1. Review of Fast Reactor Activities in Italy, April 1975; by F. Pierantoni, Italy.

I. INTRODUCTION

Since the last meeting of the International Working Group on Fast Reactors the natural vocation of the italian program to a cooperation, illustrated on many occasions, has found factual confirmation. As well-known, a broad partnership with France has been entered into.

Four agreements have been concluded, towards May-June 1974:

- between C.E.A. and C.N.E.N. for the ulterior development of the French filière and the construction and use of PEC;
- between C.E.A. and NIRA for the license on the system;
- between C.E.A. and AGIP-NUCLEARE for the fabrication of fuel for fast reactors;
- between TECHNICATOME and NIRA for the preparation of the offer and the later construction of Super-Phenix.

Those agreements are in the full logic of the previous one passed between the producers E.d.F., ENEL and R.W.E. for the construction of the first two commercial-size plants, extrapolated from Phenix and S.N.R. 300. In particular the NERSA society, acting as client for Super-Phenix, has been founded by those same producers and will receive the offer now prepared by a joint team.

The new orientation of the programme and the validity of the previous agreements for its implementation have been confirmed at governmental level by the Interministerial Economic Planning Committee (CIPE), which has also approved the third CNEN's five years Plan.

II. THE C.E.A.-C.N.E.N. COOPERATION AGREEMENT

Whereas the agreements with NIRA and AGIP NUCLEARE are of industrial character, the one with C.N.E.N. bears, with distinct modalities, on:

- the R & D still necessary for the development of the nuclear steam supply system, conventional part excluded, and of the core and fuel, retreatment excluded;
- the assistance of C.E.A. and TECHNICATOME for the final design, construction and start-up of PEC, and the later use of PEC for fuel development.

Being of long duration (15 years) and encompassing practically all aspects of fast reactors R & D, the agreement evidently aims at a merger of the respective programs, with complementary of the efforts and full exchange of the informations. As such it naturally excludes for C.N.E.N. third-party agreements on fast reactors not jointly concorded with the C.E.A.

The management and supervision of the joint R & D effort is entrusted to a Liaison Committee, made-up of C.E.A. and C.N.E.N. delegates from their top fast reactors staff. Direct and more frequent liaison between the teams is insured by a system of correspondants, for the areas into which the R & D spectrum has been subdivided e.g. Na technology, core design, safety, PEC and so on.

III. STATE OF THE WORK AT C.N.E.N.

Whereas on the industrial side the cooperation proceeds satisfactorily, in particular for the Super-Phenix offer in the joint design team, work at C.N.E.N. has been severely hampered by internal difficulties of diverse origins. An extensive internal restructuration is nearing completion, with the aim of reallocating forces and adapting the structures to the new tasks.

The status of the C.N.E.N. itself has been modified by legislation, making it a parastatal organisation. It may be hoped that present difficulties will be overcome very soon but their impact, coupled to the reorientations deriving from the agreement with the C.E.A., render perforce the present report an interim one.

On the R & D side, the main lines of that part of programme which C.N.E.N. should undertake in the framework of the agreement have been defined, jointly with C.E.A. experts. First-priority work, in support of the Super-Phenix project, is necessarily limited to what can be carried-out in existing or soon-due facilities and comprizes in particular:

- the trial of a full-size pump rotor in malfunction or accident conditions. The rig has been ordered from FIAT and will be installed in the tower of the ISA-1 sodium-water reaction facility, which will be modified accordingly. Seismic loading will be simulated, to ascertain the post-incident operational condition of the pump.
- the trial of a steam-generator module, under provoked Na-H_2O reaction, in the ISA-1 facility.
- sodium fires, and related methods of intervention.
- hydraulics and vibration studies on dummy subassemblies in the CEDI loop.
- trial of mechanisms and bearing materials in the Aspro and Moulinox rigs.
- possibly the acceptance trial of sodium valves and analogous support to various industrial fabrications in Italy.

The longer-term part of the R & D programme bears on those reactors which will follow Super-Phenix and be more economical and/or more advanced versions. Although less firmly defined, a certain number of lines of development to be pursued at C.N.E.N. have been identified, in all areas. The more demanding contributions will presumably be in the areas of:

- sodium technology and sodium safety, implying the construction of new facilities
- fuel development, on improved oxydes,carbides and venting.

For the latter part, the PEC should evidently contribute substantially by allowing irradiations in well-controlled conditions.

IV. PEC REACTOR

Starting even prior to the agreement, the design has been extensively reviewed by C.E.A. and TECHNICATOME experts. A number of conclusions, tending towards a simplification of some aspects and a greater recourse to solutions already proven at the C.E.A., have been adopted and incorporated into the design. Amongst the more significant:

- as reference solution, there will be one central reentrant irradiation loop only, instead of three. It will be capable of housing test bundles of 91 pins of Phenix-type or 61 pins of Super-Phenix-type, with a 3 MWt heat-removal capacity. The loop primary and its components handling are designed to accomodate a contamination resulting from testing to failure and localized melting.
- the transfer cell, into which the loop head emerges, has been greatly simplified. Cutting and welding dirty operations have been eliminated, save for exceptional interventions. The transfer from the loop to the handling container of an irradiated test fuel element will be under forced gas circulation.
- the design of the driver fuel element will be more closely patterned after the Phenix one. Later cores may be vented, carbide-fueled, and the primary is designed for fission gases removal.
- the fuel handling and examination complex has been partly redesigned, with a clear separation of the routes of the incoming fresh fuel and outgoing irradiated elements. It is foreseen that interim dismantling and reassembly of irradiated elements may be carried-out.
- the control rods and drives will be redesigned and patterned after the vented type developed by the CEA. A critical assembly (PECORE) at Masurca will ascertain the worth of the rods in diverse core configurations.

As regards final design and construction, a clearer definition of the roles of CNEN and NIRA has been embodied in the last addendum to the construction contract, recently approved. More overall responsability is given to the NIRA, assisted by TECHNICATOME, while CNEN remains responsible for the core and nuclear design and the safety procedures. The fabrication of the first cores should take place at the Casaccia plutonium laboratory.

Work on the facilities in support is proceeding. As regards the main ones under way:

- the IPM rigs, for the trial of prototypes of the fueling machine, of a control rod and of a hold-down sector have been completed.
- the Espresso and CEDI dummy subassembly test loops are nearing completion.
- The site of the CPC1 facility has been prepared, at Brasimone, and construction proper will start in the very near future.

2. A Review of Fast Reactor Progress in the UK, April 1975; by R. D. Smith, the United Kingdom.

A REVIEW OF FAST REACTOR PROGRESS IN THE UK

APRIL 1975 - R D SMITH

The fast reactor project in the UK is continuing at approximately the same scale of effort as last year, with great attention being paid to overcoming the difficulties being met in raising PFR to full power. Organisational arrangements for nuclear power in the UK during the year have been dominated by two interlinked issues, firstly the choice of thermal reactor system for the next stage of the British nuclear power programme, and secondly the consolidation of the British nuclear design and construction industry. On the former, widespread discussion on the merits of alternative thermal systems culminated in the announcement by the Secretary of State for Energy on 10 July 1974 that the British electricity boards would adopt the SGHWR for their next nuclear power station orders. The initial ordering programme was set at 4000 MW(E) over the next four years, with the prospect of extending the programme in the later 1970s given satisfactory initial experience of construction. Consent has now been given by the Department of Energy to the CEGB for an SGHWR station at Sizewell in Suffolk (adjacent to an existing Magnox station) and to the SSEB for one at Torness Point in East Lothian.

A Government White Paper which accompanied the ministerial announcement commented that the British Government "would maintain the UK effort on the Fast Reactor, on which the UK is in the forefront of technology, and the prospect of further international co-operation would be pursued urgently".

Progress towards the formation of the unified design and construction company has involved long and complex negotiations for the acquisition of the two previously-existing consortia companies, with their staffs and with the power station contracts they had in progress; the formal acquisition of the two consortia by the new holding company, the National Nuclear Corporation, and the agreement of terms with the electricity boards for completion of the power station contracts, was announced in mid-March 1975. During the relatively protracted period of reorganisation close working relationships have developed between the several organisations concerned.

During the past year the Nuclear Installations Inspectorate has been involved in arrangements leading up to their becoming part of the Health and Safety Executive on 1 January 1975. This body has taken over the responsibilities for inspection and licensing previously carried out by the Nuclear Installations Inspectorate and a number of other Inspectorates in the UK. The organisational changes have not affected the work of the Nuclear Installations Inspectorate who have continued to increase the effort put into fast reactor safety, with particular attention being paid to the more serious safety issues. Contacts have been maintained with licensing authorities in the USA and the rest of Europe both by specific arrangement and through the Brussels Safety Working Group and related bodies.

The Central Electricity Generating Board has continued to liaise actively with the organisations responsible for the development of LMFBRs suitable for use under UK conditions. The objectives of participation continue to be the attainment of thoroughly developed designs which will yield high reliability and availability in service, good operational and safety characteristics, easy accessibility to plant, rapid in-service inspection, maintenance and refuelling arrangements and pre-planned repair facilities. Resolution of the problems of developing high temperature design codes for the environmental conditions of LMFBRs, the substantiation of the code criteria of experimental work and the acquisition of relevant sodium materials data is recognised as being central to the provision of reactor components of adequate long-term integrity. Of similar importance is the development of an ability to verify by under sodium inspection the continued functional capability of reactor components, particularly those related to safety. Considerable attention has been given during the year to the safety characteristics and protection requirement of LMFBRs suited to anticipated UK siting conditions. Participation in the activities of the EEC Co-ordinating Committee for Fast Reactors has continued and contribution has also been made to the work of a Unipede group considering the long-term development and economic prospects for LMFBRs in Europe. Secondment of staff to PFR operations and also to Schnell-Bruter-Kernkraftwerkgesellschaft activities, in which CEGB is now a partner, has continued. Support for the Gas Cooled Breeder Research Association has been maintained and technical contributions were made to the appraisal by an EEC group of the safety characteristics of a gas cooled fast reactor.

The Central Electricity Generating Board Research Department has pursued its policy of obtaining basic information which will enable the Board to evaluate commercial fast reactor designs. Particular attention has been given to the characterisation of sodium and cover gas environments and their influence on materials properties and the performance of mechanisms.

A Fast Reactor Training Centre has been set up at Dounreay to provide courses in all aspects of Fast Reactor Technology and Operations including the handling of Liquid Metals.

DOUNREAY FAST REACTOR AND PROTOTYPE FAST REACTOR

Run 77 on the 60 MW(H) test reactor was completed at the end of June 1974 and it was then decided to postpone the Run 78 for some months so as to release experienced staff to assist with the commissioning of PFR. The opportunity has been taken to refurbish some mechanical components in DFR and the reactor has now been loaded with experiments and fuel and is due to start operation in April. Plans are well advanced for some special experiments in which fuel pins will be deliberately taken to failure by inducing coolant boiling. These experiments will use either special 3 pin rigs or mini-sub-assemblies. Failure will be induced by inlet or local blockages; the experiments are being planned for runs 80 and 81.

As reported last year, PFR started producing nuclear heat on 3 March 1974.