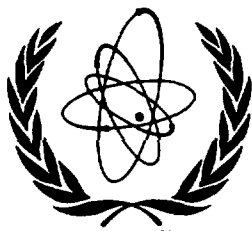




XA0201127

IWGFR/41



International Atomic Energy Agency

INTERNATIONAL WORKING GROUP ON FAST REACTORS

---

FIFTEENTH ANNUAL MEETING

Obninsk, USSR  
30 March - 2 April 1982

---

SUMMARY REPORT

FIFTEENTH ANNUAL MEETING

Obninsk, USSR  
30 March-2 April 1982

SUMMARY REPORT

Printed by the IAEA in Austria  
September 1982

## Foreword

The Fifteenth Annual Meeting of the IAEA International Working Group on Fast Reactors was held in Obninsk, USSR, from March 30 to April 2, 1982.

The Summary Report contains the Minutes of the Meeting and appendices.

Review papers on national programmes in the field of LMFBRs and other papers presented at the Meeting are published as a separate report.

## TABLE OF CONTENTS

SUMMARY REPORT .....	7
Appendix I. List of participants at the 15th Annual Meeting of the IWGFR .....	13
Appendix II. Agenda and Time Schedule of the Meeting .....	16
Appendix III. Review of the IWGFR Activities for the Period since the Fourteenth Annual Meeting of the Group .....	19
Appendix IV. Preliminary Programme of the Third International Conference on Liquid Metal Engineering and Technology in Energy Production .....	23
Appendix V. Preliminary Programme for IAEA Symposium on LMFBR Power and Test Plant Experience and Future Design Trends .....	25
Appendix VI. List of Meetings on Atomic Energy (Sponsored by the IAEA) which may be of Interest to the IWGFR Members	26
Appendix VII. Justification or Preliminary Programmes of some of the Agency's Meetings .....	27
Appendix VIII. List of Meetings on Atomic Energy (non-sponsored by the IAEA) which may be of Interest to the IWGFR Members .....	35
Appendix IX. List of Meetings on Atomic Energy (non-sponsored by the IAEA) which could be of Interest to the IWGFR and for which the Support of the IWGFR is invited .....	37
Appendix X. List of Proposed Topics for the IWGFR Specialists' Meetings .....	38
Appendix XI. Justifications of Proposed IWGFR Specialists' Meetings .....	39
Appendix XII. List of Topics Proposed by Participants of the Specialists' Meetings .....	44
Appendix XIII. Recommendations on Preparation and Distribution of Minutes and Reports .....	45
Appendix XIV. List of Meetings Sponsored by the IWGFR .....	46
Appendix XV. List of Meetings Recommended by the IWGFR to be held in the Period after the 15th Annual Group Meeting (from April 1982 through 1983) .....	50
Appendix XVI. International Working Group on Fast Reactors List of Members .....	51

## SUMMARY REPORT

### Introduction

The Fifteenth Annual Meeting of the IAEA-IWGFR was held in accordance with the recommendations of the previous Annual Group Meeting, in Obninsk, USSR, from 30 March to 2 April 1982. All Member States of the group were represented at the meeting: France, the Federal Republic of Germany, India, Italy, Japan, the Union of Soviet Socialist Republics, the United Kingdom and the United States of America. The meeting was also attended by representatives from the Commission of European Communities, the International Atomic Energy Agency and observers from Belgium and Switzerland. The meeting was opened by Mr. H. J. Laue, Director of the IAEA Division of Nuclear Power, the participants were welcomed by Prof. O. D. Kazachkovskij, Director of the Obninsk Research Centre, and the meeting was presided over by Mr. E. I. Inyutin, USSR.

The List of Participants is attached to the Summary Report (Appendix I). The Agenda and Time Schedule of the meeting are given in Appendix II.

#### 1. Review of IWGFR Activities

##### a. Approval of the Minutes of the Fourteenth IWGFR Meeting (Item 1a)

The Chairman suggested the approval of the Minutes of the Fourteenth Annual IWGFR Meeting. It was so agreed.

##### b. Report by the Scientific Secretary regarding Activities of the Group (Item 1b)

The Review of the IWGFR activities for the period since the Fourteenth Annual Meeting of the IWGFR was distributed in advance amongst the members of the Group and the Scientific Secretary mentioned only the changes which took place during the time after the distribution of the Review, including preparation of the IAEA proposal on revision of "General Recommendations Concerning Arrangements for Specialists' Meetings Organized in the Framework of the IWGFR" and "Recommendations on Preparation and Distribution of Minutes and Reports". The final version of the Review is given in Appendix III.

#### 2. Consideration of Conferences on Fast Reactors

##### a) International Topical Meeting on Liquid Metal Fast Breeder Reactor Safety and Related Design and Operational Aspects, Lyon, France, 19-23 July 1982 (Item 2a)

Mr. L. Vautrety of France reported that the preparations for the conference are going well and are almost completed. The preliminary programme of the Conference has been prepared and distributed. About 400 participants are expected to attend the Conference. The paper selection committee has selected 231 papers. Letters concerning details of presentations were sent to authors of the papers.

b) Third International Conference on Liquid Metal Technology, Oxford, United Kingdom, April 1984 (Item 2b)

The Conference was endorsed by the members of the IWGFR at the 14th Annual Group Meeting. The preliminary agenda of the Conference was distributed by Mr. R. Wheeler of the United Kingdom during the 15th Meeting of the IWGFR (Appendix IV). It is planned that the Conference will take place on 9-13 April 1984. The members of the IWGFR were invited to nominate additional members to the Steering Committee. Specialists from France, the Federal Republic of Germany, India, Italy and the United States of America have already been nominated.

c) IAEA Symposium on LMFBR Power Plants Experience and Future Trends 1984 (Item 2c)

Mr. Marth of the Federal Republic of Germany proposed to postpone the Symposium to 1985 because of some potential overlapping of this Symposium with the Conference on Liquid Metal Technology. Mr. L. Vautrey supported this proposal since the operation of Super-Phenix-I is now expected in 1984. It was therefore recommended by the members of the IWGFR to postpone the Symposium to 1985 and that it should be held in France. It was also recommended that the title of the Symposium should be "LMFBR Power and Test Plant Experience and Future Design Trends". A preliminary draft programme of the Symposium has been prepared by the members of the IWGFR (Appendix V).

d) IAEA Symposium on "Choice and Justification of the Design Solutions and Basic Parameters of Large LMFBRs" (Item 2d)

Since the topic of this Symposium is expected to be covered to some extent at the above-mentioned Symposium on "LMFBR Power and Test Plant Experience and Future Design Trends" it was agreed by the members of the IWGFR that the Symposium on "Choice and Justification of the Design Solutions and Basic Parameters of Large LMFBRs" should not be recommended as an IAEA Symposium for 1985.

e) IAEA International Conference on Nuclear Power Experience, Vienna 13-17 September, 1982 (Item 2e)

The status of preparation for this Conference was reported by the Scientific Secretary of the IWGFR. In accordance with the decision of the Paper Selection Committee, it is expected that five papers will be presented on fast breeder reactors during the plenary session No. 5, "Advanced Systems", by specialists from France, Japan, Union of Soviet Socialist Republics, the United Kingdom and the United States of America. Ten papers were selected for the technical session 5.1 on "Advanced Reactors and Their Fuel Cycles".

f) IAEA Meetings which may be of Interest to IWGFR Members (Item 2f)

A list of the IAEA meetings which may be of interest to the IWGFR members was distributed and discussed during the meeting. It is given in Appendix VI and justifications or preliminary programmes are given in Appendix VII.

g) Coordination of the Schedule for the Major International Meetings having a Predominant Fast Reactor Interest (Item 2g)

A list of meetings on nuclear energy (not sponsored by the IAEA) which could be of interest to the IWGFR members was discussed. It is given in Appendix VIII. Mr. R. Wheeler of the United Kingdom suggested that the next conference on Fast Breeder Reactor Safety be held in 1986. The members of the

IWGFR endorsed the proposal and agreed to support the conference. It was recommended that the conference should be held in 1986 somewhere in Europe (probably in the United Kingdom).

3. Consideration of Recommendations of Some of the IWGFR Specialists' Meetings for Which the Support of the IWGFR is requested

The Scientific Secretary of the IWGFR reported to the members some of the recommendations and proposals for topics for the IWGFR specialists' meetings, which were made by the participants of the following meetings:

- a) Specialists' Meeting on "Fuel Failure Detection and Location in LMFBRs", Karlsruhe, Federal Republic of Germany, 11-14 May 1981.
- b) Specialists' Meeting on "Design Features Affecting the Dynamic Behaviour of Fast Reactor Cores", Rome, Italy, June 2-5, 1981.
- c) Specialists' Meeting on "Sodium Boiling Noise Detection", Chester, United Kingdom, 9-11 June 1981.

The list of topics recommended by participants of the Specialists' Meetings is given in Appendix XII. It was agreed not to automatically include the topics in the list of proposed specialists' meetings for consideration and voting. However, the members of the IWGFR should be informed by the Scientific Secretary about the proposed topics.

The IWGFR members supported, in general, the proposal of the participants of the Specialists' Meeting on Sodium Boiling Noise Detection to organize a benchmark test for the analysis of sodium boiling noise detection data. However, it was agreed, that the final decision could be made only after the distribution of an initial proposal which is forthcoming.

4. Consideration of a schedule for specialists' meetings in 1982-1983

- a) Specialists' Meeting on Sodium Fires, Design and Testing, Richland, Washington, USA, May 24-28, 1982 (Item 4a)

Mr. Horton of the USA informed the members of the IWGFR, that the preparation of the meeting was progressing well. Six Member countries of the IWGFR have nominated participants for this meeting (France, the Federal Republic of Germany, Italy, Japan, UK and USA). Information for participants of the meeting concerning meeting arrangements, air travel, meeting aids, security arrangements, etc. was distributed amongst the members of the IWGFR early in March. Copies of the information letter were also distributed during the 15th Annual Meeting.

- b) Specialists' Meeting on "Advances in Structural Analysis for LMFBR Applications", Saclay, France, 12-15 Oct. 1982 (Item 4b)

Mr. L. Vautre reported that the meeting is under preparation. The preliminary programme of the meeting was presented to the members of the IWGFR. The official letter has been sent to the IAEA informing about the agreement of the French Government to host the meeting. It was agreed by the members of the IWGFR that the preparation and presentation by the Meeting Chairman or his representative of the summary paper based on the meeting results to the SMIRT-7 Conference could be useful.



- c) Specialists' Meeting on "Thermal Stratification in Sodium", Grenoble, France, 18-21 Oct. 1982 (Item 4c)

Mr. L. Vautre informed the members about a status of preparation for the meeting. The official agreement of the French Government to host the meeting has been sent to the IAEA. A preliminary agenda was distributed amongst the members of the IWGFR during the meeting of the Working Group.

- d) Specialists' Meeting on "Theoretical and Experimental Work on Steam Generator Safety With Particular Reference to Leak Development and Detection", Spring 1983 (Item 4d)

Mr. W. Marth reported that due to organizational changes at the Dutch company TNO, the meeting had to be postponed to spring 1983. The members of the IWGFR agreed to this date. The meeting will be held, preferentially in the Netherlands or in the Federal Republic of Germany. Comments on the preliminary programme have been received from Mr. Horton, USA. It was agreed that Mr. W. Marth would send the letter in the near future indicating the exact place and date for the specialists' meeting.

- e) Suggestions of the IWGFR on other Specialists' Meetings (Item 4e)

A new topic was proposed by the United Kingdom in January 1982 instead of the topic on Equation of State of Materials of Relevance to the Analysis of Hypothetical Fast Breeder Reactor Accidents. This new topic on Heat and Mass Transfer in the Reactor Cover Gas was included in the List of Topics for voting.

The Federal Republic of Germany also suggested to change the topic on Fast Reactors as Actinide Burners to the new one on "3-dimensional Power Distribution; Requirements for and Status of Computational Methods". It was decided that the topic would be included in the list for voting in 1983. It was agreed to delete the topic on Fast Reactors as Actinide Burners.

As a result of the discussion on the list of topics and voting, it was recommended that the IAEA should sponsor the following meetings in 1983:

- 1) Theoretical and Experimental Work on Steam Generator Safety with Particular Reference to Leak Development and Detection

As it was mentioned in item 4d, this meeting should be held in April or in May 1983 either in the Netherlands (preferentially) or in the FRG.

- 2) Properties of Structural Materials Including Environmental Effects

The United Kingdom's offer to host this meeting was accepted. September 1983 might be a suitable time for holding the meeting.

- 3) Fast Reactor Absorber Materials

The USSR's offer to host this meeting was accepted. June or July 1983 were proposed as a possible date for the meeting.

- 4) Sodium Boiling under Decay Heat Conditions

This was recommended as a reserve topic.

5. Consideration of the other IWGFR activities

a. Preparation of the Technical Report on "Status of Fast Breeder Reactors in the World"

During a detailed discussion on the preliminary outline of the report different views were exchanged. Reservations about its aims and the amount of effort required were noted. If the report is published under the auspice of the IWGFR it should be prepared very carefully in order to be able to compete with other world-wide known publications on LMFBRs, including the INFCE report of the Working Group 5. Such preparation would take a lot of effort and time. Two other possible options were proposed by the IWGFR. They are publication of national presentations at the IWGFR Annual Meetings or periodical updating of the INFCE report of the Working Group 5. It was requested that the IAEA would consider these proposals and inform the members of the IWGFR about its decision.\*

b. Revision of the "LMFBR Plant Parameters" report

The members of the IWGFR supported the proposal to up-date the report. However it was noted that the list of parameters, which was prepared by the Scientific Secretary on the basis of the list of parameters distributed by Dr. Paranjpe with modifications by Dr. Smith and which was used by the Scientific Secretary for preparation of the first draft report, had not yet been received by the members of the IWGFR. It was recommended that the style of presentation should be considered once more in the Agency and the resulting list of parameters should be distributed amongst the members of the IWGFR for comments. The draft report should be prepared before the 16th meeting of the IWGFR and discussed at the meeting.

c. Consideration of appropriate fields for coordinated research programmes

It was noted that some coordination efforts are being carried out by the CEC. The IWGFR members expressed the view that the CEC's experience could help in finding topics which might be of interest to possible IAEA actions. It was therefore recommended that the Scientific Secretary should prepare, together with Mr. Balz, a list of possible actions. This list which will be distributed amongst the IWGFR members for further consideration should also take into account actions proposed by participants of IWGFR Specialists' Meetings.\*\*

---

\* At the 14th annual meeting of the IWGFR in 1981, the Working Group was informed that the Agency intends to publish a technical report on the status of fast breeder reactors. As no reservation was recorded the activity was included in NENP's programme and financial plan for 1982. At the 15th meeting, the majority of the members were not ready to contribute to such a report, but if the Agency would be able to prepare the report without direct assistance of the IWGFR, then some of the members are willing to review it carefully and to comment on it. The report will therefore be prepared by the Agency as a timely and objective review of the status of fast breeder reactors. Good bases for such a report include the INFCE report for which certain parts have to be updated, and the national reports prepared by the IWGFR members annually.

\*\* The idea to initiate a CRP within the IWGFR was generally supported. After discussions with CEC and selection of a topic a detailed working programme should be prepared with the assistance of consultants, nominated by the IWGFR Member States.

d. Consideration of the request of the IAEA safeguards system studies section for technical experts on the design of fuel handling systems of LMFBRs

The members of the IWGFR were informed that the IAEA Safeguards system studies section was planning to hold a consultants' meeting in 1983 on safeguarding LMFBRs. They were requested to recommend 1 or 2 technical experts who could prepare and present a paper at this meeting on trends of development and design for fuel handling systems of LMFBRs.

The members of the IWGFR from FRG, USA and USSR reported that the Authorities of their countries would be ready to respond to the official request of the IAEA concerning such experts. The representative of the CEC, Mr. Balz, informed the members that the CEC is also interested in proposing an expert for the presentation of a paper at such a planned meeting. It was requested that copies of the official letter requesting nomination of participants for the meeting should be sent to the members of the IWGFR and to the CEC. The meeting could be organized by the IAEA Department of Safeguards in cooperation with the Division of Nuclear Power in order to assure direct input from the IWGFR and to receive feedback on the results achieved at the meeting. It was recommended that the Scientific Secretary should report to the members of the IWGFR about the results of the planned meeting.\*

6. Revision of "Recommendations on Preparation and Distribution of Minutes and Reports" and "General Recommendations Concerning Arrangements for Specialists' Meetings Organized in the Framework of the IWGFR"

The revised Annex II of the IWGFR Terms of Reference titled "Recommendations on Preparation and Distribution of Minutes and Reports" which was agreed upon by all IWGFR members is given in Appendix XIII.

The members of the IWGFR were not ready to discuss Annex I titled "General Recommendations Concerning Arrangements for the Specialists' Meetings Organized in the Framework of the IWGFR" since the proposed text was not submitted sufficiently in advance. The members of the Group requested also the policies and procedures from the IAEA Administrative Manual concerning organization of Technical Committee Meetings. It was recommended that discussion of the proposal should be postponed to the 16th meeting of the IWGFR.

7. Presentations and Discussions on National Programmes on Fast Breeder Reactors

The national programmes of all the Member States were presented and discussed. They will be issued as a separate report.

8. The date and place of the Sixteenth Annual Meeting of the IWGFR

It was recommended that the next IWGFR meeting should be held in Vienna, on 12 April-15 April 1983.

---

\* Some changes were made in the draft of the IAEA programme for 1983-84 after the request of the Safeguards System Studies Section in December 1981 and after the 15th meeting of the IWGFR late in March 1982. The consultants' meeting on safeguarding FBRs has been postponed from 1983 to 1984 or 1985.

Appendix I

List of participants at the 15th Annual Meeting of the IWGFR

FRANCE

L. Vautreay                      Commissariat a l'Energie Atomique  
CEN de Saclay  
B.P.No. 2  
91190 Gif-sur-Yvette

GERMANY, FED. REP. OF

M. Kempken                      Bundesministerium fuer Forschung  
und Technologie  
Heinemannstrasse 2  
Postfach 200706  
D-5300 Bonn 2

W. Marth                          Kernforschungszentrum Karlsruhe  
Projekt Schneller Brueter  
Postfach 3640  
D-7500 Karlsruhe

INDIA

S. Paranjpe                      Reactor Research Centre  
Kalpakkam-603 102  
Chingleput District  
Tamil Nadu

ITALY

F. Pierantoni                    CNEN Fast Reactor Programme  
Via Arcoveggio 56/23  
I-40129 Bologna

L. Bruzzi                          CNEN Fast Reactor Programme  
Via Arcoveggio 56/23  
I-40129 Bologna

JAPAN

Y. Matsuno  
Experimental Fast Reactor Division  
O-arai Engineering Center, PNC  
4002 Naritamachi, O-arai  
Higashi Ibaragi-gun  
Ibaragi-ken 311-13

UNION OF SOVIET  
SOCIALIST REPUBLICS

E. Inyutin  
Institute of Physics and  
Power Engineering  
Obninsk, Kaluzhskaja Region

E. Khodarev  
Institute of Physics and  
Power Engineering  
Obninsk, Kaluzhskaja Region

UNITED KINGDOM

R. Wheeler  
Fast Reactor Development  
Directorate  
United Kingdom Atomic Energy  
Authority  
Northern Division  
Risley, Warrington, WA3 6AT

C. Gregory  
United Kingdom Atomic Energy  
Authority  
Dounreay Nuclear Establishment  
Thurso, Caithness, Scotland

UNITED STATES OF AMERICA

K. Horton  
US Department of Energy  
Mail Stop B-107/GTN  
Washington, D.C. 20545

COMMISSION OF THE  
EUROPEAN COMMUNITIES

W. Balz  
Commission of the European  
Communities, Office DG XII - D/2  
200, rue de la Loi  
B-1049 Brussels  
Belgium

IAEA

H.J. Laue

DIR-NENP

V. Efimenko

Scientific Secretary of the IWGFR

OBSERVERS

SWITZERLAND

P. Wydler

Division de la physique des réacteurs  
Institut fédéral de recherches en  
matière de réacteurs  
CH-5303 Wuerenlingen

BELGIUM

P. Libotte

De la Societe Belgonucleaire,  
25, rue de Champ de Mars  
B-1050 Brussels

Agenda of the 15th Meeting of the  
International Working Group on Fast Reactors

1. Review of IWGFR Activities
  - a. Approval of the Minutes of the Fourteenth IWGFR Meeting
  - b. Report by the Scientific Secretary Regarding Activities of the Group
  
2. Consideration of Conferences on Fast Reactors
  - a. International Conference on LMFBR Safety and Related Design and Operational Aspects, Lyon, France, 19-23 July 1982
  - b. Third International Conference on Liquid Metal Technology, Oxford, United Kingdom, April 1984
  - c. IAEA Symposium on LMFBR Power Plants Experience and Future Trends, 1984
  - d. IAEA Symposium on "Choice and Justification of the Design Solutions and Basic Parameters of Large LMFBRs"
  - e. IAEA International Conference on Nuclear Power Experience, Vienna, 13-17 September 1982
  - f. IAEA Meetings which may be of interest to IWGFR Member
  - g. Coordination of the schedule for the major fast reactor meetings and other major international meetings having a predominant fast reactor interest.
  
3. Consideration of the major recommendations of some of the IWGFR specialists' meetings for which the support of the IWGFR is requested.
  
4. Consideration of a schedule for specialists' meetings in 1982-83:
  - a. SM on Sodium Fires, Design and Testing, Richland, Washington, USA, May 24-27, 1982
  - b. SM on Advance in Structural Analysis for LMFBR Applications, Saclay, France, 12-15 October, 1982

- c. SM on Sodium Stratification, Grenoble, France, 18-21 October 1982
  - d. SM on Theoretical and Experimental Work on Steam Generator Safety with Particular Reference to Leak Development and Detection, Apeldoorn, Netherlands, Spring, 1983
  - e. Suggestions of the IWGFR on other specialists meetings and their justifications
5. Consideration of the other IWGFR activities:
    - a. Preparation of the Technical Report on "Status of Fast Breeder Reactors in the World"
    - b. Revision of "LMFBR Plant Parameters" report
    - c. Consideration of appropriate fields for coordinated research programmes
    - d. Consideration of the request of IAEA safeguards system studies section or technical experts on the design and fuel handling system of LMFBRs
  6. Revision of "Recommendations on Preparation and Distribution of Minutes and Reports" and "General Recommendations Concerning Arrangements for Specialists' Meetings Arranged in the Framework of the IWGFR".
  7. Presentation and Discussions on National Programmes on Fast Breeder Reactors
  8. The date and place of the Sixteenth Annual Meeting of the IWGFR.

#### Time Schedule

#### March 30

10.00 - 10.20	Opening of the Meeting
10.20 - 13.00	Morning session
11.30 - 12.00	Break
13.00 - 14.30	Lunch
14.30 - 18.20	Evening session
16.00 - 16.30	Break
18.30 - 19.30	Cocktail Party
19.30 - 21.00	Film



March 31

09.30 - 13.00	Morning session
11.00 - 11.30	Break
13.00 - 14.30	Lunch
14.30 - 18.30	Trip to Kaluga, visit to the Museum of Astronautics
19.30 - 22.00	Dinner-Party

April 1

09.00 - 13.00	Morning session
11.00 - 11.30	Break
13.00 - 14.30	Lunch
14.30 - 18.20	Evening session
16.00 - 16.30	Break
18.30 - 21.00	Concert

April 2

09.00 - 13.00	Morning session
11.00 - 11.30	Break
13.00 - 14.30	Lunch
14.30 - 16.30	Visit to the Institute of Physics and Power Engineering
16.30 - 18.00	Cocktail Party
18.30	Departure to Moscow

Review of the IWGFR Activities for the Period since  
the Fourteenth Annual Meeting of the Group

Various activities of the International Atomic Energy Agency within the framework of the International Working Group on Fast Reactors have been carried out based on IWGFR recommendations made at the Fourteenth Meeting of the working group.

I. Specialists' Meetings

Since the last Working Group Meeting three Specialists' Meetings were held and four Specialists' Meetings are under preparation

- (a) The Specialists' Meeting on Fuel Failure Detection and Location in Fast Reactors was held in Karlsruhe, Federal Republic of Germany on 11-14 May 1981. I would like to bring to the attention of the IWGFR members the following items of General Conclusions and Recommendations of the meeting:

1. It was recognized that the problems of the failed fuel characterization and the failed fuel management are connected with other fields and specialists in these fields should be involved to solve the problems. The evolution of the cladding failure, methods for direct measurements of fuel release into the coolant could be investigated in cooperation with specialists on sodium chemistry and metallurgy. The policy of operating reactor with failed fuel should be discussed not only by specialists on fuel failure detection and location, but also by specialists on reactor safety, economics, operation and management, fuel performance.
2. A fruitful exchange of the future information obtained in different countries could be organized if a standard method would be used in all countries for the calibration of DN monitors, including using of a common type of a recoil source of an agreed upon composition or nature.
3. It was recommended by the participants of the meeting that a specialists' meeting on "Contamination Problems in LMFBRs including Contamination by Fuel" should be sponsored by the IWGFR in the near future.
4. The specialists' meeting on "Fuel Failure Detection and Location and a Strategy of Failed Fuel Management in LMFBRs" was recommended to be sponsored by the IWGFR in three or four years' time.

As it was proposed at the 14th Meeting of the IWGFR the members of the Working Group are requested to recommend whether or not the topics indicated in items 3 and 4 should be included into the list

of topics for the IWGFR specialists' meetings. It would be also appreciated if the members of the IWGFR could consider what kind of international effort should be organized in accordance with item 2.

- (b) The Specialists' Meeting on Design Features Affecting the Dynamic Behaviour of Fast Reactor Cores was held in Rome, Italy on 2-5 June, 1982. I would only like to mention the following recommendation of the participants of the meeting.

It was observed by the participants of the meeting that restraint systems were proposed for most future designs to limit radial movement of the tops of subassemblies, but the schemes proposed were different. Studies of the dynamic response of these systems aroused considerable interest. Therefore, it is recommended that the IWGFR organize a Specialists' Meeting on the bowing behaviour of fast reactor cores. This Specialists' Meeting should not be held before the second half of 1982 and should cover the following subjects:

- A. Methods for mechanics and reactivity calculations
- B. Verification and qualification of methods by
  - benchmark calculations, and
  - evaluation and recalculation of out-of-pile experiments and reactor operation data
- C. Concept studies: evaluation of mechanical and nuclear properties of different restraint systems
- D. Requirements and criteria for core restraint systems

Recommendations of the IWGFR members on including this topic into the list of topics for IWGFR meetings are appreciated.

- (c) The Specialists' Meeting on Sodium Boiling Noise Detection was held at Chester, United Kingdom on 9-11 June 1981

The participants of the meeting agreed that it would be valuable to explore the possibility of a benchmark test for the analysis of sodium boiling noise detection data. The Japanese delegates were invited to prepare an initial proposal for circulation by the IAEA for comments of members of the IWGFR and participants of the meeting. It would be appreciated if Mr. Y. Matsuno could inform the members of the IWGFR about the status of preparation of the proposal.

It was also recommended that a further meeting should be considered in about 3-4 years' time, either on boiling noise detection or more generally on acoustic surveillance for LMFBRs.

- (d) The Specialists' Meeting on Sodium Fires, Design and Testing is under preparation. The IAEA has accepted the official invitation of the government of the United States to hold this meeting in Richland, Washington on 24-28 May 1982. By the beginning of March IWGFR members from France, FRG, Japan and USA informed the IAEA and other members of the IWGFR about nominations of participants from their countries. However, nomination of participants through

official channels was only received by the IAEA from France. In order to communicate with nominated participants we also need their addresses.

- (e) The Specialists' Meeting on Advances in Structural Analysis for LMFBR Applications is under preparation. An official letter was sent by the IAEA to French Authorities enquiring whether they agree to host the meeting in question. The proposed date of the meeting is 12-15 October 1982 and we hope, that the preliminary programme of the meeting will be distributed in the near future for comments of the members of the IWGFR.
- (f) The Specialists' Meeting on Thermal Stratification in Sodium which was approved as a reserved topic at the last IWGFR meeting, is expected to be held instead of the Specialists' Meeting on "Theoretical and Experimental Work on Steam Generator Safety". The IAEA informed the Authorities of France that the Agency intends to hold the specialists' meeting on Thermal Stratification in Sodium in France and enquired their agreement to host the meeting. The proposed date of the meeting is 18-21 October 1982.
- (g) The Specialists' Meeting on "Theoretical and Experimental Work on Steam Generator Safety with Particular Reference to Leak Development and Detection" has been proposed by the DeBeNe countries to be postponed to spring 1983 and should be considered as one of three specialists' meetings which will be recommended for 1983. A preliminary programme of the meeting was distributed in January 1982 for comments by the IWGFR members.

## II. Symposia and Conferences

One important conference which was endorsed by the IWGFR has been held and two such conferences (non-sponsored by the IAEA) are under preparation

1. International Conference on Fast Reactor Fuel Cycles was held in London, on 9-12 November 1981
2. International Topical Meeting on Liquid Metal Fast Reactor Safety and Related Design and Operational Aspects will be held in Lyon, France, on 19-23 July 1982
3. Third International Meeting on Liquid Metal Technology will be held in Oxford, United Kingdom, in April 1984

IAEA Symposium on LMFBR Power Plants Experience and Future Trends has been approved for 1984 by the IAEA Scientific Advisory Committee. The new title of the Symposium was proposed instead of the previous one (IAEA Symposium on Design, Construction and Operating Experience of LMFBR Power Plants) to emphasize also prospects of LMFBR development.

## III. Publications

1. The Summary Report of the Fourteenth Annual Meeting of the IWGFR consisted of two parts:

IWGFR/37-1. Part I - Minutes of the Meeting with Appendices (distributed in December 1981)

2. With regard to the Summary Reports of the Specialists' Meetings, the following two reports were reproduced and distributed by the Agency amongst the IWGFR members and participants of the corresponding meetings:

(a) IWGFR/39. The Summary Report of the Specialists' Meeting on Design Features Affecting a Dynamic Behaviour of Fast Reactor Cores (distributed in March 1982)

(b) IWGFR/40. The Summary Report of the Specialists' Meeting on Sodium Boiling Noise Detection (distributed in March 1982).

For the Summary Report of the Specialists' Meeting on Fuel Failure Detection and Location, IWGFR/38, it was agreed by the host organization, that the proceedings of the meeting will be published in the host organization - Kernforschungszentrum Karlsruhe. We hope that the proceedings will be distributed in the near future.

IV. Preparation of other Documents in the Framework of the IWGFR Activities

(a) LMFBR Plant Parameters. A first draft of the revised version of LMFBR Plant Parameters is being prepared on the basis of the list of parameters distributed by Dr. Paranjpe with modifications proposed by Dr. Smith. The first draft is expected to be distributed for corrections and additions by the members of the IWGFR in the middle of April. We hope that final revisions to the report could be completed by June 1982 and submitted for publication by the Agency. Subsequently, it is intended also to prepare a short version of LMFBR Plant Parameters for including as an appendix to the planned publication "Status of Fast Breeder Reactors in the World".

(b) "Status of Fast Breeder Reactors in the World". The purpose of the report is to inform IAEA Member countries, including those which do not have the major programmes in the field of fast breeder reactors, about the status of fast reactor development. A preliminary outline of the report was distributed for comments by the IWGFR members. We are planning to organize a consultants' meeting in Vienna in June 1982 for compiling and preparation of the draft report. Any contributions or assistance that could be made available by Members of the Working Group would be appreciated.

(c) Revision of Annexes to the IWGFR Terms of Reference.

The IAEA proposals regarding revised versions of "General Recommendations Concerning Arrangements for Specialists' Meetings Organized in the Framework of the IWGFR" (Annex I) and "Recommendations on Preparation and Distributions of Minutes and Reports" (Annex II) were prepared in the IAEA Secretariat and distributed amongst the members of the IWGFR before the 15th Annual Meeting.

Third International Conference on Liquid Metal Engineering  
and Technology in Energy Production

This international conference is the third in a series that provides a forum for the presentation and discussion of invited and contributed papers covering recent advances in the field of liquid metal technology. Inevitably the majority of the papers will relate to the sodium-cooled fast reactor system and this is reflected in the list of conference topics opposite. Recognizing the advanced stage of development of the fast reactor world-wide it will be a main objective of this conference to assess the status and future of this reactor system by focusing attention on the critical design and development activities under way and the outstanding issues to be resolved. In support of this aim the scope of the conference has been widened and extended to include and emphasize sodium engineering, component testing and reactor operating experience in addition to the more conventional liquid metal technology aspects.

As for the previous two liquid metal conferences there will be additional sessions on other applications of liquid metals in energy production, notably fusion, solar, gas turbines, etc.

The conference programme will comprise two or three plenary sessions of invited papers (each session will comprise one half-day) and a series of sessions of contributed papers. In view of the wide scope of the conference it is expected that there will have to be sessions held in parallel, but such sessions will be of contributed papers only. It is anticipated that visits will be arranged for conference delegates to the UKAEA's establishments at Dounreay and Culham and to the CEA's Phenix.

Overseas Steering Committee

Chairman:	Dr. D.M. Donaldson	UK
Members:	Mr. Y. Fruchard	France
	Dr. W. Marth	FRG
	Mr. J. Atwood	USA
	Mr. J.A. Ford	USA
	Mr. R.D. Kale	India

Others to be nominated

UK Organizing Committee

Chairman:	Dr. D.M. Donaldson	UKAEA, Risley
Members:	Mr. P.R. Bolt	CEGB/GDCD
	Dr. K.G. Eickhoff	UKAEA/RNL, Risley

Mr. C.V. Gregory	DNE, Dounreay
Mr. J.R. Findlay	AERE, Harwell
Dr. R.S. Hall	CEGB/BNL
Mr. R.P. Hardingham	NNC, Risley
Dr. P. Hawtin	AERE, Harwell
Mr. A.R. Lunt	NNC, Risley
Dr. R.J. Pulham	Nottingham University
Dr. C. Tyzack	UKAEA/RNL, Risley

Secretary: Miss J. Green                      BNES, London

### CONFERENCE TOPICS

#### Engineering and Component Testing in Sodium

- 1 Machines for use in sodium environments (including electromagnetic devices)
- 2 The influence of sodium on the life of structures
- 3 Steam generators and other heat exchangers
- 4 Heat and mass transfer in sodium cover gases
- 5 Thermal insulation systems for sodium and its cover gas
- 6 Thermal hydraulics in sodium pool and tube bundle geometries
- 7 Instrumentation for use in sodium environments
- 8 In-service inspection, component cleaning and component requalification
- 9 Design for sodium leaks, fires and fumes

#### Chemistry and Behaviour of Materials in Sodium

Corrosion and mass transfer: metals and non-metals  
 Radionuclide distribution and control  
 Impurity control and monitoring  
 Physical chemistry and basic properties  
 Friction and wear effects in sodium environments  
 Effects of sodium on mechanical properties

#### Operating Experience with Sodium-Cooled Fast Reactors

##### Liquid Metals other than Sodium

Application in Fusion: Design concepts and engineering experience  
 Other heat transfer applications  
 Lithium chemistry and technology  
 Potassium, caesium, lead, etc. - technology and engineering

DRAFT PRELIMINARY PROGRAMME FOR IAEA SYMPOSIUM ON  
"LMFBR POWER AND TEST PLANT EXPERIENCE AND FUTURE DESIGN TRENDS"

1. Experience in physics and safety of LMFBR cores (large plant)
  - a. power, temperature distributions (calculated, actual)
  - b. control, feedback aspects
  - c. operations with failed fuel (fuel performance)
  - d. experience with meeting licensing criteria
  
2. Experience in fuel management
  - a. refuelling
  - b. spent fuel storage
  - c. cycle times
  
3. Plant operations and maintenance
  - a. fission product release
  - b. components performance (valves, heat exchangers, pumps, etc.)
  - c. radioactivity control and transfer
  - d. operations under off-design conditions
  
4. Trends in:
  - a. fuel type, distribution, burnup, cycle time, etc.
  - b. core configurations
  - c. plant design (sizing, pool, loop, etc.)
  - d. licenseability
  - e. component improvement (maintenance, sizing, etc.)
  - f. economic considerations
  - g. role of FBRs vis-a-vis thermal reactors



Appendix VI

List of Meetings on Atomic Energy (Sponsored  
by the IAEA) which may be of Interest to the IWGFR Members

1982

1. 21-25 June \* UTRECHT, The Netherlands  
International Symposium on the  
CONDITIONING OF RADIOACTIVE WASTES  
FOR STORAGE AND DISPOSAL
2. 13-17 September VIENNA, Austria  
International Conference on  
NUCLEAR POWER EXPERIENCE
3. 11-15 October MUNICH, Federal Republic of Germany  
3rd International Symposium on NUCLEAR  
POWER PLANT CONTROL AND INSTRUMENTATION
4. 8-12 November VIENNA, Austria  
International Symposium on  
RECENT ADVANCES IN NUCLEAR MATERIAL  
SAFEGUARDS
5. 22-26 November VIENNA, Austria  
International Symposium on the  
WATER CHEMISTRY AND CORROSION PROBLEMS  
OF NUCLEAR REACTOR SYSTEMS AND COMPONENTS

1983

6. 1983 International Conference on  
WASTE MANGEMENT
7. 1983 International Symposium on  
OPERATIONAL SAFETY OF NUCLEAR POWER  
PLANTS

---

\* Organized jointly by IAEA, NEA and CEC

JUSTIFICATIONS OR PRELIMINARY PROGRAMMES  
OF SOME OF THE AGENCY'S MEETINGS

1. INTERNATIONAL SYMPOSIUM ON THE CONDITIONING OF RADIOACTIVE WASTES  
FOR STORAGE AND DISPOSAL

(Jointly sponsored with the Commission of the European Communities  
and the Nuclear Energy Agency, Organization for Economic  
Co-operation and Development)

UTRECHT, The Netherlands, 21-25 June 1982

A. Bases for Conditioning  
(How much conditioning is necessary?)

Conditioning requirements for storage  
Conditioning requirements for disposal  
Risk/dose assessment and reduction  
Acceptance criteria for conditioned waste

B. Immobilization Processes  
(How are high quality waste forms produced?)

New process developments  
Waste forms produced  
Process control methods  
Control of waste form (quality assurance)

C. Packaging Methods and Materials  
(How are other engineered barriers useful?)

Containers (primary, secondary)  
Overpacks and backfills  
Impact on waste form requirements  
Impact of barrier materials on environment

D. Evaluation of Conditioned Waste  
(How are waste packages determined acceptable?)

Repository/storage conditions  
Test conditions and bases  
Standardized methods of testing  
Test results (leaching, corrosion, radiation, physical  
effects, etc.)  
Correlation of results (accelerating time and temperature)  
Quality of waste forms from immobilization processes  
Comparison with waste acceptance criteria

E. Cost/Benefit of Conditioned Waste  
(How is the degree of conditioning justified?)

Technical considerations  
Resource materials  
Socio-economic aspects  
Environmental and radiological protection needs

2. INTERNATIONAL CONFERENCE ON NUCLEAR POWER EXPERIENCE,  
VIENNA, Austria, 13-17 September 1982

1. Planning and development of nuclear power programmes

Plenary sessions 1A, 1B and 1C

Review of experience gained in the planning and development of nuclear power and fuel cycle programmes including consideration of the importance of nuclear power in national energy and economic balances for large as well as small programmes. The impacts of long-term planning as well as factors to be considered in the decision-making and execution process.

One of the three plenary sessions will be devoted to an examination of the special problems which have been faced by developing countries in the introduction of nuclear power. Programme and project experience. Requirements on domestic infrastructures for technology assimilation and experience especially from manpower development. Financing problems..

Panel discussions at the end of two of the plenary sessions.

Technical session

1.1. The session should review experience gained in individual developing countries in preparing and executing nuclear power programmes with case studies of developing and reinforcing infrastructures and transfer and assimilation of technology.

2. Technical and economic experience of nuclear power production

Plenary sessions 2A and 2B

Review of experience from the main lines of development of nuclear power plants, their design, construction and operation and from the economics of nuclear power production. Technical experience should include safety, environmental protection, and reliability aspects, as well as general construction experience and standardization efforts with different reactor types and unit sizes. Economic subjects to be covered include: capital, fuel cycle, and operating costs, the impacts of lead times and regulatory requirements on performance and costs; and projected decommissioning costs.

Two plenary sessions on construction and operation experience respectively, with a panel discussion at the end of each

Technical sessions

2.1. Plant availability

The session should review the main reasons for past plant unavailability and experience of components and systems reliability. Design for improved availability and experience of the effectiveness of quality assurance measures in design, construction, manufacturing, commissioning and operation including repair, maintenance and in-service inspection.

## 2.2. Nuclear power generating costs

The session should review past experience with predicted and actual investment costs, the reasons for experienced increases in investment costs and possibilities of foreseeing and controlling such increases. Reasons would include site characteristics, regulatory action, lead time lengthening for these and other reasons, financing modes, supply agreement and contract influences, etc.

Operating costs, including fuel, operations, maintenance and repairs, and decommissioning charges, should also be reviewed.

## 3. The nuclear fuel cycle

### Plenary session

Review of experience gained in uranium resources base development and in the supply situation. The development of process technology for uranium production, conversion, enrichment, fuel fabrication and fuel performance.

Spent fuel management: Storage, transportation, reprocessing and recycling. Management, including ultimate disposal, of fuel cycle wastes. Technological and economic aspects of fuel cycle development.

Panel discussion at end of session.

### Technical sessions

#### 3.1. Uranium resources and production A+B Uranium enrichment and fuel fabrication

The session should review production from known resources and assessment of potential future production. Experience of resource development lead times and market mechanisms and their influence on uranium availability and prices. Technical developments in the uranium production industry. Available experience of the fuel cycle industry processes conversion, enrichment fuel fabrication, in particular with regard to the realization on industrial scale, product quality, operational reliability and economics. Experience from new technologies should be used to assess their future potential for replacing present processes.

(Two sessions foreseen).

#### 3.2. Fuel design, utilization and performance

The session should review progress in proven reactor fuel design, production and quality assurance, fuel element performance and reliability, improvements in fuel utilization up to and beyond original burn-up specifications.

#### 3.3. Spent fuel management: storage, transportation, reprocessing and recycling A+B Fuel cycle waste management

Experience in spent fuel storage and transport and strategy development for management of various types of spent fuel including

reprocessing and recycling; the lead times which are to be expected under different circumstances. Experience with fuel cycle wastes in general and in particular the treatment and disposal of the tailings from mining and milling operations and the high-level wastes from reprocessing. The subject should be treated from the point of view of technology development. Strategies for management, including ultimate disposal, of high-level waste, and decommissioning of nuclear facilities.

(Two sessions foreseen.)

#### 4. Nuclear safety experience

Plenary session

The main issues which have been and are orienting nuclear safety. Design provisions for safety. Advanced safety features. Use of risk analysis in the design and in the regulatory process. Use of operating experience for improving plant safety. Operator training. Radiological protection, concepts and results.

Panel discussion at end of session.

Technical sessions

##### 4.1. Important developments in safety analysis and technology

Developments in safety analysis and in design for safety. Global approaches to safety. Safety goals.

##### 4.2. The man-machine interface in nuclear power plant control

Experience in design of displays and control rooms taking into account human factor engineering. Presentation of alarms, taking into account the importance and urgency of the information. Computer assistance to operators and special instruments for accident conditions. Operator training.

##### 4.3. Radiation protection at nuclear power plants and fuel cycle facilities

Review of the application of the dose limitation system to exposure of workers and the public. Occupational exposure limitation. Definition of release limits. Dose limitation through design.

#### 5. Advanced systems

Plenary session

Review of experience with breeder reactors and their fuel cycles to indicate the potential for large scale applications. Other advanced systems with their fuel cycles. Advanced application plans and their potential, e.g. in high temperature heat uses.

Technical session

##### 5.1. Breeder systems and their fuel cycles

The session should primarily focus on experience with the U-Pu fast breeder cycle. Empirically based estimates of industrial scale fuel

cycle lead times and breeding gains should be presented as well as time schedules for planned large-scale deployment.

## 6. International safeguards

Plenary session

Examination of the background for safeguards, scope of IAEA safeguards, the implementation of IAEA safeguards, its impact, relationship with national or regional systems and effectiveness.

Panel discussion at end of session.

Technical session

### 6.1. Safeguards implementation

The session should review the technical experience from safeguards operations in respect of goals, application approaches, inspections, data treatment and results. In addition, materials measurement techniques and containment and surveillance measures should be assessed empirically.

## 7. International co-operation

Review of experience from international agreements, their forms, scopes, substance and structures. Aspects of technology transfer should be considered. International undertakings and enterprises. Proposals for new types or examples of international co-operation.

Panel discussion at end of session.

## 3. INTERNATIONAL SYMPOSIUM ON NUCLEAR POWER PLANT CONTROL AND INSTRUMENTATION, MUNICH, FEDERAL REPUBLIC OF GERMANY, 11-15 October 1982

Each session will include review papers, to be given by invited speakers and carefully selected contributed papers. Each session is to be concluded by extensive discussion in order to give all participants an opportunity to contribute to the symposium with their main results and views, as well as with comments and suggestions.

### I. Experience with C&I of nuclear power plants

Utilities views on:

- Design, installation and commissioning problems
- Operational problems, desirable improvements
- Reliability, testability, maintainability
- Adequacy of control room layout

- Retrofitting operating reactors with new control and safety systems
- Qualified instruments for nuclear environment, seismic, QA and LOCA measurements
- Special problems and experience in the acquisition of C&I technology by developing countries
- Establishment of national training centres for C&I training of engineers and technicians
- Role of C&I specialists in regulatory activities.

## II. Improvements and new developments in man-machine communication

- Alarm handling and disturbance analysis systems
- Diagnosis systems (loose parts, leakages, etc.)
- Problems and improvements of man-machine communication in plant abnormal situations and under accident conditions
- New control room concepts; VDUs and/or conventional alarm systems
- Human engineering problems
- Organisational problems; role of operator
- Design against erroneous action of operator and maintenance personnel
- Module design
- Simulators (full scope simulators, basis principle simulators and simulators for design and development).

## III. New C&I concepts and instrment techniques

- Designing C&I to cater for retrofitting, expansion and to combat obsolescence
- Supervision and control concepts in computerized C&I systems
- Computerized protection systems
- Intelligent systems for protective functions; defence in-depth strategy-related reliability requirements
- Post-accident instrumentaton
- New/improved chemical and radiochemical measuring methods
- Data-bus systems; fibre optics, micro-processors
- New sensor techniques; digital sensors, acoustic emission sensors

- New electronics; self-checking measuring chains
- Advances in in-core instrumentation/power measurements

IV. Reliability, qualification and operability

- Process-computer and micro-processor reliability
- The role of probabilistic assessment in design of C&I systems
- Maintainability problems of C&I equipment (e.g. distributed systems)
- Qualification problems of safety-related C&I equipment
- International guidelines and regulations

4. INTERNATIONAL SYMPOSIUM ON RECENT ADVANCES IN NUCLEAR MATERIAL SAFEGUARDS, VIENNA, Austria, 8 - 12 Nov. 1982

A. Safeguards for Existing Nuclear Facilities

- Approaches and experience
- Effectiveness assessment

B. Materials Accountancy (Conventional and Near-Real-Time)

- Concept and applications
- In-process physical inventory measurements
- Evaluation of sequential material balance data

C. Use of Process Instrumentation in IAEA Safeguards

D. Containment-Surveillance in IAEA Safeguards

- Optical surveillance in IAEA Safeguards
- Extended C-S concepts and applications
- Hardware development for extended C-S systems
- C-S instrumentation (poster session)

E. Destructive and Nondestructive Measurement and Verification Techniques

- Measurement of verification of spent LWR fuel
- Installed measurement instrumentation
- Field test instrumentation
- Destructive and NDA measurement and verification techniques (poster session)

F. Verification in International Safeguards



5. INTERNATIONAL SYMPOSIUM ON THE WATER CHEMISTRY AND CORROSION  
PROBLEMS OF NUCLEAR REACTOR SYSTEMS AND COMPONENTS, VIENNA,  
Austria, 22-26 November 1982

For each of the topics or sub-topics listed in the outline below the Agency plans to schedule one to two invited review papers, to be followed by a limited number of specially selected contributed papers.

Existing experience in water chemistry for nuclear power plants with boiling water reactors

Existing experience in water chemistry for primary circuits of nuclear power plants with pressurized water reactors

Existing experience in water chemistry for secondary circuits of nuclear power plants with pressurized water reactors

Existing experience in water chemistry for nuclear power plants with heavy water reactors

Corrosion and erosion of structural materials, including fuel structural materials in different types of reactor environments

Developments in decontamination technology for nuclear power plant reactor systems

Chemical and radiochemical control of reactor systems

Developments in the technology of coolant purification of reactor primary and secondary circuits

Developments in the theoretical basis and modelling of reactor water regimes and corrosion of reactor structural, including fuel cladding, materials

LIST OF MEETINGS ON ATOMIC ENERGY (NON-SPONSORED BY  
THE IAEA) WHICH MAY BE OF INTEREST TO THE IWGFR MEMBERS

<u>1982</u>		<u>Page*</u>
1.	12-15 April SALT LAKE CITY, Utah, USA Topical Meeting on FAST, THERMAL, AND FUSION REACTOR EXPERIMENTS	28
2.	26-30 April BRUSSELS, Belgium International Conference on NEW DIRECTIONS IN NUCLEAR ENERGY WITH EMPHASIS ON FUEL CYCLES (ENC.3)	32
3.	11-12 May WASHINGTON, D.C., USA NUCLEAR POWER Assembly	35
4.	7-11 June LOS ANGELES, California, USA Annual National Meeting of the AMERICAN NUCLEAR SOCIETY	40
5.	20-24 June LAUSANNE, Switzerland FORATOM VIII: NUCLEAR ENERGY - Europe and the World	45
6.	28-30 June SCOTTSDALE, Arizona, USA, IIth Symposium on EFFECTS OF RADIATION ON MATERIALS	48
7.	19-23 July ** LYONS, France International Topical Meeting on LIQUID METAL FAST BREEDER REACTOR SAFETY AND RELATED DESIGN AND OPERATIONAL ASPECTS	51
8.	25-28 July PORTLAND, USA 2nd JOINT NUCLEAR CONFERENCE	52
9.	22-28 August MOSCOW, USSR 10th World Conference on NON DESTRUCTIVE TESTING	54
10.	6-10 September MUNICH, FED.REP. OF GERMANY 7th International HEAT TRANSFER Conference	61
11.	14-16 September BRIGHTON, Sussex, UK Meeting on HEAT AND FLUID FLOW IN NUCLEAR AND PROCESS PLANT SAFETY	64
12.	20-22 September YORK, UK Conference on NON DESTRUCTIVE TESTING	65

\* Detailed information may be found in "Meetings on Atomic Energy", Vol.14, No.1, January 1982, IAEA on indicated pages.

\*\* Endorsed by the IWGFR

13.	22-24 November	AACHEN, FED.REP. OF GERMANY 4th International Conference on WELDING IN NUCLEAR ENGINEERING	74
<u>1983</u>			<u>Page</u>
14.	12-17 June	DETROIT, Michigan, USA Annual National Meeting of the AMERICAN NUCLEAR SOCIETY	78
15.	22-26 August	CHICAGO, Illinois, USA 7th Conference on STRUCTURAL MECHANICS IN REACTOR TECHNOLOGY (SMIRT-7)	81
16.	29 Aug.-9 Sept.	GENEVA, Switzerland United Nations Conference for the PROMOTION OF INTERNATIONAL CO-OPERATION IN THE PEACEFUL USES OF NUCLEAR ENERGY FOR ECONOMIC AND SOCIAL DEVELOPMENT	82

Appendix IX

List of Meetings on Atomic Energy (non-sponsored by the IAEA) which could be of interest to the IWGFR and for which the support of the IWGFR is invited

1. 19-23 July 1982 LYONS, France  
International Topical Meeting on  
LIQUID METAL FAST BREEDER REACTOR  
SAFETY AND RELATED DESIGN AND  
OPERATIONAL ASPECTS
2. April 1984 OXFORD, England, UK  
Third International Meeting on  
LIQUID METAL TECHNOLOGY IN ENERGY  
PRODUCTION
3. 1986 International Conference  
on Fast Breeder Reactor  
Safety

List of Proposed Topics  
for the IWGFR Specialists' Meetings

<u>No.</u>	<u>Title</u>	<u>Country</u>
1	Design for Strong Motion Earthquakes	India
2	Fuel-Coolant Interactions	India
3	Thermodynamics of Advanced Fast Reactor Fuel	India
4	Thermohydraulic Studies and Out-of-Pile Experiments on Nominal and Distorted Fuel Element Bundles	Italy
5	Methods and Tools to Detect Thermal Noise in Fast Reactors	Italy
6	Sodium Boiling under Decay Heat Conditions	Japan
7	Thermal Insulation and Preheating for Sodium System	Japan
8	Maintenance and Repair of LMFBR Steam Generator	Japan
9	Properties of Structural Materials Including Environmental Effects	UK
10	Fast Reactor Absorber Materials	UK & USSR
11	Heat and Mass Transfer in the Reactor Cover Gas	UK
12	Experience with Water-Side Corrosion of Steam Generator Tubing	USA
13	<del>Fast Reactors used as Actinide Burners</del> <i>3-dimensional Power Distribution; Requirements for and Status of Calculational Methods</i>	FRG
14	Ferritic Steel and Nickel Alloys for Fuel Cladding and Wrapper Tube (Fast Reactor Cladding and Core Structural Materials)	FRG & USSR
15	Cover Gas Purification	France

JUSTIFICATIONS OF PROPOSED IWGFR SPECIALISTS' MEETINGS

1. Design for Strong Motion Earthquakes

Possible subjects are:

a. Ground Motion

- Seismic input characteristics; shape and magnitude of spectra
- Attenuation with depth
- Probabilistic procedures in the selection of SSE and OBE

b. Soil-Structure Interaction (SSI)

- Need for non-linear SSI
- Need for 3-D SSI
- Embedment effects

c. Design Criteria and Verification

- Criteria and basis for dynamic decoupling of piping and equipment
- Load combinations and factored loads
- Demonstration of functional adequacy by analysis
- Criteria and basis for core components
- Raceways ( cable tray, electrical conduit)

d. Analysis Methods

- Multi-design spectra input for piping and component analyses
- Determining equipment spectra directly from ground and building spectra
- Analysis for gaps/non-linear effects for core, piping, vessel components and supports
- Modelling techniques for non-linear effects due to concrete cracking, complex (non-circular) buildings, load paths, etc.

e. Design Guidelines and Simplified Methods

- Pipe hanger/snubber locations; effect of spring rates; alternate designs for small piping
- Anchor support stiffness requirements
- Procedure/guidance on combination of model and spatial components at load and stress levels for specific cases
- 2-D vs. 3-D; advantages and guidelines/justifications
- Simplified methods for soil-structure interaction, quasi-linear analyses for gap effects

#### f. Testing Programmes

- Realistic damping factors for structures/piping/equipment
- Seismic monitoring instrumentation and procedures
- Guidelines for testing to demonstrate meeting functional requirements

#### 2. Fuel-Coolant interactions

Fuel-coolant interactions have been the subject of various theoretical and experimental investigations on account of the theoretical possibility of a very significant fraction of the heat liberated in a nuclear incident manifesting itself as mechanical work and thereby affecting the integrity of the primary containment system. It is felt desirable that a consensus be arrived at amongst the experts from different countries on this vital subject which is linked up with licensibility and acceptability of the fast breeder reactors. In this sense, the subject is not only of interest to IWGFR members but also to other members of IAEA who have some interest in the fast reactors.

#### 3. Thermodynamics of Advanced Fast Reactor Fuel

Utility of fast breeder reactors will increase if they could produce adequate fissionable material part of which could be diverted to thermal reactors which would be more suited for specialised applications like high temperature process heat. Thermodynamics of advanced fuels like carbides or nitrides holds a key to the success or otherwise of these advanced fuels and it is felt desirable that this subject is looked into by experts after pooling their knowledge and judgements.

#### 4. Thermohydraulic Studies and Out-of-Pile Experiments on Nominal and Distorted Fuel Element Bundles

The thermal hydraulics of non-nominal conditions need calculation methods and experimental support. As a first step these problems must be treated by sub-channel analysis. Codes dealing with local effects and their experimental supports are expected to be presented. The attention will be concentrated on testing of distorted geometry for all flow regions.

#### 5. Methods and Tools to Detect Thermal Noise in Fast Reactors

Temperature noise analysis is a potential means of detecting local blockages and related faults in fast reactor sub-assemblies. It has an important early warning capability being able in principle to indicate the early stages of the sub-assembly incident and thus permitting shutdown systems to operate before boiling and significant damage or escalation occurs.

The meeting should consider the following aspects:-

- i. Experimental data from rig including the sensitivity of the technique and the influence of sub-assembly geometric factors.
- ii. Data from operating reactors notably on background noise level, band-widths and variability.

- iii. Theoretical development on the generation of temperature noise in the turbulent fields of the sub-assembly coolant stream and the effect of thermal conductivity on dissipation processes and the optimisation of sub-assembly design to enhance signal characteristics, e.g. turbulence promoters.
- iv. Instrumentation response time.
- v. Data analysis technique to increase sensitivity and/or level of information on fault characteristics.

#### 6. Sodium Boiling under Decay Heat Conditions

Knowledge of characteristics of sodium boiling leading to dry out and subsequent failure of fuel pins is essential for evaluating fuel pin behaviour under certain important accidental conditions, such as those of loss of structural integrity of primary system.

This meeting should concentrate on reviewing state of the art of predicting sodium boiling phenomena in a fuel pin bundle under decay heat conditions immediately after reactor scram, based on the experimental results so far accumulated at various laboratories.

#### 7. Thermal Insulation and Preheating for Sodium System

Because of high melting point of coolant sodium well above room temperature, it is a characteristic feature of FBR to be necessarily equipped with preheaters as well as thermal insulators. Improvement of properties of thermal insulators and of reliability of preheating system will contribute to the economization of FBR plants.

Discussion at this meeting should include:

- Selection of insulators and preheating methods
- Optimization of heating rate
- Accuracy of temperature control of preheating system
- Methods of temperature control of preheating system
- Comparison of predicted and measured temperature
- Experiences with sodium loops and reactors

#### 8. Maintenance and Repair of LMFBR Steam Generator

Sodium water reaction due to tube failure is a major concern of LMFBR steam generator, since it utilizes single thin wall tube as a barrier between the secondary sodium circuit and the high pressure water/steam circuit.

If such a failure takes place, restart of the plant would be greatly affected by the effectiveness of prompt inspection and repair of the failed steam circuit.

If such a failure takes place, restart of the plant would be greatly affected by the effectiveness of prompt inspection and repair of the failed steam generator.

Several sodium water reaction incidents have been reported in the past and useful experiences of repair and maintenance of LMFBR steam generators seem to be accumulated in various countries.



Discussion of the meeting should be devoted mainly to:

- In-service inspection of tube bundle
- Identification and inspection of failed tubes
- Repairing of failed tubes
- Cleaning of failed steam generator
- Restarting conditions for failed steam generator based on the experiences gained.

9. Properties of Structural Materials including Environmental Effects

To provide a forum for exchange of information on the behaviour of structural materials in fast breeder reactors with special emphasis on the effects of sodium and irradiation environments on mechanical properties. The main emphasis would be on austenitic materials at high temperatures, but ferritic steel for components in the secondary circuits could be considered also. The objective of guaranteeing the performance of structural steel components for the lifetime of a reactor is of increasing interest and concern throughout the world.

The meeting would in effect be a continuation of the Specialists' Meeting held at Bergisch Gladbach, FRG, 17-21 October 1977. The subject matters would include:

- Mechanical Properties of Materials in Air
- Fracture Mechanics Studies
- Effect of Environment (irradiation, Na) on Materials Properties
- Relationship of Material- Properties and Design Methods with Emphasis on Materials Behaviour Aspects

If it meets with approval the UK would be prepared to host this meeting in 1982 or 1983, probably at Risley.

10. Fast Reactor Absorber Materials

Changes in the physical and mechanical properties of candidate fast reactor absorber materials as a function of burn-up due to neutron irradiation are a well recognised phenomena. Gas release and interaction of absorber materials with cladding tubes due to swelling of the absorbers and due to general corrosion and grain boundary attack are also important in determining the design and performance of absorber pins. The main purpose of the meeting would be to assess the experience of absorber pin behaviour which has been obtained since the last IWGFR meeting on this topic in 1973 and to consider the impact of this experience on absorber pin design. Mechanisms covering the absorber material properties and behaviour should be covered as well as the actual absorber pin behaviour.

11. Equation of State of Materials of Relevance to the Analysis of Hypothetical Fast Breeder Reactor Accidents

A specialists' meeting on this topic was held at Harwell, UK on 19 - 27 June 1978. The participants of the meeting recommended that a similar meeting be held in not less than two to three years. Such a meeting would review progress on the thermodynamic properties of appropriate materials.

## 12. Experience with Water-Side Corrosion of Steam Generator Tubing

The aim of such a meeting should be discussions on stability of the magnetite layer on the steam/water side of steam generators at start-up and load cycling; extrapolation of corrosion rates to long term operation etc.

## ✓ 13. Fast Reactors used as Actinide Burners

The higher actinides contribute substantially to the hazard potential of HAW from thermal and fast reactors. On the other hand they still have an energy content that could be utilized. Once it can be shown that the separation of the actinides from reactor-HAW is technically feasible, this separation is of interest from the environmental point of view. The separated actinides can then be fissioned - or become transmitted to fissionable nuclei - in reactors and in this way will be transformed to fission products of much shorter half-lives, in average.

The main points discussed will be:

- Status of Nuclear Data Basis to calculate actinide burners
- Feasibility of actinide separation for HAW
- Concepts for burning the actinides  
(LWRs, LMFBRs, specialized reactors)
- Fuel elements
- Environmental aspects of actinides burning
- Economic aspects of actinides burning

## 14. Ferritic Steel and Nickel Alloys for Fuel Cladding and Wrapper Tube

There is a great interest to increase the fuel burn-up so as to reduce the fuel cycle cost of fast reactors. Presently the limit of the burn-up is imposed by the damage dose of the steel and not by the fuel itself. This dose induces steel swelling and creep. If steels with moderate swelling and creep were used for fuel cladding and assembly wrapper tube, the burn-up could be largely increased. Ferritic steel and nickel alloys are considered for the purpose. One must investigate their impact on the core neutronics (critical mass, breeding gain,...) and on the design of the fuel pin and of the fuel assembly including the thermal and mechanical calculations and the design criteria.

Economic evaluations on the gain of using such steels or alloys must also be performed taking into account the fuel balance, the additional cost of improved structural material and the increased burn-up.

## 15. Cover Gas Purification

Argon has to be purified:

- to eliminate any impurity which could be damageable to the sodium circuits,
- to eliminate fission products in case of important pin failures.

This meeting should cover the possible methods and devices to eliminate fission products and chemical impurities.

Appendix XII

List of topics proposed by participants  
of the Specialists' Meetings

1. Repair of LMFBR Components
2. Contamination Problems in LMFBRs including Contamination by Fuel
3. Fuel Failure Detection and Location and a Strategy of Failed Fuel Management in LMFBRs
4. Bowing Behaviour of Fast Reactor Cores
5. Acoustic Surveillance for LMFBRs, or
6. Core Surveillance by Noise Analysis Techniques

Annex II  
to Terms of Reference, IWGFR (1977)

Recommendations on Preparation  
and Distribution of Minutes and Reports

1. Two reports are issued on the basis of the annual group meetings of the IWGFR: (1) Minutes of the Meeting including appendices and (2) Status of National Programmes on Fast Breeder Reactors. Summaries of discussions on national programmes will be distributed by letter to the IWGFR members, alternates, representatives and observers.
  
2. The Minutes of the IWGFR Meeting are prepared during the Meeting. After the meeting the Minutes should be published by the IAEA as soon as possible without additional comments or approval by the members of the IWGFR.
  
3. The proceedings of the Specialists' Meetings should be published by the host organisation, if possible. If not, only evaluated summaries, conclusions and recommendations of the meeting as well as national position papers should be printed by the IAEA and placed into INIS. Some papers presented at the meeting may be included, provided authors agree. In addition, the Chairman of the Specialists' Meeting should be encouraged to prepare jointly with the Scientific Secretary a suitable summary article of the meeting for publication in an international technical journal. Any references to specialist papers in the article must be agreed with the original author(s).
  
4. The publications should be given the following distribution: one copy to each participant of a particular specialist meeting, one copy to the resident representative of each state having a member in the IWGFR, one copy to each alternate and observer, three copies to each representative of international organisations and twenty five copies to each IWGFR member. Except for the Minutes, all AGM reports (Part II) and evaluated summaries, conclusions and recommendations of the specialists meetings as well as national position papers will be inserted into INIS to be available in microfiche.

LIST OF MEETINGS SPONSORED BY THE IWGFR

1. Consultants' Meeting on Fast Reactor Problems (March 1967, Vienna)
2. The First Meeting of the IWGFR (March 1968, Vienna)
3. SM on Sodium-Water Reactions (November 1968, ANL, USA)
4. The Second Annual Meeting of the IWGFR (March 1969, Vienna)
5. International Conference on Fast Reactor Irradiation Testing (April 1969, Dounreay, UK)
6. International Conference on Physics of Fast Reactor Operation and Design (June 1969, London, UK)
7. SM on Plutonium Alpha (June - July 1969, Winfrith, UK)
8. SM on Core Instrumentation for Sodium - Cooled Fast Reactors (October 1969, Karlsruhe, FRG)
9. The Third Annual Meeting of the IWGFR (March 1970, Cadarache, France)
10. SM on Sodium Vapour Control (March 1970, Cadarache, France)
11. IAEA Symposium on Sodium - Cooled Fast Reactor Engineering (March 1970, Monaco)
12. SM on Failure Cladding Detection (October 1970, Cadarache, France)
13. SM on Fast Reactor Spectrum Measurements and their Interpretation (November 1970, ANL, USA)
14. SM on Operational Safety of Sodium Circuits (March 1971, Risley, UK)
15. The Fourth Annual Meeting of the IWGFR (May 1971, Vienna)
16. SM on Sodium - Water Reactions (May 1971, Melekess, USSR)
17. Fourth Geneva Conference on Peaceful Uses of Atomic Energy (September 1971, Geneva, Switzerland)
18. SM on Fission and Corrosion Products Behavior in Primary Systems of LMFBRs (September 1971, Bensberg, FRG)
19. The Fifth Annual Meeting of the IWGFR (19 - 21 April 1972, Vienna)
20. SM on Handling and Transportation of LMFBR Spent Fuel Elements (April 1972, Rome, Italy)
21. SM on Sodium Fires (Sodium Combustion and its Extinguishment - Techniques and Technology), (May 1972, Richland, USA)

22. Conference on Engineering of Fast Reactors for Safe and Reliable Operation (9 - 13 October 1972, Karlsruhe, FRG)
23. SM on Sodium Impurity Measurements and Control (14 - 17 November 1972, Cadarache, France)
24. SM on Decontamination of Plant Components from Sodium and Radioactivity (9 - 12 April 1973, Dounreay, UK)
25. The Sixth Annual Meeting of the IWGFR (9 - 11 May 1973, Vienna)
26. SM on Development and Application of Absorber Materials for Fast Reactors (4 - 8 June 1973, Dimitrovgrad, USSR)
27. IAEA Symposium on Fuel and Fuel Elements for Fast Reactors (2 - 6 July 1973, Brussels, Belgium)
28. Symposium on Physics of Fast Reactors (16 - 23 October 1973, Tokyo, Japan)
29. IAEA Panel on Hot-Channel Factor Calculations (22 - 24 November 1973, Karlsruhe, FRG)
30. Conference on Fast Reactor Power Stations (11 - 14 March 1974, London, UK)
31. The Seventh Annual Meeting of the IWGFR (18 - 20 March 1974, Winfrith, UK)
32. SM on Handling of the Design for and Mitigation of Thermal Transients in LMFBR Plants (17 - 21 June 1974, Canoga Park, USA)
33. SM on Operating Experience and Design Criteria of Sodium Valves (23 - 27 September 1974, Richland, USA)
34. IAEA Study Group on Steam Generators for LMFBRs (14 - 17 October 1974, Bensberg, FRG)
35. The Eighth Annual Meeting of the IWGFR (15 - 18 April 1975, Vienna)
36. SM on the Reliability of Decay Heat Removal Systems for Fast Reactors (28 April - 1 May 1975, Harwell, UK)
37. SM on Fuel Failure Mechanisms (12 - 16 May 1975, Seattle, Washington, USA)
38. SM on Fission and Corrosion Product Behaviour in Primary Circuits of LMFBRs (8 - 11 September 1975, Dimitrovgrad, USSR)
39. IAEA - IWG - NPPCI - FR SM on Core & Primary Circuit Instrumentation of LMFBRs (27 - 29 January 1976, Risley, UK)
40. SM on In-Service Inspection and Monitoring of LMFBRs (9 - 12 March 1976, Bensberg, FRG)
41. The Ninth Annual Meeting of the IWGFR (30 March - 2 April 1976, Vienna)
42. SM on Cavitation in Sodium and Studies of Analogy with Water as Compared to Sodium (12 - 16 April 1976, Cadarache, France)
43. SM on High Temperature Structural Design Technology (27 - 30 April 1976, Champion, Pa., USA)

44. SM on Aerosol Formation, Vapour Deposits and Sodium Vapour Trapping (13 - 17 December 1976, Cadarache, France)
45. SM on Fuel and Cladding Interaction (21 - 25 February 1977, Tokyo, Japan)
46. The Tenth Annual Meeting of the IWGFR (29 March - 1 April 1977, Vienna)
47. SM on the Role of Fission Products in Whole Core Accidents (27 June - 1 July 1977, Harwell, UK)
48. SM on LMFBR Flow Induced Vibrations (20 - 23 September 1977, Argonne, Illinois, USA)
49. SM on Properties of Primary Circuit Structural Materials including Environmental Effects (17 - 21 October 1977, Bergisch Gladbach, FRG)
50. SM on Sodium Removal and Decontamination (14 - 16 February 1978, Richland, Washington, USA)
51. Symposium on Design, Construction and Operating Experience of Demonstration LMFBRs (10 - 14 April 1978, Bologna, Italy)
52. The Eleventh Annual Meeting of the IWGFR (17 - 20 April 1978, Bologna, Italy)
53. SM on Leak Detection and Location in LMFBR Steam Generators (6 - 9 June 1978, Dimitrovgrad, USSR)
54. SM on Equation of State of Materials of Relevance to the Analysis of Hypothetical Fast Breeder Accidents (19 - 23 June 1978, Harwell, UK)
55. SM on Sodium Fires and Prevention (20 - 24 November 1978, Cadarache, France)
56. SM on Thermodynamics of Fast Breeder Reactor Fuel Sub-Assemblies under Nominal and Non-nominal Operating Conditions (5 - 7 February 1979, Karlsruhe, FRG)
57. The Twelfth Annual Meeting of the IWGFR (27 - 30 March 1979, Vienna)
58. SM on Theoretical Modelling of LMFBR Fuel Pin Behaviour (28 May - 1 June 1979, Fontenay-aux-Roses, France)
59. Symposium on Fast Reactor Physics (24 - 28 September 1979, Aix-en-Provence, France)
60. SM on Bellows for Sodium Systems (5 - 9 November 1979, Tokyo, Japan)
61. SM on Carbon in Sodium (27 - 30 November 1979, Harwell, UK)
62. The Thirteenth Annual Meeting of the IWGFR (9 - 11 April 1980, Vienna)
63. SM on In-service Inspection and Monitoring of LMFBRs (20 - 23 May 1980, Bergisch Gladbach, FRG)
64. SM on Demonstration of Structural Integrity under Normal and Faulted Conditions (3 - 5 June 1980, Chester, UK)

65. The Fourteenth Annual Meeting of the IWGFR (31 March - 3 April 1980, Vienna)
66. SM on Fuel Failure Detection and Location in LMFBRs (11 - 14 May 1981, Karlsruhe, FRG)
67. SM on Design Features Affecting the Dynamic Behaviour of Fast Reactor Cores (2 - 5 June 1981, Rome, Italy)
68. SM on Sodium Boiling Noise Detection (9 - 11 June 1981, Chester, UK)
69. The Fifteenth Annual Meeting of the IWGFR (30 March - 2 April 1982, Obninsk, USSR)



Appendix XV

LIST OF MEETINGS RECOMMENDED BY THE IWGFR  
TO BE HELD AFTER THE 15TH ANNUAL GROUP MEETING  
(From April 1982 through 1983)

1. SM on Sodium Fires, Design and Testing (24 - 28 May 1982, Richland, USA)
2. SM on Advances in Structural Analysis for LMFBR Applications (11 - 15 October 1982, Paris, France)
3. SM on Thermal Stratification in Sodium (18 - 21 October 1982, Grenoble, France)
4. Sixteenth Meeting of the IWGFR (12 - 15 April 1983, Vienna, Austria)
5. SM on Theoretical and Experimental Work on Steam Generator Safety with Particular Reference to Leak Development and Detection (May 1983, FRG or Netherlands)
6. SM on Fast Reactor Absorber Materials (June 1983, USSR)
7. SM on Properties of Structural Materials Including Environmental Effects (September 1983, United Kingdom)

INTERNATIONAL WORKING GROUP ON FAST REACTORSLIST OF MEMBERS, ALTERNATES AND REPRESENTATIVESM E M B E R SA L T E R N A T E SFRANCE

Mr. L. Vautrey  
 Commissariat a l'Energie Atomique  
 CEN de Saclay  
 B. P. No. 2  
 91190 Gif-sur-Yvette

GERMANY, FEDERAL REPUBLIC OF

Dipl. Ing. M. Kempken  
 Bundesministerium für Forschung  
 und Technologie  
 Heinemannstrasse 2  
 Postfach 20 07 06  
 D-5300 Bonn 2

Dr. W. Marth  
 Kernforschungszentrum Karlsruhe  
 Projekt Schneller Brüter  
 Postfach 3640  
 D-7500 Karlsruhe

INDIA

Dr. S. R. Paranjpe  
 Reactor Research Centre  
 Kalpakkam-603 102  
 Chingleput District  
 Tamil Nadu

ITALY

Prof. F. Pierantoni  
 CNEN Fast Reactor Programme  
 Via Arcoveggio 56/23  
 I-40129 Bologna

Dr. L. Bruzzi  
 CNEN Fast Reactor Programme  
 Via Arcoveggio 56/23  
 I-40129 Bologna

JAPAN

Mr. Yoshiaki Matsuno  
 Assistant Manager  
 Experimental Fast Reactor Division  
 O-arai Engineering Center, PNC  
 4002 Naritamachi, O-arai  
 Higashi Ibaragi-gun  
 Ibaragi-ken 311-13

Mr. Shigeru Bando  
 Senior Staff  
 Project Planning and Management  
 Division, PNC  
 Sankaido Building  
 1-9-13 Akasaka  
 Minato-ku, Tokyo 107

UNION OF SOVIET SOCIALIST REPUBLICS

Dr. E. I. Inyutin  
Institute of Physics and  
Power Engineering  
Obninsk, Kaluzhskaja Region

Dr. E. Khodarev  
Institute of Physics  
and Power Engineering  
Obninsk, Kaluzhskaja Region

UNITED KINGDOM

Dr. R. D. Smith  
Fast Reactor Development  
Directorate  
United Kingdom Atomic Energy  
Authority  
Northern Division  
Risley, Warrington, WA3 6AT  
TLX 629301 ATOMRY G

Dr. G. A. Welch  
Technical Secretariat  
UK Atomic Energy Authority  
Risley, Warrington, WA35 6AT

TLX 629301 ATOMRY G

UNITED STATES OF AMERICA

Dr. J. A. Leary  
US Dept. of Energy  
Mail Stop B-107/GTN  
Washington, D.C. 20545

Dr. Sol Rosen  
US Dept. of Energy  
Int. Nucl. Programs Div.  
Mail Stop B-107 GTN  
Washington, D.C. 20545

COMMISSION OF THE EUROPEAN COMMUNITIES

Dr. W. E. Balz  
Commission of the European Communities  
Office DG XII-d2  
200, rue de la Loi  
B-1040 Brussels  
Belgium  
TLX 21877 COMEU B

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Dr. D. W. Häussermann  
Head, Nuclear Development Division  
OECD Nuclear Energy Agency  
38, boulevard Suchet  
F-75016 Paris  
France  
TLX 630668 OCDE

Dr. Jacques Royen  
Nuclear Safety Division  
OECD Nuclear Energy Agency  
38, boulevard Suchet  
F-75016 Paris  
France  
TLX 630668 OCDE

S C I E N T I F I C S E C R E T A R Y

Dr. V. F. Efimenko  
International Working Group  
on Fast Reactors  
International Atomic Energy Agency  
P. O. Box 100  
A-1400 Vienna, Austria