SUMMARY

1. INTRODUCTION

For three decades, several countries had large and vigorous fast breeder reactor development programmes. In most cases, fast reactor development programmes were at their peaks by 1980. Fast test reactors [Rapsodie (France), KNK-II (Germany), FBTR (India), JOYO (Japan), DFR (United Kingdom), BR-10, BOR-60 (Russian Federation), EBR-II, Fermi, FFTF (United States of America)] were operating in several countries, with commercial size prototype reactors [Phénix, Superphénix (France), SNR-300 (Germany), MONJU (Japan), PFR (United Kingdom), BN-350 (Kazakhstan), BN-600 (Russian Federation)] just under construction or coming on line. From that time onward, fast reactor development in general began to decline. By 1994 in the USA, the Clinch River Breeder Reactor (CRBR) had been cancelled, and the two fast reactor test facilities, FFTF and EBR-II had been shutdown — with EBR-II permanently, and FFTF in a standby condition. Thus, effort essentially disappeared for fast breeder reactor development. Similarly, programmes in other nations were terminated or substantially reduced. In France, Superphénix was shut down at the end of 1998; SNR-300 in Germany was completed but not taken into operation, and KNK-II was permanently shut down in 1991 after 17 years of operation, and is scheduled to be dismantled by 2004; in the UK, PFR was shut down in 1994; BN-350 in Kazakhstan was shut down in 1998.

It is difficult to argue that fast breeder reactors will be built in the near term when no commercial market exists and there is a plentiful supply of cheap uranium. Nevertheless, it is reasonable to assume that, were nuclear energy to remain an option as part of the long term world energy supply mix, meeting the sustainability requirements *vis-à-vis* natural resources and long lived radioactive waste management will require deploying systems involving several reactor types and fuel cycles operating in symbiosis. Apart from cost effectiveness, simplification, and safety considerations, a basic requirement to these reactor types and fuel cycles will be flexibility to accommodate changing objectives and boundary conditions. This flexibility can only be assured with the deployment of the fast neutron spectrum reactor technology, and reprocessing.

At the same time that the interest in the fast reactor waned, the retirement of many of the developers of this technology reached its peak, between 1990 and 2000, and hiring diminished in parallel. Moreover, R&D programmes are being discontinued, and facilities falling in disuse. Under these circumstances, the loss of the fast reactor knowledge base should be taken seriously. One particularly important aspect of this knowledge base is given by the accumulated operational experience.

The participants in the 33rd Annual Meeting of the International Working Group on Fast Reactors, Technical Committee Meeting on Liquid Metal Fast Reactor Developments (Vienna, 16–18 May 2000), recommended holding a technical meeting (TM) on Feedback from Operational and Decommissioning Experience with Fast Reactors.

At the 34th Annual Meeting of the Technical Working Group on Fast Reactors, Technical Committee Meeting on Review of National Programmes on Fast Reactors and ADS (Almaty/Kurchatov City, Kazakhstan, 14–18 May 2001), it was further recommended to launch a Co-ordinated Research Project (CRP) on Generalization and Analyses of Operational Experience with Fast Reactor Equipment and Systems (Preserve Fast Reactor Operation and Decommissioning Experience). It was agreed to structure the TM in such a way that, apart from providing an information exchange opportunity, it would also prepare the grounds for the CRP.

2. SCOPE AND OBJECTIVES

The scope of the TM was to provide a global forum for information exchange on fast reactor operational and decommissioning experience.

The objectives of the TM were to:

- Exchange detailed technical information on fast reactor operation and/or decommissioning experience with DFR, PFR (UK); KNK-II (Germany); Rapsodie, Phénix, Superphénix (France); BR-10, BOR-60, BN-600 (Russian Federation); BN-350 (Kazakhstan); SEFOR, EBR-II, Fermi, FFTF (USA.); FTBR (India); JOYO, MONJU (Japan);
- Present the status of the work concerning the knowledge preservation efforts related to the experience accumulated in the various member states from the operation and decommissioning of fast reactors;
- Start the preparation of the planned Co-ordinated Research Project (CRP) on Generalization and Analyses of Operational Experience with Fast Reactor Equipment and Systems (narrow down scope and objectives of the CRP, propose a detailed work plan).

3. GENERAL STATEMENTS

3.1. France

3.1.1. Background

In France, the first chapter in the history of fast reactors was the construction of the mixed oxide fuelled, sodium cooled ‘Rapsodie’ reactor (1962–1966). The operation of Rapsodie was excellent from 1967 to 1978 (initially at 24 MW(th), it was upgraded to 40 MW(th) in 1971). Rapsodie was an outstanding irradiation tool, allowing the demonstration of oxide fuel capabilities, and an initial screening of the core structural material. However, from 1978 to 1982, the detection of primary sodium aerosols in areas surrounding the primary circuit disturbed its operation. The reactor was finally shut down in April 1983, after several end-of-life tests; at this time, Phénix had proved able to ensure all irradiation needs. Since 1983, the reactor has been undergoing decommissioning. The objective is to reach the IAEA level 2 by 2005, a surveillance state should then last from 2005 to 2020 before final decommissioning.

The prototype fast reactor, Phénix (a pool type reactor, 250 MW(e)) went into commercial operation in 1974. To date, 51 cycles were run and more than 20 billion KW•h were produced. As the initial lifetime of the reactor was 20 years, the reactor should have been shut down in 1994, but in the mid-nineties, the role of the reactor changed: it was to be used as an irradiation tool acting as a support to CEA’s R&D transmutation programme within the framework of the 1991 French law concerning long lived radioactive waste management. This new objective required an extension of the planned reactor lifetime. A large renovation programme was defined, and today most of this renovation programme has been accomplished. The greater part of the work still underway concerns repairs on the steam generators. Resuming power is planned for the 1st half of 2003, with a total of 6 operating cycles to carry out the experimental irradiation programme. The overall period will cover about 5½ years.

Construction of the SuperPhénix plant lasted from 1977 to 1985. Full power was reached in 1986, and until the end of 1996, the plant operated for 4½ years at different levels of power, with scheduled periods of maintenance and tests. It remained shutdown for 4½ years, although still in an operational state, due to ongoing administrative procedures, and a little more than 2 years shutdown were due to technical incidents and repairs. The last operating year was remarkable: the complete programme of overall qualification by successive stages to 30, 60, and 90% nominal power progressed without difficulty. After an interruption of activity of more than 5 years, all the parameters were found to be normal. However, following the declaration made to the French National Assembly on June 19, 1997, the French government decided on February 2nd 1998, to permanently shut down the SuperPhénix plant.

The governmental decree of 31st December 1998 finalized the immediate and permanent shutdown of the plant. In conformity with this decree, the following operations were carried out:

- Core unloading from the reactor vessel and transfer to the fuel storage pool. By the end of February 2002, all 358 fuel elements had been transferred, as well as almost half the breeders and part of the control rods. Out of a total of 650 elements, 480 have already been unloaded;
- Removal from service of non-required systems;
- Studies for primary vessel draining and sodium treatment.

In 2001, EDF made the decision to dismantle all first generation reactors, including SuperPhénix up to the IAEA level 3 by the year 2025, without intermediate safe storage status (level 2). Phénix will remain operational, as mentioned before, through 2008–2009.

3.1.2. Ongoing sodium cooled fast reactor R&D

3.1.2.1. Preservation of acquired knowledge

Considerable effort has been put into long term knowledge preservation (storage and access) for use in future sodium cooled fast reactor designs. This task involves various activities: the elaboration of synthesis reports (including the SIMMER validation and CABRI experiment synthesis for CDA analysis), SuperPhénix data storage (operational feedback), Phénix lifetime extension feedback (in-service inspection and repair), updating of neutronics data banks and code validation efforts, the new edition of RCC-MR (material analysis rules and criteria) and RAMSES2 (irradiated structural material rules).

Preserving acquired knowledge not only includes feedback obtained from the Rapsodie, Phénix, and SuperPhénix reactors, but also knowledge acquired at the time of the EFR Project (1988–1998) that allowed considerable improvements to be made after careful observation of the SuperPhénix reactor in terms of technology, in-service inspection, safety, steam generator design, and neutronics.

3.1.2.2. Irradiation programme

Experiments in the Phénix reactor (materials, transmutation of actinides, and irradiation of targets containing long-lived fission products), and in BOR-60 (transmutation of americium, nitride fuels).

3.1.2.3. Dismantling

A considerable amount of R&D has been launched to solve not only the problems encountered during the dismantling of SuperPhénix (e.g. assembly washing, draining of the reactor block, treatment of residual sodium), but also those encountered in the dismantling of experimental equipment used over the past years (the treatment of experimental devices taken from the irradiation reactor, SILOE using Na-K, technological test devices, and so forth). And finally, preliminary studies have been carried out in a new radioactive sodium waste treatment facility enabling us to process waste stored in the various CEA centres.

3.1.2.4. Maintaining the CEA expertise

CEA wishes to maintain its expertise in the field of liquid metal reactors, a competence which today is based on a R&D programme covering four decades of studies. At present, following the shutdown of the SuperPhénix reactor, our efforts in terms of R&D have been greatly reduced, but maintaining our expertise will allow us, well beyond the support provided to the operation of the Phénix reactor, to exchange knowledge with other countries pursuing R&D in the field of liquid metal fast reactor technology. This exchange of experience, acquired over a period of 25 years of operation of the Phénix reactor, operation of the SuperPhénix (on a commercial scale), and the EFR studies, along with the studies described above, will allow us to sustain extensive knowledge about the liquid metal reactor type, and thus enable us to evaluate further developments.

In conclusion, although the CEA has now decided to focus its R&D on gas cooled reactor concepts, with the prospect of perfecting a gas cooled fast reactor in the long term (4th generation), it nevertheless shall preserve activities and expertise it has acquired on sodium cooled fast reactors over the years. CEA would like to pursue further exchanges with other countries who are also engaged in liquid metal fast reactor research.

3.2. Germany

In Germany, activities related to the development and operation of fast breeder reactors have been terminated.

The SNR 300 power reactor was not taken into operation. All sodium-wetted components were removed. The inactive sodium was disposed off. The fuel elements that had already been fabricated for the first core were put into containers, welded gas-tight, and stored at the federal nuclear fuel storage facility.

The compact sodium cooled reactor facility KNK (20 MW(e)) was shut down in 1991 and currently is in the state of advanced dismantling. The nuclear fuels and sodium were disposed off. All systems were removed. Disassembly of the activated reactor tank and its internals has been started. Complete dismantling of the reactor building is planned to be completed by 2005.

3.3. India

The present status with respect to the fast breeder test reactor operating experience and prototype fast breeder reactor design are presented below.

3.3.1. Fast breeder test reactor

The fast breeder test reactor (FBTR) is a loop type reactor located at Kalpakkam, India. The reactor has been operated for 27 600 h till now at various power levels up to 17.4 MW(t). The peak burn up of 90 000 MW•d/T was achieved in the 70% PuC + 30% UC Mark-I fuel. Turbo Generator was synchronized to the grid with the nuclear steam to check its performance. Continued operation of TG is planned at high power. The post irradiation examination of the fuel discharged after 50 000 MW•d/T peak burnup showed adequate gap between fuel and clad indicating higher burn up is possible. Present linear heat rating is 400 W/cm and the target burn up of the fuel is to be increased to 100 000 MWd/T. The core has 35 sub-assemblies (SA) now.

A reversible reactivity transient, which sets in at a specific core ΔT was observed during low power operation. The magnitude of the transient reduces and the ΔT at which the reactivity transient sets in increases with respect to increase in core flow. The reactor operation was continued above a primary flow of 450 m^3/h, as the phenomenon does not occur above this value.

The core cover plate mechanism, which supports core thermocouples, got stuck at a higher position and could not be lowered. The safety implication of the above was analyzed and thresholds of core ΔT and core mean temperatures were lowered and reactor operation continued.

The effectiveness of delayed neutron detectors for detecting clad failure was tested by operating the reactor with vented fuel SA in the core. The void coefficient of reactivity at various core locations were measured using two special SA fabricated for this purpose. The void coefficient was found to be negative.

Comprehensive radiation survey has been carried out to ensure shielding efficiency in the cells having primary radiation components and cover gas system. The measured dose rates have been found to be less than the design values. The average annual collective dose is 2.2 P-mSv. This indicates very low radiation exposure from the plant.

Performance of FBTR till now has been very good and all problems encountered initially have been overcome. The experience gained in operating the reactor is valuable. It is planned to expand the core to full size in near future.

3.3.2. Prototype fast breeder reactor

The Prototype fast breeder reactor (PFBR) is a 500 MW(e), pool type sodium cooled reactor with 2 primary pumps, 4 intermediate heat exchangers and 2 secondary loops with 4 steam generators per loop. The detailed design, R&D, manufacturing technology development and safety review are nearing completion. Major engineering experiments with respect to thermal hydraulics, component testing, sodium technology etc. have been completed. To demonstrate technology development, full scale model/scaled down model/sector model of components such as primary sodium pump, steam generator, reactor vessel, roof slab, control rod drive mechanisms etc. have been fabricated. In order to design an optimum in-vessel shielding, a series of fast reactor shielding mock up experiments involving transport through typical shield configurations of steel, sodium, graphite and boron carbide have been carried out. Radiation streaming mock up experiments are also planned. PFBR will be constructed at Kalpakkam and the detailed project report for this project will be submitted for sanction shortly.

3.3.3. Knowledge preservation

India is in the initial stages of the commercialization of the fast reactors and the efforts on knowledge preservation goes in parallel with the design and operation. Care is taken to ensure that all design and operation data are documented and archived with proper identification. In FBTR all design, drawings and operation related documents are stored separately in an air-conditioned record room for immediate and future reference. However, for PFBR, from the beginning all design documents and drawings are maintained in the electronic form. It is also planned to provide access to all these documents in the Intranet at IGCAR through password protection. Utilizing the experience gained by the experienced manpower over the years is an important aspect in knowledge preservation. This is planned to a limited extent by involving the knowledgeable people by participating in seminars, training courses etc. Efforts are also on to introduce courses related to nuclear energy in colleges and sponsoring new engineers/scientists to these courses. To consolidate the knowledge available internationally, an effective way would be to post the documents regarding the operating experience of all fast reactors in electronic form and make them available to all fast reactor specialists.

3.4. Japan

JNC is undertaking a major program of research and development on liquid metal cooled fast breeder reactors, which is fully supported by the government of Japan and the electrical utilities. Hence, the perspective of JNC on knowledge preservation is rather different from that of organizations where the fast reactor project has been scaled down or discontinued. Within JNC, there is a statutory obligation to preserve documentary records of the fast reactor project. Over time the method of archiving has changed from optical (microfilm, microfiche etc.) to digital storage. It is the long term objective of JNC to convert all its records to digital format and make them available to staff over its intranet. JNC is also attempting to preserve 'human knowledge', that is, the expertise of staff who have been involved in the fast reactor project over a long period and who are now nearing retirement. Based on this information, two computerized systems are currently being constructed: one which records in a readily accessible manner the background to key design decisions for the Monju plant; and a second which uses simple relationships between design parameters to aid designers understand the knock-on effects of design choices (joint project with Mitsubishi).

To its partners in international cooperation — the US/DoE and the organizations of the Euro-Japan collaboration — JNC is proposing a joint approach to knowledge preservation and retrieval. The proposed concept, dubbed the International Super-Archive Network (ISAN), would make use of the standardized software the new technologies of the Internet increase the mutual accessibility of fast reactor information.

JNC considers it extremely important to reflect the lessons learnt from previous experience in the fast reactor field to the operation and maintenance of Monju and the design of future reactors.

3.5. United States of America

All first generation fast breeder reactors have been shutdown or decommissioned with only the fast flux Test facility remaining in a standby condition awaiting final decommissioning. Fast breeder reactor development activities have been terminated with limited technology development in transmutation and pyroprocessing.

The EBR-II, 62MW(t), has completed decommissioning steps and is now in a radiological and industrially safe condition at the direction of the US DOE. These activities followed removal of fuel for conditioning and the disposal of all bulk sodium coolant. As required by US regulations, residual sodium within reactor system will be deactivated under appropriate environmental permits after which the EBR-II will await future dismantling.

4. SESSION SUMMARIES

4.1. Session 1: Sodium cooled fast reactor operational experience

The papers presented a comprehensive overview of the accumulated experience with the operation of sodium cooled fast reactors. The worldwide 40+ years of fast reactor development represent a total of 300 years of operation. Based on this figure, it was concluded that the sodium cooled fast reactor technology has reached a mature stage. The advantages of this type of reactor were pointed out by the various presenters:

- Safe and reliable operation;
- Easy operation and maintenance;
- Low environmental impact;
- Demonstration of fuel cycle closure in some cases;
- Flexibility for fuel cycle issues.

The technical difficulties encountered during the operation of fast reactors, and their resolution, were presented. The status of fast reactor development in the different countries is currently in a wide range:

- Reactors being decommissioned;
- Operating reactors in a lifetime extension process;
- Reactors under construction or in the commissioning phase.

Several prototype reactor projects are going ahead, e.g. in China, India, Japan, the Russian Federation (these reactors are likely to be commissioned by 2010). However, large scale commercial reactor construction is not expected before 2020. There is a major interest for all countries to preserve the operational experience for both the ongoing and future long term projects.

4.2. Session 2: Sodium cooled fast reactor decommissioning experience

Decommissioning experience (both direct experience and decommissioning planning activities) with sodium cooled fast reactors was presented in contributions from France, Germany, India, Kazakhstan, and the USA. The discussions centred on common technologies and consistency of approach. Noted differences are justified on the grounds of regulatory requirements rather than differences in technologies. The resulting conclusions and recommendations were:

1) Advanced planning is essential;
2) Remove fuel as soon as possible;
3) Proceed with proven technologies;
4) Proceed quickly;
5) Move from secondary to primary (from less active to more active);
6) Primary systems dismantling require specialized techniques and expertise (e.g. remote technologies);
7) Maintain operational staff, utilize contractors familiar with the plant, minimize total staff;
8) Maintain interaction with regulators at all times;
9) Potential topics for R&D are:
    - Sharing of important information;
    - Advanced planning tools;
    - Sharing of technologies, e.g.

i. Specific techniques (carbonation, further sodium draining);
ii. Specific applications (de-fuelling, dismantling of secondary systems);
iii. Available advanced sodium removal technologies;

- Feedback for future reactor designs, e.g.
  i. Application of ^{60}Co dose rate minimization measures;
  ii. Design of sodium draining systems and components with a specific view to decommissioning.

4.3. Session 3: Fast reactor physics and engineering experiments and analyses

The technical session on fast reactor physics and engineering experiments and analyses focused on some R&D performed in experimental and power fast reactors. The work done at CEA to understand the failure due to heat affected zone stress relief or reheat cracking in austenitic stainless steel welds, particularly in stabilized 321 or 347 materials working at high temperatures was reported. In the discussions, it was brought out that 321 steel is more suitable for low temperature applications, wherein such difficulties were not experienced. RCC-MR code does not recommend usage of this material for high temperature applications. It was suggested that this study will be useful for life time extension of reactors wherein such steels are in use. The status of the RCC-MR code was presented by Framatome, ANP. The new edition of the RCC-MR code will be brought out in French and English language shortly. It was brought in the discussions that this code will find wide usage in high temperature nuclear reactor design and also in other high temperature systems.

CEA’s presentation covered neutron physics commissioning experiments for Superphénix and Phénix, which were re-evaluated using the recent ERANOS-1.2 code system. In the discussion, the following points were mentioned: The misprediction of decay component of burn-up reactivity swing needs to be investigated in the view points of use of higher neutron energy groups, or improved fission products nuclear data. Accurate modelling process should be recommended especially for control rod worth calculation, whereas 2D homogeneous modelling gives close results with 3D for other parameters as criticality mass. The ERANOS system is applicable to other type of fast reactor (e.g. gas and heavy liquid metal cooled), but the data is not validated for this applications.

The results of physics and engineering experiments in the fast breeder test reactor (FBTR) were presented as well. It was brought out that it is essential and mandatory to carryout important safety related physics and engineering tests to validate the data used in safety evaluation. The feedback in these experiments were also used to validate and redefine various mathematical models/codes for better prediction.

4.4. Session 4: Sodium cooled fast reactor knowledge preservation

France, Japan and the Russian Federation presented the status on sodium cooled fast reactor experience preservation made in these countries. The reports underlined these countries’ large experience with design, construction and operation of sodium cooled fast reactors. The discussions underlined the importance of the IAEA support for knowledge preservation of fast reactor experience.

Recognizing the importance of sodium cooled fast reactor knowledge preservation, there is the need to pursue an internationally coordinated activity aiming at the analysis of operational experience with fast reactor equipment and systems, as well as at the generalization of the lessons learned. The objectives of this activity are to:

- Safeguard the feedback from commissioning, operation, and decommissioning experience of experimental and power sodium cooled fast reactors;
- Enable easy access to the information from this feedback;
- Attempt at generalization/synthesis of lessons learned from the commissioning, operation, and decommissioning of experimental and power sodium cooled fast reactors,

and its main tasks are to:

- Establish the list of the reactors to be considered;
- Define/agree on topical areas;
- Establish the catalogue of documents and references to be included;
- Define the structure of the abstracts, and the format of the references;
- Produce key words glossary for the various topical areas;
- Define the path for sequential searches for the various topical areas;
- Establish the structure of the database and define the rules for access, sharing etc. (e.g. define several levels of access);
- Produce a synthesis/generalization of commissioning, operational, and decommissioning experience.

As a next step, the need to establish an international sodium cooled fast reactor database was put forward. In an ad-hoc working group, the session elaborated the general structure of such a database. Table 1 gives an example of the structure.

TABLE 1. STRUCTURE OF A DATABASE

Fields	Example	Remarks
Part – A		
Title	R&D LMFRs Knowledge Preservation French Project	
Authors 1	F. Baqué	
Affiliation 1	CEA, Cadarache, France	
Authors 2		
Affiliation 2		
Report number		
Key words 1 – Sequential		To be defined by technical administrator
Key words 2 – Random	Liquid metal fast reactor, LMFR, knowledge preservation, CEA, safety, working thermohydraulics, nuclear fuel	
Abstracts		
Paper text		
Paper format		Pdf
Date of publication	11.03.2002	
Part – B		
USI number		To be defined by technical administrator
Server number		Server identification where full paper is stored
Contributing organisation	CEA, Cadarache, France	

Part A of the structure deals with fields specific to the publication and the technical content of the paper, whereas Part B deals with fields required for the maintenance of the report by technical and system administrator.

The database must be designed such that it is available to the users around the world through Internet. To enable this, a suitable search facility shall be included. Searching shall be possible on specific fields such as title, author, affiliation, report number, keywords and abstracts. Restricted searching such as published during the period (from, for example 1.1.2001 to 31.12.2001) shall also be possible.

For large technical databases, sequential searching on specific, pre-defined key words will be useful. These keywords sequence shall be pre-defined by the technical administrator group and shall be assigned to each data. This keyword sequence may also be converted to a number similar to US1 classification of books. Each report can have more than one USI numbers depending on the contents. For searching reports in this way, the user has to continue search by selecting the fields from the pull down menu. An illustration is given in Fig. 2.

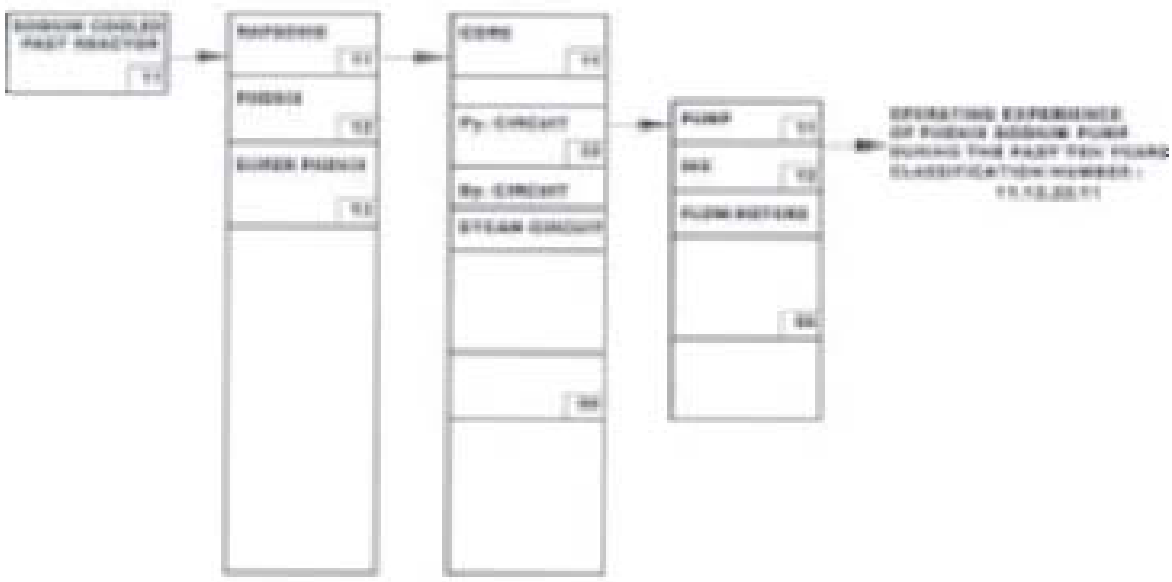

FIG. 2. Sequential searching.

The technical contents of the database shall include information from various published journals, papers presented in seminars, etc. Also classified information from specific organizations may also be placed on the database with restricted access. Hence the design shall consider provisions such as: open literature — accessible by all, information available to specific organizations, on payment through on line credit card, payment through off line procedures, to specific organizations by following specific procedures, etc.

The database shall be defined such that the data can be uploaded from specific organizations, through password control. This will enable uploading of data from various member countries. A suitable field in the database shall be available to keep track from where the data was uploaded. Additionally provision shall be available for any individual to post complete data (literature/report, etc.) through the Internet. This will be scrutinized by the technical administrator and uploaded to the database. However the allotment of a USI number shall remain with technical administrator.

A server located in a centralized place shall contain major information. It shall contain all the fields in the structure, but with or without full text of reports. This server shall contain the information that are required for execution of a search and the results are passed on to the user through Internet. Subsequently when the user asks for full text of the paper, it shall be made available to them. For storage of full text of reports, the servers containing the full text may remain distributed in the member countries. This distributed system will enable users to get all the information and at the same time satisfy the countries having classified information, the information is kept restricted and is available with them only. A pictorial representation of this arrangement is shown in Fig. 3.

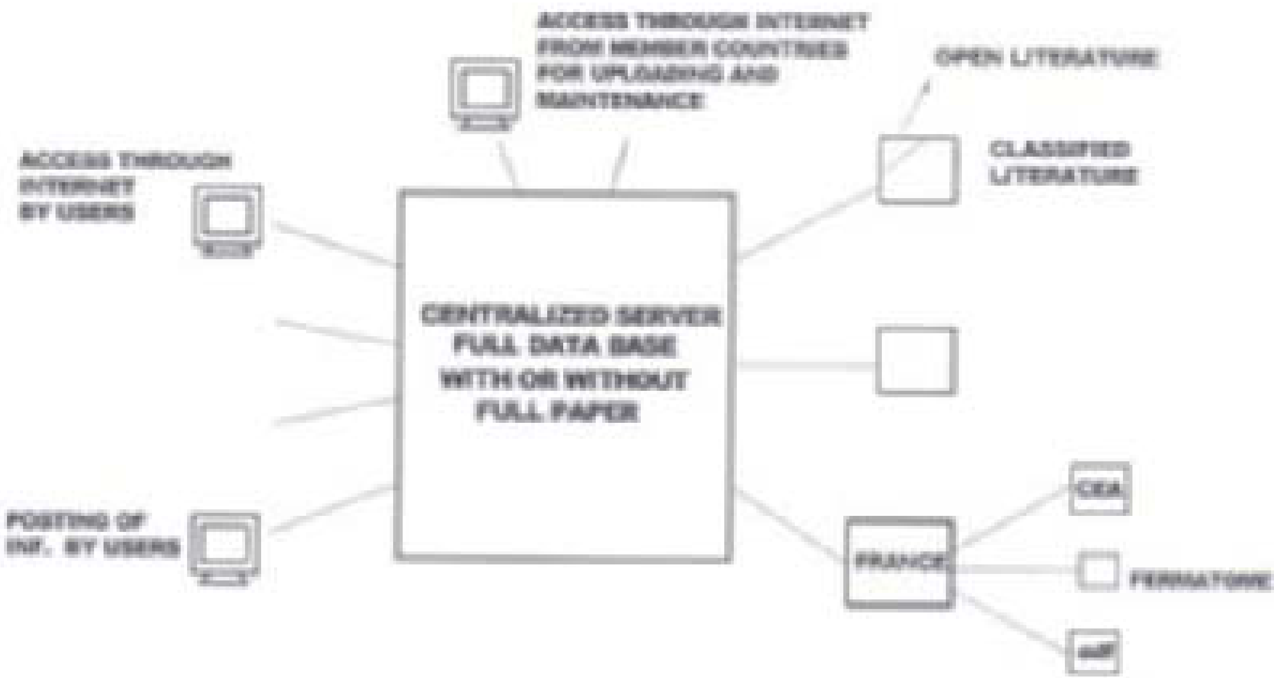

FIG. 3. Hard ware organization.

The establishment of such a database is an ambitious and time-consuming process. The implementation of such a task can be envisaged in the three phases:

1) Development and testing:
   This is a process that can be planned and completed in a reasonable time of $\simeq$ 18 months. During this period the complete architecture of the software and hardware shall be completed. The sequential searching keyword structure shall be established. The server architecture, including establishment of links to member countries can be considered. Also minimum amount of data shall be posted in the servers and tested for its functioning.

2) Uploading data and making database available to public:
   Existing information such as those in INIS Atomindex, journals etc. shall be uploaded. The organization responsible for maintenance of the full text distributed in different countries shall be defined and servers shall be made available.

3) Continuous maintenance and upkeep of database:
   Maintenance is essential so that the database is made available 24 hours per day. Also care shall be taken from development stage onwards such that the developments in the electronic media will always assist in the maintenance of the database.