EUROPEAN ATOMIC ENERGY COMMUNITY

EURATOM

THE COMMISSION

SEVENTH

# General Report

on the

# Activities of the Community

*(March 1963 - February 1964)*

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# FOREWORD

In accordance with the express wish of the European Parliament, the Commission has departed from the traditional form in this, the Seventh General Report, which this year consists of two separate volumes. The first is made up of a concise and comprehensive six-chapter survey of Euratom's activities, dealing in turn with the energy situation, the broad outline of the research programme, and going on to discuss the organization's work in sponsoring the industrial use of nuclear energy, health protection and biology, ways and means of achieving Euratom's various objectives and, finally, external relations. The second volume contains detailed explanations of the various subjects discussed in the first section. An alphabetical index is given at the end of the first volume for reference purposes.

# SUMMARY

VOLUME I



VOLUME II

Documentation attached to the seventh general report.

# INTRODUCTION

Designs for economic reactors are now available: nuclear energy is embarking upon the truly industrial stage of its development. Vast resources have been mobilized to reach this stage. But there is still a very long way to go before full benefit can be derived from nuclear techniques, although the stage already attained rules out all possible doubt as to their potential.

The time has therefore come to take stock of the nuclear problem facing the Community, from the standpoint both of energy proper and of the conditions for the development of a European nuclear industry and its repercussions on industry in general. At the same time, mention will be made of the need for the six Member States to pursue a joint industrial policy on nuclear affairs by making use of the appropriate Community bodies.

## I. Considerations relating to energy policy

*Europe is the world's largest energy importer*

The utilization of rapidly increasing quantities of energy is an essential feature of the economies of the industrialized countries. Electricity consumption, in particular, has up to now doubled every ten years, and there are no signs that this rate of increase will slow down in the near future. In the light of apparently reliable estimates, the Community's electricity requirements, which totalled 285,000 million kWh in 1960, are likely to amount to about 570,000 million in 1970 and more than a million million in 1980.

The world's reserves of those conventional fuels which can most easily be utilized will ultimately diminish, with an increase in prices as a result. As regards the Community, it possesses only five or six percent of the world's reserves of fossil fuels, while its present consumption totals about 10% of world energy consumption. Its net imports, which totalled about 5% of all its energy supplies before the second world war, had risen to 27% by 1960 and are likely to rise to over 47% in 1970 and to more than 52% in 1975. It should be noted that the contribution made by nuclear energy, which is

regarded as a domestic source, is included in this last figure, representing 3 - 5 % of the total. Without it, total imports would be at least 55% by 1975 and would certainly continue to rise subsequently.

In the foreseeable future the nuclear energy policy will do nothing more than make it possible to limit gradually the rate of increase in these imports. Nuclear energy will not itself be in a position to compete with conventional fuels produced in the Community.

One effect of the use of nuclear energy in increasing quantities in the national grids will be to reduce the costs and the risks involved in the Community's dependence on outside sources for its energy supplies, for the Community possesses reserves of nuclear fuel which, while not freeing it from the need for imports, nonetheless add to its energy wealth. Large uranium reserves are available in countries with which the Community maintains stable relations. The storage costs for nuclear fuel are lower than for other fuels, and the percentage of the price of the electricity representing the fuel cost is lower than for other types of power plants.

There is still a great deal of room for technical progress in the nuclear field. The present trend towards equipping national grids with increasingly powerful plants enables nuclear techniques to be used at the peak of their efficiency. The price of nuclear electricity will gradually decline and will restrain fuel prices in general at a time when rising consumption will be an inflationary influence.

*Nuclear energy and economic developments*

Transmission costs are only a small element in nuclear electricity costs. As a result regional differences in energy costs will gradually be able to be levelled out. It will no longer be necessary to concentrate large industrial consumers of energy near mines or ports. The economic and social importance of this is obvious, for attempts made at the political level to assist underdeveloped regions will be given a fresh, and in certain cases decisive, impetus, and will be of benefit to the economy as a whole.

A recent official American report advanced the theory that the use of nuclear energy in American grids would permit savings of the order of $ 30,000 million between now and the end of the century (at a rate of 5% these savings would at present prices amount to $ 10,000 million in 1970).

In view of the fact that the United States consumes much more energy than Europe and since conventional energy is much more expensive in Europe than in North America, there is good reason to believe that savings of somewhere

near this order of magnitude could be made in Europe, assuming that by 1980 nearly a quarter, and by the end of the century one-half of all the electric power consumed would come from nuclear installations.

A margin of uncertainty should always be allowed for in longterm estimates, but these orders of magnitude are nonetheless highly significant.

The use of nuclear energy thus being, by the nature of things, a matter for the Europe of tomorrow, the real problem is to determine the part to be played by European industry in the construction of these reactors.

## II. The nuclear industry and economic growth

The high growth rate which was a feature of the Community's economy in the fifties and at the beginning of the present decade, and which was due both to the mobilization of unused production factors and to technical advance, can only be maintained if the part played by the latter item gains even greater prominence. However, progress is necessarily slow in existing industries and more rapid and extensive in new industries. New industries are therefore in the vanguard of economic growth and pull the remainder of the economy along with them.

Owing to the complexity of the techniques on which it is based and of the organization required, the nuclear plant construction industry is obviously in the front rank of technical progress.

Leading industries such as the nuclear industry are distinguished by three features. They represent an appreciable and increasing percentage of total future industrial investment; they require a major concentration of capital and call for personnel possessing an above-average level of specialist qualifications. Finally, their very existence is likely, in the future, to be seen as the yardstick of the level of economic activity.

## III. The means of action

The construction of a great industry based on new scientific principles and new techniques raises a complex problem whose solution calls for the co-operation of the public and private sectors, each of which must devote large sums and set up the appropriate organization in its own sector. Here, indeed, the research effort and the task of creating infrastructures cannot be borne entirely by an industry only in its infancy. The public authorities must

therefore not only provide the necessary legislative framework for production, but must also take the responsibility for all regulation measures, foster research and the building of an infrastructure, facilitate investment by suitable means of participation in the transition stage, and, lastly, bear certain risks inherent in techniques now in the experimental stage.

### *The stages in the development of nuclear technology*

The development of each type of reactor costs hundreds of millions of dollars. While several avenues have had to be explored simultaneously from the outset, it is still impossible to know which perform best. Thus, while the sum total of these efforts may be expected to yield a certain benefit, each individual project entails considerable risks which industry is chary of undertaking on its own. When the first units of a series come into operation a major effort is still necessary in order to "develop" the formula. Several stages lie ahead in the technique of constructing steadily improved versions of reactors capable of extracting an ever greater fraction of the energy potential of the fuels.

Let us briefly recall the main features of these stages of development.

The reactors at present available for industrial production, and usually known as proven-type reactors, are thermal reactors. They use less than 1% of the potential energy in their fuel.

Several so-called "advanced" types of thermal reactor are under study. They will have higher performances and will also be good converters, i.e. during operation they will produce a proportionately greater quantity of plutonium than that produced by the proven-type reactors. This is the second major stage.

The full expansion of the nuclear economy, however, depends upon the development of breeder reactors, which will be capable of performances fifty or sixty times higher than those of the thermal reactors which can be constructed today. This will be the third stage.

At the present rate of consumption it is only worthwhile to use those nuclear fuel deposits which can be easily extracted. The breeder reactors will be able to use products whose extraction is fifty to sixty times more expensive. Under these conditions the world reserves of exploitable ores may be considered as inexhaustible.

Another more distant nuclear prospect is controlled thermonuclear fusion. Substantial expenditure is called for here, in spite of the fact that the outlook for harnessing fusion energy is fairly distant for the moment.

These few indications about the four technical stages in the development of nuclear energy well demonstrate the complexity of the task of promoting a nuclear industry.

It is necessary to construct proven-type reactors to produce energy, to gain familiarity with the problems of manufacturing components, and to obtain design and operational experience. The men and organizations capable of solving the same problems for advanced thermal reactors and breeders will not be available when needed if they are not trained now. Conversely, endeavours can be confined to the present technical stage only at the price of building an industry without a future. There must be a concerted advance along the four main paths.

### *Necessity for a large economic area*

A division of labour at Community level is therefore necessary. It will not be achieved under conditions appropriate to this industry merely through the existence of a common nuclear market freed from trade barriers and the benefits of competition alone.

Indeed, this market is at present very restricted and has a very special character; it is made up largely of orders placed by the States and the public authorities concerned. Both in France and in Italy it consists mainly of one large government body responsible for electricity production. Everywhere it is and will remain very concentrated.

It is apparent that the task of fostering the development of a great new industry in these conditions entails market problems which cannot be solved by regulations appropriate to already-established markets.

### *Necessity for a common policy*

(a) *Harmonization of programmes*

The conclusion must be reached that the objective can be attained only through a common policy whose first prerequisite is the gradual rapprochement, in proportion of course to the industrial strength of each, and the scale of the contribution of the Member State to the nuclear sector. A will to attain this balance progressively must become manifest in order to make possible:

— the alignment of the research and infrastructure programmes of the Member States with the Euratom Joint Programme;

— the setting of common medium-term targets for nuclear electricity production.

These two tasks are indissolubly linked. Applied research will never be coherently organized and endowed with the substantial means required unless the industrial targets are fixed.

At the moment an extensive joint task has been accomplished. A first five-year programme has been carried out, the second is under way, and the Joint Research Centre is pursuing its work of organization. Important association contracts extend Euratom's radius of action. As regards industry, certain limited experiments in co-operation between undertakings in the different countries, for the implementation of certain parts of the joint programme, suggest the possibility of arriving at a more rational organization of the European nuclear construction industry.

Nevertheless, there continue to be major obstacles to the expansion of this area of common activity.

The negotiators of the Euratom Treaty had conceived of the nuclear sector as a sort of "virgin land", uncontaminated by the protectionist spirit of already established industries, requiring construction from the outset on a European scale. But in fact a substantial programme and major plants already existed in one of the Member States. Elsewhere several plants had been built and projects launched before Euratom came into existence, or before it had reached the stage of organization and experience at which it could make its voice heard.

These departures, which preceded any harmonization, have assumed divergent forms. Some efforts made at national level are too limited to attain their objective and derive from an incomplete grasp of the nuclear problem. The main difficulty arises from the unequal commitment of the Member States, which delays the creation of the necessary solidarity.

A progressive strengthening of the joint effort is necessary. The third five-year research programme must be planned with a view to augmenting Community activity and co-ordinating national programmes around it. Meanwhile, it is essential to maintain the level of support fixed when the second Community programme was adopted; in order to do so the Commission is taking steps to have this programme readjusted, a course made necessary by rising prices.

The first essential prerequisite for intensified activity is that a relative levelling out of the contribution of Member States can be foreseen.

(b) *The fixing of industrial objectives*

The second prerequisite for progress is the fixing of medium-term nuclear electricity objectives for the Community. Technological development has now reached the stage at which this task can be tackled.

The joint research programme and the national programmes will be co-ordinated on the basis of these targets.

The Euratom Commission has for six years been engaged in negotiations with the European Parliament, the member governments, organizations and industries of the six countries, as well as the trade unions and industrial bodies. These negotiations must be broadened and deepened in order to establish the objectives.

Every opinion and every interest will have to be considered, conciliated and convinced. Such a task can only be accomplished by defining and highlighting the advantages it has for all concerned. One of the aims of these negotiations will be to bring out the very positive social impact resulting from the setting-up of an industry which will create employment for those with a high average level of qualification.

The starting-point for the discussion could be the estimate already put forward by the Euratom Commission—40,000 MWe installed by 1980.

The objectives and the development they entail must justify the commitments required for carrying out research on a scale sufficient to enable the Community to make up its leeway, give reasonable protection to its internal market, take its place in the world nuclear market and, at a given time, set up joint undertakings to handle supply, fuel manufacture and regeneration, radioactive waste disposal, transport and so on. Economic advantages of a general nature, and in particular the stimuli already referred to, will also have to be taken into account.

40,000 MWe by 1980 offers the Community industry a market of 8 to 10 thousand million EMA u.a., of which a substantial part will go to the activities most closely connected with the most complex aspects of nuclear technology, including the setting-up of reactor projects and calculation codes for them. It is in the light of the foregoing considerations that this target will have to be accepted or modified.

This starting figure includes a very wide safety margin for Community conventional-fuel producers, since it covers only a relatively modest fraction of import requirements. Hence it will be possible to increase it, should this prove necessary, without jeopardizing the interests of such producers.

Moreover, it is no paradox to say the conventional sector will have more time to adapt itself if substantial research programmes are undertaken, geared to industrial targets, and if electricity producers bear a reasonable share of this task. This would not be so if reactor designs were merely imported from abroad.

*Setting up the structures*

Nevertheless it is not simply a question of determining the scale of electricity production objectives; there must also be certainty that the necessary men and structures are available.

Qualitative choices will also be necessary. Effort will have to be concentrated on certain formulae, bearing in mind the work already achieved by all concerned. Some sacrifices will be inevitable. The results to be expected from joint action are well worth it, und every sacrifice will surely bring its reward.

A special, and by no means easy task, will be that of accommodating the two formulae "gas-natural uranium" and "water-enriched uranium" for proven-type reactors. Not only will the respective merits of the two formulae have to be assessed, but each side will have to take into account the necessities laid on the other by investments already made; not to mention the fact that when developing rapidly-evolving techniques, reinsurance is always useful. There will have to be interpenetration of the two markets.

As regards advanced thermal reactors and fast breeder reactors, on the other hand, common action will offer fewer obstacles in that substantial joint programmes are already under way, being carried out either by Euratom or with funds and research workers contributed by Euratom and Member countries.

*Industry and public authorities*

The nature of the European structure is such that the economies are being integrated without their component elements losing their physiognomy and individuality. The joint objectives must be conceived and shaped to allow each country to carry out its share of the task by the methods it finds most suitable.

Each must be able to employ public services or to allow private enterprise to benefit from the favourable conditions resulting from public programmes, just as these programmes may be carried out directly by the States, or by private laboratories or centres on behalf of public bodies. Be it direct action, creating infrastructures or using stimulating media, the important thing is to

achieve well-balanced progress towards the objectives, making sure that the Community utilizes any special source which may be insufficient in the national markets. In this way both wastage and bottlenecks will be avoided.

*Concentration*

As things stand, there is not enough contact between the industries, which often have little chance of producing original results and little prospect of a stable market.

In the United States there are two large industries which have a big home market and are building up positions on the world market, including Europe. The conditions which led up to such a concentration also exist in the Community. They are part and parcel of the task. It is clear that concentration will have to come about in the Community in keeping with the logic of European integration.

*Setting up joint policies*

A joint policy will likewise have to be pursued in the following fields:

— supply: the Supply Agency's work will gradually expand; its structure will have to grow commensurately; the pooling of materials and the safeguards and controls prescribed by the Treaty will make it easier to find a joint solution to supply problems; the Community must formulate a joint supply policy keyed to a fair sharing of collectively assumed burdens and aimed at regulation of the market, which is bound to help the consumers; a common supply policy must be combined with an active external relations policy so as to obviate pointless rivalry between private or government-sponsored projects for supplies from third countries.

— training of specialists.

It is imperative to follow up all supporting and regulatory measures, which have already been launched and to which so much importance attaches, in the fields of:

— health and safety

— dissemination of information

— insurance

— safeguards and controls.

The existing machinery for such action, which in some cases is highly complex, will prove extremely useful.

Another essential is a common energy policy, according due weight to the Community's economic problems and its medium and long-term interests. These are the considerations underlying the Euratom Commission's participation in the work of the three Executives in this field. These efforts must be pursued vigorously.

*Collaboration with the outside world*

On the extent to which the Community's nuclear industry is able to develop on the home market will depend the scope for continuing and intensifying collaboration with the outside world. On it will also depend the Community's ability to follow a commercial policy which, while taking account of the needs of an embryonic industry, is outward-looking. The danger that the various nuclear industries in the Community will fragment under the influence of external forces is only real to the extent that the Community countries' activities fail to be focussed on sufficiently concentrated, substantial and long-term aims.

If the means employed in the pursuit of these objectives, while remaining as varied as the nature of the Community requires, are as a whole in keeping with the concepts of balance, consistency and efficiency, co-operation with the outside world will act as a spur to progress without giving rise to any positions of subservience. The interest of the United Kingdom and other countries in such collaboration would increase. An Atlantic partnership, on a footing of equality, on the use of nuclear techniques would be able to be realised.

## IV. The activity of the institutions

In its six years of existence, Euratom has been able to set up a number of Community-wide facilites, more particularly the Joint Research Centre and the Specialized Departments.

The creation of these facilities is an essential prerequisite for coming to grips with the core of the problem. Another is that reactor designs should be available which will allow nuclear technology to move into the "economic" phase.

*The fusion of the Executives*

On the threshold of this second phase of its activity, designed to pave the way for the implementation of the most vital parts of the Treaty, the Euratom Commission hopes that this process will in the near future be able to be pursued, with increased resources, by the unified Executive.

Through the fusion of the Executives, it should best be possible to arrive at solutions to specific nuclear problems, set against the Community's overall political, economic and industrial background. Certain aspects of the present executive Commission's activity will have to be merged with the corresponding activities of the Common Market Commission and the High Authority.

### *An appropriate structure*

To this operation Euratom contributes an element which is both original and necessary for accomplishing the unification of the economies.

Everywhere the administrations responsible for the leading industrialized economies have had to be adapted to overcome the vast problems of industrial policy inherent in the development and exploitation of new techniques. The increasing pace of technological progress makes this aspect of the functions exercised by the public authorities ever more important.

The leading feature of the structure of the organizations thus created is the integration into a single body of:

— types of work peculiar to the public authorities and administrations whose task it is to contribute to the formulation and implementation of a policy expressed in legislative provisions and regulations;
— the administration of large scientific and technical facilities.

Such is the case with the United States Atomic Energy Commission, the United Kingdom Atomic Energy Authority, the French Atomic Energy Commission (CEA) and the Soviet Union's State Commission for Atomic Energy. The same holds good for Euratom.

Should any of these essential forms of activity be either lacking or uncoordinated in the Community, the latter will be deprived of an industrial "dimension" which is vital to its functioning.

The preparation and administration of the joint research programmes and the management of the Joint Research Centre can alone afford those responsible for these tasks the "inside" view of the problem necessary for singling out and stimulating the needs of an industry today still in its infancy.

If the Community's activity were to consist mainly—as some ill-informed people have been led to believe—in the execution of a research programme, the latter, now become an end in itself, would merely add to the other existing programmes in the Community and would cease to fulfil its proper function, i.e. that of an instrument of integration.

*Scientific and technical facilities*

The scientific and technical facilities set up must therefore maintain their present status, and this applies not only to the Joint Research Centre but also to the departments and services in the fields of dissemination of information, health and safety, investments, supply, and safeguards and controls. The co-ordination of Community programmes, forecasts, requirements and achievements will give full scope to the mechanisms created by the Treaty. Furthermore, they will be maintained in appropriate forms by the terms of the proposed single Treaty. In order to facilitate investment planning, it will be necessary to draw up studies and forecasts. This means that the co-operation of the national bodies concerned will have to be built up around a Community nucleus of considerable efficiency. The harmonization of laws in the forms and conditions laid down by the Treaty also needs to be effected by means of legal bodies possessing a thorough technical experience.

*Contribution to improved living standards*

The foregoing reflections represent the fruit of the experience acquired by the Commission and of the contemplations of its Members on the methods of attaining in the years ahead the aim which, in the words of the Treaty, is to "contribute to the raising of the standard of living in the Member States and to the development of interchange with other countries by creating the conditions necessary for the speedy establishment and growth of nuclear industries".

# CHAPTER I NUCLEAR POWER AND ENERGY, ECONOMICS AND SOCIAL AFFAIRS

*1.* From its hesitant beginnings only yesterday, atomic energy is now gathering momentum as an economic and social force in Europe. The first large-scale nuclear generating plants have been commissioned and the number of projects involving substantial recourse to nuclear power is growing.

There are three main reasons for this:

— One—alongside traditional sources such as coal, oil, gas or lignite, the atom will constitute a valuable supplement for meeting the constantly expanding energy demand.

— Two—recourse to nuclear power, the cost of which will be progressively reduced to a reasonable level as a result largely of scientific and technological research, will stem the upward trend in the energy market that could follow the relative exhaustion of fossil fuel reserves and of the hydro-electric potential. In other words, the atom should act as a brake on prices.

— Three—the use of nuclear power draws on a very wide range of industries which, to comply with nuclear technical requirements, need to improve the quality of their output and engage in research for that purpose. The atom is unquestionably an element in that technical progress which is the mainspring of economic prosperity.

These three arguments in favour of nuclear power are based on concepts of such importance that they need looking at in close detail if their force is to be properly appreciated.

## I. The growth in energy demand and how to meet it

*2.* The overall pattern of energy consumption shows a steady rise—5% per year or double every fourteen years. Expressed in terms of coal, world consumption of commercial power can be said to have been 700 million tons at the start of the century, 2,700 million tons in 1950 and 4,500 million tons in 1960. A rise such as this gives food for thought regarding the extent

of fossil fuel reserves; and since this trend is bound to become more pronounced in the coming decades while reserves remain constant, demand can be met in future centuries only by large-scale use of a new source of energy. This is a matter of peculiar concern for heavily industrialized regions which will require ever greater amounts of power to maintain their rate of expansion as time goes on.

Europe does of course possess coal deposits representing approximately 8% of world reserves, and natural gas is still being discovered in large quantities. However, while Europe's known reserves of fossil fuel amount to 5 to 6% of world reserves, this compares with an energy consumption of some 10% of the world total. Moreover, these reserves consist mainly of solid fuels, and hardly correspond to the way consumption is at present spread over the various sources of primary power in industrial countries with a high standard of living. Lastly, Europe's energy sources are relatively costly.

*3.* Thus the Community must inevitably draw increasingly on imports to satisfy its expanding consumption. Net imports, which before the second world war accounted for about 5% of its supplies, had risen to 27% in 1960 and will probably be more than 47% in 1970 and over 52% in 1975. This last figure, be it noted, already allows for a nuclear energy contribution, regarded as an internal source, of 3 to 5% of the total. Without this help from atomic power the Community would depend on imports for at least 55% of its consumption in 1975 and this proportion would go on increasing thereafter. Dependence on imports for the supply of certain raw materials is not necessarily a major obstacle to industrial development. Power supplies, however, are today of more vital importance to the economy than most raw materials. Hence any diminution of these imports, any reduction of the risk of economic paralysis which would ensue if external supplies of power were cut off, represents a positive gain.

*4.* More than any other new source of energy—solar, wind, geothermic or tidal power, the exploitation of which is seriously restricted by considerations of a physical nature—the atom affords a solution to the problem of long-term power supplies. The most important use of atomic power is for generating electricity; and electricity is one of the forms of power for which the demand is rising most steeply. Electricity consumption is increasing at a considerably faster exponential rate than power consumption generally. Since 1950 it has risen at an annual rate averaging around 9% for the world as a whole

and 8% in the Community, against 5 and 4% respectively for overall energy consumption. This disparity in the rate of increase has been apparent in varying degrees for some time, and the consequence in the Community is that energy consumed in the form of electricity today accounts for nearly 25% of the total figure. The steady growth of electricity demand is chiefly the result of the ever wider use of this form of power and also of increases in population and in economic activity. There is at present nothing to suggest that these factors will play a lesser part in future. Indeed, forecasts of electricity demand point to a sustained rise at the same pace as hitherto, more or less throughout the world.

*5.* The survey of the Community's long-term energy prospects published in December 1962 by the Executives of the three European Communities, gives the following figures:

*Electricity consumption*

| | 1950 | 1955 | 1960 | 1965 | 1970 | 1975 |
|---|---|---|---|---|---|---|
| — Thousand million kWh gross | 124 | 194 | 285 | 409 | 574 | 789 |
| — Annual rate of increase on preceding 5-year period (%) | — | 9.4 | 9.4 | 7.5 | 7.0 | 6.5 |

According to these estimates, from 1975 onwards electricity will represent at least a third of all energy consumed in the Community. By helping to cover such a large slice of electricity demand, the atom will play a significant part in meeting energy requirements as a whole and assist, if not in reducing the Community's dependence on external sources of power, at least in setting limits to that dependence which otherwise would be very considerable.

Although uranium reserves discovered in the Community are not in themselves enough to supply a large number of power plants, and some of the fuel needed will thus have to be imported, nuclear energy will serve to enhance the reliability of power supplies. The actual quantity of fuel in reactors or at reactor sites is at all times sufficient to meet temporary supply crises. At the same time, nuclear fuel can be imported from countries other than those which furnish the principal imported fuel, namely, petroleum, and countries where the reliability of supplies is guaranteed. Moreover, uranium

is easy and cheap to transport and to store. Above all, having regard to its higher energy content, the volume and value of imports needed to generate a given quantity of electric current will be substantially less in the case of uranium than for fossil fuels. In the present state of reactor technology this is already proving to be so, in respect of value, roughly in the proportion of 1 to 4. But with the expected improvement in operating conditions, and especially the transition to converter reactors and still more when it comes to breeder reactors, even bigger ratios in favour of nuclear energy can be expected.

## II. The price of nuclear energy

6. Calculation of the cost of production per kWh in nuclear power plants is now moving from the stage of theory and supposition to that of plain arithmetic. This is a significant change.

The growing numbers of projects for construction of industrial-scale power plants and the commissioning of the first of these, in the Community as in the United States or Great-Britain, are gradually providing a reliable basis for calculation. With this in mind, the Commission decided to holf a symposium in Venice in October 1963, under the auspices of the Consultative Committee for Nuclear Research, at which it was possible to take stock of the present situation and of the immediate outlook as to the cost of nuclear energy. The following are the main conclusions reached:

The cost per kWh of electricity generated in large nuclear power plants now operating is about 50% above the figure obtainable in conventional power plants of similar dimensions constructed at the same time and on similar terms as to finance. Thus for instance the cost of production at the SIMEA plant (200 MWe) is approximately 12 mills ([1]) and at the SENN plant (150 MWe) approximately 11.5 mills for an annual utilization time of 7,000 h. This handicap in comparison with traditional fuels will be reduced as time goes on and as reactor capacity increases. In fact the nuclear power plants to be commissioned in 1966, like the Franco-Belgian SENA unit (266 MWe) and the German KRB unit (237 MWe), will start showing a first reduction; the cost of production will be down to 9.5 mills approximately, although still 25 to 30% higher than the figure for similar conventional generating stations, calculated on the same basis and for the same annual utilization times

([1]) 1 mill = one-thousandth of a unit of account or US dollar.

*Chinon (France) — View of Reactors EDF 1, 2 and 3.*

(7,000 h). For the power plant EDF 3, the cost per kWh similarly calculated would be about the same as the above-quoted amounts. But because of the relatively more favourable economic and tax position of this plant compared with those located in other Community countries it will be able to generate electricity of nuclear origin at a cost of approximately 6 mills/kWh.

As to power plants on which construction might be started today for commissioning between 1968 and 1970, it seems that their costs could be brought down, by means of a further increase in size stepping up the capacity to around 500 MWe, to 5 to 7 mills depending on the terms of financing and annual utilization times.

*7.* Such costs compare with those for a reference conventional plant as nearly similar as possible, commissioned at the same period and enjoying the benefit of all the technical advances foreseeable in the meantime. However, as it is difficult to predict what the delivered price of fossil fuels will be at the end of the present decade, it was thought preferable to work out the delivered price level which would enable a coal-fired power plant to generate electricity at the same cost as the nuclear power plants referred to above. This price level varies, according to terms of financing and annual utilization, between 10 and 12 EMA units of account per ton of coal af 7,000 kcal/kg. Now it is most unlikely that at the end of the present decade fossil fuels will cost less than 12 u.a./t.c.e. Large-scale nuclear power plants will thus be economically justified in the Community as from 1968 or 1970, for utilization times of 6,000 h/yr or more. Beyond this very near future there is no doubt but that the downward trend in costs will persist. While it is not yet possible to say how far the cost per kWh of nuclear power will fall, the likelihood is that it will come down to an extremely low level, in view of the excellent prospects for progress open to a new industrial technique barely emerging from the experimental stage.

The consequences of this trend are highly important.

*8.* The increasingly profitable nature of nuclear energy means that it will be used in ever greater proportions for generating electricity. It is to be anticipated that from the beginning of the next decade it will pay better to equip new power plants with nuclear reactors than with fuel oil or good quality coal-fired boilers. On the other hand, nuclear plants will still at that time be less profitable than installations using so-called "privileged" sources such as hydraulic or geothermic power, lignite, blastfurnace gas or,

to some extent, natural gas. But broadly speaking these sources of energy are expanding less quickly than electricity demand. A steeply rising proportion of electricity output will thus have to be covered from sources not confined within quantitative limits, among which, by reason of the law of competition, nuclear energy will be the best placed. Moreover, the decline in cost will have the effect of gradually removing the limitation now imposed on nuclear power plants by the necessity for long annual utilization times. Soon they will be competitive for utilization times of 6,000 h/yr and will become so for utilization times of 5,000 h/yr or even less, which will correspondingly extend their field of application.

*9.* Another important consequence resides in the fact that the introduction of a new source with a diminishing cost factor will have a good effect on the average cost of electricity. At this time when the possibilities of reducing costs in the traditional thermal sector are beginning to shrink very seriously, nuclear power comes to take over and thus enable the historic relative downward curve of price per kWh to continue. That trend is undoubtedly a basic factor in the swift growth of electricity consumption. The favourable economic and social consequences entailed by increasing recourse to this noble form of energy thus depend to some extent on a price trend which only the advent of nuclear power can ensure. In more general terms, nuclear power will act as a regulator in the energy market as a whole.

*10.* Energy prices also affect the geographical distribution of economic activity and particularly of industry. For a long time coalfields, and more recently port areas, have attracted industry, partly at least because of the cheap power to hand. Since the cost of nuclear power is virtually independent of geographical location this new source affords a chance of equal access to cheap power for all regions and is bound to have a beneficial effect on the development of Community territory and make for economic balance between its various regions.

## III. Nuclear power and industrial development

*11.* It is not only through the provision of cheap power without regional discrimination that the atom will contribute towards economic expansion.

The construction and operation of large numbers of big nuclear power plants presupposes a great, complex industry which to a large extent has still to be created.

To give an idea of the magnitude involved, suffice it to say that the commissioning of 40,000 MWe between now and 1980 represents an investment of some 10,000 million EMA units of account.

It is not contemplated that the Community should be self-sufficient and refrain from mutually profitable international trade, but it must aim at acquiring the technical skill and industrial capacity needed to be master of its own nuclear development. To confine itself to importing what others have invented, to applying discoveries in which it has had no part, would indeed be hazardous. The danger for Europe would be that before long it would have nothing but second-class industries, techniques and manpower. The development of nuclear power involves the creation of new techniques and industries, for which a great future is in store and which, even apart from the energy aspect, will greatly influence the future pattern and prosperity of industrial activity. Likewise it brings with it many opportunities for business and progress. Thus for the Community not to proceed with the conversion of European industries to nuclear techniques would be tantamount to accepting a lowering of its industrial status, with all the economic and social consequences which that would entail.

*12.* As regards both the construction and the operation of nuclear power plants, the upswing in industry connected with the advent of nuclear power also means the creation of large numbers of highly qualified jobs and thus a considerable upgrading of skilled labour. The staff breakdown in nuclear industries itself differs greatly from that in traditional industries; the problem of quality is more pressing than elsewhere. Nuclear activities call not only for scientists, engineers, technicians and skilled workers in the nuclear field but also for highly qualified experts in practically all traditional branches. Even minor posts employing maintenance and safety personnel demand a strong sense of responsibility and at the least an elementary training in nuclear science. At the other end of the scale the nuclear research centres which are the foundation for the industry's future development require numbers of scientists, engineers and technicians able to cope with new problems.

Hence the need for vigorous development of nuclear power finds justification at one and the same time from the long-range energy policy angle and from that of more general economic and social policy. It stems from the determination not to accept a diminution of the intellectual, scientific and technological level of our countries and our peoples.

*13.* This argument for the efforts exerted, notably in the Community, to speed the peaceful use of nuclear power would be incomplete if only the need and the favourable consequences were stressed. There are also two misunderstandings which must be dispelled.

In the first place it must be repeated that given the exceptional safety measures with which it is encompassed, the use of nuclear energy involves no hazard to the general public nor to staff directly employed at power plants or other installations. With the great precautions taken it can be claimed, in the light of initial industrial experience, that nuclear industries are probably the least dangerous of all. No industry has ever been established it is true, under such close health and safety control as that which exists in the nuclear sector. This is due more particularly to the fact that at the outset nuclear energy was almost exclusively in the hands of public authorities who were able to set up a very strict safety system at laboratories and research centres, with less attention to considerations of cost. But nuclear activities are gradually extending to the private sector, to large-scale atomic industry as to small users of radioisotopes. Private industry being subject to market competition, expenditure relating to the existence of a safety system enters into the prime cost and thereby directly affects the competitiveness of the firm concerned. Hence it is necessary to insist that the safety level so far achieved in the nuclear sector be maintained in future in order effectively to safeguard the health of the growing number of persons working in the nuclear sector and of the general public.

In the second place, it must be emphasized that nuclear power will provide an indispensable addition to the traditional sources of energy. For a long time yet it will be restricted to a fraction of new electricity installations and so it does not constitute a threat either to the Community's production or to its imports of various fuels. On the contrary, these imports are still going to rise very substantially in the coming decades.

*14.* This development of nuclear energy, the need for which has been demonstrated in the foregoing paragraphs, is now in progress. The first industrial-scale nuclear power plants have been in operation in the Community since 1963. There will be others, more and more of them in the years to come; and when account is taken of improvements that may be made to the so-called proven-type reactors with which they are equipped, these power plants will soon be an economic proposition. However, other types of reactor are appearing on the horizon, advanced types which, like the heavy water reactors, promise a much lower uranium consumption and still cheaper electricity. Further ahead, breeder reactors will carry nuclear fission to maturity. It will be these which, through optimum utilization of the energy

contained in natural fissile and fertile materials, will make possible the fulfilment of the promise held out to humanity, of an inexhaustible source of energy for many centuries. Leaving aside all question of the outlook for fusion, this development presupposes unceasing progress for many years yet towards more highly advanced techniques.

CHAPTER II

# THE DEVELOPMENT OF NUCLEAR TECHNIQUES AND THE JOINT RESEARCH PROGRAMME

*15.* The development of nuclear techniques can be broadly divided at the present time into four phases.

First there are the water and gas reactors which have already been the subject of thorough-going experiment, some in the United States (boiling-water and pressurized-water types), others in France and Great Britain (EDF gas-graphite type and Calder Hall). Although these reactors have attained a high experimental level and have already undergone searching trials (hence the description "proventype" reactors) they still only represent the first stage in a development which over the years will be especially directed towards obtaining a higher uranium conversion ratio ([1]), greater specific power and more compact plants, so that the smaller sizes involved will make it possible to cut down on capital investment.

Besides the work devoted to existing reactor designs, it appeared at the same time desirable to pursue the development of new strings which, by reason of the advanced techniques employed would be able to supply electric power in the medium term at advantageous prices. As in the case of proven-type reactors, the main effort is concentrated on improving the conversion ratio and obtaining high capacities with more compact constructions. In addition, however, certain new reactors will be specially designed with a view to obtaining optimum power output from natural uranium, deposits of which are found in Europe and which will enable the complex and costly processes of enrichment by isotope separation and even fuel reprocessing after extraction from the pile, to be dispensed with.

Reactors such as these are called "intermediate-type" since in the normal course they will be followed up by a third phase, that of breeder reactors, which are expected to make a major contribution to solving the problems relating to profitability and supply. The word breeder, indeed, implies that such installations will produce more fissile material then they consume. The proportion of the uranium's fission energy which is used will in theory rise from 0.5-1% to 100% while it will also be possible to attain the same utilization rate with thorium.

([1]) The ratio between the number of Pu 239 nuclei formed and the number of U 238 nuclei which have captured a neutron.

After the proven-type reactors now being operated, these different reactors represent the short and middle-term phase respectively. A fourth and more remote phase can be discerned, i.e. controlled thermonuclear reactions, in which energy will be generated not by the fission of heavy elements such as uranium, but by the fusion of hydrogen isotopes, in other words water, so that energy output would be practically independent of problems of raw material supplies or waste processing.

The salient features of the Euratom programme as set out below are based on these four main phases.

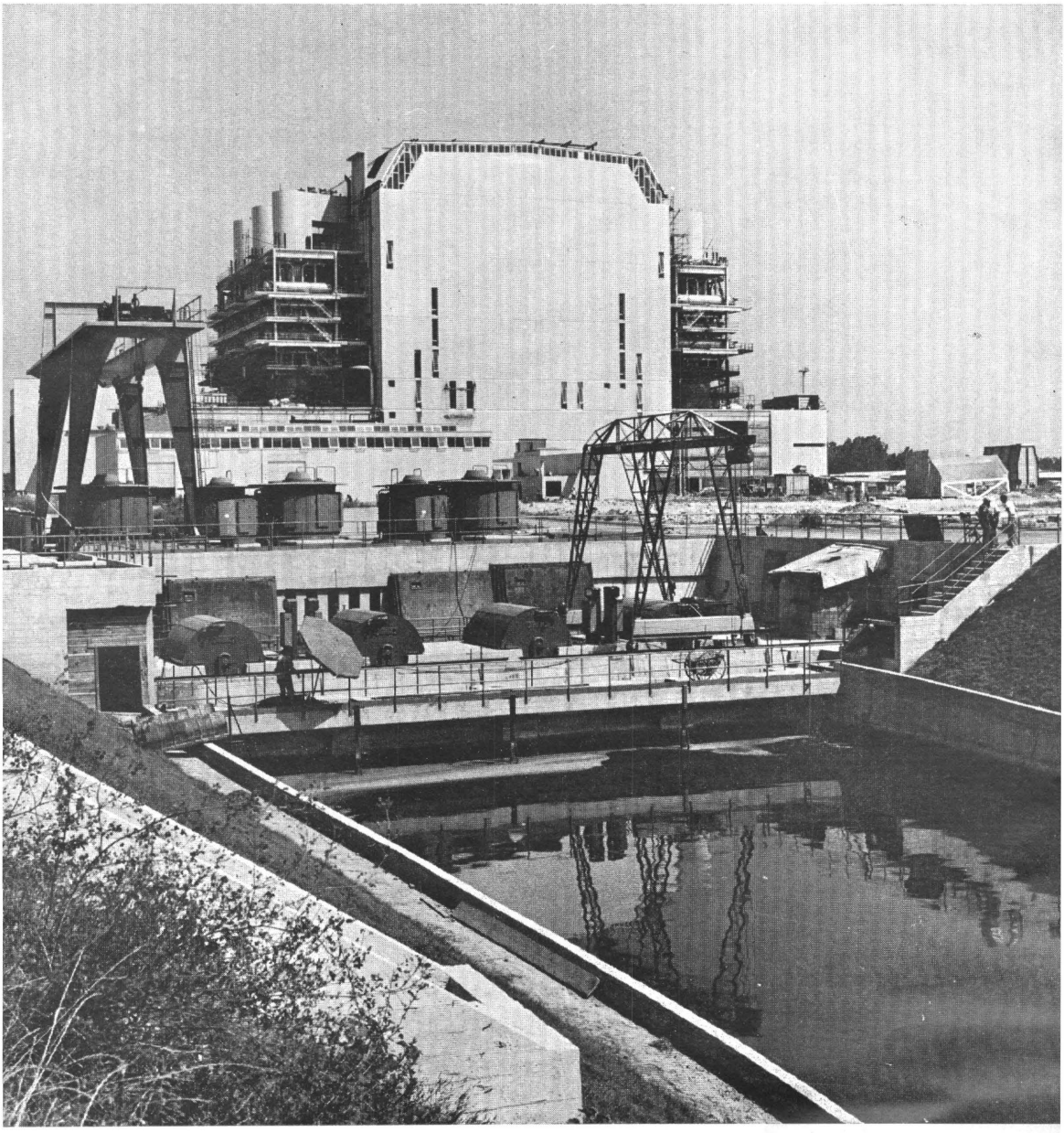
This chapter also contains a fifth section on the Commission's responsibility, alongside its chief task of reactor development, for the execution of a series of allied research projects which are an indispensable complement to the main programme or designed to explore the possibilities for future development. Included under this heading are, *inter alia,* the various operations connected with the reactor-irradiated fuel and with radioactive wastes and radioisotopes, marine propulsion, automatic documentation and scientific data processing.

## I. Proven-type reactors

*16.* The target in this field is the construction of a number of large nuclear power stations to operate as soon as possible on satisfactory economic terms, to permit the rapid development of the Community's nuclear industry.

When design studies relating to various reactor types were first initiated many years ago, the development of all the techniques involved was clouded with uncertainty and each of the various reactor strings envisaged appeared to have a more or less equal chance of success. Today, two strings have been brought to the industrial stage—the light water reactors and the gas reactors, which we call proven-type reactors.

Light water reactors were developed in the United States. The fuel used is enriched uranium, which only the United States fabricates in very large quantities and at relatively low prices. Light water serves both to slow down or moderate the neutrons and to extract the heat released by fission. The coolant is either boiling (boiling water reactors) or pressurized (pressurized water reactors). From the economic angle, this string seems in 1964 to be competitive with conventional power plants in those parts of the United States where the cost per kWh is highest. The Euratom/United States Agreement concluded in 1959 has assisted the construction and finalization of this type of power plant in Europe, the first of which—the SENN (Società Elettronucleare Nazionale) power plant at Garigliano—started up recently.



*Latina (Italy) — End view of sea-water intake channel at pump house.*

The reason why the gas-graphite reactor string was developed in England and France is that these reactors do not burn the enriched uranium which is produced in colossal isotope separation plants but natural uranium, which does not present the same processing and fabricating difficulties. The coolant is pressurized carbon dioxide and the moderator graphite. These reactors too seem ready to produce electricity at a price comparable with that obtaining for conventional power plants.

The EDF 4 plant (France, natural uranium/gas-graphite string) and the KRB plant (Germany, enriched uranium/light water string) are the biggest units on which construction started in 1963, but there are other nuclear power plant projects, namely: the SEP (Samenwerkende Electriciteits Productiebedrijven) at Doodewaard (boiling water, 50 MWe); VEW (Vereinigte Elektrizitäts Werke Westfalen AG) at Lingen (boiling water, 250 MWe of which 160 MWe nuclear and 90 MWe with conventional superheating); KBWP (Kernkraftwerk Baden-Württemberg Planungsgesellschaft mbH) at Stuttgart (light water, 240 MWe); and EDF 5 (gas-graphite, 500 MWe). Decisions on further construction may well be taken during 1964. Furthermore, several power plants went critical in 1963: Latina (gas-graphite, 200 MWe, belonging to SIMEA (Società Italiana Meridionale Energia Atomica); Chinon (EDF 1, gas-graphite, 80 MWe); and Garigliano (boiling water, 150 MWe), belonging to SENN (Società Elettronucleare Nazionale). Also, during 1963 the Latina plant reached its full capacity of 200 MWe and produced approximately 300 million kWh.

*17.* These two strings, however, are still far from their peak potential, and reductions in the cost of electricity generated should still be brought about, mainly in two ways:

— One is the construction of bigger power plants in which higher capacity per unit enables investment per installed kW to be reduced. This trend is borne out by design studies in progress. Thus EDF 4 and EDF 5 will develop a capacity of 500 MWe whereas the capacity of European power plants now operating is of the order of 200 MWe. It is a trend which raises problems for some electricity grids of limited size—problems whose solution will at least require still greater cooperation in regard to link-ups and exchange of current.

— The second way is through improved reactor performance resulting from technological and scientific advances. Much remains to be done in this field, but the prospects opened up provide ample indication of the research programme which the Commission pursued in 1963 and even amplified by including in its programme on the improvement of proven-type reactors research into gas-graphite reactors as well as organic-moderated reactors.

Thus Community industry was given the opportunity to carry out, under contract, work of a nature such as to consolidate its understanding, know-how and potential capability in the nuclear sphere. This work should enable it, among other things, to gain the experience necessary to design and fabricate fuel elements for water reactors. Subjects in respect of which research is in progress or about to be undertaken cover a wide range, from improvement of the properties of fuel materials (uranium oxide with possible recycling of plutonium oxide for water reactors, metallic fuels for gas reactors) to the preparation of fuel elements and the perfecting of structural materials (irradiation behaviour of concrete or graphite for gas reactors, cladding corrosion or steel embrittlement for water reactor vessels). In addition, the construction of integral-design cooling and loading-unloading systems in prestressed concrete vessels should lead to more compact assemblies and greater safety for gas-graphite power plants.

Here are a few figures to illustrate what was done in 1963 in the way of research. The Commission received from Community institutions and industries 104 research proposals relating to light water reactors and 61 relating to gas-graphite reactors, and authorized the signing of 39 research contracts for the reactor field as a whole.

## II. Intermediate type reactors

*18.* As stated above, large nuclear power plants in the Community will, by about 1968-70, be producing electricity at a price around that of current generated in fossil fuel plants. At that point therefore, it will be economically worth while to use electric power of nuclear origin. Moreover, it will be a necessity for a group of countries desirous of preserving their autonomy, not wanting to be too dependent on fossil fuel producer countries and experiencing a big expansion in electricity demand.

Fast neutron reactors will come to industrial maturity and start making their impact on the energy balance in the ten years 1980 to 1990. Meanwhile, therefore, it is still necessary for at least twenty years to resort to nuclear plants in which the fission reaction is sustained by moderated neutrons. In order not to jeopardize long-term supplies of nuclear raw materials, it is important that the specific consumption of fissionable material in reactors commissioned during that period should be low and that they should enable large amounts of plutonium to be obtained by conversion of the fertile starting material. In this connection it must be emphasized that the outlook for fast reactors is contingent on the production of a big initial stock of plutonium, which can only be provided in Europe through the prolonged operation of thermal reactors with high conversion ratios, such as heavy

water reactors. Thus even after fast reactors appear on the industrial scene, the most advanced types of thermal reactor seem certain to continue in operation alongside the new types for some years.

Power plants installed in a few years' time pending development of fast neutron reactors will of course benefit very greatly from experience gained in developing proven-type reactors and operating the first of them. Some strings—advanced gas reactors for instance—may draw largely on the results obtained from the development of proven-type reactors. Generally speaking, the stepped-up unit capacity and power density will give reactors constructed during this phase a big advantage over existing proven-type reactors.

Let us now review in turn the heavy water reactors, with the ORGEL string in the forefront for Euratom, the advanced gas reactors and lastly the aqueous suspension reactor project.

### 1. *Heavy-water-moderated reactors*

*19.* Quite apart from the fact that they are fuelled by natural uranium like the gas-graphite reactors, which permits of easy and diversified supplies, reactors employing heavy water as moderator offer three advantages for a long-range nuclear programme.

Firstly, their better neutron economy. This enables high burn-ups to be attained, which means low specific consumption of natural uranium. (Uranium consumption is in fact less than half that in proven-type reactors).

Second, their good conversion ratio. This makes it possible to obtain, from natural uranium, plutonium which can be used either as fuel in breeder reactors or to generate extra energy by partial combustion in the reactor itself.

Thirdly, because heavy water reactors can use high specific power ceramic fuels, compact high-capacity units can be envisaged, which will mean substantial savings in capital investment.

The various coolants so far considered for this type of reactor are: pressurized heavy water, light water (either boiling or in the form of fog), carbon dioxide and organic liquids. Not all have received the same concentrated study. Pressurized heavy water as coolant is the first solution envisaged, and the Canadians have investigated this thoroughly with the operation of the NPD 2 (Nuclear Power Development) reactor and the CANDU (Canadian Deuterium Uranium) reactor soon scheduled for start-up. Cooling by carbon dioxide is a European speciality, in view of the EL 4 prototype power plant now building in Finistère (France). Research on light boiling water or fog as coolant is far

less advanced. However, work has already been done in this direction by the CISE (Centro Informazioni Studi ed Esperienze), and will continue, under a contract with Euratom.

### *The ORGEL Project*

*20.* As regards organic liquid coolants, the Commission, as early as 1959, set about the thorough exploration of this solution and decided, with the development of the ORGEL project, to make it the focal point of the activities of the Joint Research Centre's establishment at Ispra. These researches, begun in 1960, at present occupy more than 60% of the establishment's scientific staff, while the majority of the other departments are likewise involved in general supporting activities. In addition, numbers of undertakings or research centres in the Community are sharing in the work, some by way of research or study contracts, others by the design and construction of large-scale complexes such as ECO (*E*xpérience *C*ritique *OR*gel—ORGEL critical experiment) or ESSOR (réacteur d'*ESS*ai *OR*gel-ORGEL test reactor).

The distinguishing features of an ORGEL type reactor are as follows:

— the coolant is a terphenyl mixture which enables fairly high outlet temperatures to be obtained (400° C or more) in low-pressure circuits and only needs comparatively low-cost conventional materials. The organic coolant has been chosen from among the chemical substances offering the most favourable high-temperature and irradiation behaviour. Nevertheless this substance deteriorates with use as a result of pyrolysis and radiolysis, which can thus give rise to fouling and gradual impairment of heat transfer. Current work at Ispra and in national research centres affords grounds for believing that these difficulties will be surmounted very shortly. In particular research into fouling is now so well advanced that this can no longer be regarded as seriously endangering the future of the project.

— The fuel adopted is natural uranium carbide. This was selected in preference to the oxide because of its greater fissile atom density and higher thermal conductivity. Study of heavy water/uranium carbide lattices, including research into the effects of the presence of plutonium, constitutes the priority programme for ECO.

— The cladding and structural material is SAP (sintered aluminium powder); various fabrication processes are being tried in an attempt to improve its ductility. Parallel studies are in hand on zirconium alloys which might supplant SAP as cladding material.

The studies carried out in 1963 have made it possible to gain a clearer idea of the basic advantages of the ORGEL string over reactors now at the industrial operation stage. This type of reactor will, in fact, yield a considerable saving in fissile and fertile materials, since its natural uranium consumption will be only 0.15 t. per MWe/yr against 0.18 to 0.23 for existing reactors. Furthermore, plutonium output—3.4 kg and upwards per ton of uranium—is appreciably greater than that obtained in gas-graphite reactors and *a fortiori* in the water reactors developed in the United States. These advantages, combined with a very cheap fuel cycle, in principle allow fuel reprocessing after extraction from the pile to be dispensed with or only envisaged if economic conditions—and specifically the value of the plutonium content—justify the cost.

For the moment calculations made by European, Canadian and American research workers appear to corroborate the value of the ORGEL concept. The physics studies in ECO from 1964 onwards and fuel element testing in ESSOR (1966-7) will, by 1967, provide Euratom with sufficient knowledge of this important reactor family to judge how much ground has still to be covered before constructors in the Community can be offered a very low fuel cost ORGEL-type European string. Moreover, the Commission sees this as an important stage on the road from the proven-type reactor string to the breeder string.

### 2. *Advanced gas-cooled reactors*

*21.* Proven-type gas-graphite reactors in both France and Britain have, as noted above, reached a high degree of industrial development. Their lower power density, involving large plants and big investments, is a major drawback and considerable efforts are being directed in various parts of the world at improving their performance. One obvious solution would be to confine research to the perfecting of the components of these reactors while keeping to the existing formula, and the Commission's activity in this connection has already been mentioned. Another, more ambitious, but perhaps more promising solution which suggested itself, was to study advanced variants differing from conventional types as regards their principal components and in their concept.

This led the Commission to interest itself in high-temperature gas reactors. These, while involving technological niceties beyond anything needed for the construction here and now of industrial-scale plant, do permit of very high power densities and a very good neutron economy. Moreover, it should be possible with these reactors to make better use of fuel resources by employing fertile material which is relatively plentiful in the world market

and readily available to the Community. The fuel in question is thorium. When thorium is mixed with or encloses uranium with 90 % U 235 enrichment, a fissile material U 233 is formed by neutron capture. Reactors of this type can themselves produce special fissile materials.

In addition, the high operating temperatures characteristic of these reactors (of the order of 700 tot 800° C as against 300 to 400° C for proven-type reactors) permit a very high degree of efficiency and justify the use of the most up-to-date conventional plant. Clearly, such high temperatures are not going to be obtained without presenting some extremely intricate and difficult problems. Thus for the time being no cladding material exists which can withstand $CO_2$ at these temperatures. There is no alternative therefore to using materials which can not only withstand the high temperatures planned but are also compatible with each other. This last consideration led to the choice of helium, the one gas which does not react with graphite at the temperature levels attained in the reactor core.

Another problem concerns elimination of the radioactive fission products, a certain amount of which escape into and contaminate the primary cooling system. Various methods have been tried and the one now adopted consists in an agglomeration of graphite-clad uranium and thorium carbide particles. Fabrication of this type of fuel element began in September 1963. Should it prove possible to construct a leaktight primary system at a cost not noticeably greater than estimated, a nuclear power plant based on this principle should prove an interesting proposition from the capital cost angle.

*22.* These various processes are under study at the OECD's DRAGON project in which Euratom has from the outset been a participant in its own right and on behalf of the Member States. The Community's financial contribution does not exceed 40 % of the overall budget and entitles it not only to the information obtained but also to assign a sizeable contingent of continental technicians to Winfrith Heath (Great Britain), where construction of a reactor experiment is nearing completion. A large proportion of the funds administered by the project is allocated to this graphite-moderated helium-cooled reactor experiment, which will serve to check the initial assumptions and test fuel elements developed under the parallel research programme.

*23.* While the Commission's action has hitherto been centred mainly on the DRAGON project, it is also interested in the development of a reactor using ceramic pebble-type fuel (AVR) designed in Germany, at the Jülich Research Centre, by the firms of Brown Boveri/Krupp and AVR (Arbeitsgemeinschaft Versuchsreaktor). The characteristic fuel element geometry

should in principle lead to a high degree of operational flexibility as well as an excellent neutron economy, owing to the possibility which it affords of preventing the considerable initial reactivity surges obtained with standard-type elements. Also on the credit side are the simplicity of the core assembly and of the loading-unloading mechanism, but problems of control and heat transfer still remain to be solved.

Finally the Commission contemplates participating, under the same programme, in the THTR (thorium high temperature reactor) project, which will be developed with the benefit of experience gained at the DRAGON, AVR and PEACH BOTTOM (United States) reactors due to start operating within the next two years.

It therefore seems reasonable to suppose that, around 1967-8, the uncertainties still connected with this original design will be so far dispelled that a decision to construct one or more full-scale prototypes can be seriously contemplated.

### 3. *Aqueous suspension reactor project, Euratom/KEMA association*

*24.* The characteristic feature of homogeneous reactors is the fine mixture of fuel and moderator or the solution of the former in the latter. The Commission's activity in this field is concentrated for the time being under the association with KEMA (N.V. tot Keuring van Electrotechnische Materialen, Arnhem), on a heavy-water suspension design study. This design should in theory serve to eliminate difficulties connected with the fabrication and use of fuel elements as well as making for simpler heat exchange circuits. However, there are problems to surmount regarding methods of fabricating colloidal suspensions, their irradiation behaviour and the hydraulics and erosion aspects. Despite the progress achieved in these sectors, it is not yet possible to assess the technical viability and economic value of this type of reactor. Nevertheless, laboratory research and design studies for a test reactor (KSTR) proceeded in 1963.

## III. Fast breeder reactors

*25.* Fast breeder reactors differ from the others mentioned in that they contain no moderator. The neutrons maintaining fuel fission are not slowed down and possess high energy; they are fast neutrons. These reactors have two original features:

— Very high specific power levels—a fast neutron reactor with only 1 $m^3$ core could produce 500 to 800 MWth or 200 to 320 MWe;

— The capacity to form, out of fertile material like U 238 (a component of natural uranium), more fissile material (plutonium) than they consume in operation.

This is the breeder process as opposed to conversion where, in slow neutron reactors, only 50 to 90 % of the fissile material consumed can be recovered. In short, it permits the burn-up of virtually the whole of the uranium placed in the pile.

It is these reactors with such remarkable performances, however, whose elaboration and industrial development is hedged with the greatest number of difficulties. Chief among the problems for which solutions had to be sought were those relating to:

— The study of the physics of fast neutron systems;

— Necessity for very compact, highly enriched cores to minimize the risk of neutron leakage and maintain a fairly low fissile material investment per unit of power, which means designing a very split-up and thus costly core structure to permit of heat extraction;

— Use of a non-moderator coolant to allow of heat extraction from a very compact core. After the various possible solutions had been canvassed, the choice fell on liquid sodium, the technology of which, however, was not yet understood. The possible use of high-pressure gas or else of dry steam is also being considered;

— Safety problems connected with this type of reactor and in particular those of control kinetics.

Again, if full advantage is to be taken of the breeder process, the plutonium must finally be utilized as fissile material. Thus a complete fuel technology has to be evolved by which high burn-ups can be obtained. The metallic fuels first studied do not seem capable of displaying adequate irradiation behaviour, and attention is now being directed to ceramic fuels (oxides and carbides). The first results obtained are encouraging, but the use of these ceramic fuels entails a downward shift of the neutron energy distribution to values at which the physical properties of atomic nuclei are as yet little known (resonance region).

*26.* In view of the economic benefits expected from fast-neutron reactors, these very soon aroused a lively interest everywhere. The United States having taken them up a long time ago, has so far devoted considerable efforts to this string, which ranks high in long-range nuclear energy development. Through its association with the German nuclear centre at Karlsruhe, Euratom too has been concerned in the development of an American experimental reactor,

SEFOR (South-West Experimental Fast Oxide Reactor). Mention should also be made of the important programme in this field launched by Great Britain in 1959 and of the work done in the USSR.

France was the first Community country to enter this promising field. At present, all research undertaken on this question within the Six countries is conducted in association with Euratom, namely through the Euratom/CEA and the Euratom/German centre (Karlsruhe) contracts of association. A third contract of association has been concluded with the Italian Atomic Energy Commission (CNEN).

This Community programme, which provides for the construction and operation of a number of research installations for the RAPSODIE reactor experiment and the SNEAK and MASURCA critical assemblies, is aimed at developing industrial-scale prototypes for start-up around 1972, thus preparing the way for large industrial power plants around 1980.

## IV. Controlled thermonuclear reactions

27. The fission of heavy elements exploited in reactors is not the only way of releasing the energy contained in atomic nuclei of atoms. Another method is to employ the fusion of light atoms. This type of nuclear reaction, which is the source of stellar energy, has hitherto only been used for military purposes (H-bomb). Nevertheless, methods of harnessing it are being studied in numerous laboratories throughout the world in view of the fascinating prospects it opens up. In the first place, like fission, it generates energy in vast quantities: the fusion of 10 grammes of deuterium releases as much energy as 28 tons of coal. Then again, thermonuclear fuels are plentiful and relatively easy to obtain. This applies especially to deuterium which is a constituent of water (1 molecule per 6000), so that the oceans constitute an enormous source of supply.

But there are many obstacles in the way of controlling thermonuclear fusion, in particular because deuterium nuclei are mutually repellent. To overcome this force of repulsion they have to be invested with a high degree of kinetic energy, that is to say, heated to very high temperatures, of the order of 100 million degrees; the gas thus obtained is called plasma. Here other stumbling-blocks are encountered: how for instance to heat this plasma sufficiently and how to confine it within non-material walls so that the fusion process can be triggered off. Devices using magnetic fields are being tested in the hope of resolving these problems.

Besides methods of plasma production and confinement proper, research into fusion involves the development of methods of diagnosis in which the new

laser techniques will play an important part. This entails long and costly theoretical and experimental studies, and it is obvious that a thorough grasp of plasma physics must be obtained before there can be any hope of reaching the stage at which the process can be exploited in practice. However, taken together the results so far achieved continue to justify researches which could open up an almost inexhaustible source of energy before any serious depletion of fissile and fertile material resources need be feared.

*28.* When Euratom was set up, thermonuclear research was still in its beginnings and its co-ordination within the Community was a comparatively easy task for the Commission. Thus, as in the field of fast reactors, all non-military research into fusion undertaken in Member States is carried out under contracts of association between Euratom and specialist laboratories belonging to the following institutions:

— CEA (Fontenay-aux-Roses and Saclay laboratories)
— CNEN (Frascati laboratories)
— Institut für Plasmaphysik (Munich-Garching)
— FOM (Stichting Fondamenteel Onderzoek van de Materie) (Jutphaas, Amsterdam, Utrecht and Arnhem laboratories)
— KFA (Kernforschungsanlage des Landes Nordrhein-Westfalen) (Jülich laboratories).

The part played by these associations in the advancement of world research is far from negligible, as witness the number and quality of papers submitted at various international symposia in Europe, Japan and the United States, notably the San Diego meeting on plasma physics in November 1963. Liaison and co-operation is maintained with foreign laboratories, above all in the United States and Great Britain, reinforced by exchanges of highly skilled scientific personnel.

## V. Other research connected with reactor development

### 1. *Fuel fabrication, transport, reprocessing*

*29.* Fuel, structural materials and ancillary works demand no less attention than the reactor itself. Among the subjects of investigations, the fabrication and chemical processing of fuel elements occupy an especially important place. For instance, in order to recover the enriched uranium or the plutonium formed and to get rid of the fission products which, if they accumulate, poison the reactor from the neutron standpoint, the fuel has to be purified

after a certain lapse of time which varies according to the cycle selected. Fuel extracted from the reactor must be replaced by new elements, and experience will dictate the method of fabrication. To make European nuclear industry capable of providing for the reloading of present and future power reactors, the Commission has channelled considerable resources to this work both by way of research contracts and under the power reactor participation programme. The problem of plutonium recycling is likewise linked with these studies.

The chemical processing of irradiated fuels can only be carried out in special installations, frequently remote from the reactors, and in view of fission product radioactivity these used elements call for effective safeguards and strict controls. Their transportation therefore raises technical and administrative problems. The French plant at Marcoule and, shortly, at Cap de la Hague near Cherbourg, for processing irradiated fuel elements from the CEA and EDF power reactors, at present constitute the Community's sole potential in this respect. Hence the Commission has since 1962 been trying to find one or more overall solutions to this problem which is becoming more urgent as the irradiated fuel storage capacity at several of the Community's research reactors approaches saturation. Moreover, provision has to be made for the future processing of growing quantities of fuel extracted from power reactors, leaving aside the special requirements bound up with the development of fast reactors.

The Commission's attention has been concentrated more especially on the reprocessing of highly enriched fuels, in particular MTR (materials testing reactor) type elements and aluminium/highly enriched-uranium alloy fuels from research reactors. Apart from recourse to the services of the USAEC, which is not economic owing to the high carriage and insurance costs, there are three possible ways of dealing with this question:

1. Reprocessing in the UKAEA's Dounreay plant, this being envisaged as a temporary solution until mid-1965;
2. Enlargement of the main Eurochemic plant planned for the reprocessing of natural or slightly-enriched uranium fuels, and its adaptation for the reprocessing of MTR fuels;
3. The Italian EUREX (enriched uranium extraction) project.

At the same time, pilot-stage experimental studies are being pursued with a view to the elaboration of new chemical processing methods applicable to various types of fuel (dry processing or gasification, as distinct from the aqueous processing employed in large existing plants) or high-temperature methods in which, for instance, extraction is by molten salt bath, etc.

### 2. *Waste processing*

*30.* The handling and treatment of radioactive materials and the extraction of fission products during the chemical processing of irradiated fuels give rise to varying quantities of low, medium or high-activity waste which may be in the solid, liquid or gaseous form. They present two problems. Firstly, they have to be separated from the substances they are poisoning, concentrated to reduce their bulk and treated so that they can be stored without risk of leakage and contamination of the environment. To this end the Commission is studying various solid insolubilization, liquid concentration and gas filtration processes. Secondly, the waste materials thus treated have to be stored in a safe place where they will not constitute a hazard either to occupationally exposed persons or to the general public. The Commission, in close co-operation with the competent authorities in the Member States, is engaged in a systematic study of the most appropriate methods—both from the safety angle and from the economic standpoint—for the permanent storage of such radioactive waste.

These fall under four headings:

— burial in derelict salt-mines or pits dug in salt strata,
— pouring of liquid waste or slow-setting cement into certain suitable geological formations,
— surface storage in demarcated desert regions with low groundwater table, dry climate and minimal hydrographic system,
— dumping in the sea.

The Commission is particularly careful in supervising the application of the safety standards at existing storage points.

Firms and organizations in Member States were invited, through a notice published recently in the Journal Officiel of the European Communities, to participate in the Commission's overall programme regarding the processing and storage of radioactive waste.

### 3. *Radioisotopes and marked molecules*

*31.* Some artificial radioactive substances, including certain fission products, can, because of their appropriate half-life and radiation characteristics, be employed as intense radiation sources for chemical, biological and medical uses or for purposes of space research. Work has accordingly been initiated and is in hand on these new applications of radioisotopes, pending development of new methods of preparing radioactive or stable isotopes for which applications exist or are in process of elaboration (as tracers, for radiochemical analysis and so on).

The Bureau Eurisotop, which started operating in 1961, buttresses the research effort by focussing activity on industrial sectors. Its task is twofold: it endeavours by means of a sustained publicity campaign to make industrial users aware of the potentialities and benefits of employing radioisotopes in their manufacturing, inspection and control processes; and it participates in the testing of new applications and collects and disseminates the results.

The Commission is engaged also in similar action to promote the use of the marked molecules employed in biology and medicine and to centralize data on the means and possibility of obtaining them and on their utilization. A collection of marked molecules has been formed and is held at the permanent disposal of users.

### 4. *Nuclear ship propulsion*

32. Apart from the research into reactors intended for electricity generation, the Commission is also participating in design studies on reactors for merchant ship propulsion. Such reactors must be very reliable, compact, easy to handle and not too heavy. Furthermore, high burn-ups must be possible.

Experiments are under way in the United States (NS Savannah) and the Soviet Union (the ice-breaker Lenin) on the viability of nuclear propelled vessels which would have the advantage of greatly increased range without refuelling.

Up to the end of 1962, the Commission had taken part in studies on various marine propulsion strings—organic-moderated and-cooled, boiling light water or pressurized light water reactors. Community efforts are now focussed on the pressurized water forced-circulation type, of which two variants are currently under study, while the GKSS (Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffahrt mbH, Hamburg), has just decided to build a third variant, i.e. the FDR tendered by the Deutsche Babcock & Wilcox Interatom (Internationale Atomreaktorbau GmbH) group. This reactor is designed to propel a 15,000 ton dw bulk-cargo type experimental ship on the stocks since late 1962 which will cost some 13 million EMA u.a. to build (reactor cost included). Negotiations are in hand for possible Community participation in this project. Research on two reactor projects of more advanced design is covered by Euratom association contracts with the RCN (Reactor Centrum Nederland) and Fiat and Ansaldo respectively. A survey of several reactor types has been carried out under the Euratom contract with these Italian companies with the collaboration of the CNEN.

The transition to this new method of propulsion affects naval architecture generally, from the point of view of structure, navigability, anti-collision devices and safety equipment, and shielding against ionizing radiations. These

adaptations necessitate coordinated studies and experiments which also form part of the work schedule under the contracts of association signed between Euratom and the respective partners mentioned.

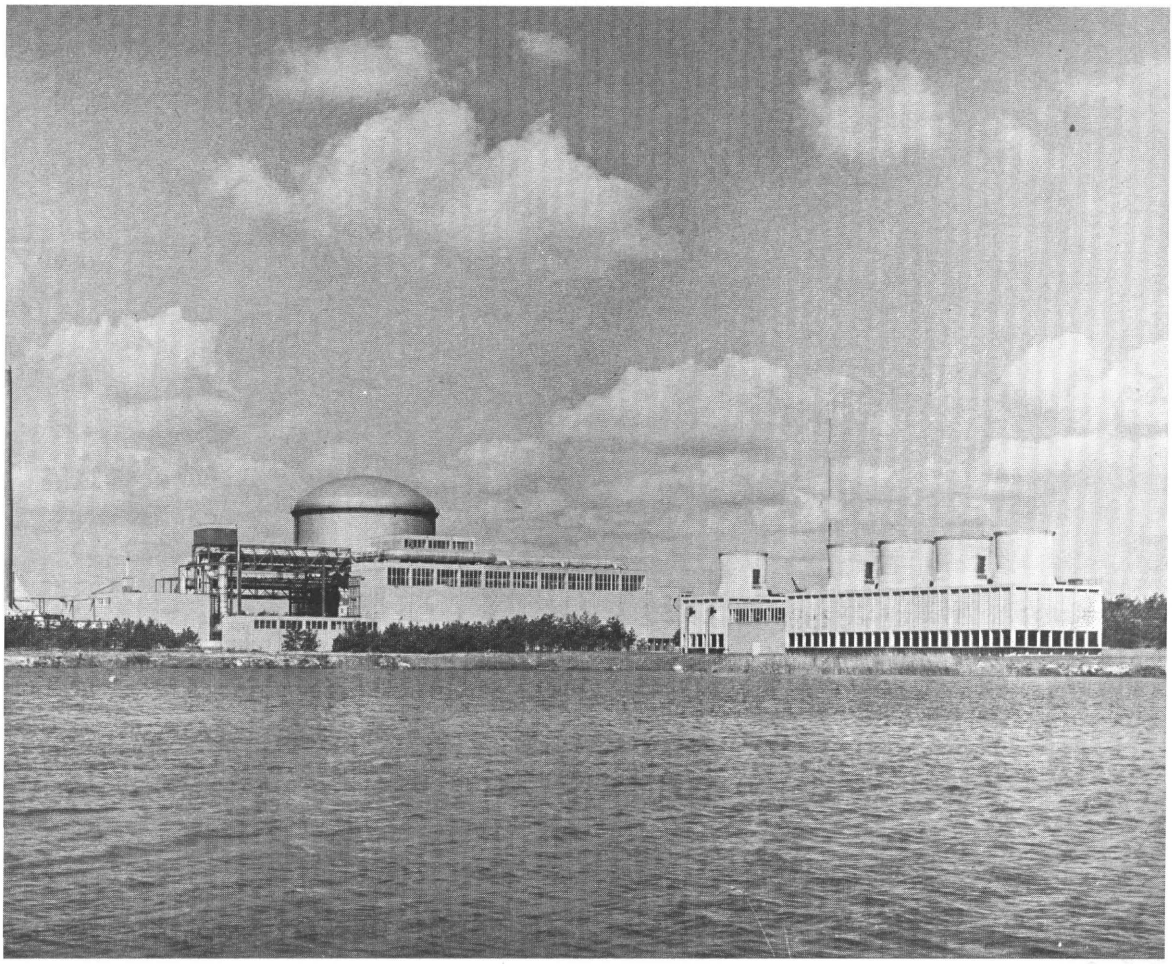
Nuclear ship propulsion must also entail coordination of legislative and administrative provisions; thus the Commission has endeavoured to bring into line the measures adopted by the Member States for the visit by the NS Savannah to European ports.

### 5. *Irradiations*

*33.* Materials destined for use as components in the various reactor projects are tested for irradiation behaviour in very high neutron flux test reactors (up to $10^{15}$ n/cm$^2$)—HFR at Petten and BR 2 at Mol. These two reactors are also made available to outside users. If irradiation results are to be truly comparable and properly interpreted (and this is indispensable since in the last resort the aim of the trials is to select the material most appropriate to each use) irradiation techniques must be further developed and knowledge of irradiation conditions must be widened (neutron flux, hydraulic and heat transfer measurement). The Petten establishment is now endeavouring to standardize the experimental conditions employed for irradiation contracts and is working on development of the irradiation capsules most appropriate for the different types of materials to be irradiated.

### 6. *Plutonium and transplutonium elements*

*34.* The Karlsruhe establishment of the Joint Research Centre is devoted mainly to plutonium research. As it is still under construction, most of this establishment's work is being performed under contract. It administers the research contracts on plutonium recycling in both proven-type water-cooled and breeder reactor fuel elements. These researches embrace, *inter alia,* investigation of the behaviour of uranium-plutonium mixed ceramics (oxide or carbide), and the neutron properties of the mixture, the studies being conducted under real conditions. The Karlsruhe Institute is also responsible for the management or execution of more fundamental research into the transplutonium elements artificially produced by irradiation, hitherto available in very small quantities and as yet little understood. It will be necessary to separate them from the irradiated parent material, purify them and study their physical and chemical properties. It is out of the question to use such radioactive substances in research and industry until accurate knowledge is obtained of their nuclear characteristics.



*Nuclear Research Centre, Mol (Belgium) — BR 2 materials testing reactor.*

### 7. *Nuclear measurements*

35. The Central Nuclear Measurements Bureau, the Joint Centre establishment at Geel, has the job of measuring the parameters necessary for the neutron calculations required in reactor development and design, such as neutron-capture cross sections, fission cross sections and inelastic scattering cross sections for different nuclei.

It has at its disposal a Van de Graaff accelerator which has just started functioning, while a Linac linear accelerator is now in course of installation. Its programme has been drawn up in close liaison with the EANDC (European-American Nuclear Data Committee). Permanent contact is maintained with the International Bureau of Weights and Measures and with standards bureaux inside and outside the Community. Thus its activities are those of a nuclear standards bureau. Moreover, it is responsible for the preparation of reference samples of pure substances, for conservation of such standard samples and for comparing them with samples from similar laboratories elsewhere in the world. It also undertakes the distribution and regular checking of secondary standards and standard samples for science, industry, trade and medicine, and is concerned with the improvement of samples and of measuring instruments and methods. This establishment is also engaged on calibration of radioelements, together with the determination of the isotopic composition of fissile products and spectrographic or purely chemical trace analysis in target materials. Generally speaking, it carries out all kinds of calibrations, measurements and physical analyses on behalf of third parties and all the detailed work of that kind which must underlie any big research project.

### 8. *Scientific data processing*

36. The electronic computers needed for the work described above make possible the Euratom Commission's entry into certain more specialized fields such as that of automatic documentation. This is a peculiarly vital question in the nuclear field with its interplay and overlapping of the most varied sciences and techniques, ranging from applied mathematics to the protection of industrial property by patents.

CETIS (the European scientific data processing centre), located at the Ispra establishment of the Joint Research Centre, has a range of equipment which covers all data processing techniques—numerical and non-numerical, analog and digital computers. These, with the specialist staff operating them, are at the disposal of users who may be grouped in two categories:

— "Nuclear" users: these include all the technical services of the Commission, its contractors and even other bodies engaged on reactor projects in Member States. These various users need to devise programmes and

carry out calculations on analog and digital computers. There is also the work of numerical analysis, economic evaluation and the machine processing of experimental data.

— "Non-nuclear" users, meaning the administrative and financial departments of the Commission, together with groups and units belonging to the various Community institutions who have come to feel the need for automation in handling the mass of material which was holding up the normal pace of work, or was about to cause bottlenecks. This relates above all to the conventional fields of automated management procedures (stores, personnel, budget, contracts, etc.) and machine-processing of the evergrowing quantities of printed matter (scientific, legal, administrative and so on) issued 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 as a guide in the formulation of Community policy.

CHAPTER III

# PROMOTION OF INDUSTRIAL DEVELOPMENT

*37.* The significance for industry of the various research activities outlined in the foregoing chapter needs no emphasis. Nevertheless the task of investigating and experimenting with the different reactor strings and improving their performance is not in itself enough and has to be extended in other directions. Of these, the most important are large-scale experimentation with power plants and the elaboration of a system of rules and of legal and institutional machinery appropriate to the specific nature of nuclear development. The present chapter also includes a third section devoted to supply problems.

To carry out these various tasks the Commission has the powers vested in it by the Treaty and the budgetary resources allocated to it under the five-year programmes. A large proportion of the funds is earmarked for research and development work carried out by Community industries.

## I. Nuclear power plant

*38.* The framework of the Commission's endeavours in the realm of power plant rests on two major programmes. The first is the one initiated under the US/Euratom Agreement for Co-operation, the second is the programme for participation in power reactor construction in the Community. In this context mention should also be made of the potentialities available through the grant of joint enterprise status and likewise of the snow-ball effect of the research contracts in which the Commission entrusts the work to Community industries, thus enabling them to gather extremely valuable experience and know-how.

### 1. *Programme of the US/Euratom Agreement*

*39.* A leading objective of the Euratom/United States programme is to familiarize electricity producers and industry in the Community with the enriched-uranium/light water type of reactor which has reached an advanced stage of development in the United States, and to promote initiative by Community industries to this end.

The Società Elettronucleare Nazionale (SENN) plant represents the first phase of the programme; the second covers the Kernkraftwerk RWE-Bayernwerk GmbH (KRB) and the Société d'Energie nucléaire Franco-Belge des Ardennes (SENA) plants. Thus three power plants totalling a capacity of more than 650 MWe will be installed under the US/Euratom programme. "Basic contracts" setting out the rights and obligations of the undertakings were signed at Frimmersdorf on 13 July 1963 with KRB and at Chooz on 17 October 1963 with SENA. They present the following advantages: fuel supplies on favourable financial terms, buy-back guarantees for the plutonium produced in the reactor, possibilities for reprocessing in USAEC plants, and loans by drawing on the credit line opened by the Eximbank in favour of Euratom. Thus loans have been granted to the amount of 20 million EMA u.a. to KRB and 16 million 1/4 to SENA.

### 2. *Participation programme*

*40.* The participation programme was launched in the course of the first Euratom five-year programme with a view to encouraging the construction of industrial-scale nuclear power plants and disseminating the results of experience with the design, construction and operation of such installations.

Contracts have been signed under this programme to an aggregate of 32 million EMA u.a. with five Community firms erecting power plants. In 1963, two applications—from the Kernkraftwerk RWE-Bayernwerk (KRB) and the Samenwerkende Electriciteits Productiebedrijven (SEP) companies resulted in the signature of participation contracts similar to those previously concluded with SENN, SIMEA and SENA. Out of Euratom's participation of up to 8 million EMA u.a. in the KRB power plant, 200,000 will be earmarked for fuel element fabrication and 7,800,000 for its share in the costs of manufacturing certain reactor components. Participation in the SEP power plant will be of the order of 5 million EMA u.a., broken down into 400,000 for additional start-up costs, 1,300,000 for fuel element fabrication and 3,300,000 towards the cost of manufacturing reactor parts. The greater part of the total contribution—about 17 million EMA u.a. out of 32 million—is only due on condition that the fuel elements for these reactor cores are fabricated in the Community. In two cases (KRB and SENA projects) participation relates to fabrication in Europe of certain reactor components such as pressure vessels, instrumentation control gear, heat exchangers, circulation pumps and other primary circuit parts, while for four projects (SEP, SENN, SIMEA and SENA) it is designed to cover part of the extra fixed charges borne during the first three years of operation, 5,400,000 EMA u.a. altogether being reserved for this purpose. The following table sets out the Commission's financial contributions to the various projects:

**PARTICIPATION BY THE COMMISSION**
(EMA units of account)

| Enterprise | Start-up costs | Fuel elements | Reactor parts | Total |
|---|---|---|---|---|
| SENN | 3,000,000 | 4,000,000 | | 7,000,000 |
| SIMEA | | 4,000,000 | | 4,000,000 |
| SENA | 2,000,000 | 6,000,000 | | 8,000,000 |
| KRB | | 200,000<br>2,000,000(1) | 7,800,000 | 8,000,000 |
| SEP | 400,000 | 1,300,000 | 3,300,000 | 5,000,000 |
| | 5,400,000 | 15,500,000<br>(+ 2,000,000) | 11,100,000 | 32,000,000 |

(1) KRB has undertaken to have the elements necessary for replacing the first load fabricated by Community firms up to a total of 2 million EMA u.a.

Two vital elements in the programme are the facilities it affords in regard to technical training of personnel and its implications for the dissemination of information. Engineers belonging to Euratom, industry or Community bodies who are assigned to contractors' installations have taken an active share in design, construction, trials and commissioning; each has been able to study problems of value for his particular work, and these have been the subject of special reports. Finally, the Commission organized information meetings for several hundred people from the relevant industrial circles, who were thus informed of the details of participation contracts concluded in 1963 and of experience gathered in the course of pre-commissioning trial programmes for the SENN and SIMEA power plants.

The two programmes—US/Euratom Agreement and participation in nuclear power plants—thus help towards solving the tricky problems encountered by Community industry in the design, construction and start-up of nuclear power plants. Furthermore, their implementation has led to the assembling of a considerable volume of experience and information which are used by the Commission and communicated to third parties in the Community who show due cause why they should be provided with such data.

### 3. *Joint enterprises*

*41.* The granting of joint enterprise status and the potential advantages attaching thereto under Annex III of the Treaty, constitutes another means open to the Community for promoting the construction of installations of cardinal importance to the development of nuclear industry.

This status, with most of the relevant advantages—in particular exemption from direct taxation and customs duties—was granted to the Kernkraftwerk RWE-Bayernwerk GmbH (KRB) and the Société d'Energie nucléaire franco-belge des Ardennes (SENA) on application by them. The Council has power to annul the benefits accruing to them if and when the economic situation of the undertakings permits. Joint enterprise status was granted subject to the obligation to make available to the Community for dissemination all non-patentable information acquired in the course of construction, installation and operation of the power plants.

## II. Legal and institutional infrastructure

The use of nuclear power can only become really widespread if a whole complex of obstacles is first eliminated, ranging from fear of nuclear accidents to uncertainty as to future availability of the experts, equipment and nuclear fuel needed for the construction and operation of power plants. There is also the question of laying down proper provisions in respect of industrial property and safeguards and controls.

### 1. *Insurance and third-party liability*

*42.* Alive to the urgency of the problems raised by hazards connected with the use of nuclear energy, the Commission has, in liaison with Member States and the various circles concerned, pursued its endeavours so that satisfactory solutions may quickly be found, with regard to nuclear insurance and third-party liability, by way of international conventions and in insurance practice. These endeavours took the form, in the first instance, of sharing in a much wider context than the Community, in the elaboration of international conventions with a view to setting up a system of third-party liability adapted to the requirements of the nuclear sector, together with machinery by which public funds can take over at the point where private guarantees leave off. By the Paris Convention of 29 July 1960 and the supplementary Brussels Convention of 31 January 1963, a unified system of third-party liability in the field of nuclear energy and of additional compensation out of public funds seems about to come into force in western Europe in respect of injury

and damage caused by land-based nuclear installations and the transportation of radioactive materials. At the same time the Commission has continued its work relating to practical problems presented in the Community by private cover—i.e. chiefly insurance—against nuclear hazards, these being problems of which the Commission has direct experience as the operator of nuclear installations.

### 2. *Trade*

*43.* Where trade is concerned, the Commission's attitude has been a liberal one, which can be expected to exert a positive influence on the development of trade relations. This liberal attitude has been exemplified in Euratom's policy on customs duties. It will be remembered that since 1 January 1959, and at least until the end of the "transitional" period, the nuclear common market, as part of the general common market being gradually formed, has been fully realized as regards its regulations; and the fact is that customs duties no longer exist in the internal market. President Kennedy's move to increase trade between Europe and the United States by slashing customs duties was very favourably received by the Commission.

Comparison of European tariffs with those of the United States, the United Kingdom and Canada, to mention those countries most concerned with nuclear energy and where it is most highly developed, shows that in these countries imports of certain nuclear products carry duty at more than double the Community's external tariff rate. It is the Commission's hope that tariff negotiations will help to ease the conditions for trade in nuclear products and hence indirectly militate for a gradual reduction in the unit price of nuclear electricity.

While on this topic, it is worth pointing out that application of a number of customs duties was suspended until 1 January 1964. The Commission did not deem it desirable to enter into the procedure required for extending the suspension of these duties. It had indeed become clear that European industry was in a position to supply the equipment to which these duties applied and that imports of these various products had in any case been extremely limited.

### 3. *Dissemination of information, industrial property and basic patents*

*44.* In a statement to the Council at its session on 1-2 April 1963, the Commission defined its policy of disseminating non-patented information deriving from its research. It also outlined its future policy on the issue of patent licences to States, individuals and firms established outside the

Community. The rules laid down by the Commission in this field are aimed at ensuring for Community industries prior or even exclusive rights in the exploitation of information of industrial value arising out of the implementation of the research programme.

As regards non-patented information, the Commission confines itself to publishing scientific data, in particular information of fundamental and humanitarian interest e.g. relating to medicine and biology. On the other hand, information of an industrial character is only published where there is no risk of depriving Community industries of priority in exploiting it. A procedure for selective dissemination of such industrial information has been devised, calling for the co-operation of six national correspondents. So far rather more than 160 persons and undertakings in the Community have asked for access to such industrial information. Each request has been carefully checked and the applicants have undertaken to observe the confidential nature of this information as far as is compatible with its optimum exploitation.

*45.* In the same spirit of collective safeguards for Community industries in the use of information of Community origin, the Commission is developing as wide and effective a patent portfolio as possible. While the Treaty includes provisions for industrial firms in the Community to obtain licences on these patents, it does not guarantee them exclusive rights. The Commission has accordingly defined the position on concession of licences to non-Community industries, namely, that save in the case where patents or data are exchanged, use of the inventions covered by such patents is restricted to industrialists in the Community. A good number of the patents in the portfolio are already being employed in Joint Research Centre establishments, by associations and contractors, and in addition six licences have been granted to industrial firms.

*46.* As regards the industrial property clauses in research contracts, the Commission had, in January 1961, laid down the rules governing patents. In its statement to the Council on the policy regarding dissemination of information, it defined the procedure governing non-patented information and in particular "know-how". This system ensures a fair balance between the rights acquired by the Community in return for its financial contributions and the industrial and commercial interests of the contractors.

*47.* Lastly, the problem of basic patents belonging to contractors has been solved. The solution obviates interference with the use by the Commission and Community industries of the results of research carried out under contract without thereby unduly prejudicing the contractor's industrial property rights.

### 4. *Safeguards and controls*

*48.* The pooling of the Community's nuclear fuel resources depends on the existence of a system of safeguards and controls in which equitable treatment is assured for all. To this extent the system constitutes one more item in the preliminary infrastructure for nuclear energy development in the Community.

Moreover, deliveries of special fissile materials from non-Community countries are directly bound up with the existence and efficient operation of the control system instituted by the Treaty. Thus the supply of highly enriched uranium and of plutonium in large quantities under the co-operation agreements with the United States and the United Kingdom for the Community's fast reactor programmes, could hardly be imagined unless the Community possessed the necessary means to secure compliance with the guarantees demanded by the supplier countries as to peaceful uses. Not only do the quantities visualized substantially exceed those delivered by virtue of any other international agreement, but in addition this is the first time that fissile materials supplied by a non-Member state have not come under the latter's control. In fact, the Euratom control system has been recognized, in the co-operation agreements concluded with the principal supplier countries, namely the United States, the United Kingdom and Canada, as affording sufficient guarantees to justify those countries in waiving their own control of the materials delivered to the Community.

Since Euratom came into being, the growth of nuclear activities in the Community has resulted in a rapid rise in stocks of materials subject to the Commission's control. This upward trend, which continued in 1963, led to an extension in activities relating to safeguards and controls; the system was streamlined to ensure the processing along rational lines of the declarations communicated to the Commission by enterprise as well as to increase the number of on-site inspections. At the same time 1963 was marked by the first application of control procedures to an industrial-scale power reactor. This development is all the more significant in that the reactor, its fuel and its equipment, were supplied under the guarantees of the US/Euratom Agreement for Co-operation.

As regards the problems involved in the application of Regulations Nos. 7 and 8 to certain installations concerned in the carrying out of military programmes, the Commission has been endeavouring, in the spirit of the European Parliament's resolution on the fifth Euratom report, to find a solution by which the imperative defence needs of the Member States and compliance with Treaty obligations might be reconciled. The Commission hopes shortly to devise a solution to these problems.

### 5. *Relations with industrial federations, employers' associations and labour unions*

*49.* During the past year, contacts were maintained, and in certain cases reinforced, with associations of electricity producers, industries self-supporting in electricity supplies, nuclear equipment manufacturers, and all organisations whose object is to promote the use of nuclear power.

Following the Tours Conference in December 1960, the symposium held by the Commission at Amsterdam on 26 and 27 September 1963 with the heads of European industries concerned in the nuclear field deserves special mention. This meeting was the occasion for a comparison of the Commission's views on the industrial-scale application of nuclear energy with those of leading persons representative of industry. A subject which received particular attention in the discussions was the middle and long-range need for the construction of large-scale power reactor strings. Exchanges of views took place regarding the financial and technical aspects of such a programme. These discussions sparked off a series of consultations between the relevant departments of the Commission and private industries.

The symposium at Venice which brought together the Commission and experts from national undertakings and bodies concerned in the construction and operation of nuclear power plants, in late October 1963, falls into the same pattern. It was apparent from the detailed studies submitted by the Commission as well as by the experts that nuclear energy has reached the stage of viability at which it can be applied on an industrial scale, always provided that it is generated by large-capacity units from about 400 MWe upwards).

*50.* As nuclear power becomes more closely interwoven with industrial activity as a whole and gradually takes over the rôle of a new source of energy, its social effects are more clearly felt and there is a growing awareness in labour circles of the prospects and problems bound up with this progress towards industrial maturity.

The Commission's information policy vis-à-vis the organized workers through the trade unions is thus essential in order to explain and popularize its aims under the Treaty. Accordingly, representatives of the Commission took part during the year in numerous trade union gatherings at national level, by means of speeches or papers on the social aspects of nuclear power and of the Commission's activities. Visits by the press and a tour of Euratom research establishments for trade union journalists were arranged in collaboration with the Joint Press and Information Service.

## III. Supply

*51.* The Community's responsibilities include the equitable and regular supply of nuclear fuel to users. The Commission judged that the moment had come to adopt a joint policy for natural uranium supply. This need emerges clearly from a report unanimously adopted by the Consultative Committee of the Supply Agency entitled "The long-term problem of uranium resources and supplies". The Commission, on receiving this document, endorsed its conclusions and published the report.

It outlines the pattern of natural uranium needs and resources until 1980 in the light of foreseeable developments in the economics of nuclear power. Part I of the report catalogues the known resources of the free world as a whole, workable at a price not exceeding 8 to 10 dollars per lb. of $U_3O_8$ and discusses their trend during the depressed phase of the market which may last until the beginning of the next decade, taking account of purchasing contracts already concluded on the one hand, and on the other of halted production programmes. Thus at 1 January 1971, free world reserves are expected to be only 320,000 tons, for the most part spread over three producer countries namely, the United States, Canada and South Africa. Against this, the cumulative free-world consumption of uranium for the ten years 1970-80 is estimated at 190,000 tons, of which 100,000 for Europe alone.

The report brings out the fact of declining demand in the free world as a whole until about 1970, which is already causing profound changes in the structure of the uranium-producing industry. In contrast, over the next decade an upsurge in demand is to be expected, with reserves and output capacities notably less than they were around 1960; and so, towards the end of the next decade output capacity will be insufficient to cover free world demand and, the report says, new deposits will have to be discovered and worked if a sharp rise in prices resulting from the use of existing deposits known to be very expensive to work is to be avoided.

Then again, the report stresses the magnitude of foreseeable European demand, approximately 20,000 t/yr in 1980, against home resources and limited output capacity, for the relevant period, of the order of 1,500 t/yr, and the consequent dependence on producer countries.

The conclusion reached in the report is that steps must be taken soon to guarantee long-term supplies of natural uranium for Community users at satisfactory prices. It would be regrettable, the report says, that through lack of adequate measures taken in time, Europe should be condemned "to obtain all its uranium on poor terms, subject to political hazards".

52. On the basis of this report and its own studies, the Commission prepared a "Note on the drawing up of a common supply policy for uranium" which it transmitted to the Council on 12 November 1963.

The need is the long-range one of guaranteeing Community enterprises access to large, economically workable uranium deposits both inside and outside the Community. To this end, and allowing for the changing structure of uranium production in the free world, a vast campaign of prospection will need to be undertaken by these enterprises. This will have to be done soon if it is to bear fruit around the middle of the coming decade, when a steep rise in demand is predicted. Experts in fact generally put the time between launching a prospection campaign and starting to market the uranium concentrates at about ten years.

It is for industry in the Community to take the initiative, to shoulder the risks and to reap the benefits. But the depressed state of the uranium market for the time being is no stimulus to extensive commitments for prospecting. Indeed, producers are not only making hardly any sales, they can no longer include in their selling prices the necessary margins for renewing resources. Thus it is vital that the public powers in the Community give effective support to the uranium industry to help it over the period of depression and enable it to meet the sharp upturn in demand in due course. In this connection it is worth recalling that the discoveries of vast uranium deposits made in the years 1950-55 were only achieved with substantial help from public funds, and that producer countries are today again taking steps to assist this branch of industry.

Under the Treaty, Community users have equal right of access to uranium resources. This entails the equitable sharing of the efforts needed to ensure long-range supplies, and more especially of the costs involved in the subventions and assistance from public sources that have proved necessary. This can only be done within the context of a joint policy carried out at the level of a great nuclear power. Such a policy, besides providing an incentive to enterprises throughout the Community to undertake the necessary measures, should ensure their maximum effectiveness and give to activities initiated outside the Community the cohesion necessary for their success. These then, as the Commission sees it, are the reasons for a common policy.

The lines of policy sketched out in the Commission's note constitute one application of the principles which, according to the terms of the European Parliament's resolution of 20 February 1962, should underlie an energy supply policy. The significance of this application is bound up with the rapidly increasing importance which uranium will assume among energy sources used in the Community. In an opinion delivered pursuant to Article 70 of the Treaty following receipt of Member States' reports for 1962 on mining

exploration, output and investment, the Commission drew the attention of Member States to the need for Community industry to launch a big uranium prospecting effort soon, within the framework of a joint policy. The concrete forms to be given to the common policy can only be defined by the Commission in liaison with the Council in the light of studies entrusted to experts on the outlook for uranium prospecting and its financial aspects in the Community and elsewhere. The Commission's note confines itself to reviewing the various ways in which the Community is able to assist enterprises prepared to undertake commitments in this respect.

On the basis of the note the Commission has embarked upon detailed discussions with the Council on long-range supply problems. It formally referred the document to the Supply Agency's Consultative Committee which has unanimously adopted a resolution emphasizing the scale of the Community's future needs, its dependence on outside sources and, consequently, the need to get a common natural uranium supply programme, based on prospection, off the ground in the near future.

The Commission has forged ahead with its activities connected with enriched uranium supplies. The policy pursued by the Community in this sphere will mean that the needs of reactors to be commissioned in Member States in the next few years can be met for twenty years to come. The Commission has laid down the broad outlines of action to be taken in order to obtain the quantities of plutonium required to implement the fast breeder reactor programme. Until sufficient quantities are available from Community sources, it intends to draw on the United Kingdom and above all on the United States for supplies. In the long term there will be problems of price stability and terms of supply in respect of fissile materials. These problems are under study in connection with the preparation of a first industrial development programme as provided for in Article 40. Here optimum use of natural uranium and plutonium breeding capacity are a vital factor in the choice of reactor strings.

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It will be seen that the characteristic features of the Commission's efforts for the development of the Community's nuclear industrial potential are the variety of points to which they are applied and the complementary nature of promotion measures which can be adopted by the Member States. From a critical examination of results hitherto obtained in the Community it is possible to sketch out the future lines of the Commission's action in the pursuit of its objective.

The Commission's endeavours, taken together, have certainly contributed towards establishing nuclear capability and promoting the construction of a

first generation of nuclear power plants which are already fairly diversified in type. Despite these first important concrete results, nuclear industry has not yet attained everywhere in the Community that degree of maturity and confidence which will give it a secure foothold in the international competitive market. The necessary industrial experience and "know-how" are still to some extent lacking, for instance as regards certain essential reactor components, fuel elements among others. So far the reason is to be sought mainly in the very restricted outlets open to it.

The logical conclusion would be to see that a second and indeed a third series of advanced-technology nuclear power plants afford fresh opportunities for nuclear constructors to come of age.

If the Commission is given a determining rôle in the promotion of industrial development, big incentives will need to be devoted to nuclear power plant construction and operation. Such incentives might consist in the partial assumption of certain risks incurred in constructing and operating power plants, or specific guarantees might be envisaged. Moreover, they would enable the Commission to encourage nuclear enterprises to form construction groups. For it is vital that Community industries be able while their labour costs are still lower than those of their competitors in non-Member countries, to make the technological advances which will bring them abreast of achievements elsewhere.

CHAPTER IV

# HEALTH AND SAFETY AND BIOLOGY

## I. Standardization and control measures

### 1. *Basic standards and implementation of Euratom directives*

*53.* When, four years ago, the Commission published the directives laying down the Basic Standards for the health and safety of workers and the general public, not only was it fulfilling an obligation under the Treaty, but it also gave real impetus to national action in the various ways specified by the Basic Standards. The existence of these directives, accompanied by the power to make recommendations with a view to the co-ordination of implementing provisions, affords a basis for standardizing action which has no equivalent in any other international organization.

The year 1963 marked an important stage in respect of implementing provisions enacted by Member States, which made special efforts to respond to the Commission's reiterated appeals to apply the directives embodying the Basic Standards. In Belgium, two royal decrees on the protection of workers and the general public were published in May 1963 and a draft ministerial order has just been submitted to the Commission. In the Netherlands, a decree on protection against ionizing radiations was promulgated in March 1963. A decree on the regulations governing basic nuclear installations was published in France in December 1963. In Italy, a decree relating to the safety of nuclear installations and health protection for workers and the general public was approved early in 1964. Germany has submitted to the Commission a draft decree amending and supplementing the 1960 "Regulation I" and another draft relating to training establishments which employ ionizing radiations. Luxembourg too, has just forwarded to the Commission a draft regulation on radiological protection which will probably be promulgated in 1964. Once this draft text has been adopted, the six Member States will each possess one or more provisions making the Basic Standards applicable in different sectors of nuclear activity.

*54.* However, it must not be forgotten that the Basic Standards cover a wide and varied range of activities and it will take some time yet before all the provisions contained in the directives are applied in their entirety,

especially as regards industrial uses of radioisotopes and the utilization of ionizing radiations in medicine. Member States have the legal equipment to pursue their regulatory action; liaison between the Commission's representatives and State public health authorities is developing in a noteworthy climate of co-operation. The Commission can therefore hope to see the essential aims of its health policy, as expressed in the Basic Standards, wholly fulfilled in the years ahead.

How definitive are the Basic Standards? It is a question which is often raised, and it is easy to answer that scientific and technical progress and the widening of the frontiers of knowledge of the harmful effects of radiations on living creatures may well lead the Commission to revise the standards in due course. A considerable part of the research programme carried out or promoted by the Commission is directed to a better understanding of the way radiations affect the individual, particularly in the fields of radiotoxicology and the epidemiology of delayed radiation effects. It should be possible as a result of these researches to define ideas as yet little understood and perhaps to modify the figures now considered acceptable in respect of exposure or contamination. But although any firm conclusion at this time would be premature, these researches will not in the near future substantially alter the coherent structure which the Basic Standards constitute today. It is likely that the effect of any immediate changes will be to improve the organization of preventive and safety measures rather than to lower or raise the permissible doses laid down in 1959. The present levels have the particular virtue of being compatible, in the present state of knowledge, with health protection and the technical and economic dictates of nuclear expansion. The Commission was led recently to review and add to the provisions regarding exceptional irradiation of nuclear workers; it devised for these intricate and difficult problems realistic solutions which should give rise to no further problems of interpretation when applied by the Member States.

The Commission regards its standardizing activities as one of the main planks in its health and safety programme; it also possesses administrative powers to keep check of compliance with the safety principles underlying the Basic Standards. It is responsible for the permanent monitoring of background radioactivity throughout Community territory and exercises indirect control over radioactive waste disposal.

### 2. *Background radioactivity monitoring*

*55.* The Member States have the responsibility and duty of establishing background radioactivity measuring posts and communicating the results to the Commission. In order to make these results comparable and be able

to express the radioactivity curve for the six countries together by way of graphs and tables, the Commission in 1960 initiated a programme for bringing into line measuring methods and the presentation of results.

Great progress has been achieved in recent months. Latest steps taken by the Commission in collaboration with Member States include the setting up of two centres, in Brussels (Belgium) and at Saclay (France), for the testing of atmospheric radioactivity monitoring devices. From the practical angle, these centres will render important service both in respect of measurement co-ordination and of possible improvement of apparatus.

For man, the chief source of contamination is through the consumption of water or food polluted by radioactive substances; adequate organization of food chain radioactivity monitoring is indispensable. While it is relatively easy, where airborne radioactivity is concerned, to set up a more or less co-ordinated overall system for the six countries as a whole, the problems are more complex when they concern arrangements for measuring radioactivity in food. The broad lines of a sampling and measuring programme are being laid down by the Commission in agreement with the competent national authorities; and it is to be hoped that in the years ahead it will be possible to record results as favourable, from the co-ordination aspects, as those already obtained for the atmosphere and for precipitation, in respect of foodstuffs for which information at present available does not allow of valid comparisons. The work of co-ordination in the first instance covers methods of analyzing milk and cereals.

### 3. *Radioactive waste*

*56.* The Commission is also responsible for delivering opinions on the disposal by Member States of radioactive waste liable to cause the water, soil or air of a neighbouring State to become contaminated. Member States have adopted various means of applying the article of the Treaty which stipulates that general data on any radioactive waste disposal project be submitted to the Commission. From the examination of projects so far communicated to the Commission, an original method of assessing the hazards has emerged which States do not usually employ but which is in close keeping with the intentions of Article 37; projects are studied not only as regards routine disposal of radioactive waste but also from the point of view of accidental discharges which in practice constitute in most cases the only possible risk of contamination of frontier zones. The group of experts which assists the Commission in drawing up its opinions has recently been enlarged by the inclusion of representatives qualified in the realm of nuclear plant safety and water and soil contamination.

### 4. *Nuclear plant safety*

57. Fresh problems have been added to the Commission's concerns in the safety field by the start-up in the Joint Research Centre establishments of nuclear installations liable to give rise to health and safety problems. Generally speaking, the Commission has to ensure that in its own establishments the Basic Standards are strictly and fully applied; in 1963, not only did its specialist departments study safety reports but they also prepared and supervised the introduction of certain measures with a view to the safeguarding and surveillance of workers and the surrounding population. This fresh activity on the Commission's part will be extended as time goes on and represents a permanent duty of inspection and control in regard to nuclear installations. Particular attention has been given this year to formulating emergency plans in case of accident, in liaison with national or regional authorities in whose territory the establishments are sited.

### 5. *Nuclear hygiene and medicine*

58. Industrial medicine as it concerns nuclear workers in particular, presents special features resulting not simply from the nature and assessment of the hazards but also from the ever greater integration of physical and chemical methods in biology and public health. Radiological protection is a crossroads where many branches of science meet and a variety of trends may be observed. The Commission has a dominant part to play in reconciling these trends and bringing into being, at Community level, a forward-looking science of nuclear medicine and public health fitted to cope with the hazards of ionizing radiations. Two important meetings were held in 1963, at Naples and Tours, on the medical supervision of nuclear workers; they were a response to the Commission's anxiety to secure co-ordination of the medical services at the Community's nuclear plants and closer links between the medical services on the one hand and the physical control and radiation monitoring services and the public authorities on the other. Specialist training for practitioners in industrial medicine is manifestly an imperative need and the Commission is endeavouring to encourage the various types of training in radiological protection and promote their co-ordination.

In the matter of exposure dose measurement, the Commission took the initiative in an experiment to compare the measurement results obtained from film badges, with the participation of the Technische Bundesanstalt, Brunswick, and the main national dosimetric services.

Among other important problems in the social sphere are the provision of information for nuclear workers and compensation for loss or injury conse-

quent on exposure to ionizing radiations. A study of these questions has been started in co-operation with the competent government departments and trade union and employers' organizations in the Member States.

## II. Research studies

*59.* A three-fold aim has been pursued in studies and research:

— association with the efforts of large European laboratories making a significant contribution to current developments in biology;

— application of the discoveries of modern biology as quickly as possible to facilitate study of radiobiological problems proper and promote further uses of nuclear energy in medicine and agriculture;

— co-ordination in the highest possible degree of studies carried out within the Community while endeavouring to synchronize them with those taking place outside the Community (especially in the United States and Great Britain).

The following are concrete instances of this policy:

### 1. *Radiobiology and radiological protection*

*60.* The object of these studies is to gain fuller knowledge of the harmful effects of radiation on living beings and to improve methods of prevention, diagnosis and treatment. In addition, they seek to determine in a more general sense the risks which the growing use of nuclear energy involves for mankind.

The two major associations instituted during the first five-year programme with the Naples Institute of Genetics and Biophysics and the University of Brussels are fully active. The object is research into problems of basic genetics, morphogenesis, immunology and enzymology in relation to radiation effects on living beings.

The contract with the Paris Institut du Radium (Professor Latarjet) for studying the effect of radiations on the DNA has been renewed.

Radioprotective substances are under study at Liège.

A series of contracts with the Centre d'Etudes nucléaires, Mol, the Association Claude Bernard, etc. for research into certain problems of pure radiobiology were continued. Genetic problems are being investigated at Pavia, Naples, the Casaccia centre and the Institut national agronomique français, Paris.

A cytogenetic study covering the staff of a nuclear power plant has been launched in Italy. The value of this work does not lie in the fact that this is a section of the population subject to abnormally high radiation doses—quite the contrary; here the doses dealt with are small but are accurately known.

Studies are in progress in Brussels, Turin and Paris on carcinogenesis and leukemia.

The research begun at Strasbourg on the action of padutine in the treatment of radionecrosis is proceeding satisfactorily.

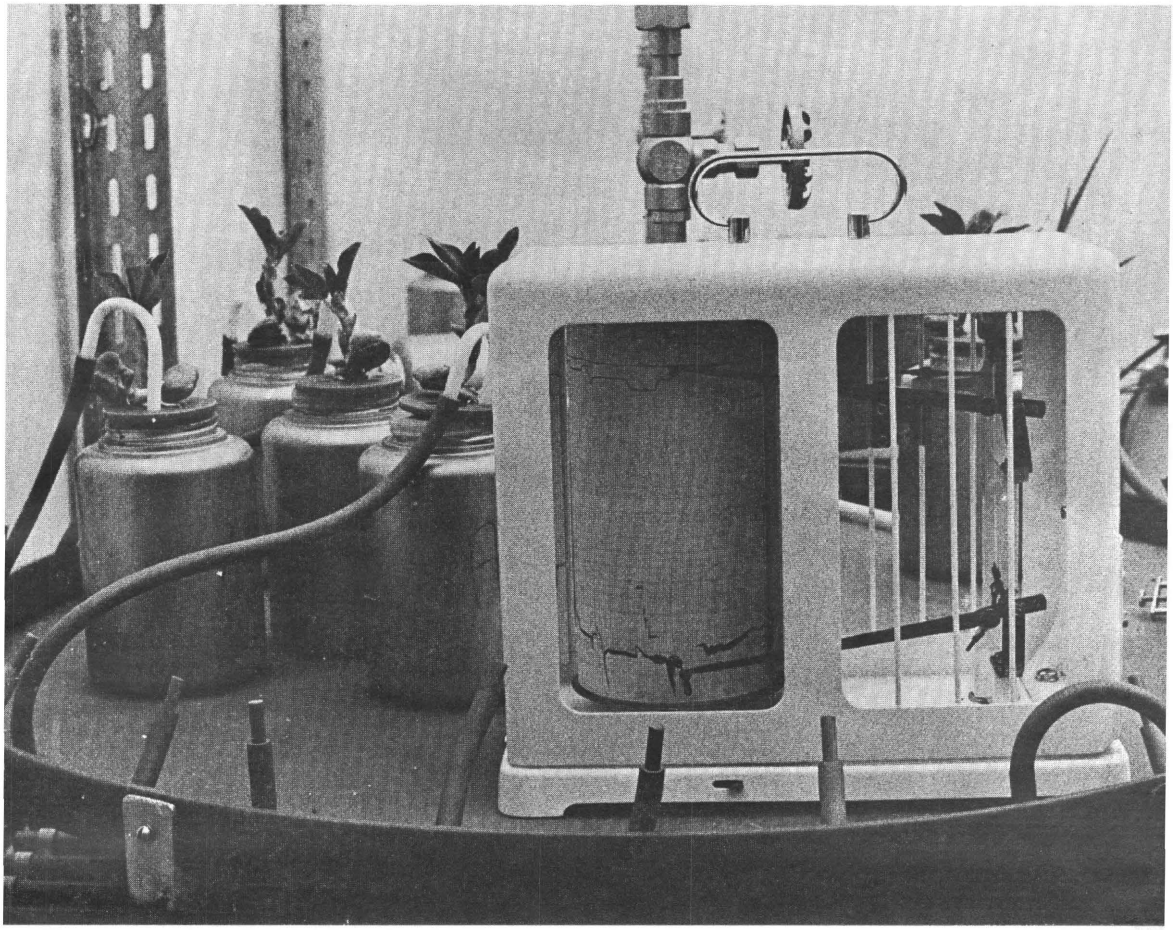
Development of the potentialities of irradiation syndrome treatment by bone marrow grafting is also, of course, receiving the Commission's fullest attention. This problem is being studied at Rijswijk more especially.

As a land-locked sea, its shores largely developed and densely populated, the Mediterranean with its importance for tourism is an area in which contamination could be an extraordinarily significant issue. The Commission and the Italian Atomic Energy Commission (CNEN) have entered into a contract of association for the study of these problems.

The Commission has likewise been engaged for two years on a full and detailed study of radioactivity in the Rhine basin. International waterways are of outstanding interest from the standpoint of possible transport of radioactive contamination. The present study will provide the Commission with exact data on the trend followed by artificial and natural radioactivity in the Rhine and its main tributaries as a function of space and time.

The Institutes at Coblenz and Karlsruhe have taken an active share in the research programme, in close collaboration with French, Dutch and Luxembourg laboratories. Switzerland is also being kept informed of progress made with the Commission's programme.

The chief source of radioactive contamination in man is his food; but little is known about this contamination. The task becomes particularly complex when it is sought to establish a precise relationship between environmental contamination and the irradiation doses which may result through the consumption of food by individuals. The Euratom Basic Standards lay down maximum permissible levels for radioactive substances present in air and water, but these values are difficult to use as a basis for figures concerning contamination of the various foodstuffs. Accordingly, the Commission has laid special stress on this problem and concluded a contract of association with the French Atomic Energy Commission (CEA) aimed at collating scientific, technical and statistical data deriving from physiology, toxicology, agronomy and nutrition studies and preparing a synthesis from which radioactive



*Institute for Atomic Sciences in Agriculture, Wageningen (Netherlands) Euratom/ITAL Association — Test device: agriculture test on rotating table in an air-conditioned chamber.*

contamination levels for food can be worked out. The programme, launched three years ago, is progressing satisfactorily and the first results have led to the definition *inter alia* of certain anatomical and physiological data on the standard man and the standard European child, and the determination, by nutritional surveys, of the kinds and quantities of food consumed by various typical population groups in the six Community countries. In addition, problems bound up with the transfer of radioactive substances through the several links in the food chain are under study at the Kiel and Detmold institutes in connection with milk and cereals respectively.

A small biology unit has been set up at the Ispra establishment. Its work is governed in the main by the various problems of a biological character which arise in the operation of the nuclear centre as a whole. These refer to controlled or accidental introduction of radioactivity into the environment; harmful substances, whether radioactive or not, involved in the Commission's reactor programmes; phenomena associated with irradiation of living beings in the working conditions of the Centre utilizable in developing preventive, diagnostic and therapeutic methods.

### 2. *Nuclear techniques applied to agriculture*

*61.* Work under the Euratom/ITAL association has continued on the lines originally laid down.

The Mutation Breeding Contact Group, which incorporates the heads of plant species improvement programmes at Wageningen, has been extended to German and Italian institutes. In the realm of food conservation by irradiation, trials carried out with a broad range of products have resulted in a few of them being selected as promising, and these will be studied more closely. A first edibility study of irradiated foodstuffs has been started, attempts being made to devise tests for the detection of possible mutagenic effects. Work has continued on the movement of radioactive ions in the soil and in plants and a method has been perfected for the exact study of ion migration in soil columns. As regards improvement of nuclear techniques, mention should be made of a new type of miniature detector using semi-conductors which has been perfected. The BARN reactor (Biological and Agricultural Reactor Netherlands) went critical on 9 April 1963. This means that the Euratom/ITAL association is equipped with a fast and slow neutron bombardment facility which is unique in the characteristics of its irradiation chamber. Regulation and adjustment trials are proceeding. Lastly, a start was made in 1963 on the construction of the radiobiology block, glass-houses, and an administrative wing to the existing building, and these are now ready for occupation.

### 3. *The atom in medicine*

62. A contract of association has been concluded with the Universities of Pisa and Brussels for the study of medical applications of nuclear techniques. Its chief purpose is to devise and perfect new methods of diagnosis and treatment utilizing the resources offered by nuclear energy. The main subjects of study will be cancer, diabetes, arteriosclerosis, and cardiac and thyroid conditions.

CHAPTER V

# RESOURCES AND FACILITIES

## I. Establishments of the Joint Nuclear Research Centre

*63.* The Joint Nuclear Research Centre was born of the determination of the six Community countries to combine their efforts in order to create the conditions necessary to the rapid development of a nuclear industry in Europe. In its very concept, the scheme for a research centre established and operated by a Community of countries recommended itself as a factor of progress. Indeed it was felt that only in this way could the necessary concentration of resources be ensured to conduct a programme complementary to those being carried out at national level and provide for dissemination of information throughout the Community. This pooling of effort was by definition meant to exclude the wasteful overlapping inevitable in research systems working in juxtaposition and so deeply entrenched that even closely co-ordinated endeavours could only partially remedy the problem. Again, the diversity of origin of the research staff was meant to afford constant opportunity for comparing widely divergent approaches and experience and thus help foster top-quality intellectual activity.

The Joint Centre, only recently set up, is not yet running in top gear despite the new advances achieved over the past year. However, the hopes placed in this undertaking by the Member States can already be said to be justified by attainments, coupled with the fact that the Joint Centre is beginning to play its part in putting European nuclear research on a rational footing.

By definition, the Joint Centre is a permanent institution having its own existence independent of the principal projects entrusted to it. Two of its establishments—Ispra and Petten—are general-purpose institutions, with installations and equipment designed accordingly, to enable them to tackle at once new tasks that arise as activities in hand gradually reach scientific maturity. At Ispra, several research teams are already engaged on circumscribed studies on subjects which could play an important part in subsequent programmes. Study of a pulsed reactor for neutron physics research, development of transformers for direct conversion into electricity of heat generated by a nuclear reactor, these are some of the fields in which Ispra is trying, as yet with limited means, to prepare for the future.

The European Transuranium Institute and the Central Nuclear Measurements Bureau, on the other hand, have a specific purpose expressed clearly in their respective titles. Their activities, focussed not so much on short-range industrial questions, are related rather to continuing, long-term needs.

Although through geographic necessity or the functional requirements of the type of research carried on, the Joint Centre establishments are widely dispersed, they in fact form a coherent whole. There is co-ordination in the elaboration and allocation of programmes and likewise in staff administration and the rotation of research workers among the establishments is beginning to get under way.

*64.* At *Ispra,* the Community was able to start work in 1961, so that a good many of the buildings included in phase one were ready for occupation this year. On the other hand, phase two had to be revised through shortage of funds, accentuated by the rise in building costs. In spite of the Council's decision to allocate certain sums remaining from the first five-year programme to the new construction phase at Ispra, and of a slight increase in Italy's financial contribution, some projects have thus been either restricted or deferred. In its revised form, the second part of the building programme, begun in 1963, will be completed around mid-1964. The buildings and other installations which were in being in 1960 when Euratom took over from the Italian authorities will thus have been increased five-fold. Construction of the ECO critical experiment and installation of its nuclear part are nearing completion. This reactor will go critical a few months later than the date planned at the beginning of 1963. Nevertheless the most outstanding fact has unquestionably been the start made on the ESSOR assembly site, where the reactor is scheduled for criticality early in 1967.

The small appropriations allowed for Ispra to add to its infrastructure will compel that establishment, from 1964 onwards, to call a halt to its extension programme. However, two new buildings—a medium-hot chemistry laboratory and a medical department—figure in the year's programme, which will also include an extension to the existing physical chemistry laboratories. From 1964 onwards, however, maintenance of existing premises (some of them, of less solid construction, due for replacement as from 1968/9) will preponderate over new building.

Operations have been seriously cramped by the general rise in prices which, in Italy, averaged something like 13% over the previous year. While this situation is common to some extent to all the Joint Centre establishments, its effect has been felt especially at the Ispra establishment, 60% of whose budget—excluding staff costs—is spent inside the country. This explains the difficult administrative position regarding personnel and plant which still persists despite some consolidation of work teams.

Work relating to the ORGEL programme absorbed some 60% of the scientific staff, most sections being concerned in it, in particular teams from the reactor physics department and the metallurgy, technology, heat transfer, chemistry and physical chemistry sections.

Besides this main programme, other work on a smaller scale in a number of fields scheduled in the five-year programme has been carried out, principally under contract. It includes research in the field of proven-type reactors, advanced gas reactors, fast reactors, irradiated fuel processing, waste processing and biology.

Furthermore, certain research units have begun project studies (like SORA) which, in present conditions as to appropriations and recruitment, can only be continued at the expense of present programme targets. Nevertheless they will enable the relevant sections to put forward technically sound and accurately budgeted proposals.

The Ispra 1 reactor, which was transferred to the Community in March 1963, has been used for numerous neutron physics experiments, while various teams have been engaged on problems of reactor shielding and safety or studies of the irradiation behaviour of nuclear materials.

Activities of the Scientific Data Processing Centre (CETIS) continued along the lines indicated in previous reports. Through the co-operation of reactor physicists, mathematicians and CETIS experts, it has been possible to make a start in setting up a European nuclear code library which OECD has just decided shall be located at Ispra.

To conclude this brief review, further work on the development of nuclear heat thermionic converters has yielded good results even though the team engaged on it is small and the budget very modest.

While at Ispra the most pressing infrastructure needs have been met, the large-scale building activity proceeding at Geel, Karlsruhe and Petten is the normal sequel to a period of programme studies pursued by the relevant departments from the moment the agreements setting up these institutions were signed.

*65.* At *Geel,* the highlight has been the completion of the building to house the Van de Graaff accelerator and the bringing into service of this device which, after a period of adjustment, now exactly corresponds to the specifications laid down. The Central Nuclear Measurements Bureau thus possesses an important instrument well suited to the operations planned, the first of which was commenced at once. The linear accelerator building is likewise finished and the installation is being assembled. If all goes well, the accelerator will come into service this summer. Besides this, two new laboratories

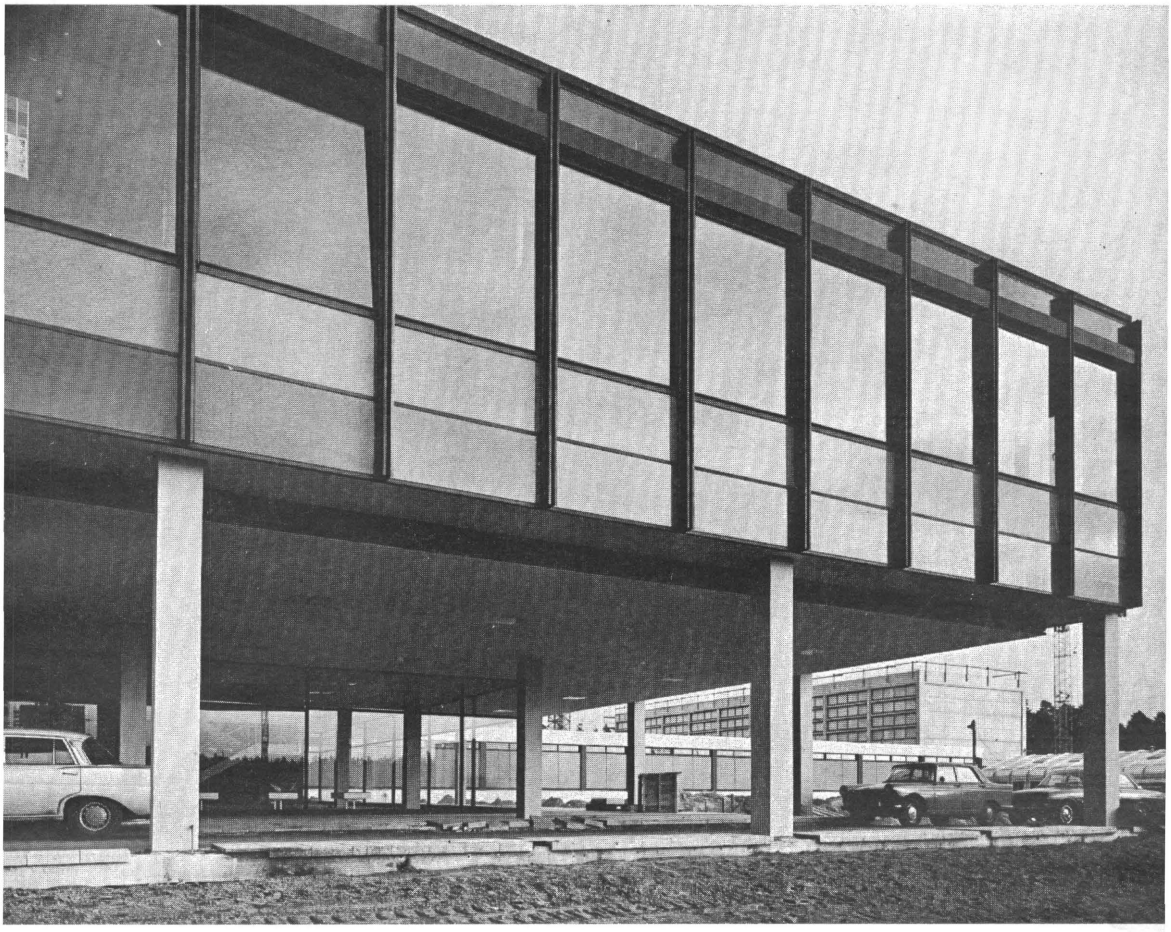
for mass spectrometry and sample preparation are nearly ready and the staff will move in during April.

66. *Karlsruhe* has been the scene of the biggest civil engineering works. Construction of the five wings of the complex has gone ahead, although phased to allow of more rational employment of resources. The first wing was completed right at the end of the year, while work on other parts of the complex has proceeded in line with the original schedule.

67. At the *Petten* establishment—the most recent of all—two buildings to house the first laboratories and some offices have been completed at the same time as a small technology hall. Work on a second, larger, technology hall started recently, to be followed in a few months by the preliminary work for the construction of a cold laboratory and a laboratory for handling medium-active substances. An addition will be made to the HFR materials testing reactor in the form of a dismantling cell, construction of which is nearing completion at the factory.

The Petten establishment was of course set up too recently for scientific results to be forthcoming yet. Work has centred on operation of the HFR reactor which functioned smoothly throughout the year. Alongside this operational research, however, studies have been launched to improve experimental conditions in this reactor, notably by the development of appropriate irradiation devices. In the high temperature field in which Petten is to become active as its installations take shape, a first item was the design and construction of a molten-salt test loop. This loop, which will be installed at Delft in collaboration with Delft University will enable research workers to familiarize themselves with the technology of molten salts which are so promising as nuclear fuels in the liquid state, or as heat transfer agents for certain high temperature applications, or again as a chemical medium for irradiated fuel reprocessing.

68. General infrastructure works have been continued at all establishments-roads, power and water supplies, mains and pipes, etc. Posting of personnel largely depends on availability of premises. No doubt staff can be recruited and posted to training courses, pending the completion of buildings, but such a policy is only justified if there are few limitations on recruitment, which is far from being the case. Hence the main effort has been devoted to establishments which already have premises, namely Ispra and Geel. Difficulties encountered stem from a variety of causes, chief among them being the shortage of good applicants, the fact that Community salaries have not by a long way kept pace with the rise observed in both private



*Karlsruhe (Germany) — European Transuranium Institute.*

industry and national nuclear research agencies, whether public or private, and the requirements of the Service Regulations which stipulate procedures that do not make for speed in the recruitment of outstanding candidates, who are thus able to choose at leisure from a variety of offers.

Scientific output has grown considerably, as can be seen from the list of published reports, and while it is to soon to say that "cruising speed" has been reached, the evidence of symposia and congresses does testify to the fact that the scientific output of the Joint Centre is beginning to be appreciated in the nuclear world.

## II. Contracts

*69.* In order to stimulate nuclear research in Europe, the Commission must make the best use of existing capacity, stimulate the accumulation of experience and know-how and ensure the balanced development of research potential in the Community. Apart from their specific value in creating scientific knowledge, the contracts and associations concluded in pursuance of the research programme largely coincide with the objectives. Consequently the Commission must select its partners carefully. At the same time it must allocate its contracts in such a way as to ensure a due measure of balanced regional development. For this reason, Euratom gives the widest possible publicity to its periodic announcements regarding the fields in which research work will be carried out in whole or in part by way of contracts. All those interested—industries, universities and public or private research laboratories—are thus enabled to submit proposals to the Commission on equal terms and to discuss with it the conditions of their participation in certain programmes. This procedure elicits numerous applications so that all the possibilities open at any given moment in the Community can be explored simultaneously and the most suitable candidates chosen for the award of contracts.

A notice published in the Journal Officiel of the Communities on 1 December 1962 invited interested bodies and institutes to submit proposals for research in a number of fields embracing, in fact, most of the activities covered by the second five-year programme. A second was published on 28 July 1963 concerning radioactive waste processing and storage. Although in each instance a closing date was set for the submission of proposals, it was nevertheless provided that further offers might be considered at a later date, depending on programme requirements and resources available.

There were 652 replies in 1963 to the first notice, mostly in the shape of firm proposals. A breakdown of the figures yields a number of findings of general import, namely:

*a.* Proposals in connection with reactor development account for slightly more than half the total number (22% for ORGEL, 20% for proven-type light water reactors and 13% for proven-type gas/graphite reactors). Next come health and safety and biology with 11%. Other fields—computation and machine documentation, technical and economic studies, industrial uses of radioisotopes, research on radioisotopes, and direct conversion—each represent about 5% of the proposals.

*b.* Industry, with some 57% of the proposals, is well ahead of other parties involved, viz. State institutions and universities and research institutes 17.5% and 14.5% respectively.

*c.* The breakdown according to country is as follows:

| | |
|---|---|
| France | 42% |
| Germany | 23% |
| Italy | 17% |
| Belgium and the Netherlands | 8% each |
| Luxembourg | 2% |

*d.* Lastly, it is noteworthy that nearly half the proposals were from bodies which had had no previous contractual relations with Euratom.

The notice concerning radioactive waste processing and storage had elicited 28 research proposals by the end of the year. This being only a provisional figure, it is not included in the above statistics.

In examining the proposals, account is taken of the general programme in view, of their respective merits and of the financial resources available under the budget. A procedure ensuring all applicants equal access to information is followed for establishing technical contacts so as to define future contractors' programmes and enable proposals relating to similar objectives to be grouped. This work, to be continued in 1964, has already afforded the Commission the possibility of selecting its partners in many fields and of concluding contracts.

The mass of proposals, which cannot be examined in isolation, has certainly meant a slight slackening in the rate of conclusion of new contracts as compared with the previous year. Nevertheless 86 research contracts and 6 contracts of association were concluded in 1963 to a tune of 36.6 million EMA u.a. (excluding the share of the partners in the associations). To this has to be added a commitment of 3,380,000 EMA u.a. resulting from additional financial clauses to earlier contracts. Under the policy adopted by the Community in 1961, a sum of 13 million EMA u.a. from the first five-year programme has been assigned to provide for Euratom participation in the construction of two new power reactors (the SEP power plant in the Nether-

lands and the KRB in Federal Germany). Finally, contracts have been signed, following invitations to tender, for a total of approximately 15.5 million EMA u.a. for construction, supplies and services.

## III. DISSEMINATION OF INFORMATION

*70.* To provide for the dissemination of scientific and technical information, the Commission is constantly developing the resources of its Information and Documentation Centre (CID). The capacities of the Centre are progressively being placed at the disposal of research workers and industrialists in the Community. It has a twofold function: first to serve as a channel for passing the results of research undertaken by the Community to possible users, and second to inform research organizations and industry as fully and rapidly as possible on the status of technical advance.

To circulate the results of the Community's research programme, the CID in 1963 established procedures for the distribution of "Communications" (limited distribution documents) to Member States, persons and enterprises in the Community. Specifically, the six national correspondents responsible for dissemination of information were appointed and took up their duties. Moreover, in view of the growing number of the Commission's scientific and technical publications, it has proved necessary to issue a new periodical—*Euratom Information*—to facilitate access to them. The first number appeared in 1963. This review gives an account, in the form of abstracts, reports and articles, of the publication of research results, the broad outlines of the programme and the subject of contracts signed and patents granted.

To make the ever increasing mass of scientific and technical information on nuclear matters more readily available in full detail, an electronic computer was set up in October 1963 to store data for automatic selection. To this end 85,000 items have already been coded. As soon as the volume of coded data programmed is enough for the electronic memory to feed back sufficiently exhaustive bibliographical selections, this automatic documentation service will be available to Community research workers and industries. Furthermore, two important contracts have been concluded to improve data selection in two particular specialist fields and to arrange publication of the data selected. The first of these contracts relates to nuclear medicine and its special object is the publication of a new series by the *Excerpta Medica* Foundation, a bibliographical journal dealing with medical matters. The second contract concerns nuclear patents and, *inter alia* the extension of the review *La Propriété industrielle nucléaire* (Nuclear Industrial Property). Together with the *Transatom Bulletin,* giving information on documents translated

from Slavonic or oriental languages, these publications will help to put document selection on a more systematic basis through their wide circulation, they will enhance the chances of utilization of scientific or technical data, published but often unnoticed by potential users, while reducing the risks of unintentional duplication.

## IV. TRAINING AND INSTRUCTION

*71.* The upsurge of nuclear industry is indissolubly linked with the training of experts in all branches involving the use of nuclear energy. The number of research workers and technicians required in research laboratories, too, is growing at a pace which can no longer be matched by the numbers of graduates. Indeed, in science, a general trend towards greater specialization is being witnessed as the volume of work increases. At the same time, scientific progress accentuates the interdependence of branches of knowledge formerly self-contained, and frequently calls for a research worker having several specialties at his fingertips. So the efforts which today all countries are applying to encourage people to take up scientific careers are in no way surprising. Notwithstanding the widespread belief to the contrary, nuclear science does not to any extent call for basic instruction specifically different in kind from that given in traditional faculties of science. On the other hand, the chemist, metallurgist or mathematician seeking a career in nucleonics must be able to follow up his general instruction either by post-graduate courses or by a period of training in industry or a nuclear research centre.

### 1. *On-the-job training*

*72.* To help in achieving this aim, the Commission has, for more than three years, been arranging training courses at nuclear research centres in the Community for advanced students. The principles of this scheme, as set out in previous reports, have not changed—the only difference being that the monthly allowance to participants has been adjusted to the current rates practised by other establishments operating a similar system. However, the number of places—406 applications accepted—is about 60% up on the previous year. While to a large extent the candidates have been assigned to national research centres, the proportion going to Euratom establishments has risen appreciably, with 39% for Ispra and 2% for the CNMB. The Commission hopes that the start-up of particle accelerators, which are first-rate instruments for the training of nuclear physicists, will shortly permit the CNMB to take on a large number of trainees.

The position is not nearly so favourable in respect of vacancies for research workers. Owing to cuts in the appropriation made by the Council, the Commission had drastically to reduce the intake of visiting scientists at its Joint Centre to 40 for a full year (against 80 in 1962). The continued operation of the scheme on this restricted scale was made possible by using the balance of the credits carried over from the previous year. With the adoption of the 1964 budget in which a sum of 90,000 EMA u.a. is earmarked for this category of course, the situation has been somewhat restored. It has, moveover, been adapted to the new needs attested by the growing interest of national bodies in Joint Centre activities and in the setting up of nuclear power plants in the Community. Henceforward, the scheme will in principle be reserved for qualified personnel who will be assigned to Euratom centres on request by research centres or industrial enterprises. Such personnel will continue to belong to their parent enterprise and return to it at the conclusion of their assignment. As the training will be done primarily in the interest of the parent enterprise, it will be for the latter to pay the applicant's monthly salary, Euratom's share being confined to an allowance for posting away from home and reimbursement of travelling expenses. More liberal arrangements, under which Euratom may assume the entire costs, are provided for in respect of non-Member countries whose technical development is as yet not very advanced.

The power reactor participation programme likewise makes provision for the training of engineers both from Euratom and from other bodies in the Community. Under agreements with power plant operators the Commission can simultaneously second ten engineers to each plant, where they may either merely keep track of the day-to-day activities of the work teams or, in cases where the partner agrees, form part of such teams. Besides Euratom personnel, some sixty engineers and ten student trainees have been seconded to the power plants constructed by SIMEA and SENN and have in particular taken part in the start-up trials of these installations. This scheme has been fully vindicated by the wide degree of interest evoked and the quality of the final reports submitted.

### 2. *Grants*

*73.* By way of backing up these activities, the Commission decided, towards the end of the year, to institute a system of grants to encourage nuclear science careers. A notice issued in the Journal Officiel of the Communities on 21 January 1964 called for candidates to submit their names. These grants will enable young research workers, graduates reading for their doctorate, and teachers in higher education to engage in research in a Community establishment during a period laid down in line with the purpose of the research. The appropriation earmarked under this heading will enable the

Commission to provide about 35 grants in 1964, for an average period of a year.

### 3. *Instruction*

*74.* The Commission's work in connection with the co-ordination of nuclear science instruction at assistant scientific staff level has continued. With the help of national experts, one basic syllabus and three detailed syllabuses (radiation hygiene, radio-chemistry and use of isotopes) were prepared and published in the form of a report (see doc. EUR 480, vols. I to IV). Two others (nuclear instrumentation and control, reactor technology and operation) are nearly ready.

Without infringing pedagogic freedom in the detailed planning of courses, the Euratom syllabuses will enable specialist schools in the Community to provide a very thorough education, which is kept constantly up to date, to take account of technical developments and is fully appropriate to the requirements of the labour market. Above all, Euratom's action will provide employers with a criterion for comparing diplomas awarded in line with co-ordinated training courses. The Commission will later consider the question of endorsing diplomas issued on the basis of Euratom syllabuses after verification of the conditions of award. This should make it easier for the holders to obtain work and also facilitate the exchange of nuclear technicians within the Community.

*75.* Lastly, the Commission applies itself to the further training of its own scientific and technical staff. By means of temporary assignments and attendance at courses, lectures, conferences and symposia, many research workers have been able to add to their scientific knowledge, receive training in an extended field or compare their own work with what is being done elsewhere. In 1963 some forty scientific officers carried out long-term assignments in laboratories working on such advanced subjects as plutonium technology, advanced reactor design, or certain aspects of biology.

CHAPTER VI

# EXTERNAL RELATIONS

*76.* While Euratom's external relations continued to develop smoothly and satisfactorily over the past year, two points deserve special mention.

First of these is the sustained vitality of the relationship between Euratom and its oldest partners, the United States and Great Britain. Development of the power reactor programme in the Community and a year of energetic activity by Euratom in the fast reactor field suggested fresh possibilities for mutually profitable extension of co-operation with these two countries. On both sides the opportunity was seized at once, to such good purpose that 1963 marked the beginning of a trend which has already led, or promises in the very near future to lead, to a further strengthening of western co-operation in the matter of peaceful uses of nuclear energy.

Secondly, on the domestic plane there was an important new event for Euratom, namely the opening of a general dialogue between the Council of Ministers and the Commission, in which the European Parliament was anxious to take part, on the Community's external relations. There is nothing abstract or theoretical about the purpose of the debate; on the contrary, the aims are quite concrete. For as the Community grows in internal dynamism and develops as a magnetic force vis-à-vis non-Member countries, new situations, essentially political in character, are emerging in external relations. In this connection, the problems raised by the implementation of Articles 103 and 104 of the Treaty call for particular mention. The common task of the institutions concerned now is to find methods of dealing with such situations; the Commission for its part has from the outset indicated its wish to arrive at practical solutions consonant in each case with the spirit of the Treaty.

*77.* Two different trends have given rise to the present state of affairs. Within the Community, the last few years have seen a growing interpenetration between Euratom research and similar activities conducted by Member States; hence the knowledge which is the principal object of Euratom's external relations has increasingly become the common property of the Community and the Member States. Simultaneously, the Community has been sought out as partner by an increasing number of countries. Thus occasions when, in entering into a commitment towards a non-Community country,

a Member State may commit the Community, and vice versa, have increased. As this trend develops the Commission remains highly aware of what is the respective province under the Treaty of Community institutions, Member States and nationals of the Member States (whether individuals or enterprises) in the matter of external relations. In the same way it has no intention of challenging the fact that any particular Member State need on occasion invoke interests or dictates of policy which are its own affair and concern neither the other Member States nor the Community. But the Commission also insists on the fact that the end purpose laid down by the Treaty in this respect is the establishment of external relations by the Community as a whole. Accordingly, the Commission deems it desirable to institute a mutual consultation procedure between the representatives of Member States and itself, by which the nature of the interests at issue could be determined before any action is taken on either side vis-à-vis the outside world. The Treaty would seem to imply that where these interests appear to be Community interests, the Community should be responsible for defending them and acting on behalf of the Member States. This solution indeed seems to be only one which fully complies with the principle of equality between Member States, a principle which is itself central to the Community spirit.

Thus it will be seen that the Commission wants the matter to be treated as one of Community solidarity; it hopes that in this way it will be possible to solve the problems which arise in a manner acceptable to all concerned.

## I. Relations with non-member States

### 1. *Countries with which Euratom has concluded co-operation agreements:*

*78. a.* While implementation of the successive agreements concluded between Euratom and the United States continued along normal lines, an amendment to the Supplementary Agreement of 1960 was signed with the Government of that country on 22 August 1963, dealing mainly with problems of special fissile material supplies. As will be remembered, by virtue of the agreements concluded with Euratom in 1958, 1960 and 1962, the United States makes available to the Community, for its own use or for use by enterprises established in the Community, certain quantities of special fissile materials to be used in power reactors or under the Community's research programmes. The latest amendment permits the United States Atomic Energy Commission to make additional quantities of U-235 available to the Community as and when authorized by American legislation and agreed between the Parties. Moreover, the amendment of 22 August 1963 extends until

*Front entrance of the European School, Luxembourg.*

1995 the term of the Supplementary Agreement at present valid until 1985. The reason for the date 1985 lay in the need to supply, for a period of twenty years, reactors expected to go critical up to 31 December 1965. Provision is now made for fuelling reactors which reach criticality after that date. At the same time, the USAEC is now prepared to conclude contracts for twenty-five instead of twenty years. The new clause in the Euratom/United States agreements which permit the USAEC to make additional quantities of U-235 available to the Community was found to be necessary for fuelling new reactors projected in the Community, such as the Italian SELNI, the Netherlands SEP, the German AVR reactors, etc. It will also enable the Community to receive additional quantities of U-235 for the fabrication of fuel elements for export, or to reprocess in the Community U-235 fuel elements from non-member as well as Member States. In short, this amendment does not alter the terms of supply prescribed in the earlier US/Euratom agreements; it provides the USAEC with the requisite legal basis for replenishing the stocks needed under these agreements within the limits authorized by American legislation.

*79. b.* Following the suspension of the negotiations on the United Kingdom's application to join the Community, the Continuing Committee for Euratom/United Kingdom Co-operation, meeting at Ispra in May 1963, gave fresh impetus to the collaboration maintained under the 1959 Agreement. Ways and means of strenthening this co-operation have been canvassed and some have already been put into practice. The fundamental objective is a constant two-way traffic in information dealing with the development of certain research programmes, as well as projects for co-operation in the fields of fast reactors, biology and radioisotopes. With respect to supplies, an important contract has been concluded providing for the delivery of plutonium by the UKAEA for the first half of the initial core of the RAPSODIE fast reactor, administered under a contract of association between Euratom and the CEA. At the same time, negotiations went on throughout 1963 with a view to the possible reprocessing in England of irradiated fuels from the BR 2 and HFR reactors. Similarly, the mutual exchange of information on the expected trend in energy prices continued. Lastly, there were numerous meetings and visits, affording scientific and technical staff on both sides an opportunity to acquaint themselves with different aspects of the UKAEA and Euratom programmes. A large British team is still working at the BR 2 reactor jointly administered by Euratom and the Belgian CEN, and individual scientists from both sides have been assigned to various research installations in the Community and the United Kingdom.

*80. c.* Implementation of the co-operation agreements with Canada, notably the Technical Agreement between the Commission and Atomic Energy of

Canada Limited, progressed satisfactorily during the year under review. This co-operation relates to heavy water reactors and in particular to the ORGEL type, and since 1962 the USAEC has been taking part in the annual meetings held by the Joint Board concerned with the carrying out of the Euratom/ Canada Agreement and in the exchanges of information which constitute one of the main features of this collaboration scheme.

*81. d.* Although the Co-operation Agreement concluded between Euratom and Brazil has still not been ratified by that country, Euratom nevertheless began in 1963 to receive a number of Brazilian trainees who spent a year at the Joint Research Centre establishment at Ispra. Future possibilities for implementation of the agreement were touched on by the Chairman of the Brazilian Nuclear Energy Commission, Professor Marcello Damy de Souza Santos, when he visited the Euratom Commission in July 1963.

*82. e.* The Co-operation Agreement between Euratom and the Argentine signed in September 1962 entered into force on 6 November 1963. It will be recalled that in February 1963 talks were started in Brussels between the Commission and Admiral Oscar A. Quihillalt, Chairman of the Argentine National Atomic Energy Commission, on ways and means of implementing the agreement (see Sixth General Report). These conversations have continued.

### 2. *Other countries*

*83.* On several occasions recently the Commission has come up against the fact that it has not the means to engage in even smallscale activities which might reasonably be expected of it by those outside the Community. This state of affairs has to be stressed, for in the long run it might give rise to doubts in some non-member countries as to the Community's readiness to co-operate and as to the openness of its constitution.

*a.* As regards Japan, the proposals for co-operation placed before the Commission in 1962 by the Japanese authorities have been very carefully studied by the Commission's departments. A draft arrangement for co-operation in the exchange of information is currently under examination.

*b.* In September 1963 a Swedish Government delegation headed by Mr. Gunnar Lange, Minister of Industry and Trade, paid an official visit to the Commission. This visit was made in return to that paid by the Commission to Sweden in 1962 and was the occasion of an exchange of information on atomic developments in Sweden and in the Community in spheres of mutual interest. It also afforded the Swedish delegation an opportunity of on-the-spot observation of Community programmes, activities

and achievements by means of visits to the Belgian CEN at Mol, the Central Nuclear Measurements Bureau at Geel, and to Ispra.

*c.* At the invitation of the Norwegian Government, the Euratom Commission made an official visit in November 1963 to Norway, where it was received by Foreign Minister Helvard Lange. While in Norway, the Commission visited the Research Centre of the Institutt for Atomenergi at Kjeller, where it also met Members of the Norwegian Council for Atomic Energy, and the electrochemical enterprise Norsk Hydro at Rjukan and in particular the heavy water production plant.

*84. d.* There is nothing fresh to report regarding the Commission's relations over the year just ended with newly-developing African countries; working contacts were maintained between the Commission and the Afro-Malagasy Organization for Economic Cooperation (OAMCE).

### 3. *Missions accredited to Euratom*

*85.* Ireland, Upper Volta and the United States of Brazil have accredited missions to the Community, bringing the number of non-member countries now maintaining diplomatic relations with Euratom to twenty.

## II. Relations with international organizations

*86. 1.* Euratom again participated actively in the work of both the Organization for Economic Co-operation and Development (OECD) and the European Nuclear Energy Agency (ENEA).

It continued to co-operate with OECD on radiological protection and in the realm of science and energy production. In addition, Mr. Sassen, a Member of the Commission, represented it at the meeting of Ministers in charge of scientific affairs in the OECD countries, held in Paris on 3-4 October 1963.

Meanwhile, within the context of the ENEA, the implementation of the DRAGON and HALDEN agreements proceeded smoothly. Another point worthy of note is that the Steering Committee of ENEA, at its 24th session held in Paris on 27 November 1963, decided on the establishment of a European library of nuclear computer programmes. Having decided in principle that this should be set up at Ispra, the Steering Committee instructed the Director-General of the ENEA to negotiate an agreement with the Euratom Commission on the subject. These negotiations are now in progress. One reason why the ENEA chose Ispra was the existence of CETIS (Scientific

Data Processing Centre) at that establishment of the Euratom Joint Research Centre.

*87.* *2.* As in previous years, the Commission was represented, at the invitation of the Board of Governors, at the General Conference of the International Atomic Energy Agency (IAEA) (Seventh Ordinary Session, Vienna, 24 September - 2 October 1963).

The competent departments of the Commission and the Agency Secretariat likewise maintained frequent working contacts in an ever wider variety of fields; but it was again apparent that the absence of formal relations between Euratom and the Agency too often inhibits more extensive contacts and the institution of organized co-operation in one or other sector of common interest, valuable though this would be to both parties. The Commission hopes that a solution may before long be found to this problem, which is purely a political one.

*88.* *3.* It will also be recalled that since 1960 the Commission has been in regular though informal contact with the Inter-American Nuclear Energy Commission (IANEC).

The IANEC felt it would be useful to put relations on a more official footing and forwarded concrete proposals to the Euratom Commission concerning the fields in which closer co-operation could be developed between the two parties and methods to that end.

This led to an exchange of letters between IANEC and the Commission in February 1964, setting out questions on which closer collaboration might be established between them, namely: problems of standardization, improvements in teaching, training and research, and dissemination of technical information. Such collaboration might take the form in particular of exchanges of documentation and of experts.

*89.* *4.* The long-standing liaison with the International Labour Organization (ILO) and the World Health Organization (WHO) continued with good effect throughout the year.

*90.* *5.* In the same way, the spirit of co-operation which has always characterized relations between the Euratom Commission and the Council of Europe has continued to be manifest. The joint autumn session of the Consultative Assembly and the European Parliament, before which the Commission expounds its views on current problems, has now become a tradition; and, of course, the various departments of the Commission and of the Council's Secretariat-General maintained close working contacts.

## III. Other activities in the field of external relations and coordination of such activities

*91.* *1.* As has already been noted, the Commission sees no objection to the initiative for the negotiation of an agreement originating in one or other Member State, acting spontaneously because of its special ties with the non-member State concerned, or in a specialist body which, within the general governmental set-up shares in exercising the prerogatives of the public authority in atomic matters.

In this respect, the nature of the interests at issue must, in the Commission's opinion, govern the choice of the appropriate framework in which to conclude the agreement. Conclusion of co-operation agreements affecting the general interests of the Community is a matter for the Institutions set up by the Treaty and there can be no question of circumventing this principle by invoking the juridical character or the special status of a given national body which may sign such an agreement.

In any case, the Commission's constant concern on this point is to avoid any discrimination. Its business is to bring out the value to the Community of the agreement contemplated and, if need be, to move the Council to issue directives. Such then is the issue, as the Commission sees it, raised by the conclusion of such agreements; it is one of the principal problems submitted to the Council by the Commission as part of the current exchange of views between the two institutions concerning the Community's external relations.

*92.* *2.* During the year just ended, several agreements of this kind have been communicated to the Commission as shown in the following list: French Atomic Energy Commission (CEA)/Pakistan Atomic Energy Commission; French CEA/Argentine National Atomic Energy Commission; Italian Atomic Energy Commission (CNEN)/Polish Atomic Energy Commission; Belgian CEA/Pakistan Atomic Energy Commission.

In the last two cases, the Belgian CEA and the Italian CNEN respectively have undertaken to communicate to the Commission for distribution within the Community all scientific and technical information exchanged under the said agreements. The Belgian CEA/Pakistan AEC agreement indeed provides that it shall be carried out within the framework of a general agreement for co-operation between the competent Pakistani authorities and the European Atomic Energy Community in the event that such an agreement shall be concluded, and that in any case any information which the Belgian CEA may receive under the terms of Article 6 of the agreement may be freely communicated to the Euratom Commission.

As to agreements concluded in previous years in like conditions by Member States and mentioned in earlier General Reports, information deriving from their implementation continued to be communicated to the Commission, which passed it on to the Member States.

# THE INSTITUTIONS OF THE COMMUNITY AND INTER-EXECUTIVE COOPERATION

## I. 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.

*93.* At its constituent session in March 1963, the Parliament re-elected Mr. Gaetano Martino as President. A predominant feature of this session was a debate on the report of the EEC Commission on the status of the negotiations with Great Britain. At its close, the Parliament adopted a resolution confirming its desire to see Great Britain and other countries join the European Community. During the same session, the Parliament adopted a resolution concerning the procedure for preparing reports on the general reports of the three Executives, and heard the reply from the three Executives to an oral question dealing with the long-term energy policy.

*94.* At the May session, the Parliament heard a statement by President Chatenet presenting the Commission's sixth general report.

*95.* The June Parliamentary session was marked by a debate on Euratom's sixth general report, introduced by Mr. Armengaud's report. The Parliament wound up this debate by unanimously adopting a resolution in which it:

Requested that the annual report be presented in such a form as to bring out yet more clearly the political, economic and social problems raised by implementation of the Euratom Treaty, as also the remedies proposed for the difficulties encountered;

Expressed its satisfaction with the Executive's achievements, with particular regard to foreign relations, dissemination of information, research, financial participation in the experimental and power reactor projects, and successes resulting from co-ordination;

Urged upon the Executive that the work of the specialist Community or national firms and organizations be made known as widely and fully as possible to Parliament, press and public opinion;

Insisted on intensified cooperation between the Member States and the bodies specially concerned with nuclear affairs in the Member States on one hand, and Euratom on the other, more especially in the following matters:

— the transmission of information to be furnished to the Executive, as laid down by the Treaty;
— the coordination of Member States' and Euratom research programmes;
— the coordination of the Member States' external relations on one hand, and Euratom's on the other;

Requested Euratom to continue taking an active part in the coordinating policy for energy and for the creation of the corresponding capital goods so that, first, atomic energy may be progressively and smoothly incorporated into the development of Europe's energy requirements and, secondly, the Community may be assured of supplies of raw materials and plant;

Requested the Executive to seek the most appropriate structure for nuclear power-generating enterprises and to report its findings to the Parliament;

Invited the Executive and the Council to make representations to the Governments, in order that the basic standards with regard to health and safety and the implementing regulations may be uniformly applied.

Invited the Executive to draw up concrete proposals for intensifying its activities in the field of training.

Insisted on the need to set up the European University and asked the Executive to state its position clearly with regard to this subject;

Having regard to the vital importance of basic research in the development of nuclear science and its uses, expressed the hope that the Executive would amplify its activities in that direction;

Having regard, moreover, to the close links between nuclear and space science, invited the Executive to extend its activities in this field in conjunction with the already existing European organization;

Expressed anxiety concerning the scant financial resources available under the 2nd plan, considering the volume of credits utilized in the last three years for the 1st plan, the health and safety and biological research work that must be done, the requirements arising out of adjustment to the rapid progress of nuclear science, and the promotion of qualified staff;

Requested the Executive and the Council to consider a periodical adjustment of the appropriations under the 2nd plan, in order to mitigate the continuous rise in costs, either by revising payment credits to a corresponding extent or by devising a new method of Community financing based on the energy consumption curve;

Expressed disquiet over the conditions governing the human and material situation of personnel, scientists in particular, with a view to offsetting the power of attraction exerted by private enterprise or national or foreign organizations, and invited the Council to lend its support to ease the Executive's task of recruiting and keeping high-quality staff;

Requested the Euratom Executive, assuming that the Executives could be merged as the European Parliament has always desired, to see that its industrial and financial purpose is maintained so as to retain its direct action in coordinating and programming projects and tasks of nuclear character.

During the same session, the Parliament heard a statement by the President of the Councils on the work of the Councils and adopted a resolution on cultural cooperation in the Member States of the Community, specifying the fields in which joint European action seems particularly desirable at the cultural level, and also a resolution concerning the prerogatives and powers of the European Parliament. In addition, the Parliament considered a report on a regulation defining the categories of officials and other employees subject to the provisions of Articles 11, 12 and 13 of the Protocols on the Privileges and Immunities of the Communities, and adopted the proposed changes thereto as submitted by its rapporteur.

*96.* In September the Parliament paid tribute to its Honorary President, Robert Schuman, a tribute endorsed by the three Executives.

It adopted a resolution on the draft Euratom supplementary operating and research budgets for 1963, in which it merely took note of the drafts as submitted by the Council.

*97.* The Parliament also held the traditional joint meeting, in September, with the Consultative Assembly of the Council of Europe. This discussion covered the activities of the European Parliament and the three Executives from May 1962 up to April 1963. On this occasion the Commission emphasized certain new aspects and important results of Euratom's work, with particular regard to the carrying out of the second five-year programme, the industrial prospects for nuclear energy and the present status of the Community's foreign relations.

*98.* The October session was mainly devoted to an important debate on the policy for energy as proposed in the Memorandum of 25 June 1962 by the Inter-Executive Group on "Energy". At the close of this debate a resolution was unanimously adopted which considered that the situation brought about by default of the Council of Ministers was incompatible with the responsibility of the European Executives and with their dignity, and invited the

latter to relinquish the task entrusted to them by the Ministers on 5 April 1962, if by 5 April 1964 the Council had failed to take a decision on the proposals which the Executives had submitted to them. During the same session, the Parliament adopted an opinion on proposals designed to revise the Statutes of Service for officials of Euratom and the EEC and to amalgamate the Statutes for officials of the three Communities. This opinion considered that satisfactory revision of the Statute provisions could only be achieved by the concerted action of the three Executives, in close liaison with the other Community institutions, and merely approved the proposed amendments relating exclusively to amalgamation of the Statutes.

*99.* The November session was marked by the customary annual Conference with the Councils of Ministers. In 1963 this bore on the Community's policy towards the great problems of world trade development.

The Parliament paid tribute to the memory of President Kennedy.

It unanimously adopted a resolution on the draft budgets for 1964 and another on the social aspects of the joint energy policy. The first of these resolutions approved the Euratom operating budget, subject to the creation of five new Category A posts, and with regard to the research budget asked that the appropriation for biology be authorized for the amount proposed by the Commission, that a new article entitled "University-level Institution" be inserted in the chapter on training and that the Council review the cuts applied to the appropriations for equipment and investments for the Joint Research Centre. The second resolution regretted that the Memorandum on the joint energy policy paid too little attention to social problems and invited the Executives to submit, as early as possible, concrete proposals to solve this question and to call a conference on the social problems connected with the energy policy.

*100.* During the session of January 1964, the Parliament adopted a resolution on the energy policy in which it again affirmed that the Council's lack of political purposes in this matter constituted a grave threat to the development of the Common Market and warned against the danger of resorting to national measures.

At the close of a debate on Euratom's external relations during which Mr. Krekeler took his leave of the Parliament, a resolution was adopted which stressed the political importance of the part played by Euratom in fulfilling the aims of the Treaty and expressed the hope that the merging of the Executives would be carried out with due respect for the special nature of the Treaty. The Parliament considered that the Community and the Member States must soon bring their external relations into line, by means of mutual

consultation between the Commission and the Member States, and called attention to the series of problems raised by the application of Article 106 of the Treaty and bilateral exploitation of the results of joint research. Lastly, during the January session, in a resolution on regional policy in the EEC the Parliament underlined the importance of the nuclear power plant construction programme and called for better cooperation among the three Executives and wider contacts between the European institutions and the local authorities of Member States.

## II. The Council of ministers

*62nd Session (1 and 2 April 1963)*

*101.* The Council met under the presidency of Mr. Eugène Schaus, Foreign Minister of the Grand Duchy of Luxembourg.

During this session it appointed new members to the Scientific and Technical Committee, on the basis of proposals put forward by the governments of the Member States and approved by the Commission.

The Council also took note of a statement by the Commission on the policy to be followed by the Community with regard to dissemination of information and on the awarding of licences by the Commission to non-member countries and to persons and enterprises established outside the Community. The Council expressed its approval of the content of this statement.

*63rd Session (8, 9 and 10 May 1963)*

*102.* The Council met under the presidency of Mr. Eugène Schaus.

During the session it exonerated the EEC and Euratom Commissions in respect of the implementation of the budgets for 1960 and 1961.

The Council then discussed with the Commissions the questions of budgetary procedure raised by the observations of the European Parliament on this subject. At the close of these discussions the Council agreed to take a certain number of steps to improve and speed up this procedure in future.

*64th Session (30 and 31 May 1963)*

103. The Council met under the presidency of Mr. Eugène Schaus.

It heard a statement by the Commission on the subject of the problems raised by "basic patents" in the context of research contracts and signified its approval of the contents of this statement.

*65th Session (18 June 1963)*

*104.* The Council met under the presidency of Mr. Eugène Schaus.

It approved two draft decisions submitted by the Permanent Representatives' Committee, namely, the decision relating to the setting up of the joint enterprise Kernkraftwerk RWE-Bayernwerk GmbH and that concerning the granting of advantages to, and the communication of certain information by, that enterprise.

*66th Session (10 and 11 July 1963)*

*105.* The Council met under the presidency of Mr. J.M.A.H. Luns Netherlands Foreign Minister.

It approved the text of an amendment to the US/Euratom supplementary agreement and authorized the Commission to sign an agreement with the Americans concerning this amendment, on behalf of the Community.

The Council next adopted a regulation on allowances to be granted to certain Euratom officials to compensate for working conditions of a particularly arduous nature (Article 100 of the Statute of Service).

*67th Session (29 and 30 July 1963)*

*106.* The Council met under the presidency of Mr. J.M.A.H. Luns.

At this session the Council adopted three draft supplementary budgets presented by the Commission, namely:

*a.* Supplementary operating budget for 1963 varying the breakdown of Commission staff for this financial year;

*b.* Supplementary research and investment budget varying the breakdown of staff provided for under the EAEC research and investment budget for 1963;

*c.* Supplementary research and investment budget for 1963 providing for an increase in the appropriations figuring in Chapter 31, to the amount of:
3,922,000 EMA u.a. as new portion authorized in 1963
1,700,000 EMA u.a. as 1963 annual fraction.

These drafts were then forwarded to the Parliament for an opinion.

In addition, the Council agreed during this session to authorize the Commission to extend until 31 December 1963, that is, for three and a half months, the third-party insurance contract which it had earlier taken out to cover the Ispra 1 reactor against risks arising out of the operation of this reactor. It was understood that this extension would be without prejudice to any solution which the Council may adopt after examining the general question of the Community's policy with regard to insurance (this question is still under review).

*68th Session (23 and 24 September 1963)*

*107.* The Council met under the presidency of Mr. L. De Block, Netherlands Secretary of State for Foreign Affairs.

It took note of the fact that the Parliament, at its session of 16 September 1963, proposed no amendments to the draft supplementary budgets drawn up by the Council at its session of 29 and 30 July 1963 and noted that these supplementary budgets were therefore finally adopted.

The Council next heard a statement by the Commission on the Community policy regarding external relations. The Council took note of this statement.

*69th Session (14 and 15 October 1963)*

*108.* The Council met under the presidency of Mr. L. De Block.

During this session it adopted the draft Community operating budget and research and investment budget for 1964.

These budgets were subsequently forwarded to the European Parliament for an opinion.

*71st Session (2 and 3 December 1963)*

*109.* At this session the Council considered what steps should be taken to cover the Community, as from 1 January 1964, against third-party risks in respect of plant for which it is responsible.

In this connection, pending definition of a "Community" policy on insurance, the Council adopted a number of provisional decisions for 1964.

During the same session the Council also adopted the regulation provided for under Article 18 of the Treaty establishing Euratom (regulation concerning the Arbitration Committee).

Lastly, the Council approved the draft regulations concerning the remuneration and social security of employees of Joint Nuclear Research Centre establish-

ments working in Italy and Belgium respectively (rules laid down under Article 94 of the regulation governing the system applicable to "other employees".

*72nd Session (20 and 21 December 1963)*

*110.* The Council met under the presidency of Mr. J.M.A.H. Luns.

At this session it finally adopted the Community research and investment budget for 1964.

*Other activities of the Council*

*111.* During its 63rd session (8, 9 and 10 may 1963) the Council took note of the draft regulations submitted by the EEC and Euratom Commissions, laying down the categories of officials and employees to whom the provisions of Articles 11, 12 sub-paragraph 2, and 13 of the Protocols on the privileges and immunities of the Communities are applicable, and agreed to forward these drafts to the European Parliament and the Court of Justice for their opinions.

The 64th session of the Council (30 and 31 May 1963) was in part devoted to a debate on the EEC and Euratom Commission's proposals for a revised Statute of Service. At the close of this debate the Council decided:

— to forward the proposals to the European Parliament and the Court of Justice for an opinion;

— to state in the accompanying letter that the Council strongly desired to receive an opinion at the earliest opportunity on the problems involved in bringing into line the Statute of Service of the three European Communities.

At its 66th session (10 and 11 July 1963) the Council appointed two new members to the Economic and Social Committee—these were Mrs. Gerda M. Hesse, succeeding Mr. R. Spaethen, and Mr. Marcel Babau, succeeding Mr. Georges Delamarre.

The Council then held discussions with the Commissions on a resolution adopted by the European Parliament during its session of June 1963, concerning the Parliament's prerogatives and powers.

At the end of these discussions the Council agreed to take this matter up again when the EEC and Euratom working programmes were discussed.

The Council next heard a statement by Mr. Rochereau, on behalf of the EEC and Euratom Commissions and the ECSC High Authority, concerning the Communities' information policy. The Council took due note of this statement.

During its 67th session (29 and 30 July 1963) the Council, by qualified majority vote, adopted the regulation on raising the percentage factors applicable to officials' salaries and to pensions (Article 65 of the Statute).

The ECSC Presidents' Committee was informed of this decision and expressed its agreement.

As its 68th session (23 and 24 September 1963) the Council adopted the text of the financial regulations on the drawing up and implementation of the separate parts of the budgets pertaining to the joint institutions.

In addition, it adopted the financial regulations designed to extend to 1963 the financial regulations governing the procedures for rendering and auditing the accounts.

Lastly, the Council held an initial exchange of views with the EEC and Euratom Commissions on the subject of the Communities' information policy.

At the 69th session (14 and 15 October 1963) the Council continued the exchange of views on the Communities' information policy.

At the conclusion of these discussions, the Council agreed to set up Community information bureaux at Geneva and New York.

During the 70th session (4 and 5 November 1963) the Council, after consulting the European Parliament and the Court of Justice, unanimously approved the regulation laying down the categories of officials and employees to whom the provisions of Articles 11, 12 sub-paragraph 2, and 13 of the Protocols on the privileges and immunities of the Communities are applicable.

During its 72nd session (20 and 21 December 1963) the Council examined the draft regulation amending the percentage factors for 1964 applied to officials' salaries and pensions.

This draft regulation had been prepared by the Permanent Representatives' Committee, following proposals put forward by the EEC and Euratom Commissions, in agreement with the ECSC High Authority, in September 1963.

The Council requested its President to confer with the ECSC Presidents' Committee in order to adopt identical decisions on this subject for the ECSC and the Brussels Communities.

## III. The court of justice

*112.* Eleven actions were brought before the Court of Justice against the Commission by private individuals. These actions are still pending.

Furthermore, the Commission was represented in a lawsuit concerning a preliminary ruling, i.e. an interpretation of certain articles of the Protocol on privileges and immunities of the Communities.

## IV. The economic and social committee

*113.* During the session of 24, 25 and 26 March 1963, the Committee heard a statement by Mr. De Groote on Euratom's activity in distributing information on questions of nuclear energy.

On the subject of coordinating energy policies, and in connection with the depositing of the "Memorandum on Energy Policy" the Energy Working Group and the special section for economic problems prepared a draft opinion which was approved by the Committee during the plenary session of 28, 29 and 30 May 1963.

At the session of 28 and 29 October 1963, the Committee issued an opinion on the Commission's proposed directive to revise the Basic Standards relating to the protection of workers and the general public against the hazards of ionizing radiations. Vice-President Medi took this opportunity to explain to the Economic and Social Committee the purpose and effect of the Commission's new directives.

## V. The scientific and technical committee

*114.* The term of office of the members of the Scientific and Technical Committee, appointed by the Council of Ministers for five years, expired on 1st April 1963.

The Council's decision to renew the terms of reference was based on proposals by the governments of the Member States and adopted after consultation with the Commission. The following were appointed members of the Committee for the period 1 April 1963 - 31 March 1968:

MM. Pierre AILLERET, Deputy Director-General, Electricité de France

Professor Arnaldo Maria ANGELINI, Director-General of ENEL (Ente Nazionale per l'Energia Elettrica)

Jean-Jacques BARON, Director of « Applications atomiques » Division of the Pechiney Company, succeeding Mr. Robert GIBRAT

Professor Louis BUGNARD, Director of the Institut National d'Hygiène

Professor Nestore Bernardo CACCIAPUOTI, Director of the Physics Institute at the University of Pisa

Dr. Giulio CESONI, Director of the « Nuclear Energy » Section of the FIAT Company

Professor Willy DEKEYSER, Professor at the University of Ghent

Marcel DE MERRE, Chairman of the Société générale métallurgique, Hoboken

Professor Tito FRANZINI, Professor of Experimental Physics at Leghorn Naval Academy

Professor Wolfgang GENTNER, Director of the Max Planck Institute for Nuclear Physics at Heidelberg (resigning)

Professor Giordano GIACOMELLO, Director of the Nuclear Chemistry Centre, National Research Council (CNR)

Professor Otto HAXEL, Director of the 2nd Institute of Physics at the University of Heidelberg

Roger JULIA, Chairman, Director-General of the Groupement atomique alsacienne atlantique (GAAA), succeeding Mr. GRAND-GEORGE

Professor D.G.H. LATZKO, Professor at the University of Delft, succeeding Professor Cohen

Professor Francis PERRIN, High Commissioner for Atomic Energy

Dr. E.H. Hans REUTER, Chairman of the Supervisory Council of the DEMOG Company (resigning) (1)

Dr. Walter SCHNURR, Director at Karlsruhe Nuclear Studies Centre

Robert STUMPER, President of Luxembourg Scientific Research Centre (resigning)

J.C. VAN REENEN, Chairman of the Rotterdamsche Droogdok Maatschappij N.V.

Professor Josef WENGLER, Chairman of the Reactor Safety Committee

Mr. Reuter having offered his resignation to the Council in December 1963, Mr. Mandel was appointed a member of the Committee for the remainder of the current term of office.

During its meeting of 9 July, the first with the new membership, the Committee appointed its officials for 1963. Mr. Willy Dekeyser was elected Chairman and Mr. Walter Schnurr Vice-Chairman.

(1) By a decision of the Council, Dr. Heinrich Mandel, Member of the Managing Committee of the Rheinisch-Westfälischen Elektrizitätswerk AG, succeeded Mr. Reuter, who resigned.

Among the topics considered by the Scientific and Technical Committee in 1963, mention should be made of plutonium recycling, the development of basic research at the Joint Research Centre establishment at Ispra, irradiated fuel reprocessing in the Community, direct conversion, radioactive waste processing and storage, revision of the Basic Standards and the Commission's policy on distribution of information and documentation.

Lastly, on the occasion of examining the draft Euratom research and investment budget, on which its opinion is traditionally invited, the Committee adopted a series of recommendations expressing its interest in the work going forward on controlled thermonuclear fusion and on the uses of direct conversion for energy and space purposes, in the progress of the ORGEL string, the launching of new basic research programmes envisaged by the Commission, the SORA pulsed source reactor and the question of reactor safety.

## VI. The consultative committee for nuclear research

*115.* During the three meetings it held in 1963, on 4-5 February, 22-23 April and 17-18 July, the Consultative Committee for Nuclear Research considered amongst other matters the problems relating to irradiated-fuel reprocessing, the development of basic research work at Ispra and the nuclear applications of space research.

Whereas the July meeting took place before the annual budget session of the Council of Ministers and so was devoted exclusively, as formerly, to detailed discussion of the Community's research programmes and the corresponding estimates of expenditure drawn up by the Commission for 1964, the two previous meetings, reflecting the same spirit of cooperation and mutual information that marked the inception of the Committee, featured statements on fresh developments in the Member States' programmes and on the new research projects launched in certain specific fields. These statements dealt mainly with those branches of research in which the Commission is starting activities (research on gas reactors) or has so far taken limited action only (irradiated-fuel reprocessing, radioactive effluent processing) or, again, in fields where the budget cuts imposed when the 2nd five-year programme was adopted, make the closest cooperation imperative (biology, health and safety). During this discussion a document from the Commission, giving a balance-sheet and analysis of the national programmes in the same fields, was also examined and the Commission was requested to broaden and give official form to the survey for which Article 5 of the Treaty makes provision, with a view to achieving better coordination and more orderly presentation of the various programmes before the Committee.

## VII. Inter-executive cooperation

### 1. *The Joint Press and Information Service*

*116.* In accordance with the undertaking it gave at the end of 1962 to the EEC and Euratom Councils and the European Parliament, the Board issued a "Memorandum on the Communities' information policy" in June. This memorandum, which was communicated to the competent committees of the European Parliament, demonstrates the need for a joint policy for information on European problems, inside and outside the European Community, analyzes the ways and means available for use in implementing such a policy and describes the respective tasks of the Joint Service and the Official Spokesmen's Groups.

The Councils considered this memorandum at their session of 23-24 September, and at their session of 14-15 October they declared themselves in favour of setting up two new Press and Information Offices, at Geneva and New York, in 1964.

Together with the Official Spokesmen's Groups, the Joint Service has initiated a series of new approaches in its drive to develop working relations with the public and private owners of mass communication media.

The breakdown of its activities, by audience addressed and technical media employed, is as follows:

*Fairs and Exhibitions*

*117.* The Communities participated in nine events in our countries, either directly with an information stand or indirectly by collaboration and technical contribution. In Greece they had a stand at the Salonika Fair, arousing interest among both the eminent and the general public of this recently associated land.

The mobile exhibitions sent round France and Italy proved to be a very good method of popularizing Community activities. The populations of ten provincial towns (Rouen, Angoulême, Limoges, Asnières, Colmar, Châlons-sur-Marne, Chatellerault, Aurillac, Roanne and Dijon) were able to see the French mobile exhibition, which caused general interest. The Italian mobile exhibition, which was on its first tour, visited the towns of Chiavari, Pordenone and Busto Arsizio.

The mobile stands supplied to the Bonn, Hague, Londen and Washington offices and to the Belgian Ministry of National Education continued touring the Federal Republic of Germany, the Netherlands, Great Britain, the United States and Belgium. The Official Spokesman's Group also continued

improving and keeping up to date the permanent Euratom exhibition at the Atomium (Brussels), which, owing to its instructive contents and layout, is increasingly useful as a display of nuclear information and European nuclear activities. In 1963 more than 300,000 people visited this exhibition.

*Publications*

*118.* Eight new pamphlets and two re-issues on the subject of Euratom were published in the four Community languages and in English. The Official Spokesman's Group wrote or published two booklets on the sixth general report and the Ispra establishment and two off-prints from reviews dealing with Euratom, in particular "Neue Technik" and the information page in the Courrier de Madagascar.

The German monthly magazine came into circulation at the beginning of 1963 and adopted a new format towards the end of the year. The English and Italian magazines also changed and considerably improved their format. As to the French magazine, a first step towards organizing sales of the Service's publications in France was taken by substituting a subscribers' card-index for the free index.

Several wall maps are being brought out, together with a new issue of the folder of maps published in 1962.

The Service's book and picture libraries and the documentation and circulation departments continued to expand during the year.

*Radio, Television, Cinema*

*119.* Fast-recording studios were set up in Brussels at the Service's headquarters. Interviews and films of important events and eminent visitors rose in number and technical aid to reporter teams from radio and television organizations was stepped up.

Six joint television programmes were broadcast to the six Community countries and closer cooperation was arranged with radio-broadcasting services, particularly those aimed at the African countries.

The Official Spokesman's Group also produced adaptations of a cartoon film and a film ("Tonbildschau") as well as reproducing and modernizing a number of documentaries.

In order to stimulate interest among amateurs and professionals, various European projects were launched—a European contest for scenario-writers, a European prize for "Filming and Photography for Young People" and a scheme for "European Film Congresses". A working group was formed of producers of films for the young (Eurofilm Junior).

*Workers' and Labour-Union Information*

*120.* Workers and trades unions were kept informed by articles and statements, as well as by some fifty events organized in Community countries. In particular, ten visits to the Euratom headquarters in Brussels provided information on the national and international level to Community organizations of the ICFTU and IFCTU and English trades unionists.

A tour was arranged for ICFTU and IFCTU journalists to visit the various Joint Research Centre installations in the Community countries.

A monthly trades union information bulletin has been published under the title "Notes d'information" and will appear regularly during 1964.

*Information Visits and Lectures*

*121.* 171 groups, comprising some 1800 persons from the Community and other countries, were received at Euratom headquarters in Brussels during 1963. A number of visits were also organized for journalists, to the Euratom Joint Research Centre establishments and several national centres.

*Information to universities, youth, adult education*

*122.* In order to learn more about the extent of research into the progress of integration and Community activities, the Communities cooperated in the survey carried out by the European Community, Institute for University Studies in member countries, Great Britain and Switzerland.

It emerged from this survey that the Communities are an important focus for research workers, and also that the universities are spontaneously adjusting to the new European era. Furthermore the survey provided a more accurate estimate of the growing need in university circles for highly specialized and advanced information.

## 2. *The Statistics Office of the European Communities*

*123.* The Board of the Statistics Office met on 1 February and 2 July 1963 to review the Office's programme of work and consider problems of budgeting, of adjusting careers under the future unified Statute of Service for officials of the three Communities, and of filling posts.

The Conference of Directors-General of the national Statistics Offices met on 26/27 February and 17/18 October. At the first meeting the Conference discussed the programme of work for the Statistics Office and the various national offices, for 1964 and subsequent years. The second meeting, held in

Athens, dealt more especially with Greece's statistical problems and with the necessary arrangements for collaboration between the Statistics Offices of Greece and of the European Communities. In the course of those two meetings certain problems of a special nature were likewise examined, such as surveys; the possible scope and limits within which Community statistics can be brought into line; standardizing the national accounts of the six Member States; the consequences of the EEC Action Programme during the second stage and the expediency of creating a statistical programme.

The last of these topics was also examined and discussed by an ad hoc working group of legal experts which met in Brussels on 13 February 1963 to work out a legal basis which would entitle the Community Statistics Office to ask the national Statistics Offices for the detailed information it needs in order to draw up comparable Community statistics. This is an important question which needs careful handling and is still being studied.

The Statistics Office, as such, has continued carrying out its own programme. As a joint service, it has been active in all the various sectors that concern the three Communities. With reference more especially to Euratom, the specialist departments of the Statistics Office have received constant enquiries from various Euratom directorates, on energy questions in particular. The Statistics Office has pursued its efforts to establish Community-scale overall energy balance-sheets. At the present time annual and quarterly balance-sheets for each energy source are kept regularly up to date, in sufficient detail to form sound working bases, from 1958 onwards, for medium-term orientation of the nuclear and conventional energy policy and for short-term quarterly estimates of energy requirements. Electricity statistics, in particular, are thoroughly detailed, both for fuel consumption in power plants and for area electricity consumption.

As to nuclear statistics, the Office has furnished data for an economic survey of the radioisotope market. In addition, it has assisted in analyzing and interpreting replies to the market survey questionnaire sent out by the Euratom Supply Agency.

### 3. *The Joint Legal Service of the European Executives*

*124.* The Joint Legal Service is sub-divided into three branches, each handling the work that relates to its own Executive. Under these conditions—unchanged since 1958—The Euratom branch of the Legal Service carried on its work in 1963. Since it forms part of a joint service, it maintained very close liaison with the High Authority and EEC Commission branches, in order to ensure that the opinions issued on the numerous matters of common interest were properly harmonized.

The number of legal experts specially assigned to study matters pertaining to the Euratom Commission has stood at ten since 1958. During the initial period they dealt mainly with listing and studying the facilities with which the Treaty provided the Commission to enable it to perform its task and to organize its implementation. Subsequently, their work tended more towards the accurate definition and solution of the legal problems that arose as the Community developed its activities, and they were also occupied with the few lawsuits that ensued. The Legal Service is responsible for keeping check on the legality of the actions of the Commission's various departments and establishments, and is therefore closely associated with all the Institution's activities. It is likewise called upon to uphold such actions when their legality is challenged by individuals or groups outside the Institution in respect of whom the Commission either exercises certain prerogatives of public authority or is bound by contract.

The following list gives an idea of some of the subjects which have particularly engaged the attention of the Legal Service in the past year:

— Working out a policy for the distribution of information based on the provisions of the Treaty;
— launching the Research Centre establishments and ironing out the many difficulties—especially those due to conflicting laws—which ensued when these set up in the various Member States;
— preparing sundry agreements between the Commission and non-member countries, more especially with reference to the supply of fissile materials;
— negotiating and concluding a great number of research contracts, dealing with legal problems connected with their execution, and settling various legal actions out of court;
— helping to draft the international conventions on third-party liability for nuclear damage;
— studying questions affecting the Institutions;
— studying numerous internal administrative matters such as implementation of the Statute, budgetary and other questions.

Eleven actions against the Commission were brought before the Court of Justice in 1963. Throughout both written proceedings and hearings the Commission is represented entirely by members of the Legal Service.

### 4. *Inter-Executive Cooperation on Energy.*

*125.* At a restricted meeting of Ministers responsible for energy questions, held in Rome on 5 April 1962, the three-Community Inter-Executive Group on "Energy" was instructed to draft at an early date a joint energy policy proposal, as detailed and complete as possible, to be based on the general

directives laid down by the Ministers. The Group therefore prepared a "Memorandum on Energy Policy" which was submitted to the ECSC Council of Ministers on 25 June 1962. This document, which constitutes the first rough outline of a true energy policy for the European Community, was examined and debated at several sessions of the Council of Ministers in 1962 and 1963. Having failed to reach agreement on either the principles of the memorandum or any alternative solution, the ECSC Council of Ministers decided on 2 May 1963, to set up a special "Energy Policy" Committee. This committee, also known as the "Comité des chefs de file", is composed of high officials representing the Member States and the three Executives. Its task was to report back to the Council, before 31 October 1963, on the principles, practical measures and priorities best calculated to solve the Community's energy problems and the difficulties besetting the gradual implementation of a joint energy policy. In reaching its conclusions it was to bear in mind the Memorandum on Energy Policy drawn up by the three Executives in June 1962 and the standpoints adopted by the Ministers during the Council debates.

Apart from a technical report drawn up by a sub-committee, which includes an appreciation of the basic factors contained in the "Review of Long-term Energy Prospects" prepared by the Inter-Executive Group, the "Comité des chefs de file" submitted to the Council a "draft resolution" proposing certain measures for coordination in the energy sector.

On 3 December 1963, the ECSC found itself unable to accept this draft resolution. Moreover, the Brussels Commissions had on their side expressed serious reservations, since they considered that this draft made little advance towards a joint energy policy. Fresh instructions were given to the "Comité des chefs de file" to put forward proposals in keeping with the Memorandum and the draft resolution.

Since then the High Authority, perceiving that divergent national measures are being taken or contemplated with regard to assistance to the coal industry, has considered it advisable to formulate a new draft resolution which it presented at a meeting of the Inter-Executive "Energy" Group on 4 February last. The Brussels Commissions made certain comments and asked the High Authority to concentrate mainly on solutions to the coal industry's difficulties and to make it clear that this draft did not actually constitute a definition of the joint energy policy. It was this new version that President Del Bo put before the Member States during visits to the six capitals.

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