MINUTES OF THE
39TH MEETING OF WORKING GROUP OF NIH
HELD AT NIH, ROORKEE, DURING OCTOBER 21-22, 2013

The 39th meeting of the Working Group of NIH was held at NIH, Roorkee, during October 21-22, 2013 under the Chairmanship of Director, NIH. The list of the participants of the meeting is given in Annexure-I.

ITEM NO. 39.1: OPENING REMARKS BY THE CHAIRMAN

Er. R D Singh, Director, NIH & Chairman, WG welcomed the Working Group members and the Scientists of the Institute. The Chairman mentioned the monthly monitoring of milestones/deliverables by the Ministry of Water Resources, and suggested that the scientists should prepare the internally-funded studies in the same format as of the sponsored projects (including the provision of budget under defined heads).

The Chairman then asked the Member-Secretary to take up the agenda of the meeting.

ITEM No. 39.2: CONFIRMATION OF THE MINUTES OF 38TH MEETING OF THE WORKING GROUP

The 38th meeting of the Working group was held during April 3-4, 2013. The minutes of the meeting were circulated to all the members and invitees vide letter No. RMOD/38th WG/NIH/13 dated July 1, 2013. As no comments were received on the circulated minutes, the minutes were confirmed.

ITEM No. 39.3: ACTION TAKEN ON THE DECISIONS/RECOMMENDATIONS OF THE PREVIOUS WORKING GROUP MEETING

Dr. V. C. Goyal, Scientist F & Member Secretary, gave a brief account of the actions taken on the recommendations/decisions of the 38th working group meeting.

ITEM No. 39.4: PRESENTATION AND DISCUSSION ON THE STATUS AND PROGRESS OF THE WORK PROGRAMME FOR THE YEAR 2013-14.

The Member-Secretary requested the respective Divisional Heads to present their progress of studies and work programme of the year 2013-14 in the meeting. Accordingly, the progress of various studies and sponsored projects was presented by all scientific Divisions on their turn during two day deliberations of the Working Group. The Division wise minutes of each study/project presented during the meeting are given below:

ENVIRONMENTAL HYDROLOGY DIVISION

S.No.	Title of the Study, Study Group, Date of Start and Completion	Recommendation/Suggestion
1.	Assessment of Water Quality in Hindon River Basin Study Group: M. K. Sharma (PI), Omkar Singh, Rakesh Goel, Dayanand DOS: 11/11, DOC: 10/14	Dr. S. N. Rai suggested to include metal concentrations for calculating water quality index for ground water. Dr. N. B. Narasimha Prasad advised to take a new study in future to study the extent of river pollution on ground water quality considering ground water flow direction.
2.	Development of Low Cost Media for Fluoride Removal from Drinking Water of Fluoride Affected Areas Study Group: Rajesh Singh (PI), Dayanand DOS: 04/2011, DOC: 09/2013 Extended for 6 months up to March 2014	Dr. V. C. Goyal suggested to include some photograph of column study. Dr. S. N. Rai suggested patenting the developed adsorbant, which was further supported by Dr. V. C. Goyal to do patenting through RMOD.
3.	Applications of Nanotechnology in Water Sector Study Group: C. K. Jain (PI), Dinesh Mohan (JNU), Babita Sharma DOS: 04/13, DOC: 03/14	No comments.
4.	Ground Water Quality Mapping and Surveillance for Safe Water Supply in District Hardwar and Dehradun, Uttarakhand Study Group: C. K. Jain (PI), Rama Mehta, S. K. Sharma, Yatveer Singh, Babita Sharma DOS: 04/2013, DOC: 03/2014	No comments.
5.	Water Quality Modelling using Soft Computing Techniques Study Group: Rama Mehta (PI), C. K. Jain DOS: 04/2013, DOC: 03/2014	Dr. S. N. Rai suggested to prepare a User Manual for using the developed software.
6.	Environmental Flows Assessment of Hemavathi River in Karnataka Study Group: D. G. Durbude (PI), C. K. Jain DOS: 04/2013, DOC: 03/2015	No comments.

7.	Ionic Enrichment Dynamics of Glacial Sediment and Melt water of Gangotri Glacier Study Group: M. K. Sharma (PI), C. K. Jain, Renoj Thayyan, Manohar Arora, Naresh Saini, Jatin Malhotra, Rakesh Goyal DOS: 10/2013, DOC: 09/2016	No comments.

GROUND WATER HYDROLOGY DIVISION

Dr. N.C. Ghosh, Scientist-F and Head of the division presented an overview of studies and activities carried out by the Division during the period April – September, 2013. While presenting the technical activities carried out and progress made on different studies during last six months, he gave an account of scientific personnel available at the division and the consultancy projects being pursued by the division. He informed that out of 6 R&D studies approved for the year 2013-14, two are in house studies and 4 are sponsored continued studies of the year 2012-13.

The division has proposed two activities to be organized during 2013-14, one braining storming session and one training course training course. Initiative has already been taken up to get those activities sponsored from external sources. Besides those activities, Dr. Anupma Sharma, Scientist-D organized one half day joint interactive workshop on 'DSS(P) Applications for Mahi Basin, Gujarat' at State Water Data Centre, Gandhinagar on Aug. 29, 2013. As professional scientific activities, scientists of the Division have submitted/published a number of research papers in various journals/conferences/symposia, delivered lectures in various training courses and guided ME/M.Tech and summer trainees during the period.

The study-wise progress reported and suggestions emerged are given below.

Project Ref. Code: NIH/GWD/NIH/13-14: **Estimation of specific yield and storage coefficient of aquifers**

Dr. Surjeet Singh (PI) presented the progress of the study and various methods for the estimation of specific yield and storage coefficient. Dr. N.C. Ghosh explained the importance of precise estimation of specific yield and storage coefficient in estimation of groundwater resources. The PI also presented merits and demerits of various methods and techniques, their data requirements and a qualitative assessment on suitability of methods. Dr. Singh reported that the quantitative assessment on suitability of various methods for varying field conditions is to be carried out. Dr. S.N. Rai suggested reviewing few more recent research papers on the estimation of specific yield.

Project Ref. Code: NIH/GWD/NIH/13-14: **State-of-the-Art Report on Modeling of Coastal Aquifers Vulnerable to Sea Water Ingress.**

The preparation of the state-of-the-art report emerged as an action suggested by the Ministry of Water Resources under its National Water Mission on Climate Change has been reported.

Project Ref. Code: NIH/GWD/HP-II/10-12: **Coastal Groundwater Dynamics and Management in the Saurashtra Region, Gujarat.**

Dr. Anupma Sharma (PI) presented the progress of the study and groundwater salinity issues in the coastal Saurashtra region and the various measures taken by the State Deptt. to prevent ingress of saline water through creeks and freshwater reservoir schemes. The details of data collection program undertaken for the Minsar Basin, topography and geology of Minsar Basin, observation well network, rainfall pattern in the area etc. were also presented. Impact of low rainfall in the previous year and normal rainfall in the current year with resulting variations in water table and groundwater salinity along the coast during different months were also explained. Variation in profile salinity during different months and locations was illustrated. Results obtained from chemical analysis of water samples were shown using various plots of different water quality parameters. Possible cation exchange reactions in the region were discussed. Dr Deshpande suggested studying the time lag in the phenomena of advance and retreat of the salinity and related ion exchange in the groundwater system. Dr Jacob enquired about the depth of wells in the study area. The variation in the well depths near and away from the coast was explained using a scatter plot. The importance of runoff from the hilly region in terms of its utilization in the downstream areas was discussed and simulations from hydrologic modeling were shown.

Dr. Sharma reported that extensive field investigations had been carried out under this PDS of HP-II to gather representative data from the field. She informed, the study would be completed within the stipulated time.

Members of the Working Group appreciated such detailed investigations and systematic data collection efforts. Dr. S. N. Rai suggested that NIH can think bringing out 'Professional Paper' on studies, which involved detailed field investigations and innovative approach in field data collection.

Project Ref. Code: EU-sponsored Project no. 282911 : Saph Pani - Enhancement of natural water systems and treatment methods for safe and sustainable water supply in India"

Dr. N. C. Ghosh presented the progress made during the last six months period in the EU sponsored collaborative R & D project, 'Saph Pani'.

Dr. Ghosh informed that water sampling campaign in Haridwar RBF site from 29 locations to determine the concentrations of 20 water quality constituents (16 physico-chemicals, 2 bacteriological and 2 heavy metals) and isotopic composition carried out bimonthly during monsoon months. Other auxiliary data, such as river stages and groundwater levels had also collected for modelling the well fields of the RBF wells. . Dr. Ghosh informed, the analyzed results are being shared with task leaders from time to time for carrying out other tasks of this work package. The transient simulation of the steady-state model developed for the case study site is in progress at the HTWD, Germany. Dr. Ghosh informed that semi-analytical models involving a new approach for analyzing "River, Canal, Aquifer and Well field interaction" have been developed for estimation of increase in canal recharge and river depletion consequent to pumping in the vicinity of the river and canal network. The models have been applied to simulate the wells field of the Haridwar site.

Dr. Ghosh informed that during July, 2013 a second round of visit to different potential RBF sites of Bihar, Jharkhand, Andhra Pradesh, and Jammu had been carried out by respective Regional Centre of NIH along with HTWD, Germany and collected data from various places as part of the activities of baseline data generation to prepare master plan.

The other technical activities carried out under the Work Package-7 : Training and Dissemination, had also been reported. It was also informed that the 4th biannual review meeting together with the third and the last training course of its series on "Application of wetlands and other natural systems in India" is being organized by IIT Bombay and NIH at Mumbai during 20-26 November, 2013.

Project Ref. Code: NIH/GWD/NIH/11-14 : Managed Aquifer Recharge (MAR) and Aquifer Storage Recovery (ASR)

Mr. Sumant Kumar (PI) presented the progress and achievements made during last 6 months and the future plan of the study. PI informed that bathymetric survey of the Telebanda lake has been conducted and geometry and capacity of the lake has been determined. The status of some water quality constituents has also been analyzed to know the pollution level of the lake. The weekly water level of the lake is being monitored from June, 2013. The future plan of the study has been envisaged as to estimate the groundwater recharge using water balance approach.

Project Ref. Code: EU-sponsored Project no. 282911 : **Flow and Contaminant Transport Modeling of Riverbank Filtration.**

As the PI of the study Ms. Shashi Poonam Indwar, Sc.-B is on long leave on health ground; the progress of this study has not been reported. The work programme of the division for the year 2013-14 is given at annexure-I.

Annexure-I

WORK PROGRAMME OF THE GROUND WATER HYDROLOGY DIVISION FOR THE YEAR 2013-14

S. No. & Reference Code	Project	Project Team	Duration & Status	Funding Source
1. NIH/GWD/NIH/13-14	Estimation of specific yield and storage coefficient of aquifers	Surjeet Singh (PI) N.C. Ghosh (Co-PI) Sumant Kumar	1 year (04/13 – 03/14) **Status**: Continuing	NIH
2. NIH/GWD/NIH/13-14	* State-of-the-Art Report on Modeling of Coastal Aquifers Vulnerable to Sea Water Ingress	Anupma Sharma (PI) C.P. Kumar (Co-PI) Rajan Vatsa	1 year (04/13 – 03/14) **Status**: Continuing	NIH (Reffered by MoWR)
Sponsored & HP-II Projects				
3. NIH/GWD/HP-II/10-12	Coastal Groundwater Dynamics and Management in the Saurashtra Region, Gujarat.	N. C. Ghosh (Coordinator) Anupma Sharma (PI) C P Kumar SE(GWRDC, Gujarat) C.K. Jain Sudhir Kumar D.S. Rathore M.S. Rao Surjeet Singh Rajan Vatsa	3 years (10/09 – 12/13) **Status:** Continuing	PDS (HP-II)

4. EU-sponsored Project no. 282911	Saph Pani - Enhancement of natural water systems and treatment methods for safe and sustainable water supply in India"	Project Coordinator & P.I. : N. C. Ghosh Other Team Members V. C. Goyal C. K. Jain Sudhir Kumar B. Chakravorty A. K. Lohani Anupma Sharma Surjeet Singh Sumant Kumar Shashi Poonam Indwar	36 months (Oct., 2011-Sept.,2014) Status: Continuing	European Union under 7th - Framework Programme
5. NIH/GWD/NIH/11-14	Management of Aquifer Recharge (MAR) and Aquifer Storage Recovery (ASR)	Sumant Kumar (PI) Rajan Vatsa N.C. Ghosh C.P. Kumar Surjeet Singh Sanjay Mittal	3 years (04/11 – 03/14) **Status:** Continuing	Saph Pani Project
6. EU-sponsored Project no. 282911	Flow and Contaminant Transport Modeling of Riverbank Filtration	Shashi Poonam Indwar (PI) N.C. Ghosh Anupma Sharma Rajan Vatsa Sanjay Mittal **Support:** Uttarakhand Jal Sansthan (UJS	2 ½ years (04/12 – 09/14) **Status:** Continuing	Saph Pani Project
Consultancy Projects				
7.	Study of hydrological and hydro-geological aspects of the Jhabua Power Project in Madhya Pradesh to assess water source sustainability	N.C. Ghosh (PI) M.K. Goel A.K. Lohani T.R. Nayak S.P. Rai Surjeet Singh T. Thomas Sanjay Mittal	03 months **Status:** In progress	JPL, APIL, Gurgaon
8.	Study of hydrological and hydro-geological aspects of the Korba Power Project in Chhattisgarh to assess water source sustainability	N.C. Ghosh (PI) A.K. Lohani S.P. Rai Ravi Galkate Surjeet Singh R.K. Jaiswal Sanjay Mittal	03 months **Status:** In progress	KWPCL, APIL, Gurgaon

HYDROLOGICAL INVESTIGATIONS DIVISION

S. No.	Title of Study/Project, Study Team, Date of Start (DOS) and Date of Completion (DOC)	Status and Recommendations/Suggestions
	INTERNAL STUDIES	
1.	Assessment of Sensitivity of Open Water Evaporation to Increase in Temperature for Different Climatic Regions of India S. D. Khobragade (PI), C. P. Kumar, Manohar Arora, A. R. Senthil Kumar DOS: 04/2012, DOC: 03/2014	Status: On-going Study There were no specific suggestions.
2.	Water Quality, Hydrogeology and Isotopic Investigations in SW Punjab M. S. Rao (PI), C. P. Kumar, Gopal Krishan DOS: 07/2012, DOC: 06/2014	Status: On-going Study There were no specific suggestions.
3.	Water Availability Studies for Sukhna Lake, Chandigarh S. D. Khobragade (PI), C. P. Kumar, Sudhir Kumar, A. R. Senthil Kumar, P. K. Garg, V. K. Agarwal DOS: 04/2013, DOC: 03/2015	Status: On-going Study There were no specific suggestions.
4.	Isotope Studies for the Identification of Different Aquifer Groups and their Dynamics in Upper Yamuna River Plains Sudhir Kumar (PI), C. K. Jain, S. P. Rai, S. D. Khobragade, P. K. Garg, Two Officers from CGWB DOS: 07/2013, DOC: 06/2015	Status: New Study The wells for collection of sampling have been identified. Forty samples have been collected from U.P. side of the study area. Preliminary isotopic analysis of the samples indicates that deeper aquifers are not directly recharged by the shallow aquifers. There were no specific suggestions.
5.	Identifying Wind Patterns and Cloud Condensation in Parts of Himalayas using Isotopes M. S. Rao (PI), C. P. Kumar, Gopal Krishan DOS: 10/2013, DOC: 09/2015	Status: New Study Dr. N. K. Sharma suggested to interact with SASE and install few additional stations including one at Ladakh/Leh. Dr. N.C. Ghosh suggested to include this as part of IWIN Phase-II.

S. No.	Title of Study/Project, Study Team, Date of Start (DOS) and Date of Completion (DOC)	Status and Recommendations/Suggestions
6.	Estimation of Radon Concentration in Waters and Identification of Paleo-groundwater in Parts of Satluj River Basin Using Isotopes S. K. Verma (PI), S. P. Rai (Co-PI), M. S. Rao, C. P. Kumar, Mohar Singh DOS: 10/2013, DOC: 09/2015	Status: New Study There were no specific suggestions.
SPONSORED PROJECTS		
7.	National Program on Isotope Fingerprinting of Waters of India (IWIN) M. S. Rao (PI), Sudhir Kumar, S. P. Rai, S. K. Verma, P. K. Garg, Gopal Krishan DOS: 07/2007, DOC: 12/2013	Status: On-going Study Dr. S. N. Rai suggested to update the graphs with 2013 data in the final report. Dr. S. K. Bartariya expressed his willingness to participate in IWIN Phase –II.
8.	Groundwater Dynamics of Bist-Doab Area, Punjab using Isotopes M. S. Rao (PI), Sudhir Kumar, S. K. Verma, P. K. Garg, Gopal Krishan, CGWB Officials DOS: 10/2008, DOC: 12/2013	Status: On-going Study There were no specific suggestions.
9.	Groundwater Management in Over-Exploited Blocks of Chitradurga and Tumkur Districts of Karnataka Sudhir Kumar (PI), J. V. Tyagi, S. P. Rai, Anupma Sharma, B. K. Purandara, C. Rangaraj DOS: 10/2008, DOC: 03/2014	Status: On-going Study There were no specific suggestions.
10.	The Use of Environmental Isotopes to Assess Sustainability of Intensively Exploited Aquifer Systems in North Eastern Parts of Punjab, India M. S. Rao (PI), C. P. Kumar, S. P. Rai DOS: 09/2012, DOC: 08/2015	Status: On-going Study There were no specific suggestions.

S. No.	Title of Study/Project, Study Team, Date of Start (DOS) and Date of Completion (DOC)	Status and Recommendations/Suggestions
11.	The Structure and Dynamics of Groundwater Systems in Northwestern India under Past, Present and Future Climates S. P. Rai (PI), M. S. Rao, Surjeet Singh, S. K. Verma, C. P. Kumar, Sudhir Kumar, V. K. Agarwal, Rajeev Gupta, S. L. Srivastava, Vishal Gupta, Mohar Singh DOS: 06/2012, DOC: 05/2015	Status: On-going Study Dr. S. N. Rai suggested to prepare subsurface geology map for demarcation of confined and unconfined aquifer conditions. Dr. Noble Jacob suggested plotting of $\delta^{18}O$ data of groundwater with depth and also emphasized on seasonal analysis of rainfall isotopic data instead of annual analysis.
12.	Review of Groundwater Resources in the Indo-Gangetic Basin: A Case Study on Resilience of Groundwater in the Punjab to Withdrawal and Environmental Change M. S. Rao (PI), C. P. Kumar, Gopal Krishan DOS: 02/2013, DOC: 05/2014	Status: On-going Study Dr. N. B. N. Prasad suggested to update the irrigation data of Ganga basin and refer the report of Dr. Sunita Narayan of CSE, New Delhi. Dr. V. C. Goyal and Dr. N. C. Ghosh suggested to keep the review report mainly confined to groundwater component, as stated in the project title. Dr. S. Bartariya suggested to refer the report of Highnoon project.
13.	Assessment of Baseflow and its Impact on Water Quality in the Part of Satluj River in India using Environmental Isotopes and Age Dating Techniques S. P. Rai (PI), R. V. Kale, M. S. Rao, C. P. Kumar, Sudhir Kumar, V. K. Agarwal, Vishal Gupta, Mohar Singh DOS: 10/2012, DOC: 09/2015	Status: On-going Study There were no specific suggestions.
14.	Integration of Isotope Hydrology in Aquifer Mapping Efforts in India: A Pilot Study of Upper Yamuna Plains Sudhir Kumar (PI), S. P. Rai, C. K. Jain, P. K. Garg DOS: 05/2013, DOC: 04/2015	Status: New Study The wells for collection of sampling have been identified. Forty samples have been collected from U.P. side of the study area. Preliminary isotopic analysis of the samples indicates that deeper aquifers are not directly recharged by the shallow aquifers. There were no specific suggestions.
CONSULTANCY PROJECTS		

S. No.	Title of Study/Project, Study Team, Date of Start (DOS) and Date of Completion (DOC)	Status and Recommendations/Suggestions
15.	Integrated Hydrological Investigations of Sukhna Lake, Chandigarh for its Conservation and Management S. D. Khobragade (PI), C. P. Kumar, R. D. Singh, S. P. Rai, C. K. Jain, V. K. Agarwal DOS: 07/2011, DOC: 06/2013	Status: Project completed
16.	Pre-dredging and Post-dredging Bathymetric Survey of Ramgarh Tal Lake, Gorakhpur, UP S. D. Khobragade (PI), C. P. Kumar, R. D. Singh, V. K. Agarwal DOS: 11/2012, DOC: 04/2013 (Pre-dredging)	Status: On-going Project
17.	Assessment of Impact of Coal Mining from Mahan Coal Block on Groundwater Recharge and Sedimentation in Rihand Reservoir and to Suggest Appropriate Measures to Mitigate the Identified Impacts Sudhir Kumar (PI), Sanjay Kumar Jain, J. V. Tyagi, Surjeet Singh, S. D. Khobragade, R. K. Jaiswal, P. K. Garg DOS: 04/2013, DOC: 09/2013	Status: Project completed
18.	Hydrogeological Study for Dewatering of Jhamarkotra Mines, Distt. Udaipur Sudhir Kumar (PI) DOS: 05/2013, DOC: 04/2016	New Project
19.	Impact Assessment of Ash Pond on the Groundwater Quality in the Surrounding Villages of NTPC Simhadri through Stable Isotopic Studies Sudhir Kumar (PI) DOS: 07/2013, DOC: 06/2014	New Project

S. No.	Title of Study/Project, Study Team, Date of Start (DOS) and Date of Completion (DOC)	Status and Recommendations/Suggestions
20.	Identification of Source and Locations of Leakage/Seepage from Kaushalya Dam, Haryana S. P. Rai (PI) DOS: 08/2013, DOC: 01/2014	New Project

SURFACE WATER HYDROLOGY DIVISION

1. CLIMATIC VARIABILITY ANALYSIS AND ITS IMPACT ON HIMALAYAN WATERSHED IN UTTARAKHAND

Dr. Avinash Agarwal, Scientist F presented the study and the results in the light of suggestions from previous meeting. Presented study area and methodology and results so obtained in details along with the climatic variability and the impacts on stream and spring flows. The study is concluded and the draft of the report was presented for its finalization.

2. MONITORING AND MODELLING OF STREAMFLOW FOR THE GANGOTRI GLACIER

Mr Jatin Malhotra presented the progress of the study. He informed that the field investigations for the summer season (May to October) 2013 have been completed. He informed that Bhagirathi River experienced a major landslide event comprising of big boulders, cobbles, sand and silt from 16th to 18th June 2013. The total rainfall during this 5-day storm was 178 mm. Sudden increase of discharge in the river resulted in flooding of the downstream area. Mr Malhotra explained the house besides many difficulties due to unusual flood event the NIH team successfully completed the data collection for the summer season and analysis of the data is in progress. During the presentation Director, NIH suggested that necessary action should be taken to upgrade the observatory and discharge site before the start of the next summer season.

3. HYDROLOGICAL STUDIES FOR UPPER NARMADA BASIN

Mr. Jagadish Prasad Patra, PI of the study presented the progress during past six months. Objectives of the study with brief methodology and work progress with results achieved

were presented. The Mike-flood model setup and initial runs with PMF were discussed in details during the presentation. There were no specific comments from the members.

4. STUDY OF HYDRO-METEOROLOGICAL DROUGHTS FOR CHITRAKOOT DISTRICT OF BUNDELKHAND REGION IN INDIA

Dr R.P. Pandey, PI of the project presented details of activities carried out in respect of ongoing study during past six months. Dr Pandey reported that the Bundelkhand region of the country had faces acute drinking water shortages during summer months and this problem was very severe during drought years in the recent past i.e. 2004-2008. The major objective of the study is to quantify water scarcity during droughts and to identify possible options for augmenting water supply and minimizing crop loss due to droughts**.** The PI further reported that the necessary data processing, preparation of base maps and analysis of rainfall data have been completed. He further informed that the long-term monthly rainfall data for 1901-2010 and daily rainfall and other meteorological records for 1969-2011 were collected and analyzed for rainfall departure, probability distribution of annual and seasonal rainfall, dryspell analysis and estimation of supplemental water requirement for dry-spell periods for kharif season crops have been completed and same was presented in the meeting. It was informed that a new methodology has been devised for regular drought monitoring using rainfall data. The method has been compared with Standardized Precipitation Index (SPI) and Effective Drought Index (EDI). The method provides comparable assessment of onset of drought and its progression. Further, it was informed that the same methodology has been incorporated in the DSS(P) for identification of onset of drought events and quantification of their severity. The results of the method applications were demonstrated in the meeting. The PI informed that the flow measurement records for Paisuni river are not available. Therefore, MIKE Basin NAM Model has been used to estimate flow series using Tons flow data for its calibration. The River Tons is flowing adjoining to the Pasuni river and have nearly identical topographic features. It was informed that the interim Report on progress of this study was submitted in June 2013.

5. SEDIMENTATION STUDIES FOR PONG RESERVOIR, HIMACHAL PRADESH

Dr. A. R. Senthil kumar, PI of the project, presented the objectives, methodology and progress of the study for the period from October 2012 to March 2013 and from April 2013 to September 2013 in brief. He presented the development of sediment yield model for pong dam using ANN and the simulation of sediment yield for future 25, 50, 75 and 100 years using the generated series of rainfall and flow volume. He also presented the uncertainty analysis of the rainfall and flow volume for future 25, 50, 75 and 100 years. Dr. S. N. Rai (SNR) inquired about

the division of data for the calibration and validation of the model. The PI replied that the data of 1987 to 2007 and 2008 to 2009 have been used for the calibration and validation of the model respectively. SNR suggested to update the data and carry out the analysis. The PI replied that the base year of the modelling would be changed then. SNR requested to model the effect of sediment consolidation in the recharge from the dam. Dr. N. C. Ghosh replied that the selection of the dam site is made in such a way that the recharge from the reservoir is almost zero.

6. DEVELOPMENT OF REAL TIME FLOOD FORECASTING FOR DOWNSTREAM OF HIRAKUD DAM

Dr. A K Lohani presented the background and objectives of the study. Dr Lohani mentioned that the floods are regular phenomenon in the downstream portion of the Mahanadi river. Flood forecasting is used to provide warning to people residing in flood plains and can alleviate a lot of distress and damage. Dr Lohani presented the data collection, processing and flood forecasting model development tasks carried out during the period from April 2013 to September 2013. He presented the soft computing based models developed for the forecasting of the floods. He further mentioned that the work is in progress and likely to be completed by March 2014. Mr R.K. Khanna appreciated the study and suggested that these models will be useful for the Central Water Commission. Further, Dr V.C. Goyal, Sc F suggested that the technology transfer workshop may be organised to disseminate the knowledge and technology to the field engineers.

7. APPLICATION OF DSS (P) FOR INTEGRATED WATER RESOURCES DEVELOPMENT AND MANAGEMENT

Dr. A K Lohani presented the background and objectives of the study. Dr Lohani mentioned that the DSS(P) software has been developed under HP-II and the same model will be applied in a selected basin to demonstrate the capabilities of the DSS(P) model. Dr Lohani mentioned that the data has been collected from Chhattisgarh for the application of DSS(P) software in a sub basin of Seonath basin. Dr Lohani mentioned that the collected data has been computerized and a model has been setup in Mike basin and Mike -11 RR. Some trial runs of NAM model have been taken for the selected site. Members of the working group appreciated the proposed study.

8. STATUS REPORT ON SOIL EROSION AND SEDIMENT TRANSPORT MODELLING

Dr. J. V. Tyagi, PI of the study informed the house that the National Water Mission document of National Action Plan on Climate Change (NAPCC) has recommended for building

a Universal Soil Loss model depicting erosion and sediment transport etc. Before taking up the model development, the action plan of the activity envisages preparation of a state-of-the-art report on soil erosion and sediment transport modeling and the work is entrusted to NIH. Accordingly, preparation of state-of-the-art report has been taken up. Dr. Tyagi further informed that the literature on soil erosion and sediment transport modeling has been collected from various sources. Collection of some more literature is in progress. A thorough review of the collected literature on various methodologies available for soil erosion and sediment transport modelling is being carried out for preparation of the state-of-the-art report. The report will be submitted as per schedule. There were no comments on the study.

9. QUANTITATIVE ASSESSMENT OF UNCERTAINTIES IN RIVER DISCHARGE ESTIMATION

Dr. Sanjay Kumar presented the study on "Quantitative assessment of uncertainties in river discharge estimation". He explained the background and objectives of the study and mentioned that study is a part of the systemic review of uncertainty clause of the ISO 9123 document. He explained the methodology based on ISO documents GUM (Guide to the expression of uncertainty in measurement), HUG (Hydrometric uncertainty guidance) and presented the progress made in the study. He mentioned that a NWIP (New Work Implementation Plan) has been submitted along with a working draft of the uncertainly clause of the above ISO document. He also mentioned that NWIP and the submitted document are currently under review of ISO committee on Water Resources (WR).

10. SUSPENDED SEDIMENT FLUX MODELLING IN THE LARGEST SUB-BASIN OF BRAHMAPUTRA

Mrs Archana Sarkar, PI of the study presented the background, objectives, methodology, progress of last six months and expected deliverables of the new study. Mrs Sarkar informed that the study area is the Subansiri River basin, the biggest northern tributary of Brahmaputra River within India which originates in Tibet, contains snow-fed tributaries and glaciers and has a huge hydropower potential for the country. She informed the house that Hydrological modeling studies in Brahmaputra basin" is one of the thrust areas of "12th Five Year Plan" of the institute. She further informed Subansiri River promises stupendous hydropower potential (22 projects having potential of 15,191 MW already proposed/in progress) for the country, therefore, accurate assessment of sediment flux is of prime importance. Mrs Sarkar presented the identified ANN models to be developed for the study and also presented the data processing and data preparation for the models already done in the last six months.

Mrs Sarkar informed that this study would conclude by providing discussion about how the different type of input data, length of input data, lagging of input data and scale of input data effect the accuracy of sediment flux estimation in a large Himalayan River basin and also guidance on the types of tasks for which different types of input data may be preferable. Dr Bartaria enquired about the input variables for various ANN models if lineament etc. are directly considered. Mrs Sarkar informed that for the present study, hydro-meteorological data along with snow cover area data have been considered which in turn also account indirectly for other basin characteristics. Working group members noted the progress of the study.

11. EVALUATION AND MODELING OF HYDROLOGICAL SUPPORT SYSTEM FOR WATERSHEDS OF GARHWAL, UTTARAKHAND HILLS

Dr. Agarwal presented a new study and informed that this study has been submitted to DST for possible funding. Some prelim works on spring recession envelop and delineation of spring shed were presented for further suggestions. Dr. Rai suggested that study of lineament and flow in aquifer is important for proposed work. Dr SK Bartarya suggested the confirmation of spring recharge zones using stable isotopes is essential as identified in the study by assuming similarity with surface flow similarity under lineaments control. Dr NC Ghosh suggested that for the cases when flow in aquifer bypass the lineament the conservation of mass is not preserved and delineating the spring shed may not be correct. After discussion it was agreed that the springs of the area do not bypass the lineaments and the work will be suitable for the springs in which the aquifer flow is controlled by the lineaments. Working group accepted the study as internal study subjected to financial approvals from Director NIH.

WORK PROGRAMME OF SURFACE WATER HYDROLOGY DIVISION FOR THE YEAR 2013-14

S. No. & Ref. Code	Title	Study Team	Duration
Internal Studies			
1. NIH/SWD/NIH/ 10-13	Climatic variability analysis and its impact on Himalayan watershed in Uttarakhand	A. Agarwal, Manohar Arora R K Nema	3 years (Nov. 10 – Oct. 13)
2. NIH/SWD/NIH/ 08-	Monitoring and modelling of streamflow for the Gangotri Glacier	Manohar Arora Rakesh Kumar	March 08 -To be continued
3. NIH/SWD/NIH/ 11-14	Hydrological Studies for Upper Narmada Basin.	Jagdish P. Patra Rakesh Kumar Pankaj Mani T R Sapra	3 years (April 11 – March 14)

4. NIH/SWD/NIH/ 12-15	Study of Hydro-Meteorological Droughts for Bundelkhand Region in India	R.P. Pandey	3 years (April 12- March 15)
5. NIH/SWD/NIH/ 12-15	Sedimentation Studies for Pong Reservoir, Himachal Pradesh	A. R. S. Kumar, Manohar Arora Suhas D Khobragade, A. Agarwal, Sanjay K. Jain	3 years (April 12 – March 15)
6. NIH/SWD/NIH/ 13-14	Development of Real Time Flood Forecasting for downstream of Hirakud dam	A.K. Lohani	1 year (April 13- March 14)
7. NIH/SWD/NIH/ 13-15	Application of DSS(P) for Integrated Water Resources Development and Management	A.K. Lohani Surjeet Singh Rahul Jaiswal,	2 year (April 13- March 15)
8. NIH/SWD/NIH/ 13-14	Status Report on Soil Erosion and Sediment Transport Modelling	J.V. Tyagi	1 year (April 13- March 14)
9. NIH/SWD/NIH/ 13-16	Quantitative assessment of uncertainties in river discharge estimation	Sanjay Kumar Sharad Jain	3 year (April 13- March 16)
10. NIH/SWD/NIH/ 13-16	Suspended Sediment Flux Modelling in the largest sub-basin of Brahmaputra	Archana Sarkar Rakesh Kumar	1 year (April 13- March 14)
11. NIH/SWD/NIH/ 13-16	Evaluation and modelling of hydrological support system for watersheds of Garhwal, Uttarakhand hills	Avinash Agarwal Manohar Arora R K Nema	3 years (Nov 13- Oct 16)

WATER RESOURCES SYSTEM DIVISION

Dr. Sanjay K. Jain presented about the scientific strength of the Division and the activities carried out by the Division during last six months. He has given brief overview of all the ongoing as well as of the new studies. He also informed about the sponsored and consultancy projects undertaken by the Division. After that PI of the study presented progress of the study carried out in detail. Following are the comments received from different working group members on the different studies.

Ongoing studies

Study title: *NIH_Basin* – A WINDOWS based model for water resources assessment in a river basin

Dr. M. K. Goel (MKG) presented the progress of the study. He informed that as per the objectives of study, a WINDOWS interface has been planned and model modifications have been initiated. MKG presented the layout plan of the software which consists of four main modules: Database preparation, GIS analysis, Model execution, and Analysis of results. The basic functionality of these modules was explained. He also presented one sample form for

entry of attribute data. In the process of model modification, MKG presented the equations to be adopted for representation of elevation-area and elevation-capacity curves for various reservoirs in a river basin.

In response to a query from Dr. N. C. Ghosh (NCG), MKG informed that the present model provides more detailed hydrological analysis at the basin scale in comparison to the hydrological tools (NAM/Mike BASIN) used in the recent DSS development. In response to various queries from Dr. Kishore Kumar (KK), MKG informed that the present development is being made on the Java platform and it is not a web-based tool. Rather, it is planned to be made available on NIH web-site for downloading and further use. In response to a query from Sh. R. P. Singh (RPS), MKG informed that irrigation return flow is accounted for in the model. Dr. R. K. Khanna (RKK) and Dr. S. K. Mittal (SKM) suggested discussing the model development with CWC and CGWB. MKG informed that recently, the detailed model report has been sent to the Director, CWC (NTBO), Gujarat. Further, after developing the interface (so that it can be easy to adapt and understood), the model will be demonstrated to different concerned departments. It is also planned to organize a few courses for its dissemination and widespread use. Dr. S. N. Rai (SNR) suggested some modifications related to the use of terminology in the presentation which was accepted for correction in subsequent stages.

Study title: Web GIS based snow cover information system for Indus basin

The progress of the study was presented by Mr D.S. Rathore. It was informed that MODIS snow cover maps (Terra and Aqua 8-day composite) and MODIS reflectance (band 1-7) for Terra 8-day composite were downloaded for 2007. Reflectance data were processed using bands 2, 4 and 6 for snow delineation (snowmap algorithm excluding snow in vegetation covered area and Temperature threshold). Two snow maps were overlaid. MODIS snowmap algorithm is cloud conservative (maximize cloud) and snow covered are also likely to be identified as cloud. Using NDSI and NIR criteria alone leads to reduction on cloud area compared to NSIDC snow cover product (those having cloud cover). Various classes namely snow using MOD10A2, MOD09A1, combined MOD10A2 and MOD09A1, over bare land and in vegetation covered land, additional snow from MOD09A1 and cloud (MOD10A2) classes were presented graphically. Shri Kishor Kumar inquired regarding year of the data. It was informed that data for year 2007 were being processed. Dr Rai had given suggestion on improving presentations.

Study title: Assessment of Water Footprint of the National Capital Territory (NCT) of India

Mrs. Deepa presented the study. She informed that the water footprint of an area is defined as the volume of water needed for the production of the goods and services consumed by the inhabitants of that area. Looking at the increasing skewed supply and demand of the water resources in NCT region of India, this study has been undertaken to make an assessment of the Water Footprint of the NCT region, which may help the decision makers and government bodies in making timely intervention.

She added that NCT is an urban area and domestic water use has an important contribution. As a first step, water footprint assessment is purely done for the domestic water use. In this regards a simple use-friendly calculator has been developed for the NCT region to give the residents an estimate of the water they use on a daily basis. A demonstration of the web-based software developed for this purpose was done.

Director, CWRDM enquired whether such study has been done earlier. He suggested that such type of studies can be done for a small area. Mrs. Deepa replied that as lot of data is required for such type of studies, data availability is a problem. As data availability of NCT is better so this area has been selected for the study. Dr S N Rai enquired about the use of this study. Dr V

C Goyal informed that it can be used for increasing the water use efficiency. Mrs Deepa informed that the calculator will be installed on the institute's website.

Working group noted the progress of the study.

Study title: Impact of Climate and Landuse Change on Floods of Various Return Periods

Dr. P K Bhunya presented the status of the completed study under HP2 and in brief covered the on-going study starting with the objectives, then methodology and results achieved so far. He further appraised the house regarding duration of this study. Also informed the house about the major objectives that has been stressed during the period since the last working group. They are briefly the processed hydrological stream flow data, imagery and geomorphology characters from toposheets taken from the HP2 report. Dr. Bhunya presented briefly the expected outcome, results in regards to the objectives and the works to be distributed to individual study group members. He also presented the uncertainty band in return period flood and the land use in Mahanadi basin as reported by WALMI in Orissa. The technical publications that are allied in this project area were also discussed. There were no questions from the members.

Study titles:

1. Glaciological studies of Phuche Glacier, Ladakh Range (Ongoing)

2. Cryospheric system studies and runoff modeling of Ganglass catchment, Leh, Ladakh Range (Ongoing)

Dr. Renoj J Thayyen, Scientist "D" presented the above two studies. There were no specific suggestions/ comments from any Working Group Member.

Study Title: Trend and variability analysis of Rainfall and Temperature in Himalayan region

The study was presented by Sh. L. N. Thakural. The objective of the study is to create the database (Rainfall, Temperature) for the Himalayan region and carry out statistical analysis to detect trend and variability in these variables in the Himalayan region, India. The parametric and non-parametric approaches are being used to determine the trends in the time series data of these meteorological variables. During the presentation, analysis for the hydro meteorological data in the eastern Himalayas for temporal and spatial characteristics was explained. The climate change variability and trend of temperature and rainfall carried out for the observational sites in the eastern Himalayan region was also presented.
Dr. S. N Rai, NGRI, Hyderabad suggested that it is very important to make field visits to some of the stations lying in the study area. There were no specific comments.

Study title: Assessing Climate Change Impact across KBK (Kalahandi- Bolangir-Koraput) region of Odisha

The status of the study was presented by Shri P.K. Mishra on behalf of his team. His presentation was centred around the approved work plan in the 38th Working Group meeting and the progress made in the last six months (April-September 2013). During the last six months Shri Mishra informed on the progress made in the data requirement vis-à-vis its collection from different sources/ agencies. He further informed on the digitization work ongoing on the SOI toposheet (21 nos.) and Soil map (04 nos.). He presented the results and inferences drawn from the trend analysis of the rainfall data (1901-2010) for the KBK region. Dr. N.B.N Prasad & Shri R D Singh suggested finding the linear trend as shown after removing the outliers. Dr. S N Rai enquired on the temperature trend as well as suggested to explore soft

computing techniques (ANN) for the downscaling as per the 2nd objective of the study. The presenter noted the suggestions. Shri Mishra ended the presentation informing the next course of actions (finalization of data collection yet to be collected; finalization of digitization works for different themes; conducting a field visit; analyzing trend for other variables) during the next six months.

New study

Study title: Glacier change and glacier runoff variation in the upper Satluj river basin

The study was presented by Dr. Sanjay K Jain, Scientist "F". There were no specific suggestions/ comments from any Working Group Members.

Study title: Variability of the Hydro-climatic variables in Punjab Plains of lower Satluj

During the presentation of this new study by Shri Manish Nema, Scientist "B" there was no specific comment except about the timeframe of the project. One of the members of working group (Dr. SN Rai) suggested that the time frame of the study should be more elaborated in terms of quarterly progressive divisions instead of yearly segments. Suggestion has been noted.

Study title: Present status of water storage and diversions in major rivers in India

Shri P. K. Agarwal, Scientist "B" presented the proposed new study. Dr. Niladri Naha informed that the work may have been done by ISRO & CWC. He suggested that before taking up the work, the status may be examined.

The approved work program of the division for 2013-14 is given below in Table 1.

Table 1: Approved work program for the year 2013-14

S. N.	Title	Study Team	Duration	Funding
Ongoing Internal Studies				
1.	NIH_Basin A WINDOWS based model for water resources assessment in a river basin	Dr. M.K. Goel Dr. S.K. Jain Smt. D. Chalisgaonkar Shri P.K. Mishra	2 years (4/13-3/15) **Continuing study**	NIH
2.	Web GIS based snow cover information system for the Indus basin	Shri D.S. Rathore Smt. D. Chalisgaonkar Shri L.N. Thakural Shri Tanvear Ahmed	2 years (4/13-3/15) **Continuing study**	NIH
3.	Assessment of Water Footprint of the National Capital Territory (NCT) of India	Smt. D. Chalisgaonkar Dr. Sharad K. Jain Shri P.K. Mishra	2 years (4/13-3/15) **Continuing study**	NIH
4.	Impact of climate and landuse change on floods of various return periods	Dr. P.K. Bhunya Dr. Sanjay Kumar Shri D.S. Rathore	2 years (4/13-3/15) **Continuing study**	NIH
5.	Cryospheric system studies and runoff modeling of Ganglass catchment, Leh, Ladakh Range	Dr. Renoj J Theyyan Dr. S P Rai Dr. M.K. Goel	4&1/2 years (9/09-3/14) **Continuing**	NIH

			study	
6.	Trend and variability analysis of rainfall and temperature in Himalayan region	Shri L.N.Thakural Dr. Sanjay Kumar Dr. Sanjay K. Jain Dr. Sharad K. Jain Shri Tanvear Ahmed	3 years (10/11-09/14) **Continuing study**	NIH
7.	Assessing climate change impact across KBK region of Odisha	Shri P.K. Mishra Dr. Sharad K. Jain Dr. Sanjay K. Jain Dr. P K Bhunya Smt. A Choudhury	2 years (4/13-3/15) **Continuing study**	NIH
Sponsored Studies				
1.	Glaciological studies of Phuche Glacier, Ladakh Range.	Dr. Renoj J Theyyan Dr. S P Rai Dr. M.K. Goel	5 years (1/10-12/14) **Continuing study**	DST
2.	Preparation of Ganga River Basin Environment Management Plan (GRBEMP)	Dr. Sharad K Jain, Dr. N.C. Ghosh, Dr. Sanjay K Jain, Dr. M.K. Goel	**Continuing study**	
New Internal Studies				
1.	Variability of the Hydro-climatic variables in Punjab Plains of lower Satluj	Shri Manish K. Nema Dr. Sharad K. Jain	**New study**	NIH
2.	Glacier change and glacier runoff variation in the upper Satluj river basin	Dr. Sanjay K. Jain Dr. Sharad K. Jain Dr. Renoj J. Theyyan	**New study**	NIH
3.	Present status of water storage and diversions in major rivers in India	Shri P K Agarwal Shri Tanvear Ahmed Dr. Sharad K. Jain Dr. Sanjay K. Jain Dr. M.K. Goel	**New study**	NIH

RESEARCH MANAGEMENT AND OUTREACH DIVISION (RMOD)
2013-14

S.N.	Title of Project/Study, Study Team, Start/Completion Dates	Status and Recommendations/Suggestions
1.	Recession Flow Analysis for Evaluation of Spring Flow in Indian Catchments **Team:** Ravindra V. Kale (PI), V. C. Goyal DOS: Apr 2011; DOC: Mar 2014 (with extension)	**Status:** Ongoing study No specific comments. The study was granted the requested extension.
2.	Pilot Basin Studies (PBS) at six identified sites, jointly with the RCs and CFMSs (**Joint Study)** **NIH HQs:** V C Goyal (Leader) Omkar Singh Ravindra V. Kale	**Status:** Ongoing study No specific comments.

	NIH RCs/CFMSs: RC-Belgaum, RC-Jammu, RC-Kakinada, RC-Sagar, CFMS-Guwahati, CFMS-Patna DOS: Apr 2012; DOC: Mar 2015	
3.	Action Research for Water Conservation and Management in Selected Village (s) in Hardwar District (Uttarakhand) **Team:** Omkar Singh, V.C. Goyal and C.K. Jain DOS: Apr 2013; DOC: March 2015	**Status:** Ongoing study Dr. Prasad appreciated the study and informed that some studies of ponds have also been carried out by CWRDM. Dr. S.N. Rai was keen to know about next steps in this study, and Dr. Goyal responded to his query. Er. R.K. Khanna, informed about RRR program of MOWR is relevant to this study for possible funding. Dr. Arya opined that photographs of the village ponds may be useful for developing histroy of the water conservation efforts in the village.
4.	Integrating hydrology, climate change and IWRM with livelihood issues: Development of methodology and a DSS for water-scarce Bundelkhand region in India (Sponsored by TIFAC, GOI under INDIA-IIASA Programme of TIFAC) **Team (NIH):** Dr. V. C. Goyal (PI) Dr T Thomas (Co-PI) Dr. R. V. Kale (Co-PI) **Nodal Coordinator :** Dr (Mrs.) K Vijaya Lakshmi, DA, New Delhi Dr Sandeep Goyal, MAPCOST, Govt. of MP (India) **International Collaborators:** IIASA, Austria DOS: Aug 2013; DOC: Jan 2016	**Status:** New Study No specific comments.

The Working Group noted the progress of the studies undertaken by all divisions. Dr. N.C. Ghosh, Scientist F & Head, GWH Division presided over the proceeding of the working group on 2nd day and thanked the members for their valuable contributions during deliberations in the Working Group meeting.

The meeting ended with vote of thanks to the Chair.

ANNEXURE-I

List of Working Group Members attended the 39th WG meeting

1.	Er. R.D. Singh, Director, NIH	Chairman
2.	Dr. R P Singh, Regional Director, CGWB, Dehradun	Member
3.	Sh. Sanjiv K. Sharma, Dy. Director General, GSI, Faridabad	Member
4.	Dr. R.D. Deshpande, PRL, Ahmedabad	Member
5.	Dr. Kishore Kumar, NIC, New Delhi	Member
6.	Dr. S.N. Rai, CSIR-NGRI, Hyderabad	Member
7.	Dr. N.B. Narasimha Prasad, CWDRM, Kozhikode	Member
8.	Dr. S.K. Bartarya, WIHG, Dehradun	Member
9.	Dr. S C R Vishvakarma, GBPIHED, Almora	Member
10.	Dr. Nobel Jacob, BARC, Mumbai	Member
11.	Sh. Niladri Naha, State Water Invest. Dir., Kolkata	Member
12.	Dr. B M M Krishna Rao, Director, GW Deptt., Hyderabad	Member
13.	Er. R K Khanna, Chief Engineer (Retd.), CWC, New Delhi	Member
14.	Dr. Ritesh Arya, Arya Drillers, Haryana	Member
15.	Sh. A Tharanirajan, Dy. Director (NWP), CWC, New Delhi	Member
16.	Dr. G P Juyal, CSWCRT, Dehradun	Member
17.	Dr. S K Mittal, CSIO, Chandigarh	Member
18.	Dr. N.C. Ghosh, Sc. F & Head GWH Division, NIH	Member
19.	Dr Rakesh Kumar, Sc. F & Head SWH Division, NIH	Member
20.	Sh. C.P. Kumar, Sc. F & Head HI Division, NIH	Member
21.	Dr. V.C. Goyal, Sc. F & Head RMO Division, NIH	Member-Secretary

Scientists from National Institute of Hydrology, Roorkee

1. Dr. S. K. Singh, Sc. F
2. Dr. Sanjay Jain, Sc.F
3. Dr. Avinash Agarwal, Sc.F
4. Dr. J.V. Tyagi, Sc.F
5. Dr. Sudhir Kumar, Sc.F
6. Dr. M.K. Goel, Sc.F
7. Smt. D.Chalosgaonkar, Sc.F
8. Dr. D.S. Rathore, Sc.F
9. Dr. A.K. Lohani, Sc.F
10. Dr. R.P. Pandey, Sc.F
11. Er. Omkar Singh, Sc.E
12. Dr. P.K. Bhunya, Sc.D
13. Dr. S.P. Rai, Sc.D
14. Dr.A R Senthil Kumar, Sc.D
15. Dr. Anupama Sharma, Sc.D
16. Dr. M S Rao, Sc.D
17. Dr. Sanjay Kumar, Sc.D
18. Dr. Surjeet Singh, Sc.D
19. Dr. Renoj J. Thayyen, Sc.D
20. Sh. S K Verma, Sc.D
21. Dr. D G Durbude, Sc.D
22. Smt. Archana Sarkar, Sc.C
23. Dr. M K Sharma, Sc.C
24. Sh. P.K. Garg, Sc.B
25. Dr. Ravindra Vitthal Kale, Sc.B
26. Sh. J.P. Patra, Sc.B
27. Sh. Sumant Kumar, Sc.B
28. Dr. Rajesh Singh, Sc.B
29. Sh. L.N. Thakural, Sc.B
30. Sh. P.K. Mishra, Sc.B
31. Sh. Manish Nema, Sc.B
32. Sh. Tanveer Ahmad, Sc.B
33. Sh. P K Agrawal, Sc.B