reactor installation – Fission product trap (v. 152)	Hosegood	Euratom	Dragon Project
94	Dispositif de chargement et de déchargement des éléments combustibles contenus dans les canaux d'un réacteur nucléaire	Gillieron Vitry (Indatom)	(Indatom) Euratom	Indatom Contract (ESSOR)
95	Dispositif de verrouillage mécanique des éléments combustibles dans un canal de réacteur nucléaire	Laurent (Indatom)	Indatom Euratom	Indatom Contract (ESSOR)
96	Boucle rotative d'expérimentation pour réacteur nucléaire	Gumuchian (Indatom)	Indatom Euratom	Indatom Contract (ESSOR)
102	Improvements in or relating to processing particulate material	Sturge Smyth	Euratom	Dragon Project
104	Improvements in or relating to automatically operable equipment for operating an annular weld	Ellinger	Euratom	Dragon Project

(*) Inventors whose names are followed by the letters (EUR) are members of the Commission staff.

File N°	Title of Patent	Inventors	Holder	Origin
111	Procédé et dispositif de mesure des coefficients de température dans un réacteur nucléaire	P. Bonnaure (EUR) Aranovitch (EUR) J. Dufresne (EUR)	Euratom	Euratom (ORGEL)
113	Dispositif de manutention et d'observation de corps allongés émettant des radiations	Baudiffier (EUR) Rossetti (EUR)	Euratom	Euratom (ORGEL)
114	Dispositif d'oscillation d'un élément combustible irradié pour réacteur d'essais nucléaires à modérateur liquide	Arhan (EUR) Bonnaure (EUR) Raievski (EUR) Sciuto (EUR)	Euratom	Euratom (ORGEL)
116	Improvements in or relating to retarding devices for weight lowering mechanism	Dean	Euratom	Dragon Project
124	Boucle d'expérimentation pour réacteurs nucléaires	Canet (Indatom) Vitry (Indatom)	Indatom	Indatom Contract (ESSOR)
130	Barra di controllo a sezione variabile per reattori nucleari	Raievski (EUR)	Euratom	Euratom
131	Experimentier- und Regelstab für Kernreaktoren	Lopes-Cardozo (EUR)	Euratom	Euratom
133	Dispositif pour le verrouillage des cartouches de combustible dans un canal de réacteur nucléaire refroidi par circulation de fluide sous pression et réacteur nucléaire pourvu de ce dispositif	Vitry (Indatom)	Indatom Euratom	Indatom Contract (ESSOR)
134	Réacteur nucléaire hétérogène modéré et refroidi par liquide	Bernard (EUR) Bunge (EUR) Dufresne (EUR) Finzi Volta	Euratom	Euratom (ORGEL)
142	AD-DA computer linkage system	Green (EUR) Debroux (EUR) D'Hoop (EUR)	Euratom	Euratom

File N°	Title of Patent	Inventors	Holder	Origin
147	Verfahren zur Herstellung von Hydrazin	Schäfer (EUR)	Euratom	Euratom
148	Flutventil, vornehmlich für Sicherheitsbehälter von Schiffsreaktoranlagen	Karlsen (Interatom)	Interatom	Interatom Contract (Marine Propulsion)
149	Pneumatisches Niveaumessgerät für Flüssigkeitsstände	Desmazier (EUR) Genet (EUR) Neisse (EUR)	Euratom	Euratom
150	Improvements in or relating to electrical control circuits – Control circuits for stepping motors	Dean Caldarola	Euratom	Dragon Project
151	Improvements in or relating to methods of determining the temperature and certain other characteristics of materials — Temperature measurement	Bell Jacques Thorne	Euratom	Dragon Project
152	Improvements in or relating to closed circuit cooling systems – Modification to the liquid N2 cooled fission product trap (v. 82)	Hosegood	Euratom	Dragon Project
153	Abbremsvorrichtung an Rohrposthülsen	Geist (EUR) Kranert (EUR) Kutschera (EUR)	Euratom	Euratom
154	Kombinierte Lade- und Steuerstation für Rohrpostanlagen	Geist (EUR) Kranert (EUR) Kutschera (EUR)	Euratom	Euratom
155	Rohrpostpatrone mit stirnseitigem Verschluss, insbesondere für Rabbitanlagen in Kernreaktoren	Geist (EUR) Kranert (EUR) Kutschera (EUR)	Euratom	Euratom
156	Perfectionnements aux pièges de condensation pour pompes à diffusion	Sledziewsky (CEA)	Euratom	Euratom/CEA Association (Fusion)

File N°	Title of Patent	Inventors	Holder	Origin
158	Procédé et dispositif pour obtenir des courants continus d'intensité élevée dans des décharges gazeuses	Allen (CNEN) Magistrelli	Euratom	Euratom/CNEN Association (Fusion)
159	Platine-support à emplois multiples pour la micro-analyse à sonde électronique	Lemaître (EUR)	Euratom	Euratom
160	Élément combustible nucléaire et son procédé de fabrication	Gretz (EUR)	Euratom	Euratom (ORGEL)
161	Perfectionnements apportés aux appareils du genre de ceux pour mesurer la puissance d'un rayonnement nucléaire	J. Droulers (CEA) P. Mas (CEA) P. Sciers (CEA)	CEA	CEA Contract (ORGEL)
162	Procédé et dispositif pour aplatir le flux neutronique axial d'un réacteur nucléaire	V. Raievski (EUR)	Euratom	Euratom
163	Dispositif de commande automatique pour appareil photographique	Godaert (EUR) Vleminckx (EUR)	Euratom	Euratom/CEA Association (Fusion)
164	Verfahren zur Herstellung von Einkristallen von Nuklearstoffen mit metallischer Komponente, insbesondere von keramischen Kernbrennstoffen- und Anordnung zur Durchführung des Verfahrens	Beucherie (EUR) Wurm (EUR)	Euratom	Euratom
165	Anlage zur elektrolytischen Raffination von Nuklearmetallen	Wurm (EUR)	Euratom	Euratom
166	Improvements in or relating to high temperature gas cooled reactors – Preventing graphite corrosion by mass transfer in gas purged fuel elements	Kinsey Valette Lothe	Euratom	Dragon Project
167	Nouveau procédé de spectrométrie et appareil en faisant application	Capet (CEA)	Euratom	Euratom/CEA Association (Fusion)

File N°	Title of Patent	Inventors	Holder	Origin
168	Reactorkern met splijtstofstaven en steunroosters voor die staven	Wilman	RCN	RCN Contract (Marine Propulsion)
169	Trennsubstanz für die Gaschromatographie von Gemischen hochsiedender ungesättigter aromatischer Kohlenwasserstoffe, insbesondere von Polyphenylgemischen	Geiss (EUR) Versino (EUR)	Euratom	Euratom
170	Trennsubstanz für die Gaschromatographie von Polyphenylen	Geiss (EUR) Versino (EUR)	Euratom	Euratom
173	Improvements in or relating to torque transmitting mechanism – Epicyclic gearbox for remote handling equipment	Ellinger	Euratom	Dragon Project
174	Crayon de combustible à gaine mince souple pour réacteurs nucléaires	Alfillé (EUR)	Euratom	Euratom (ORGEL)
175	Improvements in or relating to methods and apparatus for comparing the magnitude of two numbers in binary code	Becker (EUR)	Euratom	Euratom
176	Ensemble de liaison de l'accouplement statique réversible entre un calculateur digital et un calculateur analogique	A. van Wauve (EUR)	Euratom	Euratom
179	Vanne à obturateur sphérique	Martin (CEA)	Euratom	Euratom/CEA Association (Fusion)
180	Traitement protecteur de métaux légers	Giolito Laporte (Progil)	Progil	Progil Contract (ORGEL)
181	Dispositif pour la constitution d'éléments combustibles formés de barreaux combustibles en grappes et destinés aux réacteurs nucléaires	Boiron Zwingenberger (GAAA)	GAAA	GAAA Contract (ESSOR)

File N°	Title of Patent	Inventors	Holder	Origin
182	Dispositif d'assemblage permettant l'intervention des grappes constituant un élément combustible du type accroché, pour réacteurs nucléaires	Boiron Archer (GAAA)	GAAA	GAAA Contract (ESSOR)
183	Barre de démarrage et d'appoint pour réacteurs nucléaires	Boiron (GAAA)	GAAA	GAAA Contract (ESSOR)
184	Mode de montage des tubes de force dans un réacteur nucléaire	Boiron (GAAA)	GAAA	GAAA Contract (ESSOR)
185	Canal autonome de réacteur nucléaire	Archer Boiron (GAAA)	GAAA	GAAA Contract (ESSOR)
186	Verfahren zur Herstellung von Formkörpern aus Metallcarbiden, insbesondere aus Urancarbid	Hofman Schäfer (NUKEM)	Euratom	NUKEM Contract (EUR/US Programme)
187	Procédé de formation et d'accélération d'un plasma et canon en faisant application	Veron (CEA)	Euratom	Euratom/CEA Association (Fusion)
189	Canon annulaire à plasma	Samain (CEA)	Euratom	Euratom/CEA Association (Fusion)
190	Procédé et dispositif de production d'une structure matérielle conductrice de l'électricité, dans une enceinte sous vide	Haegi Maisonnier (EUR)	Euratom	Euratom/CNEN Association (Fusion)
194	Vorrichtung zum Regeln der Reaktivität eines Reaktors	Miss	GKSS	Interatom/GKSS Contract (Marine Propulsion)
195	Inrichting en werkwijze voor het opslaan, het in voorraad houden en/of het met instelbare concentratie afvoeren van de zwaardere fase van een vloeibaar mengsel	Bugter Houtzeel	RCN-KEMA	Euratom/KEMA Association (SUSPOP reactor)

File N°	Title of Patent	Inventors	Holder	Origin
203	Werkwijze en inrichting voor het filtreren van vloeistoffen	Bauch (EUR) Diletti (EUR) Lanza (EUR) Rutten (EUR)	Euratom	Euratom
206	Balance électronique	Herzberger Boullet (EUR)	Euratom	Euratom
207	Steam-water mixing device for steam-cooled reactor	A. Goldman G. Breidenbach (NDA)	Euratom	USAEC/NDA Contract (EUR/US Programme)
208	Dosimètre calorimétrique pour la mesure de rayonnements ionisants	F. Romano (EUR) J. Chatelet (CNAM) E. Calvet (CNRS) J. Cordier (SRAT) R. Puig (CEA)	CEA	CEA Contract (ORGEL)
209	Joint d'étanchéité par changement d'état physique	P. Cogez (EUR) L. Guiducci (EUR)	Euratom	Euratom (ORGEL)
210	Élément combustible pour réacteur nucléaire à haut flux et refroidissement par eau	J. Archer (GAAA) J. Boiron (GAAA)	GAAA	GAAA Contract (ESSOR)
211	Système de protection en cas de rupture d'un tube de force dans un réacteur nucléaire	J. Boiron J. Etheimer (GAAA)	GAAA	GAAA Contract (ESSOR)
213	Vorrichtung zum Regeln der Reaktivität eines Reaktors	R. Miss	GKSS	Interatom/GKSS Contract (Marine Propulsion)
215	Porte-échantillons pour analyses à la microsonde de Castaing	Bouvelle (EUR) K. Weber (EUR)	Euratom	Euratom
216	Porte-échantillons avec bande adhésive pour l'analyse de poudres à l'aide d'une caméra à rayons X Guinier	Bouvelle (EUR)	Euratom	Euratom

File N°	Title of Patent	Inventors	Holder	Origin
217	Armierter Pfeilerschaft	Prüss (EUR)	Euratom	Euratom
218	Druckmessgerät für hochtemperierte flüssige Medien, insbesondere Flüssigmetalle	Schelten (EUR) Petersen (EUR) Schulze (EUR)	Euratom	Euratom
219	Élément de combustible à barrière de diffusion perfectionnée pour réacteurs nucléaires	Alfillé (EUR) Brossa (EUR) Theisen	Euratom	Euratom (ORGEL)
220	Werkwijze voor het vervaardigen van platen bestemd voor chromatografie in dunne lagen en aldus verkregen platen	Geiss (EUR) H. Schlitt (EUR)	Euratom	Euratom
221	Werkwijze voor het vervaardigen van platen bestemd voor chromatografie in dunne lagen en aldus verkregen platen	Geiss (EUR)	Euratom	Euratom
222	Gerät zur Verwendung in der Durchwaschchromatographie	H. Schlitt (EUR)	Euratom	Euratom
224	Perfectionnements aux réacteurs nucléaires	Geist (EUR) Grenon (EUR) Berthod (Sogréah) Huffenus (Sogréah) Benoist (CEA)	Euratom	Sogréah Contract (SUSPOP reactor)
225	Verfahren und Anlage zum Schmelzen und Giessen von auch höchstschmelzenden und/oder stark reaktiven Materialien im Schmelzofen	E.G. Hess (EUR) M. Portal (EUR)	Euratom	Euratom
226	Tube oscillateur	Etievant (CEA) Perulli (CEA)	CEA	Euratom/CEA Association (Fusion)
227	Werkwijze voor het vervaardigen van een ionenuitwisselaar	Baetsle (CEN)	CEN	CEN Contract (Radioisotope)

File N°	Title of Patent	Inventors	Holder	Origin
228	Brandstofpatroon voor een kernreactor in het bijzonder voor een proefreactor		CEN	BR 2 Association
231	Vorrichtung zur Kupplung oder sonstigen Handhabung von radioaktiven Teilen	Cyron	Interatom	Interatom/GKSS Contract (Marine Propulsion)
232	Sicherheitsventil	Karlsen	Interatom	Interatom/GKSS Contract (Marine Propulsion)
233	Pompe à piston libre	Martin (CEA)	CEA	Euratom/CEA Contract (Fusion)
236	Gerät zur kontrollierten Befeuchtung und Trocknung von Dünnschichtchromatographie-Platten mittels eines Trockenmittels, vorzugsweise Schwefelsäure verschiedener Konzentrationen	F. Geiss (EUR) H. Schlitt (EUR)	Euratom	Euratom
237	Werkwijze en inrichting voor chromatografie in dunne lagen	F. Geiss (EUR) H. Schlitt (EUR)	Euratom	Euratom
239	Detektor zur Erfassung des burnout in Rohrsträngen von Zweiphasen- Wärmübertragungsanlagen	Herzberger (EUR)	Euratom	Euratom
248	Preparazione di un composto colloidale marcato con fosforo-32 ad elevata stabilità	Rosa (SORIN) Sosi (SORIN)	SORIN	SORIN Contract (Radioisotopes)

Annex VII

SCIENTIFIC AND TECHNICAL REPORTS STEMMING FROM THE EURATOM RESEARCH PROGRAMME AND PUBLISHED BY THE COMMISSION

from 1 April 1962 to 28 February 1963

(The authors of the publications listed are members either of the Euratom research teams or of enterprises with which Euratom has signed contracts)

SUMMARY

1. BIOLOGY AND MEDICINE

DALEBROUX M. — Etude biométrique de la variabilité génétique induite, par radiations ionisantes, dans une lignée pure d'une plante diploïde autofécondée
Euratom report N° EUR 143 f - Reprint

DEVREUX M.
SCARASCIA-MUGNOZZA S.T. — Action des rayons gamma sur les premiers stades du développement de l'embryon de nicotiana rustica L.
Euratom report N° EUR 216 f - Reprint

FABRY C.

L'évolution du poids des organes du corps humain, de la naissance à l'âge adulte, en Europe occidentale
Euratom report N° EUR 147 f

FRACCARO M.
KLINGER H.P.
SCHUTT W.

A male with XXXXY sex chromosomes
Euratom report N° EUR 137 e - Reprint

FRACCARO M.
TAYLOR A.I.
BODIAN M.
NEWNS G.H.

A human intersex (« True Hermaphrodite ») with XX/XXY/XXYYY sex chromosomes
Euratom report N° EUR 182 e - Reprint

LEVI E.

An artifact in plant autoradiography
Euratom report N° EUR 120 e - Reprint

MERLINI M.

Applicazioni dell'Analisi per Radioattivazione alla Biologia
Euratom report N° EUR 128 i

RODESCH J.
MASSART A.

Données récentes en matière de traitement des radiolésions
Euratom report N° EUR 125 f

2. CHEMISTRY

BEAUDET C.
HORLAIT J.
MARCQ A.
BELPAIRE G.

Synthèse de produits de référence apparentés aux polyphényles
Euratom report N° EUR 31 f

COLLIN J.L.

Dosage de fer, chrome et nickel dans les terphényles
Euratom report N° EUR 29 f

FRITZ G.

Density and surface tension measurements of pure polyphenyls and some polyphenyl-mixtures
Euratom report N° EUR 165 e

LAUER K.F.
LE DUIGOU Y.

Genaue Endpunktsbestimmung in der Potentiometrie
Euratom report N° EUR 44 d - Reprint

NORMAND M.J.
GEISS F.

Fortschritte bei der Analyse von Polyphenylgemischen
Euratom report N° EUR 90 d

SANDRONI S.
GEISS F.
Les complexes colorés tétracyanoéthylène - polyphényles
Euratom report N° EUR 87 f

VOS G.
DE SPIEGELEER W.
Le dosage des traces de Fe, Ni et Cr dans les polyphényles par spectrographie X
Euratom report N° EUR 28 f

VOS G.
DE SPIEGELEER W.
Le dosage semi-quantitatif de Ba, Nb, Sr, Fe, Mn et Zn dans les carbonatites par spectrographie des rayons X
Euratom report N° EUR 32 f

VOS G.
TOUSSAINT C.
Le dosage des impuretés dans le SAP par spectrographie des rayons X
Euratom report N° EUR 21 f

AT PRESS :

COLOMBO A.
Determinazione dell'ossigeno nel monocarburo di uranio mediante estrazione a caldo nel vuoto
Euratom report N° EUR 204 i

DE SPIEGELEER W.
TOUSSAINT C.
VOS G.
Le dosage du silicium et du cobalt dans les aciers inoxydables par spectrographie des rayons X
Euratom report N° EUR 203 f

SOMMARIVA A.
Microanalisi delle impurità dell'acqua distillata prodotta per il circuito primario di un reattore nucleare per la propulsione navale
Euratom report N° EUR 224 i

3. MACHINERY AND APPARATUS

BACKS A.
Pumpen zur Förderung heißer, radioaktiv verseuchter organischer Flüssigkeiten
Euratom report N° EUR 148 d - Reprint

DEBUS G.H.
The determination of mass discrimination in a mass spectrometer
Euratom report N° EUR 97 e - Reprint

DELATTRE P.
PROSDOCIMI A.

Les activités du Groupe de travail « Dosimétrie » d'Euratom
Euratom report N° EUR 88 f

DE LOTTO I.
GIANNELLI G.
STANCHI L.

Power supply for ESONE standard plug-in system
Euratom report N° EUR 30 e

FRAYSSE G.
PROSDOCIMI A.

Studio di un detettore di neutroni termici per determinare la distribuzione del flusso in un fascio collimato
Euratom report N° EUR 133 i

FRIZ G.
NEHREN R.

Vergleich dreier Methoden zur Messung der Oberflächenspannung von Polyphenylen
Euratom report N° EUR 209 d

HERRINCK P.

Possibilités d'utilisation progressive de l'énergie thermique libérée par des explosions nucléaires
Euratom report N° EUR 16 f

KRUIDHOF E.W.
MORET H.

Measurement of the electrical resistance of metal layers evaporated on non-conducting foils
Euratom report N° EUR 50 e - Reprint

LEMAITRE J.
THEISEN R.

Description d'un nouveau dispositif complémentaire à la microsonde de Castaing - Applications nouvelles à la microanalyse élémentaire et structurale
Euratom report N° EUR 109 f

LOPES CARDOZO R.

Gas-phase controlled mass transfer of packed columns correlated to the loading-point
Euratom report N° EUR 138 e - Reprint

MORET H.

Measurement of the internal cell length of glass measuring cells
Euratom report N° EUR 52 e - Reprint

MORET H.

Construction of a sample changer based on the Geneva wheel principle
Euratom report N° EUR 98 e - Reprint

SCHMELING P.
FELIX F.

Experimental methods and equipment for diffusion measurements of radioactive rare-gases (rare-gas diffusion in solids)
Euratom report N° EUR 111 e

AT PRESS :

BONNET C.
MORIN R.
Etude à propos de l'anomalie de la distribution des températures dans les couches superficielles d'une paroi chauffée ou refroidie, constatée par M. Jacq
Euratom report N° EUR 237 f

CANALI U.
NICKS R.
PLEINEVAUX C.
Courant à travers la surface latérale d'un cylindre uniformément émetteur et autoabsorbant
Euratom report N° EUR 205 f

ESCHBACH H.
Methoden und Anwendungen der Ultra-Hochvakuum Technik
Euratom report N° EUR 231 d

FRAYSSE G.
PROSDOCIMI A.
Spectrométrie des réactions (n, α) et (n, f) à l'aide de détecteurs à l'état solide
Euratom report N° EUR 222 f

ROSSI G.
Détermination rapide du rapport d'intensité des raies spectrales par la méthode d'auto-calibration
Euratom report N° EUR 202 f

4. GEOLOGY, MINERALOGY AND METEOROLOGY

COPPEZ A.
PICCIOTTO E.
Bibliographie des mesures d'âges absolus en Antarctique
Euratom report N° EUR 229 f - Reprint

LEDENT D.
LAY C.
DELHAL J.
Premières données sur l'âge absolu des formations anciennes du « socle » du Kasaï (Congo méridional)
Euratom report N° EUR 199 f - Reprint

MONTEYNE-POULAERT G.
DELWICHE R.
CAHEN C.
Ages de minéralisations pegmatitiques et filoniennes du Ruanda et du Burundi
Euratom report N° EUR 200 f - Reprint

MONTEYNE-POULAERT G.
DELWICHE R.
CAHEN L.
SAFIANNIKOFF A.
Ages de minéralisations pegmatitiques et filoniennes du Kivu méridional (Congo oriental) - Indications préliminaires sur les âges de phases pegmatitiques successives
Euratom report N° EUR 198 f - Reprint

SAFIANNIKOFF A.
VAN WAMBEKE L.
Sur un terme plombifère du groupe pyrochlore-microlite
Euratom report N° EUR 45 f - Reprint

VINIKAS B. — Distributions comparées de quelques éléments rares et mineurs dans des charbons nord-américains
Euratom report N° EUR 131 f

5. HEALTH AND SAFETY

AT PRESS :

ANZANI A.
BENCO A.
DE BORTOLI M.
DOMINICI G.
GAGLIONE P.
GANDINO C.
MALVICINI A. — Misure di radioattività ambientale, Ispra, 1961
Euratom report N° EUR 223 i

6. INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

CRAVAROLO L.
HASSID A.
VILLANI S. — A beta-ray attenuation method for density measurements of liquid-gas mixtures in adiabatic flow
Euratom report N° EUR 48 e - Reprint

7. MATHEMATICS AND COMPUTORS

ALBERIGHI-QUARANTA A.
RIGHINI B. — Un nuovo codificatore
Euratom report N° EUR 184 i

BEHRINGER F.A. — Der DOCA - Maschinenpark
Euratom report N° EUR 191 d

CALIGIURI G.P.
CLAES W.
D'HOOP H.
VICHNEVETSKY R. — Recherche sur la simulation tridimensionnelle des réacteurs nucléaires
Euratom report N° EUR 213 f

CALIGIURI G.P.
D'HOOP H.

Nuovo metodo sperimentale analogico per la simulazione tridimensionale dei reattori nucleari
Euratom report N° EUR 145 i - Reprint

CAMION P.

Sur une propriété de l'espace normé C et ses applications aux matrices unimodulaires
Euratom report N° EUR 139 f - Reprint

CASINI G.
DE HAAN W.
DIANA E.
FOGGI C.
KIND A.
ROSSI G.

CAROLINE I - A calculation method for non irradiated organic liquid heavy water lattices
Euratom report N° EUR 134 e

DEBROUX A.
DEL BIGIO G.P.
GREEN C.
D'HOOP H.

Le code APACHE, destiné à la programmation d'un problème analogique au moyen d'un calculateur digital
Euratom report N° EUR 215 f

DEL BIGIO G.
D'HOOP H.

APACHE I - Analog programming and checking
Euratom report N° EUR 189 f

GLODEN R.F.

Propriétés des polynômes associés aux fonctions de Laguerre de seconde espèce généralisées et questions connexes
Euratom report N° EUR 207 f

LAMBERT P.V.
NEUTS M.F.

Application de la théorie des jeux aux problèmes d'approximation
Euratom report N° EUR 124 f

LOMBARDI L.

Three working papers on the theory of computation
Euratom report N° EUR 192 d e

MONTEROSSO R.

Rapporto sui programmi di risoluzione di equazioni in algebra di Boole
Euratom report N° EUR 126 i

OSTANELLO A.

Nouvelle démonstration du théorème de König
Euratom report N° EUR 144 f

PLEINEVAUX C.

DIFF - Un programme Fortran 7090 pour déterminer les constantes de diffusion neutronique relatives à un calcul à six groupes
Euratom report N° EUR 106 f

PLEINEVAUX C.

Table des fonctions intégrales exponentielles
Euratom report N° EUR 108 f

ROSSI G.

THERMIDOR- AN IBM 7090 Fortran code to evaluate the thermal neutron spectrum in an ORGEL type fuel element
Euratom report N° EUR 105 e

ROUSSEAUX J.

Statistique et théorie de l'information - Les fonctions de distribution exponentielles
Euratom report N° EUR 196 f

AT PRESS :

CAMION P.

Nombre minimum d'inverseurs dans un schéma analogique
Euratom report N° EUR 190 f

DEBROUX A.

Code pour la solution de systèmes d'équations Booléennes
Euratom report N° EUR 211 f

D'HOOP H.

La simulation dynamique à trois dimensions des grands réacteurs nucléaires
Euratom report N° EUR 197 f

GAMP J.

Etude systématique de la génération de retards au moyen d'unités analogiques classiques
Euratom report N° EUR 240 f

LARISSE J.

Processus multiplicatifs, équations différentielles stochastiques et applications
Euratom report N° EUR 217 f

RIOTTE A.

« CANDIDE » Plan d'ensemble sur les développements possibles du couplage des calculateurs analogiques et digitaux du CETIS
Euratom report N° EUR 150 f

8. METALS, CERAMICS AND OTHER MATERIALS

BLANCK H.
DELAVIGNETTE P.
AMELINCKX S.

Dislocations and wide stocking faults in Wurtzite type crystals : zinc sulfide and aluminium nitride
Euratom report N° EUR 201 e - Reprint

BONNET P.
GRIN M.

Contribution à l'étude de la fragilité à chaud du matériau composite aluminium-alumine
Euratom report N° EUR 208 f

BROSSA F.
THEISEN R.
HUET J.J.
TYTGAT D.

Etude du nickel comme barrière de diffusion entre l'uranium et l'aluminium
Euratom report N° EUR 17 f

COLOMBO R.
FRIGERIO G.

On the occurence of uranium metal particles in fused UO2
Euratom report N° EUR 214 e - Reprint

DE MUNCK L.
KLIMZACK-MATHIEU L.
MERTENS C.
MEUNIER J.
POURBAIX M.
VANLEUGENHAGHE C.
WARZEE M.

Sur le comportement d'aciers inoxydables en solution sulfurique
IV — Recherches expérimentales
Euratom report N° EUR 37 f

FRIPPIAT J.
NICKS R.

Courbes de rayonnement gamma relatives à l'acier, à l'aluminium et à l'uranium
Euratom report N° EUR 103 f

KLIMZACK-MATHIEU L.
MEUNIER J.
POURBAIX M.
VANLEUGENHAGHE C.

Sur le comportement d'aciers alliés en solution chlorurée
I — Influence de chlorure et d'oxydants en présence de bicarbonates
Euratom report N° EUR 34 f

KLIMZACK-MATHIEU L.
MEUNIER J.
POURBAIX M.
VANLEUGENHAGHE C.

Sur le comportement d'aciers alliés en solution chlorurée
II — Influence de bicarbonate et de sulfate, à 20° C
Euratom report N° EUR 35 f

KLIMZACK-MATHIEU L.
MERTENS C.
MEUNIER J.
POURBAIX M.
VANLEUGENHAGHE C.

Sur le comportement d'aciers alliés en solution chlorurée
III — Influence de la température sur les tensions de « rupture » et de « protection » d'aciers, et sur les concentrations de « rupture » et de « protection » en chlorure (solutions bicarboniques)
Euratom report N° EUR 36 f

MERCIER J.

Filage d'oxyde d'uranium enrichi à 5,5 % pour essais d'irradiation dans le réacteur VBWR de Vallecitos
Euratom report N° EUR 180 f

MERTENS C.

Sur le comportement d'aciers inoxydables en solution sulfurique
V — Etude bibliographique
Euratom report N° EUR 38 f

MEULEMANS M.
TYTGAT D.
VAN AUDENHOVE J.
BRIOLA J.
JEHENSON P.

Electron beam welding of sintered aluminium
Euratom report N° EUR 39 e

PERETTI J.

Superconductivity of transition elements
Euratom report N° EUR 226 e - Reprint

RICHARDS J.

Contribution à l'étude du système niobium-aluminium
Euratom report N° EUR 132 f

RUEDL E.
DELAVIGNETTE P.
AMELINCKX S.

Fission fragment damage to platinum
Euratom report N° EUR 104 e - Reprint

RUEDL E.
DELAVIGNETTE P.
AMELINCKX S.

Electron microscopic study of dislocations and fission damage in platinum foils
Euratom report N° EUR 113 e - Reprint

RUEDL E.
DELAVIGNETTE P.
AMELINCKX S.

Electron microscope study of irradiated platinum
Euratom report N° EUR 115 e

XXX

Herstellung von UO_2 - und UO_2-BeO Mischpellets
Euratom report N° EUR 116 d

AT PRESS :

HAUSER R.

Filage de l'oxyde d'uranium - 2ème année
Euratom report N° EUR 89 f

JUNG-KOENIG W.
RICHTER H.
TVERBERG J.C.
WINCIERZ P.
ZWICKER U.

Untersuchung von Legierungen des Zirkoniums mit Niob und Zinn im Hinblick auf deren Verwendung als Hüllmaterial in wassergekühlten Kernreaktoren
Euratom report N° EUR 86 d

9. PHYSICS

ALLEN J.E.
BRUNELLI B.
TOSCHI R.

La ricerca sul plasma nei suoi aspetti più recenti di interesse generale
Euratom report N° EUR 167 i - Reprint

BASSANI G.
COLLI L.
GADOLI E.
IORI I.

The (n, d) reaction on Fe 54
Euratom report N° EUR 181 e - Reprint

BASSI P.
FERRETTI B.
VENTURINI G.
BERTOLINI G.C.
CAPPELLANI F.
MANDL V.
RESTELLI G.B.
ROTA A.

The reaction Be^7 (n, α) He^4 and parity conservation in strong interactions
Euratom report N° EUR 99 e - Reprint

BIZZETTI P.C.
BIZZETTI-SONA A.M.
BOCCIOLINI
DI CAPORIACCO G.
MANDO M.

Cross-section fluctuations in the Si^{28} (γ, p) reaction at 17,64 MeV
Euratom report N° EUR 227 e - Reprint

COLLI L.
FACCHINI U.
IORI I.
MARCAZZAN M.G.
MILAZZO M.
SAETTA MENICHELLA E.
TONOLINI F.

Study of the Si^{28} (n, α) reaction and experimental evidence of the Ericson fluctuations
Euratom report N° EUR 136 e - Reprint

COLLI L.
IORI I.
MILAZZO M.
MARCAZZAN M.G.

Ericson fluctuations in the Si^{28} (n, α) Mg^{25} reaction
Euratom report N° EUR 212 e - Reprint

HUBERT P.

Les recherches expérimentales sur la fusion contrôlée
Euratom report N° EUR 80 f - Reprint

JEAN M.
RICCI R.A.
VAN LIESHOUT R.

Effects of pairing and quadrupole forces on the branching ratios from the higher excited states in spherical even-even nuclei
Euratom report N° EUR 228 e - Reprint

KIND A.
NICKS R.

Abschirmstudien im Forschungszentrum Ispra
Euratom report N° EUR 142 d

NICKS R.
PLEINEVAUX C.

Détection de la pénétration des neutrons rapides dans l'eau au moyen de détecteurs à seuil
Euratom report N° EUR 107 f

SEGRE S.E.
ALLEN J.E.

Magnetic probes of high frequency response
Euratom report N° EUR 169 e - Reprint

TAKAHASHI H.
Space and time dependent eigenvalue problem in neutron thermalization
Euratom report N° EUR 22 e

TAKAHASHI H.
Thermal neutron spectrum in a medium with two different temperatures
Euratom report N° EUR 23 e

XXX
Neutron time-of-flight methods
Euratom report N° EUR 1 e

AT PRESS :

BLAESSER G.
Theoretical foundations of parameter oscillation measurements
Euratom report N° EUR 221 e

KIND A.
NICKS R.
Attività del C.C.R. di Ispra nel campo delle schermature
Euratom report N° EUR 233 i

PAULSEN A.
LISKIEN H.
Compilation of cross-sections for some neutron induced threshold reactions (Second series)
Euratom report N° EUR 119 e

POLLEHN H.
NEUERT H.
Tables of cross-sections of nuclear reactions with neutron in the 14-15 MeV energy range
Euratom report N° EUR 122 e

10. REACTOR TECHNOLOGY

BLAESSER G.
BONNAURE P.
CASINI G.
CENERINI R.
RAIEVSKI V.
TOSELLI F.
ECO - Expérience critique pour l'étude de la filière ORGEL
Euratom report N° EUR 130 f

BLAESSER G.
CASINI G.
PILLON J.
Variation de la réactivité à long terme pour différents types de circulation du combustible
Euratom report N° EUR 129 f

BOEUF A.
TASSAN S.
A measurement of the fine structure of the thermal flux in simple geometry ORGEL type lattice
Euratom report N° EUR 206 e

BONALUMI R.
ZORZOLI G.B.

Fine flux measurements on concentric annuli fuel elements
Euratom report N° EUR 24 e

BONALUMI R.
ZORZOLI G.B.

Heavy water lattice buckling measurements
Euratom report N° EUR 25 e

CANALI U.
NICKS R.
PLEINEVAUX C.

Manuel du blindage de l'expérience critique ORGEL (ECO)
Euratom report N° EUR 149 f

CASINI G.
FOGGI C.
TOSELLI F.

Critical experiments on natural uranium oxide, organic cooled heavy water moderated lattices
Euratom report N° EUR 114 e - Reprint

CASINI G.
PASSERINI C.
PROSDOCIMI A.

Nuclear composition of natural uranium fuel under long term irradiation in a thermal reactor
Euratom report N° EUR 73 e - Reprint

CASINI G.
PILLON J.

Poids statistique pour le calcul de l'effet sur la réactivité du xénon à l'équilibre
Euratom report N° EUR 102 f

LENY J.C.
ORLOWSKI S.
CHARRAULT J.C.
LAFONTAINE F.

ORGEL - a European power reactor design
Euratom report N° EUR 85 e

ORLOWSKI S.

Cycles de vapeur pour une centrale de puissance ORGEL
Euratom report N° EUR 83 f

AT PRESS :

CASINI G.
KIND A.
ROSSI G.

A simplified method for organic, heavy water lattice calculations
Euratom report N° EUR 238 e

CASINI G.
KIND A.
ROSSI G.

Development program for D_2O lattice reactivity calculations
Euratom report N° EUR 239 e

XXX

ORGEL Program
Euratom report N° EUR 101 e

11. RADIOACTIVE WASTE PROCESSING AND DISPOSAL

BAESTLE L.

Physicochimie de la migration de cations dans le sol
Euratom report N° EUR 141 f

BAESTLE L.
DEJONGHE P.
LOPES CARDOZO R.
MAES W.
SIMPSON E.S.
VAN DE VOORDE N.

Research program on the treatment and storage of radioactive wastes
Euratom report N° EUR 81 e

BAESTLE L.
DEJONGHE P.
MAES W.
STANER P.

Etat d'avancement du programme d'études sur le mouvement de radioéléments dans le sol au C.E.N. à Mol
Euratom report N° EUR 140 f

SCHMETS S.
CAMOZZO G.
FRANCESCONI A.
HEREMANS R.
PIERINI G.
SPEECKAERT Ph.
VAN VLASSELAER S.
BROOTHAERTS J.
LAMBIET C.
VANDERSTEENE J.

Retraitement des combustibles irradiés
Euratom report N° EUR 82 f

AT PRESS :

XXX

Etude du transport vers les Etats-Unis des combustibles irradiés dans les réacteurs de puissance européens
Euratom report N° EUR 112 e.f.

XXX

Rapport d'étude pour le transport des combustibles irradiés
Euratom report N° EUR 185 f.d.e.

12. LAW, ECONOMY AND INDUSTRY

AT PRESS :

VON LOESCH T.

Öffentlich-rechtliche Konsequenzen der Verwendung technischer Hilfsmittel bei der Staatstätigkeit
Euratom report N° EUR 194 d

13. DOCUMENTATION

BERNSTEIN H.H. — Anleitung zur Programmierung des Flexowriters
Euratom report N° EUR 195 d

ROUSSEAUX J. — Théorie de l'information appliquée au prix des calculs
Euratom report N° EUR 146 f

AT PRESS :

BERNSTEIN H.H. — Richtlinien zum Aufbau von Literaturkarteien im Hinblick auf ihre Eingabe in elektronische Datenverarbeitungssysteme
Euratom report N° EUR 232 d

BERNSTEIN H.H. — Lochstreifenschreibmaschinen auf dem europäischen Markt und ihre Brauchbarkeit für die Dokumentation
Euratom report N° EUR 234 d

BERNSTEIN H.H.
MEYER-UHLENRIED K.H. — Erfahrungen beim Einsatz von Lochstreifen für die Datenerfassung bei Euratom
Euratom report N° EUR 127 d

CONZE K.
ROTHKIRCH-TRACH K.Chr. — Tonbandeinsatz bei der Literaturauswertung - Zentrale Datenverarbeitung bei dezentraler Datenerhebung
Euratom report N° EUR 188 d

IHM P.
LECERF Y. — Eléments pour une grammaire générale des langues projectives
Euratom report N° EUR 210 f

MEYER-UHLENRIED K.H. — Das System DOCA - ein Weg zur automatischen Dokumentation
Euratom report N° EUR 218 d

REICHARDT G. — Organisation und Literatur der kernwissenschaftlichen Forschung der Sowjetunion
Euratom report N° EUR 236 d.e.

ROTHKIRCH-TRACH K.Chr.
KREUSLER — Randlochkarten als Sprachwörterkartei
Euratom report N° EUR 187 d

RUSTON E. — Die kombinierte Rand- und Sichtlochkartei
Euratom report N° EUR 235 d

SCHEFFER E. — Recueil de stemmas (Volume I)
Euratom report N° EUR 220 f

14. GENERAL

GUEBEN G. — Ispra - Centre commun de recherche d'Euratom
Euratom report N° EUR 54 f - Reprint

GUERON J.
LENY J.C. — Euratom research activities - An illustration: the ORGEL program
Euratom report N° EUR 110 e

PIETSCH E. — Aufbau einer automatischen Dokumentation - insbesondere für den Bereich der Atomkernenergie
Euratom report N° EUR 186 d

EURATOM — Répertoire des installations nucléaires de la Communauté européenne de l'énergie atomique - 2ème édition
Euratom report N° EUR 183 d.e.f.i.n.

PUBLICATIONS DEPARTMENT OF THE EUROPEAN COMMUNITIES
3287/5/1963/6