BACKGROUND INFORMATION

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BACKGROUND NOTE

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EUROPE ENERGIZES RESEARCH

Energy and environmental protection, two issues of increasing importance in the European Community, are the major focus for the 1977 - 80 program of the Community's Joint Research Center. The 346 million unit of account program (over $400 million) will be carried out at the four JRC research institutes at Ispra, Italy; Petten, the Netherlands; Geel, Belgium, and Karlsruhe, Germany.

Another part of the Community's R & D activity, about $150 million per year, involves the co-funding of specific research projects in the scientific institutes and industries of the member states to achieve coordination and unify as far as possible European R & D.

The four - year JRC program will include 10 major lines of research. It was accepted by the research ministers of the nine European Community member nations earlier this year, but only finally approved this month after Britain withdrew its budgetary objections.

The JRC energy research is part of the Community's overall energy strategy and will be, in great part, concerned with aspects of nuclear safety, a subject that arouses keen public interest in all the member countries. One of the objectives will be to improve the safety of light - water reactors and liquid metal fastbreeder reactors by studying the phenomena associated with simulated accidents, by improving the assessment of reliability and risk and by measures to prevent the failure of reactor components.

The environmental research will include the study of more effective means of combatting air and water pollution and the setting up of a data and documentation network on chemicals harmful to the environment.

The four JRC institutes, according to JRC director Stelio Villani, seek to coordinate the related research in member states and, at the same time, to pursue

e programs that are of common interest to the Community's

ram, pared down from 22 subjects of research in the previous
comprises:

lear Safety
- Reactor safety
- Plutonium fuels and actinide research
- Nuclear materials and radioactive waste management

* Future energies
- Solar energy
- Hydrogen
- Technology of thermonuclear fusion
- High temperature materials

* Environment and resources

* Measurements, standards and reference techniques (METRE)

* Service and support activities

Of the total budget of 346 million u.a., about 70 per cent is allocated for energy and environment research. The other activities fall under the public service role of the Community and provide expertise and support to the services of the Commission. Staff costs -- the JRC program employs 2,340 persons -- account for 196 million u.a., and 150 million u.a. is expected to cover running expenses and investments.

Nuclear safety is the most important single theme of the JRC program and it will account for about 48 per cent of the total effort. The activities planned under the first of its three programs, reactor safety, to be carried out mainly at Ispra, fall into one or the other of the following types of studies: (a) overall analysis of safety concepts; (b) theoretical and experimental study of possible accidents; and (c) prevention of component failure.

The first type of study proposes to compare and synthesize the risk evaluation methods adopted in the Community and the United States.

The studies of Light - Water Reactor accidents will be concerned essentiall with theoretical and experimental analysis of the consequences of a depressuriz accident in a coolant circuit. An important effort will also be directed to of core melt-down and fuel-coolant interaction.

The program also provides for studies on sodium-cooled fast reactor -ooling anomalies, fuel-sodium reactions, core melt-down and the me uences of an explosive accident. In all, the reactor safety p reliability and risk assessment; light - water reactor liquid metal fast - breeder subassembly thermohydrau nd core melt-down; dynamic structure loading and e prevention.

The second program under nuclear safety deals with plutonium fuels and actinide research. Because of the alpha radioactivity and toxicity of plutonium and other actinides, research activities can only be conducted in very specialized installations, such as those of the Karlsruhe Institute for Transuranium Elements.

The research on plutonium fuels concerns the development of fast reactor fuels (particularly of advanced type) and the study of their behavior in nuclear reactors especially in safety terms. Specific aspects of fuel cycle safety, resulting from the presence of plutonium and the elements derived from it, are also studied. Actinide research, the second part of this program, is an essentially long-term fundamental work, with the Transuranium Institute playing a focal role at the European level.

The nuclear materials and radioactive waste management program covers the safety aspects of certain phases of the fuel cycle. An evaluation will be made, for instance, of the long-term hazard of radioactive waste disposal, in particular with the study of safety aspects of the permanent storage of radioactive wastes in appropriate geological formations (see Background Note No. 16/1977). A probabilistic approach is envisaged. Other studies dealing with the problems of reactor component decontamination will cover the water circuit decontamination mechanisms, the nature of contaminated layers and the action of decontaminating agents.

The future energies theme includes research activities on new energy sources that should complement or replace those available today. It will utilize 12 per cent of the 4 - year appropriations.

In solar energy, the work will be centered around thermal conversion in housing applications (heating and cooling systems, heat storage) with a part of applied research on materials; orientative research on advanced applications such as the bioconversion of solar energy, and the development and construction of a European indoor facility to simulate solar irradiation for accelerated aging tests, measurements of system performances, etc. The facility will be put at the disposal of European manufacturers of solar energy systems. The special role of the JRC as a catalyst and a driving force in hydrogen research (particularly, at present, in the study of thermochemical methods or hydrogen production) has already been established, as shown by the Commission responsibility as project leader within the hydrogen program sponsored by the International Energy Agency.

In addition to the thermochemical processes for water decomposition, the JRC hydrogen program will study the coupling of the production process with the necessary source, particularly from the standpoint of different interface solutions and safety and risk analysis.

In the field of fusion research, JRC activities are concentrated on the technology of fusion reactors, where the competences of the Center in engineering, technology and nuclear physics will be used. In close coordination with the indirect action program of the Community for fusion and plasma physics, the JRC is working in the field of conceptual studies of fusion reactors, of materials for fusion reactors, in particular their behavior under irradiation, and of safety and environmental problems.

The simple availability or the improvement in technical characteristics of materials for high temperature applications may play an essential role in future developments of the energy strategy. This is why the research program in this field has been included in the future energies theme. The work is concentrated at Petten; one project called "Meeting Point Petten" proposes to evaluate the industrial needs for advanced refractory materials and the corresponding R & D programs to keep an informational "white book" continuously updated, and to organize meetings and set up an information service.

Other projects include the study of various aspects of the behavior and characteristics of materials in high temperature applications.

The research program on the environment and on renewable (agricultural) resources responds to a concern felt both at the level of government and of the general public. The program content shows an evolutionary character, along with a certain progressive orientation toward energy ecology subjects.

The JRC program, to be carried out at Ispra with about 10 per cent of the overall budget, is divided into four projects: Three of them cover research on pollution in the atmosphere, water and that caused by chemical products, respectively; and the fourth studies agricultural resources through data collected from satellites. The latter project is aiming at the development of techniques for harvest forecasting, the localization and identification of crop diseases, and the detection of water resources, to evaluate, by remote sensing, the agricultural potential in underprivileged regions of the Community. This project is a cooperative venture with the United States National Aeronautics and Space Administration.

The JRC also participates in three other NASA projects. The Coastal Zone Color Scanner will investigate coastal water quality and productivity. The Heat Capacity Mapping Mission will evaluate soil moisture and heat budget in selected European zones of agricultural and environmental interest. The Stratospheric Aerosol and Gas Experiment will monitor stratospheric ozone.

For these remote sensing projects the Ispra center acts as a focal point and NASA liaison for several activities that are performed by various European institutions outside the JRC.

The program METRE (Measurements, standards and reference techniques) regroups both nuclear and non-nuclear activities into an identical approach to problems, similar research techniques and sometimes the same type of equipment. JRC activities in nuclear measurements are concentrated at the Central Bureau for Nuclear Measurements at Geel, which meets the need for nuclear data on a Community scale by a central Community organization.

In non-nuclear standards and reference materials, the JRC work is led by the Geel establishment, with the participation of the Ispra and Petten establishments. This activity essentially supports the indirect action led by the Community Bureau of Reference. Community work is aiming at "the elimination, as between member states, of quantitative restrictions on the import and export of goods, and of all other measures having equivalent effect" and at "the approximation of the laws of member states to the extent required for the proper functioning of the Common Market," according to Article 3 of the EEC Treaty.

To this end, the JRC program provides for actions such as the calibration of measuring apparatus and the verification of analytical methods, the characterization of a reference oil, the development of reference analytical methods and their application to pesticide residues in foodstuffs, research on the release of toxic elements by ceramics or the study of analytical reference methods for fertilizers.

The service and support activities program includes all the tasks that the JRC, as a public service organization, fulfills in behalf of other Commission agencies or to the profit of organizations, public or private, in Community member countries.

The five projects of the program cover the operation of the high flux reactor at Petten, which is put at the disposal of European users along with JRC technical assistance; information processing and dissemination services such as EUROCOPI (European Computer Program Institute) and ESIS (European Shielding Information Service) at Ispra; training and education activities, among which the organization of training courses at Ispra is of particular importance; the development of control and surveillance systems as well as of measuring methods and techniques in the field of nuclear safeguards aiming at preventing the divertion of special nuclear materials for illegal purposes; and technical evaluations carried out on request from different services of the Commission in sectors such as energy, raw materials, renewable resources, environment and information processing.