

**27<sup>H</sup> MEETING**

**HELD AT**

**HPCL REFINERY, BOMBAY**

**ON**

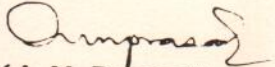
**FEBRUARY 3 - 4, 1993**

**उच्च प्रौद्योगिकी केन्द्र**  
**CENTRE FOR HIGH TECHNOLOGY**

April 6, 1993

Sub: Minutes of the 27th meeting of the Scientific Advisory  
Committee of the Ministry of Petroleum & Natural Gas,  
held at HPCL, Bombay on Feb. 3-4, 1993

Kindly find attached the minutes of the SAC meeting held at HPCL, Bombay on Feb. 3-4, 1993. This has been approved by the Chairman SAC and may please be circulated to all concerned for necessary action.

  
(A.M. Prasad)  
Director

Encl: As above

Shri K.C.Katoch, US, MOP&NG

CC: Shri M.B.Lal, Adviser(R), MOP&NG



Minutes of the 27th meeting of the Scientific Advisory Committee  
of the Ministry of Petroleum & Natural Gas  
held at HPCL, Bombay on Feb. 3-4, 1993

Participants: List is enclosed as Annexure-I.

A. Points pertaining to last MOM

27.1 The Chairman, SAC welcomed the members and other participants of SAC.

The minutes of the 26th SAC meeting were confirmed.

Action points arising from the last MOM were discussed as follows:

27.1.1 Report on EIL R&D Centre (IInd phase of activities)

EIL's report covering the details of the second phase of activities of their R&D Centre (and estimated investments) was discussed; Dr. S.J.Chopra of EIL made a presentation giving the schedules of various proposals. SAC agreed that the Chairman would discuss this with Chairman, EIL and report to SAC for further consideration.

27.1.2 Development of catalyst for LO-CAT process

The note prepared by EIL(R&D) Centre was discussed. EIL informed SAC that a formal understanding on the scope of responsibility between GNFC and EIL has been reached. The testing of catalyst in a laboratory scale reactor has been completed and further testing in a bench scale reactor is in progress.

It was agreed that the pilot plant should be at a location where gas containing H<sub>2</sub>S of varying composition can be made available safely. In this context, the location of this pilot plant adjacent to ONGC's Hazira plant appears to be most suitable.



27.1.3 Structured packing developed by EIL

Dr.S.J.Chopra of EIL presented the status of studies at AU III of Barauni Refinery; mechanical completion of this is expected by March, 1993.

27.1.4 High Efficiency Trays

EIL made a presentation on its proposal for the development of high efficiency trays which are particularly suitable to deal with situations like high vapour and low liquid loads in distillation columns. EIL's proposal for developing these high efficiency trays at an expenditure of Rs. 30 lakhs was considered highly important and so recommended by SAC. This expenditure includes Rs. 6 lakhs on manpower which will be absorbed by EIL. So Rs. 24 lakhs is sought to be funded by CHT.

27.2 Short Path Distillation Unit at Digboi

Chairman, IOC informed SAC that the cost estimate of Rs. 29.0 crores needs to be revised and a fresh economic analysis of the project prepared. This has become necessary since fresh offers would have to be obtained from M/s Buss AG and the benefit of increased distillate production incorporated in economic calculations. Chairman, IOC stated that IOC would furnish this report in 3 months' time.

Chairman, SAC desired that a detailed note be submitted to SAC for discussion in the next meeting.

27.3 Hydrocracker Technology Development

- (a) IIP's note on hydrocracker catalyst development circulated to the participants was discussed. IIP made a presentation on the various actions in progress and Dr.Prasada Rao informed SAC



that a separate group has been formed to work on this project. He also indicated the instrumentation problems being encountered by IIP. SAC suggested that IIP may take help from Shri P.K.Pandian, formerly Dy.General Manager of IOC(R&D), in this matter.

(b) Hydrocracker Pilot Plants:

IOC (R&D) presented the status on this project as follows:

- Basic process package prepared by IOC(R&D) was reviewed by EIL in October, 92.
- P&IDs for various systems were completed in November, 92
- Review meeting with foreign laboratories is expected in May, 93.
- DPR is scheduled to be ready by June, 93.

27.4 FCC & Resid Cracking

(a) The status of various activities at IOC(R&D) and IIP were presented by IOC(R&D) Centre. Detailed discussions had been held by IIP and IOC(R&D) and a joint proposal for catalyst development has been developed. It will be further discussed and finalised for VGO and resid cracking.

(b) IOC(R&D) made a presentation regarding co-operative research utilising the existing facilities in different industry R&D Centres for improving FCC operation in areas such as:

- Condition monitoring of equilibrium catalyst
- Selection of fresh catalyst
- Selection of catalyst additives to suit a particular FCC
- Mathematical modelling



IOC(R&D) indicated that excluding the cost of additional equipment required to be put up in the IOC(R&D) Centre to cater to this requirement, approximately Rs. 10 lakhs/year per unit will have to be borne by the refineries. Representatives of refineries sought a number of clarifications. Chairman, SAC directed that IOC(R&D), MRL, HPCL, CRL & CHT should discuss this aspect further and reach a mutually acceptable arrangement.

c) Pilot Plant for FCC (2 bbl/day)

CRL's proposal for 2 bbls/day integrated FCC pilot plant (entailing an expenditure of about Rs. 17.0 crores as per CRL's estimate on July, 1991 prices) was discussed in detail along with the merits of a small capacity FCC pilot plant with split units. Given the very heavy investment in the integrated pilot plant and its merits, SAC felt that cold model studies combined with a split unit pilot plant costing about Rs. 1.0 crore (IOC-R&D estimate) would be the more cost efficient system for the present. Consequently, Chairman SAC desired that a complete frame work of cold model studies should be developed by IOC(R&D)/ EIL(R&D) and presented to SAC during its next meeting. CRL may consider erecting a split unit pilot plant.

27.5 Identification of Research Institute for R&D work related to development of FCC Catalyst additives

SAC members were informed that CHT had written to IIP, NCL, RRL Trivandrum, IIT Madras and IICT Hyderabad regarding R&D work on additives for FCC catalyst for SO<sub>x</sub> control, ZSM - 5, CO promotor and resid cracking. Responses from NCL, IIT (M) and IIP have been received, and those from others are awaited. CHT along with IOC(R&D) will call a meeting of all concerned to finalise the programme of R&D work at each centre and inform SAC.



27.6 Catalyst & Process Development for Hydrogenation  
of Coker Distillate

A report has been prepared by IIP & EIL jointly on the present status of technology. A draft on an integrated R&D proposal has been also prepared for discussion between IIP and IOC(R&D) and the proposal as finally formulated will be forwarded to SAC for its consideration.

27.7 Inclusion of studies on effect of dewaxing aids  
in Wax Crystal Morphology studies

IIP's proposal for studies on the subject involving a cost of Rs. 16.3 lakhs was discussed and accepted in principle but it was agreed that this study should be taken up after completion of the present study at IIP.

27.8.1 Facilities for gasoline testing at IIP, Dehradun  
- Sharing of cost- Use of multi-functional additives

Director, IIP informed SAC that IIP has received the contribution from CRL and expects to receive from others shortly.

27.8.2 Proposal on development of antiknock lead substitute

IIP's proposal and background paper on technology development of an organometallic antiknock system was sent to Director, IOC(R&D). Following his comments, a meeting of the Committee comprising Adviser(R), ED-CHT and representatives from IIP and IOC(R&D) was held at CHT and it was decided that IIP would prepare a modified proposal restricted to exploratory work only. The modified proposal has been prepared. Chairman desired that the proposal be considered by this Committee for making recommendations to SAC.



27.9 Advanced Education & Training

SAC was informed that a 3-day programme on fluid bed technology was organised in Delhi in January, 1993 with faculty from the American Institute of Chemical Engineers and was attended by engineers from refineries, R&D Centres and academic institutions. The programme was found very useful in providing indepth knowledge of fluid bed technology and FCC operations and the areas in which operations of existing FCC plants in the country can be improved as well as the large scope for debottlenecking. This programme will be repeated again in Bombay. But in the meantime, action should be taken by CHT to pursue the areas in which improvements are possible as well as the scope for debottlenecking (in consultation with EIL, IOC-R&D and concerned refineries).

Based on the excellent experience gathered in the limited continuing advanced/<sup>education</sup> programmes undertaken so far, it was agreed that CHT in consultation with EIL(R&D), IOC(R&D) and IIP will prepare a schedule of such programmes covering all major areas in refining operation and technology that should be held regularly and identify the Faculty that should be assembled.

27.10 Catalytic Dewaxing of different types of lube stocks

SAC agreed that this should be taken up after satisfactory completion in NCL of catalytic dewaxing for production of low pour refrigeration oil.

27.11 Further development of indigenous Bi-metallic reforming catalyst

CHT has sought details of manpower and equipment cost and IIP's reply is awaited. IIP informed SAC that the work has been initiated.



27.12 Trial run of IPCL/IIP catalyst at MRL

The performance of the catalyst after second regeneration has been found to be very satisfactory and a note in this regard was circulated to the members. A detailed report of second catalyst regeneration is under preparation.

Chairman, SAC appreciated the joint effort of IIP, IPCL & MRL for successful regeneration of the catalyst. He desired that the operating manual prepared by IPCL should be jointly studied by MRL and IIP for their suggestions so that it is finalised.

27.13 Development of process package for reformer

SAC was informed that for the preparation of the process package for pre-treater, joint discussions were held with IIP, EIL and UCIL. IIP and UCIL representative will visit Haldia Refinery shortly to collect the requisite data and identify the gap areas so that IIP/EIL can commence work to develop the process package to fill these gaps. SAC also noted that IIP is also developing a simulation for the pre-treater to generate the basic design data required for the process package.

27.14 Vapour liquid distributor for distillation application

EIL has submitted the proposal as approved by SAC and this will be put up by CHT to its Advisory Committee/Executive Committee shortly for approval.

27.15 Gas Liquid Separator

EIL(R&D) is collecting data for comparative performance analysis of existing separators at ONGC & OIL to identify areas of further improvement and then put up the revised proposal for consideration of SAC.



27.16 Furnace Efficiency Studies

Shri G.C.Tiwari, EIL made a detailed presentation of the studies carried out on furnace efficiencies in the refineries. He informed SAC that EIL had developed the technology for glass tube air preheaters and presented the results.

- Chairman, SAC directed that CHT should discuss with refineries in its Activity Committees about acceleration of the furnace efficiency improvement programme in each refinery.
- It was also stressed that frequent test runs should be conducted in refineries and data generated be analysed using test rigs fully.
- Development of improved burners should be considered by EIL.
- Advanced control system should be fully utilised for efficiency improvement in existing furnaces.

ED, CHT stressed that while going in for improved designs, the quality of actual fuel in the refineries should be kept in view, as future fuels are likely to be heavier. EIL accepted this and informed that it is exploring technology for on-line tube cleaning.

Chairman, SAC desired that a study should be conducted on as to how many test rigs (possibly of simpler design) are required to assess all the furnaces in all the refineries so that these can be revamped rapidly (say in 3 years) in order to achieve optimal benefits within the shortest possible time and costs and benefits of this programme.



27.17 IIP's proposal to OIDB for better analytical facilities

IIP informed SAC that action has been initiated to augment the infrastructural facilities and suitable manpower for proper utilisation and maintenance of these instruments.

SAC requested IIP and IOC-R&D to list out the instrumentation and test facilities that each refinery should have for yield and energy optimisation studies.

27.18 Separation of Alpha Olefins from coker kerosene fractions

SAC was informed that IIP has submitted the proposal to CHT and this will be analysed by CHT in consultation with IIP, EIL & IOC(R&D).

27.19 Yield & Energy Optimisation

IOC(R&D) made a detailed presentation on the literature survey it has carried out for optimising the yield and energy usage in the refineries, covering all potential areas of energy conservation.

Chairman, SAC stressed the need for detailed yield and energy optimisation study of each refinery in view of the high benefits likely to be achieved by doing so. He desired that the refineries should give the status of action taken in this regard and CHT coordinate this.

27.20 Advanced Control & Optimisation in refineries

It was noted that most of the refineries have installed DDCS. The refineries should now indicate their plans for adoption of advanced control system.



27.21 Development of multipurpose dynamic simulator

A status note on the subject by EIL(R&D) was circulated to members. SAC was informed that EIL's proposal will be put up to Governing Council of CHT shortly.

Separately refineries were requested to work out the sub models that need to be developed also for their use in order that the dynamic simulator be utilised with benefit.

27.22 Re-refining of used lube oils

Dr.Bhattacharya of NRDC informed SAC that Balmer Lawrie has already taken up erection of a pilot plant at an estimated capital cost of Rs. 71 lakhs and the plant is expected to be commissioned very soon. SAC drew Balmer Lawrie's attention to the notes prepared by IOC(R&D) and EIL(R&D) and requested Balmer Lawrie to collect the requisite data from its pilot plant.

27.23 Lubricant formulation

A paper prepared by IIP was circulated to the members. Dr.Himmat Singh of IIP made a brief presentation. Please see paragraph 27.27(iii).

27.24 Hydrocarbon evaporation losses

A presentation was made by HPCL - Marketing Division on hydrocarbon losses in product handling.

Chairman, SAC directed that a detailed study (including detailed literature survey) should be carried out on what is being done in other countries to control these losses, at each point - installation, depots, service stations and outlets as well as rail and road transportation together with techno-economic analysis of improvements so as to determine those that need to be introduced in this country.



27.25      Advanced Maintenance Techniques

SAC was informed that CHT organised a visit to Mathura refinery by a team from CMERI from 11th to 14th January, 93 led by Director, CMERI. A report is expected from CMERI on the areas of improvement which may lead to longer run-lengths of refinery units with improved reliability of equipment.

27.26      Advanced Safety Techniques

Shri Ravichandra, ED, OISD illustrated a case of vapour cloud explosion of a LPG road tanker, and circulated a note on this. He emphasised the need for mathematical modelling for vapour cloud explosion, dispersion etc. ED, OISD will make a presentation on R&D needs related to safety in the next SAC meeting and EIL will make a presentation of the models it has developed and what more it considers it will be able to do.

27.27      R&D Activities at industry R&D Centres  
other than IOC(R&D)

Detailed presentations were made by HPCL, BPCL, MRL, CRL and BRPL on their R&D programmes. Following points emerged:

- i) Cooling towers is an area in which substantial improvement is required. Chairman, SAC desired that EIL and oil companies should develop concrete technology development plans in this regard.
- ii) Dr.S.Varadarajan suggested that good technology for desalination has been developed for industries using sea water for cooling purposes. Some non-corrosive materials are now also available in the market. SAC agreed that a sub-group headed by EIL along with 2-3 persons should formulate a plan after a visit to Kalpakkam.



- iii) Inadequacy of engine testing facility was felt to be a severe handicap in the formulation of lubricating oils. IOC has engine testing facilities in its R&D Centre that it will augment but the facility will be largely for its own use. Other major lube oil formulators notably HPCL & BPCL do not have such facilities and both agreed that comprehensive engine testing facilities should be put up by IIP with which they can have long term arrangements. Therefore, SAC agreed that IIP should prepare a plan for this in consultation with HPCL & BPCL and submit this to SAC as quickly as possible.

SAC also agreed with the suggestion of Chairman IOC that there must be also a national independent engine testing facility for setting national standards and national certification. Chairman SAC will discuss this further with Chairman, IOC.

- iv) Chairman, SAC observed that there is a gap in R&D facilities with respect to FCC, hydrocracker, bitumen processing, bitumen - aggregate inter-relationship. The plan to fill up these gaps needs to be formulated expeditiously as also a study on new requirements that will be required in the future specially in the context of new product specifications and environmental standards adopted in developed countries that are likely to be adopted in this country also in due course. IOC(R&D) was requested to prepare a paper on this for consideration of SAC in its next meeting.

B. NEW ITEMS

27.29 Utilisation of natural gas by direct conversion to methanol & olefins

Dr.S.Narayanan of IICT made a presentation on the above proposal. SAC felt that IICT has good analytical facilities and gas handling systems including safety aspects and therefore initial work should be done at IICT with its own resources. The RC of IICT will examine this and advise SAC.



27.30 Alkylation of isobutane with butenes

Dr.D.K.Chakravorty of IIT (Bombay) made a detailed presentation of a proposal for process and catalyst development for alkylation of isobutanes with butenes. Exploratory work at IIT Bombay at a cost of Rs.5.14 lakhs was recommended for approval.

27.31 Pilot Plant for conversion of natural gas to middle distillate (referred by Governing Council of CHT for review)

Shri S. Viswanathan, GM, BPCL made a brief presentation of the earlier proposal for a pilot plant which it had abandoned. Chairman, SAC desired that the detailed report prepared by BPCL be sent to him for clarifying the position to the Planning Commission and others who continue to attach importance to this project.

27.32 Proposal on development of mathematical modelling groups in each refinery

Prof. A.P.Kudchadkar of IIT (Bombay) elaborated the need for developing groups in each refinery that will be able to undertake mathematical modelling which is essential for yield and energy optimisation. Each refinery can identify engineers with aptitude in mathematical modelling and form a small group that will interact with the CAD Centre at IIT(B) which will arrange training programmes and help in developing models sought by refineries. The proposal was accepted in principle. Prof. Kudchadkar will submit a detailed proposal (after discussion with HPCL & BPCL) for consideration in the next SAC meeting.

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27.33 International Advisory Committee on Petroleum Refining

Dr.S.Varadarajan suggested that we may consider forming an International Advisory Committee on petroleum refining on the pattern of the International Advisory Committee on Biotechnology set up by the Department of Biotechnology which has proved to be of great value. The Committee may consist of scientists and experts in the field from within the country and Indians working abroad in refineries, consultancy & engineering companies and academic institutions. This suggestion was welcomed by SAC. Chairman desired that letters may be addressed to the C&MDs of oil companies, EIL, IIP and NCL with a request to suggest names of such persons.

27.34 Chairman informed SAC that distinguished scientists and technologists from a number of overseas countries were available to help in significantly improving refinery operation and in technology development. IIP has been appointed by CSIR to coordinate this in relation to CIS. This will need to be pursued in relation to our needs that have to be urgently identified.

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(List of Action Points attached - 3 pages)



List of Action Points  
(27th meeting of SAC held on Feb.3-4, 1993)

<u>S.No.</u>	<u>Item No.</u>	<u>Subject/Action</u>	<u>Action by</u>
1.	27.1.2	Progress of laboratory work on Lo-Cat process & location of pilot plant	EIL
2.	27.1.3	Status of studies on structured packing at AU-III, Barauni Refinery	EIL(R&D)
3.	27.1.4	Necessary approvals on EIL-R&D's proposal on High Efficiency Trays as recommended by SAC.	CHT
4.	27.2	Detailed note on the proposed Short Path Distillation Unit at Digboi in 3 months' time.	IOC
5.	27.3 (a)	IIP may take help from Sh.P.K.Pandian to resolve the instrumentation problems of the bench scale hydrocracking unit at IIP.	IIP
6.	27.3 (b)	Status on Hydrocracker Pilot Plant	IOC (R&D)
7.	27.4 (a)	FCC & Resid cracking - status of catalyst development proposal	IOC(R&D)/IIP
8.	27.4 (b)	Co-operative research to improve FCC operations in the country	IOC(R&D)/MRL HPC/CRL/CHT
9.	27.4 (c)	Develop complete frame work of cold model studies for FCC	IOC(R&D) & EIL(R&D)
10.	27.5	Identification of Research Institute for R&D work related to development of FCC catalyst additives	CHT/IOC(R&D)
11.	27.6	Catalyst & process development for hydrogenation of coker distillate - Proposal for SAC's consideration	IIP/EIL
12.	27.8.2	Modified proposal on exploratory work on development of antiknock lead substitute for SAC's consideration	Adv(R)/IOC(R&D)/ CHT/IIP
13.	27.9	i) To pursue action in the areas where debottlenecking and improvements are possible in FCC operations	CHT/EIL(R&D) IOC(R&D)/ concerned refineries



		ii) To prepare schedule of continuing education programme in major areas of refining operation & technology	CHT/EIL(R&D) IOC(R&D)/IIP
14.	27.11	Necessary approvals & status of IIP's proposal on further development of bi-metallic reforming catalyst	CHT/IIP
15.	27.12	Finalisation of operating manual for the IPCL/IIP catalyst	IPCL/MRL/IIP
16.	27.13	Status on development of process package for reformer	EIL/IIP
17.	27.14	Necessary approvals on EIL(R&D)'s proposal on vapour liquid distributor as recommended by SAC	CHT
18.	27.15	Gas Liquid Separator - performance data of existing separators at ONGC-OIL	EIL(R&D)
19.	27.16	Furnace Efficiency Studies - following actions were decided:	
		- furnace efficiency improvement plans of the refineries	CHT/Oil companies
		- development of improvement burners	EIL(R&D)
		- assessment of requirement of test rigs for furnace efficiency studies in the refineries	EIL(R&D)
20.	27.17	Instrumentation & testing facilities required by refineries for yield & energy optimisation studies	IOC(R&D)/IIP
21.	27.18	Status of IIP's proposal on separation of Alpha Olefins from coker kerosene fractions	CHT/IIP/ EIL(R&D)/ IOC(R&D)
22.	27.19	Status of action taken on yield & energy optimisation studies by the refineries	All refineries/ CHT
23.	27.20	Advanced control & optimisation in refineries - programme of adoption	All refineries
24.	27.21	Proposal on development of multi-purpose dynamic simulator	
		- status of approval	CHT
		- refineries to work out sub-models for their use	All refineries



25.	27.22	Re-refining of used lube oils - status of Balmer Lawrie's pilot plant	Balmer Lawrie
26.	27.24	Study on hydrocarbon loss in product handling	HPC
27.	27.26	i) Identification of R&D needs related to safety techniques	ED, OISD
		ii) Presentation on mathematical models developed by EIL on subjects related to safety	EIL
28.	27.27	Following action points emerged during presentation on R&D activities at industry R&D centres	
		i) Need for improvement in cooling towers	EIL/oil companies
		ii) Desalination of sea water for cooling purposes: Visit to Kalpakkam	EIL
		iii) Plan for developing engine testing facilities at IIP for lube oil formulators (HPC/BPC)	IIP/HPC/BPC
		iv) Development of R&D facilities in refining processes - paper for SAC's consideration	IOC(R&D)
29.	27.29	Utilisation of natural gas by direct conversion of methanol & olefins - IICT, Hyderabad to do initial work and advise SAC.	IICT Hyderabad
30.	27.30	Necessary approval on IIT(Bombay)'s proposal on Alkylation of isobutane with butenes	CHT
31.	27.31	BPCL's detailed report on pilot plant for conversion of natural gas to middle distillate to be sent to Chairman SAC	BPC
32.	27.32	Development of mathematical modelling groups in refineries - IIT(Bombay) to submit detailed proposal after discussions with BPC/HPC	IIT(Bombay)/ BPC/HPC



27th meeting of SAC held at HPCL-Bombay  
on February 3-4, 1993

I Chairman, Shri Lovraj Kumar

II Members

1. Shri M.B.Lal, Adviser(R), MOP&NG
2. Smt. Lalita B.Singh, Adviser (PC)
3. Prof. A.P.Kudchadker, IIT, Bombay
4. Shri K.Vasudeva, IIT, Delhi
5. Dr.A.V.Rama Rao, IICT, Hyderabad
6. Dr.A.C.Ghosh, RRL, Jorhat
7. Dr.I.S.Bhardwaj, IPCL
8. Dr.T.S.R.Prasada Rao, IIP, Dehradun
9. Dr.S.Varadarajan, Ex-consultant, Planning Commission
10. Shri T.S.Krishnamurthi, CHT
11. Shri J.K.Das, PCRA
12. Shri M.P.Singh, Adviser (Chemicals), DGTD

III Invitees

1. Shri K.N.Venkatasubramanian, Chairman, IOC
2. Shri P.Ramakrishnan, CMD, HPCL
3. Shri H.Krishnamurthy, CMD, MRL
4. Shri K.L.Kumar, CMD, CRL
5. Shri J.M.B.Baruah, CMD, BRPL
6. Shri K.Ravichandra, ED, OISD
7. Dr.P.K.Mukhopadhyay, Former Director, IOC(R&D)

HPCL

Shri S.N.Mathur  
Shri A.S.Tulaskar  
Shri A.P.Ram  
Shri K.Murali  
Shri J.U.Mazumdar

CRL

Dr. M.A.Siddiqui

BRPL

Shri B.K.Gogoi

MRL

Shri A.Varadarajan  
Shri K.S.Balaraman



BPCL

Shri R.P.Garg  
Shri S.Viswanathan

IOC(R&D)

Shri A.M.Uplenchwar  
Dr.S.Ghosh  
Dr.R.P.Varma  
Shri A.K.Mishra

IICT

Dr.S.Narayanan

LIL

Dr.A.S.Sarma

IIP

Dr.Himmat Singh  
Shri R.P.Malhotra

RRL, Jorhat

Dr.I.Suryanarayan

EIL

Shri S.C.Gupta  
Dr.S.J.Chopra  
Shri G.C.Tiwari

CHT

Shri A.M.Prasad  
Dr.G.P.Rai  
Shri H.P.Singh