उच्च प्रौद्योगिकी केन्द्र
(पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय)

सी एच टी

Centre for High Technology
(Ministry of Petroleum & Natural Gas, Govt. of India)

CHT/AKA/SAC

Date: 30th January 2008

To,

1. All Members and permanent invitees of the Scientific Advisory Committee on Hydrocarbons of Ministry of Petroleum & Natural Gas
2. Chief Executives of PSU Oil Companies – IOCL, BPCL, HPCL, GAIL, ONGC,
3. MD – BRPL, MRPL, NRL, CPCL

Dear Sir,

Sub: **Minutes of the 62nd Meeting of the Scientific Advisory Committee on Hydrocarbons of Ministry of Petroleum & Natural Gas held on 22nd November 2007 at PPAC Conference Room, SCOPE Complex, New Delhi**

Enclosed please find a copy of the Minutes of the 62nd Meeting of the Scientific Advisory Committee on Hydrocarbons of Ministry of Petroleum & Natural Gas held on 22nd November 2007 at PPAC Conference Room, SCOPE Complex, New Delhi, for your kind information and necessary action.

Thanking you,

Yours faithfully,

(Dr.K.S.Balaraman)
Executive Director

Encl. As above.

पाँचवां तल, कोर 6, स्कोप कॉम्पलैक्स, लोधी रोड, नई दिल्ली- 110 003
5th Floor, Core 6, SCOPE Complex, Lodhi Road, New Delhi-110 003
E-mail : cht@giasdl01.vsnl.net.in Fax : 4362879, 4367350 Tel.:.....

CHT/AKA

Date: 30th January 2008

Minutes of the 62nd Meeting of Scientific Advisory Committee (SAC) on Hydrocarbons of MOP&NG held on 22nd November 2007 at PPAC Conference Room, 2nd Floor, Core-8, SCOPE Complex, Lodhi Road, New Delhi-110 003:

62.1 **INAUGURAL SESSION:**

62.1.1 **Dr.K.S.Balaraman**, Executive Director, Centre for High Technology and Member Secretary, SAC welcomed Chairman-SAC, Members, permanent invitees and special invitees to the 62nd meeting of Scientific Advisory Committee (SAC). He briefed about the agenda of the meeting. Dr.Balaraman said that OIDB wants that the projects, which have been completed long back, needs to be financially closed before end of this financial year.

62.1.2 **Shri Mahesh B.Lal, Technical Member (PNG) and Chairman, Scientific Advisory Committee (SAC) and Chairman, Auto Fuel Policy Review Committee** welcomed the members of the SAC, scientists, academicians and invitees to the 62nd SAC meeting.

He said that the world is witnessing some unprecedented events such as record crude oil prices, a rapid rise in global warming, and explosive growth in several countries in personal transportation, which had led to problems of local pollution and congestion in several cities.

On the domestic front, there is a strong growth in the economy, which has increased the demand for various fuels, especially for transport needs and for cooking. Several of the technology related challenges emanate from these changes and the SAC should set its priorities accordingly.

Developing capabilities to process heavier and cheaper crude such as high acid crude, increasing energy efficiencies of equipment and processes, developing cost effective technologies and catalysts for cleaner fuels and for increased conversion and reduced heavy ends in Refineries, developing know-how for utilising coal and other substitutes and finding ways to enhance value addition from crude oil are some of the areas which need to be explored further.

Hydrogen is a stated priority for the oil industry and we need to take a comprehensive view and direct research efforts in a coordinated manner. Biotechnology holds the promise of offering more cost effective solutions to developing cleaner fuels, and therefore could be pursued.

Shri Lal also highlighted the need for developing in-house capabilities like process modelling and simulation, which can go a long way in enhancing the performance of refineries.

He asked the members and participants to identify new research proposals, which would provide cutting edge technology to the petroleum industry.

On the problems faced by several research bodies regarding acceptance of technologies by user industry, Shri Lal said that while it goes without saying that indigenous technology has to match the best available in the world, we need to set-up extensive pilot plant and demonstration units where such technologies can be demonstratively proven to the user group. The perceived risks can be minimised if research groups can identify likely problems that may arise on scale up and how these are going to be addressed in the design stage.

CH-SAC concluded his opening remarks by saying that need of the hour is to generate the knowledge and make our organisations stronger.

62.1.3 Prof. S.K.Biswas, who was attending the SAC meeting for the first time agreed with the views of the Chairman on self-reliance in technology and creation of centre of excellence. He said that wide knowledge base is available in India but we need to bring all the expertise together. Indian Institute of Science, Bangalore is celebrating centenary year next year and promised to extend all support for nano technology, hydrogen etc to the SAC and the industry.

62.1.4 List of participants is given in **Annexure.**

62.2 **PRESENTATION ON THREE NEW PROJECT PROPOSALS:**

62.2.1 **"Hydrogen Generation by Thermo Chemical Process" by Dr.D.M.Kale, ED (R&D), ONGC:**

62.2.1.1 ONGC has established ONGC Energy Centre Trust (OEC Trust) to undertake programmes / projects of fundamental and applied research for improving and developing commercially viable energy mediums and source beyond hydrocarbons, especially in clean / renewable energy options. Towards this end, OEC Trust has set up the ONGC Energy Centre (OEC).

62.2.1.2 OEC proposed to work on thermo-chemical process for generation of hydrogen as fuel for tomorrow. The project aims to achieve the objective in three stages viz. lab scale generation at 50 litre / hour, pilot plant studies at 13 M^3 / hour and commercial scale demonstration to generate hydrogen at 80,000 M^3 / hour.

62.2.1.3 India is having more than 40% reserves of world thorium. BARC has a programme for thorium-based reactor for generating hydrogen using a thermo-chemical process. Accordingly, ONGC has entered into an MOU with BARC under which ONGC through OEC will establish, laboratory facilities for study of iodine-sulfur (IS) and other thermo chemical processes for hydrogen generation from water. This will require setting up of laboratory and pilot plant facilities at Panvel.

62.2.1.4 OEC has also entered into an agreement with the University Institute of Chemical Technology (UICT), Mumbai to undertake work on the Copper-chloride (Cu-Cl) process. Negotiations with IIT-Delhi are in an advanced stage to undertake research on various aspects of IS process.

62.2.1.5 On a query, Dr Kale said that theoretically these processes have 57% energy efficiency, but, 50% efficiency is achievable. In fact higher the process temperature, higher is the efficiency.

62.2.1.6 ED-CHT said that economics should be worked out. He also cautioned that material of construction (MOC) of the reactor might be one of the major hurdles while chemistry is not. Hurdles should therefore be identified on priority.

62.2.1.7 CH-SAC supported in principle the project. CH suggested that various related issues should be identified and sorted out before the commencement of the project. He is of the view that there must be a cohesive plan for hydrogen production, storage and transportation. CH desired to see the base document on Hydrogen Corpus Fund (HCF), which ONGC / IOC-R&D agreed to submit.

62.2.1.8 It was clarified that Planning Commission had constituted the National Hydrogen Energy Board (NHEB), which consists of high-level representation from the Government and industry, including Secretary, P&NG and other Secretaries of the concerned Ministries of GOI. The National hydrogen Energy road map was prepared by a steering group set up by the NHEB under the Chairmanship of Mr. Ratan Tata.

Accordingly, for carrying out various activities for use of hydrogen as an auto fuel, MOP&NG had approved the creation of Hydrogen Corpus Fund (HCF) to the tune of Rs.100 Crores. The contributors to the fund are OIDB (Rs.40 Crores), ONGC, GAIL and IOC (Rs.16 Crores each) and HPCL and BPCL (Rs.6 Crores each). The Ministry had also constituted two committees viz. i) Technical Committee on hydrogen and ii) Steering Committee for managing the R&D projects to be taken up for funding from HCF. OIDB had been given the responsibility for maintaining a separate account for HCF.

62.2.1.9 Dr.R.K.Malhotra, ED, IOC (R&D) clarified that as per the guidelines of MOP&NG for funding a project from HCF, it is first to be examined by a technical committee comprising senior officials from R&D Divisions of PSU oil & Gas companies with secretariat at IOC-R&D. The project proposal after clearance from technical committee is to be forwarded for approval of SAC and then to Steering Committee headed by Secretary, P&NG.

Accordingly, after due examination by the technical committee, the project proposal with an estimated project cost of Rs.1634.5 Lakhs was sent to SAC for approval. This project fits under the guidelines of MOP&NG.

62.2.1.10 CH-SAC asked ONGC to make a detailed technical presentation at a later date. Resources available on manpower should be suitably outlined in the project proposal.

62.2.2 **Development of Fuel Cell Vehicle and Fuelling Infrastructure by Dr.Mathew Abraham, GM, M&M Limited and IOC-R&D:**

62.2.2.1 The objective of the project proposal is to develop and integrate fuel cell powered vehicles; to conduct performance, reliability, durability and safety validations on fuel cell vehicles and to demonstrate technologically ready fuel cell vehicle prototypes.

62.2.2.2 Hydrogen is commercially being utilised in transport sector on an experimental basis in the existing IC engines in admixture with CNG or in neat form. In future hydrogen is likely to be utilised in more energy efficient devices like fuel cell that are under development.

62.2.2.3 Fuel cell technology is very costly. Though few companies and R&D institutes in India have demonstrated the technology feasibility in vehicle, the prototypes produced lack commercial viability. Accordingly, OEMs have to rely on foreign suppliers whose technology is more mature.

62.2.2.4 Accordingly, M&M and IOC-R&D proposed to develop and integrate third party supplied fuel cell stack and related supporting sub-systems and controllers thereof into M&M's vehicles. Integration of the technology will be done in 4 wheeler Scorpios and three wheelers provided by M&M. So far no study has been done else where on three wheelers.

62.2.2.5 On a query it was mentioned that peak requirement of power will be made through the battery box. It was stated that they will be using Pembe type fuel cell.

62.2.2.6 Phase-I of project includes fuel cell sub-system, hybridisation sub-system and vehicle development by M&M. IOC-R&D will set up hydrogen fuelling station and test the fuel cell powered vehicle for durability, reliability and safety on all weather chassis dynamometer facility. Data collected will also be analysed by IOC-R&D for validation tests.

62.2.2.7 Estimated project cost is Rs.1760 Lakhs, which is proposed to be shared by OIDB on one hand and M&M and IOC-R&D on other hand on 50:50 basis. The time schedule of the entire project is 21 months from the date of approval. The funding is required from Hydrogen Corpus Fund.

62.2.2.8 IOC-R&D mentioned that they might put up hydrogen fuelling station near Common Wealth Games village.

62.2.2.9 CH-SAC suggested that the project needs to be reoriented for funding by the SAC. Accordingly, IOC-R&D was advised to reorient the proposal and submit the same.

62.2.3 **Coal to Liquid (CTL) Technology" by Dr.S.Banik, GM, EIL-R&D:**

62.2.3.1 The project comprises of two phases. Phase-I will comprise of technology development and BDEP preparation for demo plant while phase-II will include installation of demo plant. Estimated cost of the Phase-I of the project is Rs.2582.98 Lakh.

62.2.3.2 IOC-R&D will work for gasification technology development. EIL and BPCL will associate with IOCL at various stages of technology development. FT technology development will be taken up by EIL and BPCL. Indirect process of coal to liquid comprises of four stages viz. gasification of coal to produce raw syngas, syngas clean up, hydrocarbon synthesis from syngas through FT process and up-gradation of FT liquid to clean fuel.

62.2.3.3 EIL mentioned that type of gasifier best suited for Indian coal is to be identified first. For petcoke, moving bed gasifier is not good as it requires high temperature. However, coal and petcoke can be mixed for moving bed gasifier. On a query, EIL said that no licensor is ready to give technology for a 200 MT/day pilot plant. SASOL technology, which is a moving bed technology, is good for Indian high ash coal.

62.2.3.4 On a suggestion from CH-SAC that BHEL should be involved in the study, EIL said that BHEL expertise would be utilised for gasification study. The proposed study should consider co-gasification of coal, petcoke and residue.

62.2.3.5 Chairman advised that the proposal be revised considering at least 50% contribution from the industry for putting up the same for consideration of the SAC.

62.3 **PRESENTATION ON COMPLETED PROJECTS:**

62.3.1 **Assessing the Impact of Regulations on Ambient Air and on Health in Delhi – Phase-1 by Dr.S.Velmuragan, Senior Scientist, CRRI and Ms Shobha Pandey from TERI:**

62.3.1.1 The objective of the project was to analyse air quality data, estimation of emission of critical air pollutants and to assess the available baseline studies and morbidity data to design a suitable epidemiological study on health impacts of air pollution in the city of Delhi.

62.3.1.2 The project was approved for an amount of Rs.18.03 Lakhs with completion schedule of 9 months from the zero date i.e. July 2006. The project has been completed and draft report received in January 2007. Salient observations are as under:

62.3.1.2.1 Government of NCT data showed that there were 4.87 million vehicles in Delhi in 2005-06. Cars and two wheelers contributed to major share of traffic on all the roads. The quantum of slow moving traffic is significant on the roads, which are nearer to the border of the city.

62.3.1.2.2 Traffic flows and related emission in Delhi during 2001-2006 was quantified by updating the traffic and emissions data through interpolating the 2002 CRRI study and present study results. Accordingly, estimated traffic loads, fuel consumed and corresponding air pollution loads due to estimated traffic during 2001-2006 has been estimated.

62.3.1.2.3 As per the data, CNG autos contributed for more PM than CNG buses. CRRI could not clarify on higher estimated HC emission from CNG buses compared to diesel buses. It was mentioned that counting of vehicles was done manually.

62.3.1.2.4 TERI did the health part of the study. It was observed that during most of the monitored period of 2002-2004, average concentration of RSPM exceeded the ambient air quality standard of 100 g/M^3.

On about 10% of the monitored days, NOx concentration exceeded the air quality standard of 80 g/M^3. During this period, SO_2 concentration was, however, well within the standard of 60 g/M^3.

Highest sectoral contribution of PM and NOx emission was from power plants followed by transport sector. For SO_2, power plants were the major contributors followed by industries.

62.3.1.2.5 While collecting Medical Record Data (MRD), non-uniformity in the classification of diseases and maintenance of records was observed in different hospitals. Sub classification of diseases was also missing, which was necessary for analysis of data.

62.3.1.2.6 Non-availability of MRD data was the major constraint in carrying out retrospective morbidity / health data analysis. Accordingly, this part could not be completed.

62.3.1.2.7 It was suggested that sales of medicines for some of the diseases viz. Asthama can be considered as the basis for analysing the data.

62.3.1.1 In consideration of the above, it was decided that the project be treated as complete and closed.

62.3.2 **Catalyst Development for Isomerisation of Light Naphtha by Dr.G.Murali Dhar, IIP & IOC-R&D Centre:**

62.3.2.1 The objective of the project was to develop a zeolite based catalyst for Isomerisation of light Naphtha. Estimated cost of this project was Rs.55.44 Lakhs with completion schedule of 2 years from the zero date i.e. April 2004. However, the project was completed within the extended schedule of September 2005. Final report received in May 2006.

62.3.2.2 Zeolite based catalyst developed by IIP / IOC-R&D was used for Isomerisation of Panipat Naphtha. Significant improvement in RON (12 units) and considerable benzene reduction (from 4% to 0%) was achieved while treating feed naphtha with the developed catalyst.

62.3.2.3 However, the platinum impregnation & crushing strength of the catalyst was not in line with the desired specifications. IIP said that dispersion of platinum is not a major problem and crushing strength can be resolved during scale up.

62.3.2.4 IOC-R&D has shown interest in commercialisation of this Isomerisation catalyst for which IIP has drawn road map. IOC-R&D mentioned that one ex IPCL person has purchased catalyst-manufacturing facility of IPCL at Goa and is ready to produce catalysts for IOC. IOC-R&D is considering this route for catalyst manufacture on semi commercial scale.

62.3.2.5 CH-SAC suggested that IOCL and BPCL could jointly consider putting up of catalyst manufacturing facility.

62.3.2.6 In view of the above, it was decided that the project be treated as complete and closed.

62.3.3 **Development of Catalyst for Ultra Deep Desulphurisation of Gas Oil by IIP:**

63.3.3.1 The objective of the project was to develop a catalyst for producing ultra low sulfur (50 ppm) diesel from 2500-ppm sulfur gas oil.

63.3.3.2 Estimated cost of the project was Rs.53.2 Lakhs with completion schedule of 24 months from the zero date i.e. November 2004. The project was completed in November 2006 and final report received on 30th July 2007.

63.3.3.3 IIP had developed various recipes of catalyst and tested them with diesel feed from Mathura Refinery having 1940-ppm sulfur for desulphurisation. Before desulphurisation, feed was fractionated for FBP of 360° C. Desulphurisation study was carried out at varying temperature of 330°-360° C, pressure of 25-50 bar and LSHV of 1 to 3.

63.3.3.4 UD-25 (CoNiMo / Alumina zeolite) catalyst was found to be the best recipe, which resulted in gas oil sulfur reduction from 1940 ppm to 45.4 ppm at 330° C, 50 bars and 1 LSHV. Subsequently 30 gm sample of this recipe was produced and tested.

63.3.3.5 Long duration performance of this catalyst for its stability was studied for about 500 hours, after which the sulfur level was found < 50 ppm.

63.3.3.6 In view of the above, it was decided that the project be treated as complete and closed.

62.4 **PRESENTATION ON ON-GOING PROJECTS:**

62.4.1 **Development of Technologies for Synthetic Aviation Lubricants from Renewable feed stocks by Dr.P.Vijaya Lakshmi, IICT, Hyderabad:**

62.4.1.1 The objective of the project is to develop Synthetic Aviation Lubricants Technology for lubricants of aircraft engines and ancillary systems including turbo prop and turbo jet aircrafts.

62.4.1.2 The project is being executed by IICT, IOC-R&D, NAL, HAL, GTRE and CEMILAC. The estimated project cost is Rs.1732.28 Lakhs, which comprises contribution of Rs.844.90 Lakhs by CHT / OIDB and Rs.188.40 Lakhs by DRDO, Rs.150.00 Lakhs by CSIR and Rs.548.98 Lakhs by Research Institutes. The completion schedule of the project was 48 months (revised to 60 months) from the zero date i.e. December 2007.

62.4.1.3 Renewable resources like Diesters and polyol esters were considered as the feedstock for SAL production. Base oil production facilities of 1 kg, 5 kg and 100 kg batch as well as analytical testing facilities were created at IICT, Hyderabad. Base oil samples so produced from 5 kg and 100 kg units were sent to IOC-R&D for evaluation / testing and blending. These samples met all the target specifications of synthetic aviation lubricants.

After completion of laboratory testing, the samples will be sent to Naval Air Warfare Centre, Aircraft Division, USA for Ryder test of SAL product.

62.4.1.4 Centralised facility for testing both indigenously developed and imported bearings and SAL for bearing applications was developed and created at NAL, Bangalore, which is in operation.

62.4.1.5 Engine testing of the developed formulation will be conducted at HAL facility at Bangalore.

62.4.1.6 In view of various delays, IICT has requested to extend the project up to December 2008, for which SAC agreed.

62.4.2 **Development of Bio-catalytic Process for Desulphurisation of Diesel by IIP:**

62.4.2.1 The objective of the project is to develop Bio-catalytic Process for Desulphurisation of Hydro-treated Diesel & cracked distillates for reduction of Sulphur level from 2500 ppm to 100 ppm in the finished product.

62.4.2.2 Estimated cost of the project was Rs.122.59 Lakhs with completion schedule of 36 months from the zero date i.e. September 2004.

62.4.2.3 Though cloning of the entire desulphurising genes in a test organism (E.coli) done, the crucial step i.e. expression of the genes in a suitable host organism remains incomplete.

The study could result in only 52.4% decrease in total sulfur of hydro treated diesel (500 ppm) in 12 hours.

Overall rate of desulphurisation of diesel could not be achieved and the work could not be completed, as the potential recombinant biocatalyst was not available for further studies.

62.4.2.4 IIP mentioned that they need the help of genetic engineer to resolve some of the issues they are facing. Prof.S.Pushpavanam, IIT-Madras readily agreed to help IIP in this regard.

62.4.2.5 As desired by IIP, SAC agreed to give further extension to the project.

62.4.3 **Development of Feed Nozzle System and Study of its Effect on Performance of FCC Riser Reactor: A Computational Fluid Dynamics Approach by EIL:**

62.4.3.1 The objective of the project is to develop and test a feed nozzle system for FCC riser as well as to develop a CFD based model for FCC riser reactor with capability of predicting effect of feed nozzle system on FCC conversions and yield pattern and comparison of CFD model with experimental observations on fluidisation and vaporisation aspect.

62.4.3.2 The estimated project cost was Rs.92 Lakhs with completion schedule of 30 months from the zero date i.e. June 2005. However, on EIL request it was extended up to March 2007.

62.4.3.3 EIL mentioned that Computational Fluid Dynamic (CFD) software development for predicting the performance of FCC riser has been completed. However, problems are there in setting up the pilot plant (experimental facility) for conducting experiments for generation of data for validation.

62.4.3.4 In view of the high cost of the high-speed camera with software for spray characterisation, it was dropped and the possibility of conducting drop size measurements at IIP, UICT or NCL shall be explored. EIL also decided to use toluene as test fluid instead of water, being it closer to the actual FCC operating conditions for qualitative evaluation of nozzles.

62.4.3.5 Since no quotations were received for test nozzles, nozzles will be designed and fabricated at EIL-R&D.

62.4.3.6 In view of the above EIL requested for extending the project schedule by another 21 months without any cost implication. CH-SAC agreed for the extension of the project.

62.4.4 **Add-on facilities for development of Trickle Bed Reactor Technology; Part-I: Large Scale hydrodynamic studies for distributor and re-distributor / quench system by EIL:**

62.4.4.1 The objective of the project is to carryout research work in large diameter column for development of Trickle bed technology for addressing various aspects of hardware.

62.4.4.2 The estimated cost of the project is Rs.135.48 Lakh with completion schedule of 24 months from the zero date i.e. March 2006. However, on EIL request it was revised to September 2007.

62.4.4.3 Analysis of data generated under Phase-I & II, development of internals & experimental set up and conceptualisation of internals design and fabrication, procurement and installation of 12" dia column as well as data generation

completed. Design, fabrication of internals for 1.2-meter dia column, Equipment procurement & installation and CFD modelling of TBR is in progress. IIT-Delhi has procured workstation for CFD simulation. IOC-R&D has created a cold flow TBR facility (600 mm dia). However, part procurement of detectors for tomographic study made and subsequent procurement in progress.

62.4.4.4 EIL requested for extending the project schedule without any cost implication. CH-SAC agreed for the extension of the project.

62.5 **Development of Regenerative Process for Sulfur Dioxide Removal from Lean Gas Stream by IIP / EIL:**

62.5.1 EIL mentioned that NRL is ready to implement the IIP / EIL developed technology at their Refinery, for which design is in progress. However, NRL wants its name to be included in the licensing for Intellectual Property Right (IPR) as it is providing the first platform for implementing the same and taking the risk. Royalty from its implementation will be shared between CHT and IIP, EIL & NRL on 50:50 basis. EIL was of the opinion that this is a good way for commercialisation of the indigenously developed technologies.

62.5.2 CH-SAC suggested that IIP / EIL may talk to IOC for commercialisation of the same.

62.6 This being the last SAC meeting for Shri S.Makhija, ED, IOC-R&D as he will be retiring towards end of the month from the services of IOCL-R&D after attaining the age of superannuation, members expressed their gratitude to Shri Makhija for his contributions to the oil industry and the SAC.

62.7 CH-SAC advised that another meeting of SAC to discuss Centre for Excellence be called within next 3-4 weeks.

62.8 CH-SAC suggested that next meeting can be held at HPCL training centre near Pune.

Annexure

Participants to the 62nd Scientific Advisory Committee (SAC) meeting held on 22nd November 2007 at PPAC Conference Room, SCOPE Complex, New Delhi:

S. No.	Name, S/Shri	Designation	Organisation
1.	M.B.Lal	Chairman	SAC
2.	Dr.M.O. Garg	Director	IIP, Dehradun
3.	S.Pushpavanam	Professor	IIT, Madras
4.	S.K.Biswas	Professor	IISc, Bangalore
5.	Dr.D.M.Kale	ED (R&D)	ONGC
6.	M.K.Joshi	Director (Tech.)	E IL
7.	Dr.K.S.Balaraman	ED	CHT
8.	T.S. Balasubramanian	Financial Advisor	OIDB
9.	S.Makhija	ED	IOC (R&D)
10.	Dr.M.A.Siddique	ED	BPCL (R&D)
11.	Dr.S.Banik	GM	E IL (R&D)
12.	Dr.R.P.Verma	Consultant (R&D)	HPCL
13.	Dr.R.K.Malhotra	ED	IOC (R&D)
14.	Dr.B.Basu	GM	IOC (R&D)
15.	R.T.Mookken	DGM	IOC (R&D)
16.	U.Venkata Ramana	CM (Technical)	IOC-R HQ
17.	Dr.N.V.Choudary	Chief Manager	BPCL-R&D
18.	Dr.V.Ravi Kumar	SM	BPCL-R&D
19.	Dr.R.N.Lahiri	AGM	EIL
20.	R.N.Maiti	SM	EIL
21.	R.K.Kaul	Accounts Officer	OIDB
22.	Dr.G.Murali Dhar	HOD	IIP
23.	D.K.Adhikari	Scientist 'F'	IIP
24.	R.Prasad	Scientist 'E-II'	IIP
25.	S.Pandey	Dr. Fellow	TERI
26.	Shobha Pandey	Research Assistant	TERI
27.	Dr.S.Velmurugan	Sr. Scientist	TES Division, CRRI
28.	Dr.Mathew Abraham	GM	M&M Limited
29.	Dr.Prasad Gade	DGM (R&D)	M&M Limited
30.	Dr.P.VijayaLakshmi	Scientist 'F'	IICT, Hyderabad
31.	Dr.R.B.N.Prasad	Scientist 'F'	IICT, Hyderabad
32.	S.K.Shukla	Additional Director	CHT
33.	A.K.Agarwal	Additional Director	CHT
34.	G.K.Dey	Additional Director	CHT

S. No.	Name, S/Shri	Designation	Organisation
35.	C.S.S.Narayana	Joint Director	CHT
36.	S.C.Das	Joint Director	CHT

1. Shri M.B.Lal
Chairman,
Scientific Advisory Committee (SAC) on Hydrocarbons,
B-25, Mayfair Gardens,
4th floor, Little Gibbs Road,
Malabar Hill,
Mumbai-400 006

2. Dr.M.O.Garg,
Director,
Indian Institute of Petroleum,
P.O.IIP, Mohkampur,
Dehradun-248 005 (Uttrakhand)

3. Professor S.K.Biswas,
Department of Mechanical Engineering,
Indian Institute of Science,
C.V.Raman Avenue,
Banglore-560 012

4. Professor D.N.Saraf,
University of Petroleum and Energy Studies,
Village Bitholi, Via Prem Nagar,
Dehradun-248 007 (Uttrakhand)

5. Dr. S.Pushpavanam,
Professor,
Chemical Engineering Department,
Indian Institute of Technology-Madras,
P.O. IIT,
Chennai-600 036

6. Shri B.N.Bankapur,
Director (Refineries),
Indian Oil Corporation Ltd.,
SCOPE Complex,
5th Floor, Core-2,
Lodhi Road,
New Delhi-110 003

7. Shri R.K.Singh,
Director (Refineries),
Bharat Petroleum Corporation Ltd.,
Bharat Bhawan,
4&5 Currimbhoy Road,
Ballard Estate,
P.B. No. 688,
Mumbai-400 001

8. Shri M.K.Joshi,
Director (Tech.),
Engineers India Limited,
EI Bhawan,
1, Bhikaiji Cama Place,
New Delhi-110 066

9. Dr. D.M.Kale,
Executive Director (R&D),
Oil & Natural Gas Corporation Ltd.
Jeevan Bharti Building,
124, Connaught Circus,
New Delhi-110 001

10. Secretary,
Oil Industry Development Board,
301, World Trade Centre,
Babar Road,
New Delhi-110 001

11. Shri M.S.Srinivasan,
Secretary,
Ministry of Petroleum & Natural Gas,
Shastri Bhawan,
New Delhi-110 001

12. Shri Prabh Das,
Joint Secretary (Refineries),
Ministry Of Petroleum & Natural Gas,
Shastri Bhawan,
New Delhi-110 001

13. Shri D.Pathak,
Director (R&A),
Ministry Of Petroleum & Natural Gas,
Shastri Bhawan,
New Delhi-110 001

14. Shri M.A. Tankiwala,
Director (Refineries),
Hindustan Petroleum Corporation Ltd.,
17, Jamshedji Tata Road,
P.O. Box No. 11041,
Mumbai-400 020

15. Shri Anand Kumar,
Director (R&D),
Indian Oil Corporation Ltd.,
R&D Centre,
Sector-13,
Faridabad-121 007

16. Dr. M.A.Siddiqui,
Executive Director (R&D),
Bharat Petroleum Corporation Ltd.,
Corporate R&D Centre,
Plot No. 2A,
Udyog Kendra,
Greater Noida (U.P.)

17. Shri K.Murali,
Executive Director (R&D),
Hindustan Petroleum Corporation Ltd.,
Mumbai Refinery,
Corridor Road, Mahul,
Mumbai-400 074

18. Dr.S.Banik,
General Manager (R&D)
Engineers India Limited,
Sector-16,
Gurgaon-122 001