

F. No. 4-1/2018-RE  
 MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE  
 (RE Division)

**Minutes of the Fourth Meeting of Steering Committee on R&D Scheme to consider R&D projects of XIth and XIIth Five-Year Plans held on 28<sup>th</sup> September, 2018 at Indira Paryavaran Bhawan, New Delhi**

1. The Fourth meeting of the Steering Committee on R&D Scheme was held on **28<sup>th</sup> September, 2018** at Indira Paryavaran Bhawan, Jor Bagh, New Delhi to consider R&D projects funded in XIth and XIIth Five-Year Plans. The list of participants is at **Annexure-1**.

2. **Confirmation of Minutes of 3<sup>rd</sup> Meeting of Steering Committee**

The minutes of the Third Meeting of Steering Committee held on 30.08.2018 were circulated to the Committee members and were confirmed.

3. Dr. T. Chandini, Advisor welcoming the members of the Committee and participants, informed that the agenda includes review of Final Technical Reports (FTRs) of 6 R&D projects completed during the XIth/XIIth Five-Year Plan and Annual Progress Reports (APRs) of 15 ongoing projects of XIIth Five-Year Plan under the R&D Scheme which ended on 31<sup>st</sup> March 2017. The PIs were requested to briefly present the Final Technical Report (FTR)/Annual Progress Report (APR) of their projects in terms of the broad objectives, the major findings/outputs and outcome thereof etc. Projects listed at S.Nos. 3, 4, 7, 8, 20, 21, 22 were not considered as PIs did not attend the meeting. In addition, 12 projects listed for internal consideration were deferred for consideration in the next meeting. Thus, of a total of 33 projects listed at **Annexure-2**, 14 projects were considered in the meeting.

4.0 The projects were considered under various thematic areas:

4.1 **“Dairy Wastewater treatment using pilot –scale hybrid sub-surface Constructed Wetland systems operating under different recirculation rates”** of Dr. Pradeep Kumar Sharma, Graphic Era University, Dehradun (UK) (F.No. 19-72/2014-RE)

Project Details: This ongoing project was started on 27<sup>th</sup> May, 2016 for a period of 3 years with a total cost of Rs. 42,39,680/-. The tenure of the project will be over in 21<sup>st</sup> May, 2019. A total of Rs 31,24,596/- has been released so far out of approved project cost of Rs 42,39,680/-. PI has submitted Annual progress Reports (APR) for 2017-18 and stated that Audited Utilisation Certificate, Expenditure Statement, GFR 12, DBT details, photographs of equipment etc for the FY 2017-18 by post has been sent by post during the week but division has not received these documents so far. Since the PI is an NGO, registration of the NGO are also required on MoEFCC NGO Portal.

Objectives:

- To investigate the nutrient purification and removal potential of hybrid sub-surface flow constructed wetland systems for the treatment of dairy wastewater.
- To investigate the optimal recycling rate for achieving maximum removal of nitrogen, phosphorus and suspended solids from dairy wastewater.

- To investigate the effects of seasonal variations on nutrient purification and removal potential of hybrid sub-surface flow constructed wetland (HCW) system operated for treatment of dairy wastewater.
- To investigate the nutrient uptake capacity of *Phragmites australis* grown on vertical sub-surface beds of hybrid constructed wetland system.
- To grow seasonal vegetables (*Hibiscus esculentus* and *Solanum melonjena*) on the horizontal sub-surface beds of hybrid CW systems and assess the potential of treated wastewater for use as ferti-irrigation.
- The effect of removal/reduction in BOD, COD, TSS and TDs, and other parameters such as Total N, NH<sub>4</sub>-N, NO<sub>3</sub>-N, NO<sub>2</sub>-N, Total P, etc were also studied as these are high in the effluents/wastewater from cattle-dairy farming.
- The plant species *Phragmites australis* was chosen as it is highly efficient in absorbing P from beds.

PI made a presentation on the progress of the study. The major findings of the study are:

- The Hybrid Constructed wetland (HCW) system constructed for the study were studied with no recirculation of wastewater, 50% recirculation and 75% recirculation. The system was installed in a dairy farm with 70 cattle heads. A total of 6000L of wastewater from the cattle farm is being treated through this system in a 40 sqm area.
- The HCWs removed 95-96% BOD, 92-95% of COD, 74-79% of Total N and 77-81% of Total P during dairy waste water treatment. TSS removal was 91%. TDS was the lowest and removed to 29-39% but was within limits.
- After recirculation of treated water to influent, wastewater removal rates were further increased & maximum increase in removal rates were observed as:
  - An increase of 30% (from 64-94%) in total P removal rate with 75% recirculation arrangement.
  - An increase of 8% (from 68-76%) in Total N removal rate with 50% recirculation arrangement.
- Hybrid CW systems do not show fluctuations in removal efficiencies due to seasonal variations i.e., these systems can tolerate seasonal variations.
- The partially treated wastewater in hybrid CW system is a reliable technology for treatment of dairy wastewater and may be used as a liquid fertilizer for growing vegetable crops. This will help generating an extra income source to the dairy farmers. The system can be operated for 10years.
- Treated wastewater meets discharge standards w.r.t parameters of N, P and TSS. Treated water can be reused in dairy operations i.e., cattle bath, floor washings etc.

The PI requested for approval for engaging a Research Associate and a SRF for 2<sup>nd</sup> year of study. The SC requested for a formal letter with justification for balance scope of work consideration of the Ministry.

4.2 **“Nano Bio Remediation of Textile Industrial Effluent in Tirupur District Tamil Nadu”** by Dr. P. Jegathambal, Water Institute, Karunya University, Coimbatore (F.No. 19-183/2013-RE).

Project Details: This ongoing project was started on 9<sup>th</sup> September, 2016 for a period of 3 years with a total cost of Rs. 42,17,000/-. The tenure of the project will be over on 8<sup>th</sup> September, 2019. A total of Rs 18,26,500/- has been released so far out of approved project cost of Rs 42,17,000/-. PI has submitted audited Utilization Certificate, Expenditure Statement, GFR 12 A, GFR 19, bills/invoices and undertaking for completion of the project and 5 copies of Annual Progress Report for the FY 2017-18 during the meeting.

Objectives:

- To develop efficient and cost effective treatment method of textile wastewater using nanotechnology (nanoclay and carbon nano tubes) and Bioremediation (Using Bio Blocks, Algae).
- To model behavior of sorption and biotransformation processes.
- To determine the adsorption capacity, Kinetic coefficients, effects of pH and concentration of adsorbent and Kinetics of microorganisms onto the removal of dye, organic matter and inorganic salts on a Nano Bio Block.
- To develop and integrated cost effective alternative for dye and inorganic salt removal by combining stabilization pond with micro algae and biocoagulation using *Moringa oleifera* seed extract.
- To characterize the influent and effluent parameters of the wastewater.
- To standardize the design and operational parameters.
- To determine the techno economic viability of the proposed methodology.

PI made a presentation on the progress of the study. The major findings of the study are:

- Microbial biodegradation has been demonstrated as a viable treatment of textile effluent based on the batch studies resulting in 90-96% removal of colour from textile effluents.
- The domestic sewage treatment plant in Karunya University itself is a viable source of mixed microbial culture for biodegradation of textile effluent.
- Microbial activity mediated fixation of nitrates and sulphates was observed resulting in decrease of their concentration in the leachate.
- The continuous flow soil reactor can be extended to reactive barrier technology in *in-situ* application. The robustness of the system was demonstrated by 6 weeks of treatment without any external inputs.
- Mixed microbial culture mediated in-situ bioremediation is a feasible solution to clean up of textile dye waste contaminated soil-aquifer systems.
- After 6 hours of contact time the removal efficiency of the carbon nano tubes has been found to be 21% and that of the *Moringa* alginate beads is 26% in the clayey soil.
- By increasing the contact time from 6hr to 24 hr, the dye removal also increased from 21% to 28% using carbon nano tubes and from 26% to 35% using *Moringa* beads in the clayey soil. and from 13% to 20% in the sandy soil.
- In the sandy soil the removal % increased from 30% to 57% using carbon nano tubes and from 36.5 % to 60 % using *Moringa* beads.

- After 36 hrs of contact time, the dye removal in the clayey soil was 34% using carbon nano tubes and 36.5% using *Moringa*. While the removal of dye in the sand was 69% using *Moringa* and 59% using carbon. This implies that the dye removal efficiency of the alginate beads differs with the type of soil. The low removal percentage in the clay soil may also imply the water retaining property of the soil.
- The moisture content of the clay soil is maintained at 24% to 26% and in the sand 4 to 8 % implying the constant release of water from the alginate beads.

Work Plan (October 2018 – August 2020):

- Upflow fluidized bed reactor using eco-friendly materials – encapsulated hydrogel/beads – October 2018 – March 2019.
- Performance Evaluation of PVA hydrogel/beads and Magnetite beads (as barrier with membrane) in remediation of dye contamination - April 2019 – December 2019.
- Transfer of Technology to the small scale dyeing unit – June 2020 – May 2020.
- Report writing – June 2020 – August 2020. Propose to apply for patent for the technology.

The Committee desired to know the economics of treatment vis-a-vis conventional treatment and efficacy of colour removal and other physico-chemical parameters vide notified standards and sustainable use of the technology in real conditions in textile industries in a comparative table.

4.3 **“Genetic diversity of heavy metal resistant endophytic fungi from Eastern Ghats and their application for restoration of contaminated sites”** of Dr. T. Vijaya, Sri Venkateswara University, Tirupati (AP) (F.No. 19-112/2013-RE)

Project Details: The project was started on 10<sup>th</sup> September, 2015 for a period of 3 years with a total cost of Rs. 43,54,140/-. The tenure of the project was over on 9<sup>th</sup> September, 2018. A total of Rs 41,95,658/- has been released so far. FTR, Consolidated UC, ES and other documents are awaited. In addition, information on DBT related data is also awaited. PI was requested to present the Final Technical Report before the Committee but has however not attended the meeting. The consideration of the project was deferred as PI did not attend the meeting.

4.4 **“Insecticidal potential and biological Activity of *Semecarpus anacardium* against Defoliators”** of Dr. S. Murugesan, Division of Bio-prospecting Institute of Forest Genetics and Tree Breeding (IFGTB), ICFRE, RS Puram, Coimbatore (F.No. 19-250/2013-RE)

Project Details: The project was started on 22<sup>nd</sup> July, 2015 for a period of 3 years with a total cost of Rs. 13,27,788/-. Tenure was over on 21<sup>st</sup> July, 2018. A total of Rs 10,66,275/- has been released so far out of approved project cost of Rs. 13,27,788/-. UC, ES, GFR 12A for FY 2017-18 have been received, however, FTR, Consolidated UC, ES and other documents are awaited for final settlement.

PI was requested to present the Final Technical Report before the Committee but has however not attended the meeting. PI vide his email dated 27<sup>th</sup> September, 2018 has declined to attend the meeting and has stated that Final Technical Report (FTR) will be submitted within a week time along with required financial statements, and requested for release the further instalment in order to prepare Final Technical Report (FTR) and to pay outstanding bills. He has informed that he may attend the next meeting subject to release of funds. The consideration of the project was deferred as PI did not attend the meeting.

4.5 **“Development of Hybrid Nanomaterials–based water filters for affordable potable water”** of Dr. V. Alexander, Department of Chemistry, Loyola College, Chennai (F.No. 19-68/2012-RE)

Project Details: This ongoing project was started on 1<sup>st</sup> January, 2016 for a period of 3 years with a total cost of Rs. 71,78,000/-. The tenure of the project will be over on 31<sup>st</sup> December, 2018. A total of Rs 47,14,160/- has been released so far out of approved project cost of Rs 71,78,000/-. PI submitted utilization certificate, GFR 19 during the meeting. Progress report, ES and GFR 12A for FY 2017-18 have also been received.

Objectives:

- Synthesis of silica- and TiO<sub>2</sub> nanoparticles and surface modification by siloxylation.
- Preparation of MCM-41 mesoporous silica nanosphere (MSN) nanoparticles.
- Preparation of pore- expanded MCM-41 MSN nanoparticles and surface modification.
- Preparation of macro cycle functionalized silica-and titanium dioxide nanoparticles by covalently conjugating macro cycles via the siloxane linkage.
- Preparation of functionalized-dendritic wedges appended silica- and titanium dioxide nanoparticles by covalently conjugation the wedges via the siloxane linkage.
- Development of inorganic-organic hybrid nanomaterials by covalently conjugating macro cyclic ligands onto the interior walls of the MSN nanoparticles.
- Development inorganic –organic hybrid nanomaterials by covalently conjugating dendritic wedges onto the interior walls of the MSN nanoparticles.
- Quantification of the grafting agents onto the surface of the nanomaterials.
- Study of the morphology of the inorganic-organic hybrid nanomaterials.
- Study the sorption behaviors of metal ions, inorganic anions, and organic matters by the inorganic-organic hybrid nanomaterial and their subsequent regeneration.
- Study of the disinfection of natural biological pathogens from water samples by the dendritic wedges appended TiO<sub>2</sub> nanoparticles under UV/ Visible light irradiation.
- Development of Hybrid nanomaterial packed column reactor for the purification of water from natural aquifers.
- Development of composite nanomaterial packed bed reactor for the purification of water from metal ions, organic impurities, and pathogens.
- Development of hybrid nanomaterial packed column reactor for the purification of water from natural aquifers.

PI made a presentation on the progress of the study. Outcome of the study:

- Heavy metals such as Copper, Cadmium, Zinc, Nickel, and Iron ions were not detected after treatment of water sample from industrial estate using SiO<sub>2</sub>L1 and Treatment of well water sample from tannery area and pond water using TiO<sub>2</sub>L1.
- The NPs serve as fast and high-capacity adsorbents.
- These hybrid nano particles are well-dispersed in water, stable over a wide pH range, and expand the sorbent-based separation technology for the removal of waterborne contaminants.
- The sorption capacity of these hybrid materials can be exploited for the rapid and efficient removal of metal ions, organic matters, and biological pathogens from natural water.
- The application potentials of nano particle-based adsorbents can be expanded by changing the ligands capable of binding with the waterborne contaminants.

The PI stated that the product and technology developed under this project will be potentially useful, demand driven, and could be implemented by other agencies and users. These hybrid nanomaterials are nontoxic and environmentally friendly. These nanofilters are easily recycled after prolonged use without additional cost input and environmental pollution.

Regarding cost-benefit analysis in terms of physical outputs and environmental benefits, the PI stated that the hybrid nano materials are expensive than the naturally occurring clay-based filters. These nano adsorbents are recyclable with 100% efficiency. In terms of long life and the operational efficiency of these nano materials and the water purification process is economically viable. These hybrid nano adsorbents are nontoxic.

The Committee noted that the Column-type reactor assembly for water purification is to be developed and regeneration and recycling of used nano adsorbents is to be tested. The Committee after discussions was of the view that the project requires being completed to draw definitive conclusions on the efficacy of the new methodology for the synthesis and use of macrocycle and dendritic wedges functionalized silica- and TiO<sub>2</sub> nano particles and testing of the sorption behavior of metal ions, inorganic anions, and organic matter by the nano filters. The Committee sought details of the balance work to be completed and time frame for completion. The Committee also desired that a comparative table of the techno-economic feasibility and efficacy and long-term sustainability of the technology be furnished in terms of all the physico-chemical parameters of water treatment as per ISI standards by conventional treatment vis-à-vis the present technology in the Final Technical Report at the stage of completion of the project.

4.6 **“Bulk Utilisation of Red Mud for Making Advanced Ligno-Silico Aluminous (LSA) Geopolymeric Materials”** of Dr. Manish Mudgal/Dr. S. S. Amritphale, CSIR-AMPRI, Bhopal (MP) (F.No. 19-339/2013-RE).

Project Details: This ongoing project was started on 1<sup>st</sup> June, 2016 for a period of 3 years with a total cost of Rs. 63,90,920/-. The tenure of the project will be over on 31<sup>st</sup> May, 2019. A total of Rs 28,47,520/- has been released so far out of approved project cost of Rs 63,90,920/-. UC, ES, GFR 12 A, Proforma for maintain assets and Progress report for FY 2017-18, etc have been received. PI has submitted 5 copies of Interim Progress report,

Executive Summary, Undertaking of project completion, Bills/ invoices & photographs of equipment, proforma of maintain assets and details of R&D work done in the meeting.

#### Objectives of the study:

- Bulk utilisation of red mud for making Advanced Ligno-Silico- Aluminous (LSA) Geopolymeric Materials.
- Year-wise work Plan is as given below:

#### First Year

- Identification of Red Mud for the project Activity
- Transportation of bulk quantity of Red Mud from HINDALCO to CSIR-AMPRI
- Identification and Transportation of Rice Husk to CSIR-AMPRI, Bhopal.
- Characterisation of as such and heat treated Red Mud and Fly Ash for physico-chemical and Leachability characteristics.

#### Second Year

- Development of Rice Husk based Ligno –Silico Alkaline Activator
- Optimization compositions and Process Parameters for making Ligno -Silico- Aluminous Geopolymeric Binder.
- Development of Mix design for Geopolymer Mortar.

#### Third Year

- Development of Mix Design for Geopolymer Concrete
- Development of Geopolymeric Prefabricated Paver Blocks
- Evaluation of physical and engineering properties of developed Geopolymer Concrete and paver blocks.
- Dissemination of outcome of Research work.
- Report Preparation

#### PI made a presentation on the progress of the study. Methodology of the project:

- Characterization of Red Mud and Fly Ash.
- Development of Ligno-Silico (LS) alkaline activator utilizing agro waste i.e. rice husk and alkaline chemicals.
- Characterization of the developed Ligno-Silico (LS) alkaline activator.
- Optimization of Chemical additives, Process Parameters for Synthesis of Red Mud-Fly Ash based Geopolymeric Binder and Mortar using Ligno-Silico (LS) and conventional alkaline activator.
- Development Mix Design for Ligno-Silico- Aluminous (LSA) Geopolymeric Concrete,
- Development of Prefabricated Paver Blocks as construction material.

The PI stated that the red mud has a high content of FeO<sub>3</sub> to the extent of 34% and has low Silica content. As a result, the strength of red mud as building and construction material is low. By mixing with flyash which has very high silica content, the strength of geo-polymer mortar in the red mud-flyash blend mix is increased. It was stated that a 20% blend of red mud is good for use as making pre-fabricated materials and also for construction of pavement blocks/bricks. The most important issue is the replacement of cement with red mud, thereby reducing the CO<sub>2</sub> emissions to an extent of 80% by replacing cement with red mud-flyash mix. The PI stated that, to begin with, the technology should be used within the premises of bauxite mines and the linked Alumina industrial projects and also used in pavement making within a radius of 5-10 km of production of red mud.

The Committee desired that the exact data on reduction of carbon footprint by use of red mud-flyash mix material vis-a-vis other conventional materials may be furnished. The Committee also desired that details of physico-chemical properties of material produced by this technology vide use of conventional materials may also be furnished in a comparative table. The Committee also desired that the hazardous nature of the blend may be examined as Red mud has been classified as a hazardous substance and requires prior consent/authorisation from SPCBs.

- 4.7 **“Evaluation of Toxic Agrochemicals Effect on Recurrence of Algal Biodiversity”** of Dr. Ramakant, Department of Botany, Ramakrishna Mahavidyalaya, Unakoti (Tripura) (F.No. 19-142/2014-RE)

Project Details: This ongoing project was started on 28<sup>th</sup> June, 2016 for a period of 3 years with a total cost of Rs. 21,24,500/-. The tenure of the project will be over on 27<sup>th</sup> June, 2019. A total of Rs 8,93,750/- has been released so far out of approved project cost of Rs 21,24,500/-. Audited UC, ES, GFR 12 A, GFR 19, Annual Progress report and other documents for FY 2017-18 are awaited.

PI was requested to present the Progress Report before the Committee. The consideration of the project was deferred as PI did not attend the meeting.

- 4.8 **“Development of viable technology for mercury remediation from industrial and dental hospital waste waters using polymer nanocomposites”** by Dr. Nalini Sankararamakrishnan, Scientist, Centre for Environmental Science and Engineering, IIT Kanpur (F.No. 19-59/2008-RE).

Project Details: The project of XIth Plan was started on 15<sup>th</sup> January, 2011 for a period of 3 years with a total cost of Rs. 12,06,775/-. The tenure of the project was over on 30<sup>th</sup> July, 2014 (with extension). A total of Rs 9,11,050/- has been released so far out of approved project cost of Rs 12,06,775/-. PI is yet to submit Audited Consolidated UC and ES, bills of PE amounting to Rs. 1,50,000/-. The FTR of the project was placed before the PAC in 21st meeting held on 18-19 March, 2015 and had advised the PI to submit the revised FTR incorporating the modifications suggested by them. FTR with other documents are still awaited.

Details of Outcome-Outputs are also not available, therefore, the PI was requested to make a brief presentation before the Committee on outputs-outcome of his findings for final settlement of Accounts, but PI vide her email dated 19.09.2018 has informed that she will not attend the meeting. Copies of FTR were also sought for circulation for dissemination to all relevant organisations. The consideration of the project was deferred as PI did not attend the meeting.

- 4.9 **“Remediation of Ground Water Contaminated with Hexavalent Chromium in Sukinda Valley, Odisha, Using Nano Zero Valent Iron (n-ZVI) Technology”** of Dr. Alok Sinha, Centre of Mining Environment, Indian School of Mines, Dhanbad (F. No. 19-79/2013-RE)

Project Details: This ongoing project was started on 3<sup>rd</sup> March, 2017 for a period of 2 years with a total cost of Rs. 24,80,800/-. The tenure of the project will be over on 2<sup>nd</sup> March, 2019. A total of Rs 17,12,320/- has been released so far out of approved project cost of Rs.



24,80,800/-. Audited UC, ES, GFR -12A, GFR 19 and 5 copies of APR for FY 2017-18 have been received. The PI has submitted Executive Summary, Geo. Coordinates and an Undertaking for completion of the project.

Objectives of the study:

- To establish the current groundwater quality at Sukinda Mining area for different seasons.
- To study the mobility of n-ZVI slurry in soil obtained from study area and to optimize the mobility of n-ZVI slurry using different surfactants.
- To study the feasibility of reduction of chromate by n-ZVI and modified n-ZVI by preparing synthetic groundwater samples.
- To study the impact of associated water quality parameters on the reduction of chromate.
- To conduct pilot scale studies for in-situ remediation of contaminated groundwater as per actual geology of the area.

It was stated that experimental results indicated that Reetha (*Sapindus trifoliata*) extract can be used as an alternative of synthetic surfactant for nZVI modification, the effective size of nZVI is between 50 nm to 100 nm for better transport capability, collector and nZVI surface charge influences the transport mechanism.

PI made a presentation on the progress of the study. Sukinda Valley, Odisha carries the largest deposit of chromite ore ( $\text{FeO} \cdot \text{Cr}_2\text{O}_3$  or  $\text{FeCr}_2\text{O}_4$ ) in India, which approximately produces the 96% of the total chromite ore in India. Presently there are 14 chromite mines operating in Sukinda. Out of these, one mine, Mahagiri Chromite Mines (IMFA) has started its operation of mining lumpy chromites, recently at the foot hills of the Mahagiri hill range. The concentration of Metal in sukinda sediments varies in order of  $\text{TCr} > \text{Mn} > \text{Ni} > \text{Co} > \text{Zn} > \text{Cu}$  with average concentration 26.778 g/kg, 3.098 g/kg, 1.813 g/kg, 0.184 g/kg, 0.116 g/kg and 0.044 g/kg respectively. Concentration of Cr (VI) ranged between 0.02- 0.23mg/l in the Damsal Nala and BDL- 0.13 mg/l in tubewells water. Tubewells in areas such as in Patna Majhi Sahi are showing Cr (VI) concentrations as high as 0.484 mg/l which is nearly 10 times of the drinking water quality standards. Generally mine owners treat their effluents by adding  $\text{FeSO}_4$  to convert Cr (VI) into the less toxic Cr (III), by adjusting the pH and Total Dissolve Solids.

The PI stated that the next stage would involve testing the technology in Sukinda Mines.

Work under progress/to be done:

- Kinetic Studies for reduction of Cr (VI) by n-ZVI in batch reactors with and without stabilizing nano particles (n-ZVI) is under progress.
- The procurement of Planetary Ball Mill is under progress.
- The impact of various concentration of n-ZVI in slurry on the reduction of Cr(VI) and to optimize the dose of n-ZVI for proper remediation of Cr(VI).
- The impact of associated water quality parameters on the reduction of chromate is under progress.
- Pilot scale tests will be performed to simulate actual site conditions. It was informed that TISCO has agreed to have the trials done at their mines.

- Impact of the injection of n-ZVI slurry in columns/boxes containing soil saturated with simulated groundwater, moving at actual velocity, will also be studied and analyzed in laboratory is to be done on the month of December.

The Committee desired that the efficacy of the technology vide conventional technology may be examined vide standards and also the cost-economics of treatment of effluents and groundwater vide conventional treatment and details furnished as part of the report.

4.10 **“Phytoremedial Assessment of Metal Tolerant Flora in the Vicinity of Metal Based Industrial Clusters of Western Tamil Nadu”** by Dr. P. Thangavel, Department of Environmental Science, Periyar University, Salem (F.No. 19-150/2014-RE)

Project Details: This on-going project started on 25<sup>th</sup> September, 2016 for a period of 3 years with a total cost of Rs. 50,67,710/-. The tenure of the project will be over on 24<sup>th</sup> September, 2019. A total of Rs 25,53,100/- has been released so far out of approved project cost of Rs 50,67,710/-. PI has attended the meeting. UC, ES, GFR 12A, GFR 19, Proforma of Assets, Bills/invoices and progress report have been received in August, 2018. It has already been informed to PI in the meeting to submit UC, ES, GFR 12A, GFR 19 financial year wise. The PI has also submitted copies of APR, photographs of equipment and an undertaking for completion of the project.

Objectives:

- To investigate the availability of soil heavy metals and minerals nutrient profiles in the vicinity of metal based industries in western Tamil Nadu especially Coimbatore, Tiruppur and Salem.
- To identify the existing metal tolerant plants and their rhizosphere metal and nutrient profile in the vicinity of metal based industries for the above mentioned district.
- To assess the phytoremediation efficiency of collected native plants from the metal based industries with the several established biological factors/ criteria.
- To categorize the collected metallophytes into indicator, excluder, accumulator and hyper accumulator- this will be potentially useful for remediation of metal contaminated soils in terms of hypo extraction and phyto stabilization strategies.

PI made a presentation on the progress of the study. Present status of the Project:

Completed:

- Heavy metal and mineral nutrient profiles of soils and collected plants from different mine sites (Bauxite, iron ore, magnesite and limestone ) at Salem district
- Identified of existing metallophytes and their accumulation ability in these mine sites
- Assessed the metal specific or multi-metal accumulation ability based on the accumulation
- Categorized into indicator, excluder, accumulator and hyperaccumulator based on several established factors/criteria (EF or BF, TF and TI)

Ongoing:

- Soils and plants were collected in the vicinity of metal based industries at Coimbatore

**Key findings:**

- (I) **Higher Al & Fe in roots** – *Grievillea robusta* (1227.08 mg kg<sup>-1</sup>); Stems – *Acacia mearnsii* (4443.84 mg kg<sup>-1</sup>) and leaves – *Simarouba glauca* (7258.63 mg kg<sup>-1</sup>)
- (II) **Al hyperaccumulators** (> 1000 mg kg<sup>-1</sup> in leaves)
- *S. glauca* (7258.63 mg kg<sup>-1</sup>) (TI = 4.66)
  - *Pteridium aquilinum* (4818.01 mg kg<sup>-1</sup>) (TI = 4.32)
  - *Eucalyptus* (1434.53 mg kg<sup>-1</sup>) (TI = 13.11)
  - *Arisaema leschenaultii* (1010.25 mg kg<sup>-1</sup>) (TF = 584)
- (III) **Based on TF**
- *A. leschenaultii* – TF>10 (Hyperaccumulator) for Al and Ni
  - *A. mearnsii* – TF>10 (Hyperaccumulator) for Al
  - *Conyza bonariensis* – TF>10 (Hyperaccumulator) for Pb
- (IV)
- **Higher Mn in leaves (3198.31 mg kg<sup>-1</sup>)** – *Cyanotis axillaris* - 30 to 127 fold higher than roots and stems
  - Higher Mn in roots (448.30 mg kg<sup>-1</sup>) – *Lantana camara* and stems (609.68 mg kg<sup>-1</sup>) – *A. leschenaultii*
- (V)
- **Higher Cu & Zn** in stems – *Conyza bonariensis*
  - Higher Cu & Zn in roots – *C. bonariensis* & *Eucalyptus*
  - **Higher Cu in leaves (280.08 mg kg<sup>-1</sup>)** – *Pavetta indica* - Possible Cu hyperaccumulator (threshold level is 300 mg kg<sup>-1</sup>).

**Heavy metal accumulation:**

- Cd>Pb>Ni
- Fe>Zn>Cu>Mn
- Root metal accumulation : Fe > Zn > Mn > Pb > Cd
- Shoot metal accumulation : Fe > Mn > Zn > Cd > Pb
- *Solanum xanthocarpum* – TF >10 (Hyperaccumulator) for Fe
- *Ficus benghalensis* and *Ageratum conyzoides* – TF >1 (Accumulator) for Zn and Fe
- *Solanum pubescens* – TF >1 (Accumulator) for Zn and Mn
- *Bulbostylis barbata* – TF >1 (Accumulator) for Fe and Mn
- *Solanum xanthocarpum* – TF >1 (Accumulator) for Cd
- *Casuarina equisetifolia* – TF >1 (Accumulator) for Zn

Next phase of the Project to be done:

- Soil and Plant analyses– to be done – awaiting funds
- Heavy metal and mineral nutrient profiles of soils and collected plants from different mine sites (Bauxite, iron ore, magnesite and limestone) at Tiruppur & Erode districts
- To be identify the existing metallophytes and their accumulation ability
- To be assess the metal specific or multi-metal accumulation ability based on the accumulation
- To be categorize into indicator, excluder, accumulator and hyperaccumulator based on several established factors/criteria (EF or BF, TF and TI)

The PI requested the Committee/Ministry for release of funds for completing the 2<sup>nd</sup> and 3<sup>rd</sup> year work.

The Committee sought details of the heavy metals characterisation in soil and in plants before and after remediation and how do the results compare with that from a control site which does not require remediation (i.e a site not falling within or around the bauxite/iron ore/limestone mines). The Committee also sought justification of selecting limestone mines as part of the study. The Committee desired to know what would be the fate of the plants which have accumulated the heavy metals – how would they be treated/disposed in an environmentally friendly manner.

4.11 **“Metal Oxides Based Advanced Oxidation Technology for Industrial Pollution Control”** by Dr. K. Byrappa, University of Mysore, Mysore (F.No. 19-78/2009-RE).

Project Details: This project was started on 28<sup>th</sup> November, 2014 for a period of 3 years with a total cost of Rs. 24,48,000/-. Tenure of the project was over on 27<sup>th</sup> November, 2017. A total of Rs 9,91,000/- has been released so far out of approved project cost of Rs. 24,48,000/-. No information has been received from the PI so far.

4.12 **“Sequential Production of Bio-diesel, Ethanol, Hydrogen and Methane as a “Biorefinery” Concept using Leather Solid Wastes and Effluent Treatment Sludges”** by Dr. P. Shanmugam Scientist EII, CLRI, Adyar, Chennai (F.No. 19-112/2010-RE).

Project Details: The project was started on 31<sup>st</sup> December, 2015 for a period of 3 years with a total cost of Rs. 77,11,400/-. Tenure of the project will be over on 30<sup>th</sup> December, 2018. A total of Rs 55,00,000/- has been released so far out of approved project cost of Rs 77,11,400/-. A discussion was held with PI in MoEFCC on 10.07.2018 and a letter dated 13<sup>th</sup> July, 2018 and email dated 16<sup>th</sup> July and 9<sup>th</sup> August, 2018 has been sent to PI to submit the required documents. The PI has submitted UC, ES, Bills/ invoices & photographs of equipment, Executive summary, undertaking of completion of project and 5 copies of APR. The PI has informed in the meeting to submit GFR 12A, GFR 19 with uploading of UC in PFMS, DBT related information, etc.

Objectives of the study:

- A better waste to energy technology from leather, slaughterhouse solid waste and treatment plant sludge by recovering biodiesel, bio-ethanol, bio-hydrogen and bio-methane than the existing solid waste management technology.
- Paradigm shift from bio-methanisation technology for solid wastes into a bio-refinery.
- High energy output from solid wastes and high GHG emission reduction.
- Genetically modified organisms that can maximize the bio-ethanol, bio-hydrogen and bio-methane recovery.
- Optimum CSTR gas mixing system for gas liquid and solid separation, a new digester technology.
- To scale up and develop a pilot studies for the four stage sequential production of bio-diesel, bio-ethanol and bio-hydrogen and bio-methane from the complete conversion of Leather solid waste and treatment plant sludge.

PI made a presentation on the progress of the study. It was informed that the project has been conceived as an Industry (RANITECH)-CLRI partnership project as a research-cum-demonstration project. The project is for utilisation of the entire solid wastes generated from tanneries before tanning process leading to Zero-Solid-Waste-Discharge. The project is designed as a sequential production of waste to oil at every stage of the process. The various types of oil (hydrocarbons) that would be produced at every stage of the process are – bio-diesel, bio-ethanol, bio-hydrogen, and bio-methane. The oil/HCs so produced can be used both as automotive and locomotive oil. The cost economics of the unit indicates that the technology is cost effective as the cost of this bio-diesel is about Rs 45/l and can run a vehicle for 26-28 km/l as compared with a normal diesel at 16-20km at existing cost of

diesel. The technology helps produce about 75L of bio-diesel/T of solid wastes. The technology can also in addition to solid wastes from tannery industry take in solid wastes from slaughter houses, wastes from hotels and restaurants, food industry, and other similar types of wastes which are “Fat rich” and can produce energy from “Waste to Wheel”. Based on this pilot plant study of 2T capacity, it is planned to upgrade the demo unit as a Bio-refinery unit and help to implement a large scale Bio-Refinery commercial Plant for the entire solid waste of Vellore district. The technology has been patented and also can avail CDM credits.

The project was approved in 2010 for a total cost of Rs 1.12 crores and sanctioned in 2015 with a fund assistance of MoEFCC-Industry (RAINTEC) contribution of Rs 77 lakhs:Rs 35 lakhs. In 2016, due to material cost escalation due to late start of project has led to escalation of cost of equipment and overall budget.

The PI briefly explained the Methodology adopted for production of bio-ethanol:

- Firstly, the oil was extracted from the dried fleshing by means of combination of thermal methods.
- The proteins and carbohydrates i.e. ethanol precursors, obtained after the oil extraction is made to undergo acidogenesis process by anaerobically for 4-5 days.
- For the carbon source, crude Glycerol (byproduct of biodiesel production) from biodiesel plant is used.
- Commercial Yeast was activated in YPD broth and cultured in YPD medium with crude glycerol and ethanol precursor (protein and carbohydrates) is used as inocula for fermentation process.
- The ethanol precursor (after acidogenesis processes) led into a fermenter and the fermentation process is being carried out with seed inocula and crude glycerol (by product of biodiesel process).
- Molasses, is being used as an add-on product and the process is being investigated at different pH levels.
- After an HRT of three days, the product ethanol will be recovered by distillation process followed by fractional distillation to purify ethanol.

Outputs achieved so far:

- Laboratory confirmation research on bio-refinery study was completed on December 2016.
- All the detailed engineering drawings, layouts and sizing for pilot-scale demonstration scale up activity was evaluated and completed by April 2017.
- Tendering process of Bio-diesel, Bio-ethanol and Bio-hydrogen and bio methane was started on August 2017.
- First limited tender was floated on October 2017 and cancelled on December 2017, as there was only two tenderer quoted against the GoI rules of minimum demand of three tenders were needed.
- First Biodiesel plant in the world for 2-tons per day was built on March 2018 and being operated now can be inspected by expert team of MoEF &CC anytime.

Current Status of the Project:

- Biodiesel Plant has been commissioned and batch production biodiesel from Leather fleshing waste under progress
- Minifat oil recovery equipment has been installed and fat oil recovery is being done regularly in batches

**Constraints faced in the implementation of the project:**

Due to late sanction of the project and delay in funding there has been a cost escalation. As the technology is quite new, less bidders/tenderers were available in the market to execute the bio-refinery plant caused the delay in execution of bio-hydrogen and bio-methane plant. In addition, for the second time, Bio-hydrogen and bio-methane plant had to be cancelled again as there was no appropriate bidder was found. Construction of bio-hydrogen and bio-methane works has now been undertaken by Engineering works division of CSIR-CLRI and ready to build onsite will be completed its execution by 31<sup>st</sup> December 2018. However, Bio-ethanol plant and other onsite permanent Equipments work needs additional sanction of fund of Rs44.98 lakhs before tendering. The annual material cost escalation between the cost estimated /proposal submitted year (2010) and the year of project sanctioned (2015) and year of execution (2018). In addition, the JRFs/JPFs resigned from the project because of non-payment of fellowship of Rs 1.82 lakhs which has delayed the laboratory process of the execution of the project.

The PI has assured that if the balance escalated cost of Rs 63, 03,056/- is made available for the project, the entire project can be completed by February, 2019.

**The Committee after deliberations sought the following:**

- 1) Original objectives of the sanctioned approved project in 2015 – of which those achieved and balance requiring to be completed.
- 2) Detailed deliverables of each of the objectives/steps of those achieved and balance requiring to be completed.
- 3) Approved list of equipment and their cost in the sanctioned project – of which those purchased and balance to be procured.
- 4) Contribution of MOEFCC and Industry (RANITECH) for the equipment to be purchased for each of these steps.
- 5) A table comparing original cost and escalated cost of each step and equipment purchased and balance to be purchased under each step.
- 6) Time-frame for completion of balance steps/objectives

The Committee requested the PI to furnish these details for further consideration of the Committee. The Committee agreed that the pending amount of funds due to JRFs/SRFs should be processed for release immediately.

- 4.13 **“Comparative study of ESBL producing and PMQR *E.coli* and *K.pneumoniae* from purified tap water and unpurified samples of Yamuna”** by Prof. Arif Ali, Jamia Millia Islamia, Delhi (F.No. 19-60/2013-RE).

Project Details: The project was approved by Apex committee in its 5<sup>th</sup> meeting held on 20.08.2014. First Instalment of Rs. 16,67,074/- was released on 29.10.2014 for FY 2014-15. The sanction order contained some errors. In Sept, 2016, PI came to know that fund was received by the University but PI could not launch the study as a result of the funds not being transferred.. PI has requested to revalidate the whole amount for FY 2016-17 as he could not utilized the amount in FY 2015-16 as he was abroad. This Project is not started so far. Decision on re-validation is pending with Ministry.

- 4.14 **“Bioremediation of Bauxite Residue (Red mud), a waste product generated in Alumina industry through Integrated Biosolid Microbe (IBM) Combinations”** by Dr. Kumud Dubey, Centre for Social Forestry and Eco-Rehabilitation, Allahabad (F.No. 19-22/2014-RE)

Project Details: This project was started on 10<sup>th</sup> July, 2015 for a period of 3 years with a total cost of Rs. 24,17,100/-. Tenure of the project was over on 9<sup>th</sup> July, 2018. A total of Rs 12,90,870/- has been released so far out of approved project cost of Rs 24,17,100/-. The PI has refunded a DD of Rs. 12,63,894/- vide letter dated 24.04.2018 intimating that she is unable to execute the project and same has been deposited to Govt. Account. Final settlement is due.

- 4.15 **“Identification of Potential Risk from Ecologically Relevant Toxicants on Narmada River and Evaluation of its Health Using Aquatic Macro Invertebrates”** by Dr. Virendra Kumar Mishra, Department of Environmental Science, IGNTU, Amarkantak (F.No. 19-59/2013-RE)

Project Details: This ongoing project was started on 6<sup>th</sup> October, 2016 for a period of 3 years with a total cost of Rs. 54,22,400/-. Tenure of the project will be over on 5<sup>th</sup> October, 2019. A total of Rs 30,57,100/- has been released so far out of approved project cost of Rs 54,22,400/-. PI got new job at Banaras Hindu University and left the implementing agency i.e. IGNTU Amarkantak. PI has requested vide email dated 15<sup>th</sup> November, 2017, for the transfer of the Project from IGNTU to BHU and on 27.01.2018, PI has submitted the NOC. Status on transfer of the project is pending.

- 4.16 **“Development of efficient processes for biomethanation and bioremediation of cassava sago effluent by nitrogen amendments and Spirulina cultivation under HRAP system for safe recycling”** by Dr. K. Kumar, Department of Agricultural Microbiology, TNAU, Coimbatore (F.No. 19-86/2009-RE)

Project Details: The project was not started so far. Initially fund could not been released due to pending UC issue. After receiving UC's, IFD re-concurred the release of fund as 1<sup>st</sup> Installment but fund could not been released. As per the telephonic message, PI has retired from the post now.

- 4.17 **“Utilization of Red Mud as Particulate filler in Polymer Composites”** by Prof. Alok Satapathy, Department of Mechanical Engineering, NIT, Rourkela (F.No. 19-342/2013-RE)

Project Details: The project has not started so far. PI has regretted to take up project. PI had intimated vide letter dt.10<sup>th</sup> January, 2016 that he is not proposing to take up the project. No Funds released so far.

- 4.18 **“To Investigate the Toxicology and Biomagnifications of Nano ZVI Present in Consumer Products and Released after Use in the Environment”** by Dr. Kavita Shah, Environmental Science & Technology, BHU, Varanasi (F.No. 19-224/2014-RE)

Project Details: The project was not started so far. A sanction of Rs. 19,49,700/- dated 20.05.2016 has been issued but fund could not be released due to UC pending issue.

There were 12 UCs pending with BHU of which 3 have been received. Hence PAO has not released the funds and project is yet to take off.

- 4.19 **“Design Production and Durability of Geo-polymer Concrete”** by Dr. Dharendra Singhal, Deenbandhu Chhotu Ram University of Science Technology, Sonapat (F.No. 14/259/2015-RE).

Project Details: The project was started in September, 2016 for a period of 3 years with a total cost of Rs. 31,24,750/-. The tenure of the project will be over in September, 2019. A total of Rs 26,64,750/- has been released so far out of approved project cost of Rs 31,24,750/-. No funds spent so far. The division has sent letters on 16.01.2018 /02.02.2018/ 27.02.2018 for APR, UCs and other documents. On 12.01.2018, PI sent one letter submitting brief Progress Report and PI mentioned in the same that no funds have been utilized till date. On 06.02.2018, PI sought revalidation of funds and submitted one brief PR and UC of “ 0” expenditure (no information on interest accrued). On 27.02.2018, Ministry’s sent one letter asking why PI did not utilize the funds. PI on 21.03.2018, wrote one letter justifying the reason for non utilization of funds and PI has sought revalidation from 2016-17 to 2017-18 and from 2017-18 to 2018-19. Decision on revalidation of funds is pending.

Objectives of the study:

1. To establish design mix for Geopolymer concrete using waste materials.
2. To investigate the structural properties of the GPC & their relationships with ordinary concrete.
3. To establish the design and analysis methods of GPC.
4. To establish the non destructive techniques of GPC.
5. To establish the Durability of the GPC.

PI made a presentation on the progress of the study. It was stated that the overall objectives of the study are:

- Reduce the environmental pollution.
- Reduce the %age of CO2 emission.
- Energy saving.
- Environmental friendly.
- Economical.

The Committee was informed that the funds of Rs 26,64,750/- released by Ministry have not been utilised as the equipment purchase so far were done through another project “Technical Education Quality Improvement Programme” funded by World Bank. These include: (i) Concrete Mixer, AIMIL, HEICO, (ii) Table Vibrator, Ultra Sonic Pulse Velocity Tester, and Permeability Testing Equipment. The project’s first 3 objectives as stated above have been completed. The PI has applied for a patent for the product.

In order to complete the balance scope of work (Objectives 4 and 5), the PI requires purchasing the following equipment for a total cost of Rs 24 lakhs: (i) Humidity Chamber (HEICO, AIMIL) to maintain standard test condition for curing, (ii) Oven (as Geopolymer concrete may require curing at higher temperature), (iii) Rebound Hammer (Required for non-destructive testing), (iv) Flexural Testing machine (Required to assess strength under bending of concrete), (v) Mould for Beams, Cylinders and Cubes (Required for casting of



concrete), (vi) Potentiostate (Required for durability testing), and (vii) Extension Metre Required for stress-strain behaviour.

The PI informed that it would take after approval about 6 months for purchase of the equipment and one year thereafter for completing objective (4) To establish the non destructive techniques of GPC and Objective (5) To establish the Durability of the GPC.

The Committee desired to know whether institutions such as CRRI, CBRI, NBCC, etc have examined the materials from strength and other characteristics and how it compared with other materials used normally in building and construction sector. The Committee also desired to know the cost economics of the material vis-a-vis other materials used commonly. The Committee also desired that the PI may furnish details of potential benefits in terms of reduction in CO<sub>2</sub>, energy savings, reduction in environmental pollution, etc by use of this material in construction sector instead of other materials normally used. The Committee decided that after furnishing of these details, a decision may be taken by Ministry whether the project should be at all carried forward.

- 4.20 **“Studies on Ecology and Diversity of Nematodes of Pir Panjal Range in Jammu & Kashmir”** by Dr. Dr. A.A. Shah, CBS School of Biosciences and Biotechnology, Baba Gulam Shah Badshah University, Rajouri, Jammu & Kashmir (F.No. 14/15/2010-ERS/RE).

Project Details: This XIth Plan project was started on 31<sup>st</sup> January, 2012 for a period of 3 years for a total cost of Rs. 31,17,190/-. The tenure of the project was over on 30<sup>th</sup> January, 2015. A total of Rs. 23,29,200/- has been released so far out of approved project cost of Rs.31,17,190/-. FTR was accepted by the PAC in 17<sup>th</sup> Meeting held on 06-07<sup>th</sup> October, 2016, however details of Outputs-Outcome of the project are not available. Executive summary, UC and other documents are still awaited.

This case was also listed for consideration in 2<sup>nd</sup> & 3<sup>rd</sup> Meeting of SC held on 18.07.2018 & 30.08.2018. PI had been again requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project and for furnishing of documents for settling of accounts, however PI has not attended the meeting.

- 4.21 **“A study of diversity of Insect Fauna in Loktak Lake of Manipur”** by Dr. M. Bhubaneshwari Devi, Reader, Dept. of Zoology, P.G. Centre, D.M. College of Science, Imphal (Manipur) (F.No. 14/9/2011-ERS/RE).

Project Details: The project was started on 22<sup>nd</sup> March, 2012 for a period of 3 years for a total cost of Rs.18,00,125/-. The tenure of the project was over on 21<sup>st</sup> March, 2015. A total of Rs.16,22,999/- has been released so far out of approved project cost of Rs.18,00,125/-. FTR was accepted by the PAC in its 17<sup>th</sup> Meeting held on 06-07<sup>th</sup> October, 2016, however details of Outputs-Outcome are not available in records. As per checklist, GFR-12A etc. are awaited. Final settlement is to be done. Deatils given in consolidated UC and ES are not identical.

This case was also listed for consideration in 2<sup>nd</sup> Meeting of SC held on 18.07.2018. PI had been again requested to make a brief presentation before the Committee on the Outputs-Outcome of the project, however PI has not attended the meeting.

- 4.22 **“Assessment of Biodiversity in Uttarakhand, Western Himalaya”** by Dr. Geeta Asthana, Reader, Dept. Of Botany, University of Lucknow, Lucknow(UP) (F.No. 14/30/2008-ERS/RE).

Project Details: This XIth Plan project was started on 6<sup>th</sup> January, 2010 for a period of 3 years for a total cost of Rs.10,17,324/-. The tenure of the project was over on 5<sup>th</sup> January, 2013. A total of Rs 9,16,600/- has been released so far out of approved project cost of Rs.10,17,324/-. FTR was accepted in the 15<sup>th</sup> Meeting held on 29<sup>th</sup> February and 01<sup>st</sup> March, 2016, however details of Outputs-Outcome are not available. Audited consolidated ES & UC and other documents are still awaited.

This case was also listed for consideration in 2<sup>nd</sup> Meeting of SC held on 18.07.2018. PI had been again requested to make a brief presentation before the Committee on the Outputs-Outcome of the Project and for furnishing of documents sought above for settling of accounts, however PI has not attended the meeting.

- 4.23 **“Patterns of tree cavity occurrence and use by vertebrates in tropical forests of the Western Ghats: a community web approach and its implications in forest management”** by Dr. P. Balakrishnan, Division of Conservation Biology, Jawaharlal Nehru Tropical Botanic Garden & Research Institute, Palode, Thiruvananthapuram (Kerala) (F.No. 14/34/2014-ERS/RE).

Project Details: This ongoing project was started on 21<sup>st</sup> June, 2016 for a period of 3 years with a total cost of Rs. 42,52,910/-. The tenure of the project will be over in 20<sup>th</sup> June, 2019. A total of Rs 18,94,000/- has been released so far out of approved project cost of Rs 42,52,910/-. PI has attended the meeting. The PI has submitted UC, ES, GFR 12, 19 A, Proforma for maintain assets, bills/ invoices & photographs of equipment, undertaking for completion of project, 6 copies of APR and Executive summary for FY 2017-18.

Objectives of the study:

- To develop practical conservation strategies for the conservation of cavity-bearing trees for the survival of cavity-using vertebrates and thereby maintaining the critical ecosystem services provided by them.
- Assess the spatial variation in the densities of tree cavities and cavity-bearing trees in different forest types.
- Study the formation of tree cavities.
- Identify the cavity-using vertebrates and assess their composition.
- Identify the characteristics of tree cavities and cavity-bearing trees in relation to vertebrate preference.
- Investigate the sequential cavity use by vertebrates.
- Study the habitat selection by individual cavity-using species.
- Construct cavity-using vertebrate community-webs for tropical forest ecosystem.
- Analyse the implications of tree-cavity microhabitat and cavity-using vertebrate community-web in tropical forest conservation and propose management strategies.

PI made a presentation on the outcome of the study. Major findings/achievements/leads:

- Developed a database of the cavity-using vertebrates of India for the first time.
- Working reference catalogue of the types and characteristics of tree cavities of tropical forests based on literature and field study.
- Working reference catalogue of Tree-related Microhabitats of tropical forests.
- Refined methodology for cavity-bearing tree and cavity assessment for tropical forests by comparison of multiple methods.
- A database on the tree cavities, cavity-bearing trees and vertebrates use of cavities for the evergreen and deciduous habitat.
- Ten peer-reviewed papers expected.
- Policies for conservation management of tree-cavities and cavity depended species

The PI stated that there had been a delay of 6 months in the recruitment of research fellows due administrative delay from institute's head quarters. One research fellow resigned as forest permission delayed. Supply of equipment delayed due confusion regarding GST. Monsoon surveys to study cavity-amphibian interactions could not be done due to tough field conditions due to heavy rains/landslides. Assessing cavities in large trees time consuming/labour intensive than expected. Most cavity-using species are elusive: repeated cavity inspection required. 200 days were spent in the forest in connection with the project work. However, of the eight objectives, work for six could be initiated during the reporting period and progressing well.

Progress and future plan:

The PI stated that more sampling effort is required in all the forest types to collect statistically significant data on cavity-bearing trees, tree- cavities, cavity-using vertebrates and their sequential use to construct cavity-using vertebrate community-web/s and analyse the implications of tree-cavity microhabitat and cavity-using vertebrate community-web in tropical forest conservation and propose management strategies.

The Committee observed that the study is unique and the findings are important and need to be implemented for the survival of the tree species which offer cavities for various types of other species is very important. The trees form a complex ecosystem support a large number of various types of biodiversity by offering species-specific micro habitats for invertebrates such as insects, and worms and vertebrates such as birds, snakes, amphibians, etc and require being conserved and protected. Such species in all types of forest ecosystems and biosphere reserves require being conserved and protected. The Committee recommended further release of funds for its completion and the database so prepared should be shared with States and Forest institutions in the country for their knowledge, use and implementation.

4.24 **“Spider diversity in the Eastern Ghats of Odisha”** by Dr. Sanjay Keshari Das, Guru Gobind Singh Indraprastha University, Sector – 16C, Dwarka, New Delhi (F.No. 14/3/2011-ERS/RE).

Project Details: This ongoing project was started on 3<sup>rd</sup> May, 2016 for a period of 3 years with a total cost of Rs. 49,06,640/-. The tenure of the project will be over on 2<sup>nd</sup> May,

2019. A total of Rs 42,10,390/- has been released so far out of approved project cost of Rs 49,06,640/-. PI has attended the meeting.

Objectives of the study:

- Documentation of spider diversity across different habitats in the Eastern Ghats of Odisha.
- Preparation of distribution map for spider species that are of conservation importance and identification of biodiversity hot spots using geospatial techniques for long term monitoring of spider rich areas.
- Test spider assemblage as conservation tool in different land-use practise.
- Create awareness about the positive role of spiders amongst locals.
- Preparation of conservation action plan for threatened spider species.

PI made a presentation on the outcome of the study. Outcome of the study:

- Spider diversity of Odisha comprises 158 species belonging to 97 genera and 32 families and Eastern Ghats of Odisha comprises 100 species belonging to 65 genera and 24 families before the present study.
- In the present study 253 species of spiders belonging to 138 genera and 42 families were recorded from Odisha (all these species reported from Eastern Ghats of Odisha except two species which were recorded from outside the Eastern Ghats of Odisha).
- The present study indicates that the spider diversity of Odisha is 305 species belonging to 158 genera and 44 families and Eastern Ghats of Odisha goes to 251 species belonging to 138 genera and 42 families.
- This study reports for the first time a total of 12 families 61 genera and 147 species of spiders from Odisha. Of 147 species first time reported from Odisha, 145 species were from the Eastern Ghats of Odisha.
- Among the spiders reported in the present study, 10 new species were discovered and 12 species belonging to 11 genera were found to be first report from India. The study also reported two rare spider species viz. *Inthaeron* spp. from Odisha.

Species new to science identified under the project:

- *Scalidognathus* sp. nov.
- *Cithaeron* sp. nov.
- *Inthaeron* sp. nov.(1)
- *Inthaeron* sp. nov.(2)
- *Brignolia* sp. nov.
- *Gamasomorpha* sp. nov.
- *Pellicinus* sp. nov.
- *Ariadna* sp. nov.(1)
- *Ariadna* sp. nov.(2)
- *Ariadna* sp. nov.(3)

The Committee desired that a distribution map of the spiders across the Eastern Ghats be prepared for conservation of the various spider species from the study area and to identify areas rich in spiders and requiring urgent conservation. The involvement and role of various stakeholders including local communities need to be brought out in the Handbook for the purpose of sensitising populations in conservation of biodiversity and the spiders

(especially the Rare-Endangered-Threatened-Vulnerable species) and the ecosystems that they are found, in particular.

- 4.25 **“Exploration of Biodiversity and Conservation issues of Talley Valley Wildlife Sanctuary, Arunachal Pradesh with reference to wildlife species distribution along climate and topographical gradients”** by Dr. (Mrs.) Ashalata Devi, Assistant Professor, Dept. of Environment Science, Tezpur University, Napaam, Tezpur, Assam (F.No. 14/8/2014-RE)

Project Details: This on-going project was started on 1<sup>st</sup> January, 2017 for a period of 3 years with a total cost of Rs. 38,96,640/-. The tenure of the project will be over on 31<sup>st</sup> January, 2020. A total of Rs 15,13,200/- has been released so far out of approved project cost of Rs 38,96,640/-. PI has attended the meeting. The PI has submitted audited UC, ES, GFR 12, Proforma for maintaining assets, bills/ invoices & photographs of equipment, undertaking for completion of project, 5 copies of APR and Executive summary for FY 2017-18. GFR 19 with updation of UC in PFMS, DBT related data, etc are required.

Objectives of the study:

- To explore the distribution, status, and diversity of animal communities along climatic and topographical gradient.
- To study the distribution of plant communities along climatic, edaphic and topographical gradient in wildlife surveyed areas as well as other parts of sanctuary.
- To identify the species specific conservation and management issues of keystone species in the study area.
- To quantify the local community pressure on biodiversity of sanctuary due to their day to day household needs and find out solution to manage it on sustainable basis.

PI made a presentation on the progress of the study. Objectives undertaken so far:

- For the first objective, exploration of animal communities at different altitudinal gradients have almost completed in Pange area of the sanctuary. Some of the findings of the study conducted in the Pange area have been given in this report.
- Vegetation sampling for studying distribution of plant communities and their quantitative characters have done in the Pange area of the sanctuary at different altitudinal gradients. The data analysis is undergoing and will be reported in the next annual progress report.
- During the study period 2017-2018, 4 species of felidae, of which the Clouded leopard (*Neofelis nebulosa*) is one to be the first photographic presence in the sanctuary. *N. nebulosa* is a scheduled I species under the Wildlife Protection Act, 1972 of India and categorized as a vulnerable species by International Union for Conservation Nature (IUCN, 2017). We are communicating with the forest department of Arunachal Pradesh for the study and species specific conservation of clouded leopard in the sanctuary.
- From the beginning of the project study we are collecting the data of local community pressure on biodiversity of the sanctuary in different parameters, like hunting, logging, collections of NTFPs, livestock grazing, etc.

Outcome:

- Mammals: A total of 18 mammalian species belonging to 17 families were recorded during the survey, highest numbers of species were recorded from the Sciuridae family.
- 4 species of felidae found in the sanctuary, of which two species were camera trapped.
- A total of 55 birds recorded (39 identified), of that highest bird species were recorded from the Muscicapidae family.
- 30 species of butterflies were recorded belonging to 8 families, out of which only 18 species were identified systematically.
- A total of 6 reptiles belonging to 4 families and 9 amphibian species belonging to 9 families were recorded during the study period.
- A total of 60 quadrates were laid in the Pange area of Talley valley wildlife sanctuary (altitude range of >1800 m msl-2200 m msl).
- A total of 40 tree species (28 identified) of 20 genera belonging to 22 families, 21 shrub species from 18 genera of belonging to 14 family and 24 herb species belonging to 18 genera and 20 families were recorded.

Present status of the project along with the final phase of the project for completion:

- Exploration of wildlife species distribution pattern, species diversity, population status, habitat structure along climatic and topographical gradients is continuing and completed in Pange area. A total of 11 field studies had been conducted (Feb., 2017-June, 2018).
- Study on plant species diversity, distribution and community structure along the along climatic, edaphic and topographical gradients in wildlife surveyed area were conducted in Pange area and undergoing in Talley area.
- Identification of species and community quantitative data are being analyzed.
- Soil samples are being collected seasonally to determine physiochemical characteristics of the soil.
- Identification of the conservation and management issues of wildlife species in the study area is undergoing by collecting data from local people. Community pressure on biodiversity of sanctuary is being identified during field survey and informal conversation with the forest staffs and selected local people.
- Detail of ecological study of some selected keystone species observed in the sanctuary for its better conservation planning is to be established based on the recorded data.
- Data compilation and analysis, preparation of database and formulation of suitable conservation recommendation and preparation of final technical report will be the final phase of the project etc.

The Committee observed that the scope of work taken up under the project is very large and difficult to undertake. The Committee recommended further release of funds for its completion.

- 4.26 **“Studies on the moth fauna of Pachmarhi Biosphere Reserve – an assessment of the species richness, relative abundance and distribution as environmental indicators”** by Dr. S. Sambath, Central Zone Regional Centre, Zoological Survey of India, Scheme No.05, Plot No.169, Vijay Nagar, Jabalpur, Madhya Pradesh (F.No. 14/41/2014-RE)

Project Details: This on-going project was started on 30<sup>th</sup> June, 2016 for a period of 3 years with a total cost of Rs. 36,58,620/-. The tenure of the project will be over in 29<sup>th</sup> June, 2019. A total of Rs 13,71,000/- has been released so far out of approved project cost of Rs 36,58,620/-. The PI has attended the meeting. PI has submitted copies of Annual Progress Report and copy of bills/invoices of equipment. The PI agreed to submit all documents UC, ES, GFR 12, DBT related data, etc. Proforma for maintaining assets and DBT related information etc has been sent in original by post.

Objectives:

- To determine the species composition and relative abundance of moth population across different season and habitat in Pachmarhi Biosphere Reserve.
- To determine the microhabitat associations, host plant relationships and to relate moth species composition to vegetation across the different habitat.
- To prepare the distribution map of the moth fauna using GIS techniques.

PI made a presentation on the progress of the study. Objectives of study undertaken so far:

- Three field surveys have been carried out in Satpura Tiger Reserve and Pachmarhi National Park as parts of PBR to assess the species composition of moths.
- Survey have also been made to record the vegetative composition of different localities of above localities.
- 1050 morpho species have been collected with the help of Light Trap.
- Data have been analyzed to find out species composition and relative abundance.

Achievements:

- Three surveys were conducted from Satpura TR , Pachmarhi National Park, Bori WLS and surrounding areas, district Chhindwara, Hoshangabad, Madhya Pradesh.
- A total of 1050 morpho species were collected, and were identified into 100 species and 89 genera belonging to 13 families.
- Of the 100 species recorded, 44 species belonging to Erebidae, 16 species belonging to Crambidae, 12 species belonging to Geometridae and Noctuidae, 3 species each belonging to Sphingidae, Notodontidae and Nolidae. 02 species belonging to Euteliidae and 1 species each belonging to Attevidae, Hyblaeidae, Drepanidae, Lasiocampidae and Uraniide.
- Host plants of the moth species have also been collected.
- The species richness and diversity of moths observed in the Matkuli region followed by the FRH, Mahadev and Panar Pani Forest area.
- Among the different localities, Matkuli and FRH Mahadev Forest regions showed high similarities followed by Panar Pani and FRH Dela Kheri.
- Of the 100 species recorded, 10 species are very common (VC), 67 species are Common (C), and 23 species are rarely (R) recorded during the course of study.

- Diversity of Moth species among different families was also observed.
- Genital studies of moths were also initiated for the cryptic species.

**Outcome:**

Moths play a significant role in the terrestrial ecosystems and considered in conservation. They are highly habitat sensitive to change in the environment due to abiotic and biotic factors which directly or indirectly affect at the species level. They are one of the efficient pollinators, ecological indicators; serve as food of various animals including insects. It also have economic importance as most of them cause injuries to various plants and attain the status of pests of economically important agriculture, horticulture crops and forest tree species.

The present study will generate detailed information on distribution, population status and conservation on moth fauna of Pachmarhi Biosphere Reserve. Identification of rare, endangered and threatened species based on the observations. The information will be available for wildlife manager and other forest administrators for the preparation of the management plans. Suitable conservation measures would be suggested for moth species studied. Based on the results, a poster on the moth of PBR and a field guide on common moths of PBR are being prepared to disseminate information about the moths and their conservation and management to the foresters, academicians, policy makers, etc.

The Committee noted that moths play a very important role as a pollinator and their conservation in various types of forest ecosystems and other natural landscapes of the country is important. The Committee desired that a Handbook may be prepared which could be shared with all relevant institutions, State Biodiversity Board and State Government Departments for their use and implementation.

4.27 **“Ecosystem Services in changing biodiversity state: A comparative study of Western and Eastern Himalayan forest stands”** by Dr. R. C. Sundriyal, G.B.Pant Institute of Himalayan Environment & Development, Kosi Katarmal, Almora (F.No. 14/222/2014-ERS/RE)

Project Details: This on-going project was started on 6<sup>th</sup> June, 2016 for a period of 3 years with a total cost of Rs. 31,99,560/-. The tenure of the project will be over in 5<sup>th</sup> June, 2019. A total of Rs 11,40,000/- has been released so far out of approved project cost of Rs 31,99,560/-. PI has attended the meeting. PI has submitted bills/invoices & photographs of equipment. PI was agreed to submit revised UC, ES, GFR 12A, GFR 19, Proforma of Assets, undertaking, DBT related data, etc.

Objectives of the study:

- To investigate temporal and spatial variation in vegetation cover at selected forest stands in western and eastern Himalayan region.
- To assess species composition, richness, functional traits, regeneration and distribution pattern of selected forest stand.
- To analyze dynamics of aboveground biomass, productivity, litter fall and forest floor nutrient pool, and carbon sequestration under changing biodiversity state.



- To qualify various ecosystem provisioning services by the selected forest type and their dynamics of use of local residents.
- Quantify environmental vulnerability and directional change in selected ecosystem process and ecosystem services and suggest suitable conservation approaches.

PI made a presentation on the progress of the study. Outcome of the study:

- Data revealed that forests in Uttarakhand state are better managed leading to improve density, basal cover and biomass-carbon accumulation.
- Forest stands in Sikkim are under increased biotic stress leading to decline in species richness, density and basal area.
- Tree biomass in subtropical forest stands of western Himalaya forest stands increased leading to carbon accumulation.
- More detailed analysis of these data would lead to some new scientific information.
- Litter fall and forest floor phytomass sampling to be continued.
- Litter decomposition and nutrient dynamics study to be continued.
- Net primary productivity and Carbon sequestration work under progress.
- Physico-chemical properties analysis of soil is in progress.
- Seedling survival and mortality analysis is in progress.

The Committee sought details of further/balance work to be carried out and the expected outcome of the study.

4.28 **“Conservation of seven RET medicinal Plants of the Western Ghats through standardization of seed and seedling Identification, Germination, Species Restoration, Seed and Field Gene Banking”** by Dr. Anilkumar C, Seed Bank, Plant Genetic Resource Division, Jawaharlal Nehru Tropical Botanic Garden and Research Institute(JNTBGRI), Palode, Thiruvananthapuram (F.No. 23/23/2012-RE)

Project Details: This project was started on 15<sup>th</sup> October, 2015 for a period of 3 years with a total cost of Rs. 14,64,750/-. The tenure of the project will be over on 14<sup>th</sup> October, 2018. A total of Rs 11,44,000/- has been released so far out of approved project cost of Rs 14,64,750/-. Audited UC, ES for FY 2017-18 have been received. PI has submitted bills/ invoices of equipment. PI agreed to submit GFR 12A, GFR 19 and updation of UC in PFMS and DBT related data for further release of funds.

Objectives of the study:

- Documentation of fruit/seed and seedling morphology up to the species/variants level for substantiating adaptations and germplasm authentication/ certification.
- Seed banking aspects through seed categorization, standardization of storage and germination.

- Seedling ecology studies and seedling production for the development of a field gene bank and species restoration programmes.

PI made a presentation on the progress of the study. Objectives undertaken so far:

- Carried out seed studies of *Ensete superbum*, *Garcinia indica*, *Piper barberi*, *Rauwolfia micrantha*, *Rauwolfia hookeri* and *Hydnocarpus pentandra*.
- Seedling studies were carried out in order to standardise seedling production and reintroduction.
- Initiated nursery establishment of the seedlings of *E. superbum*, *G. indica*, *S. travancorica*, *Piper barberi*, *Hydnocarpus pentandra* and *Rauwolfia micrantha* and started seedling supply.
- Voucher specimens were deposited in JNTBGRI Herbarium (TBGT).

Outcome of the project:

- Standardized the dormancy breaking treatment of *E. superbum*, *R. micrantha*, *H. pentandra* and *R. hookeri*.
- Short term storage method standardized for *Piper barberi* and *Garcinia indica*.
- Published the results via oral presentations at two national seminars and Jammu & Kashmir Science Congress. Three manuscripts are ready for publication in journals.
- Established nursery with the seedlings of *E. superbum*, *G. indica*, *S. travancorica*, *Piper barberi*, *Hydnocarpus pentandra* and *Rauwolfia micrantha*.
- Submitted the herbarium specimens of 5 candidate species comprising 13 sheets to JNTBGRI herbarium.
- Introduced 50 seedlings of *G. indica* seedlings to Ranipuram hill station located at Kasaragod district of Kerala.
- Supplied seedlings of *E. superbum* to Kerala Raj Bhavan medicinal garden and monitored its establishment.
- Supplied 82 seedlings of *E. superbum*, 30 seedlings of *H. pentandra* and 26 seedlings of *G. indica* to Colleges, Research institutes and visitors during this year.

Achievements:

- Located wild populations of all the candidate species
- Documented the morphology of flowers, fruits and seeds of all candidate species
- Carried out seed categorization, germination studies and initiated seed storage studies of *E. superbum*, *S. travancorica* and *H. pentandra*
- Initiated nursery establishment of the seedlings of *E. superbum*, *G. indica* and *S. travancorica*.

The PI has requested for six months extension of the project (Up to this financial year 31<sup>st</sup> March 2019) without additional fund for the following:-

- To plant seedlings and replenish floral wealth at the recently flooded selected areas of Kerala state.

- Seed storage studies and reintroduction of endemic species *Rauwolfia hookeri* and *R. micrantha*, and restoration of *Ensete superbum* and *Piper barberi*.

The Committee agreed for extension of the scheme without additional funds.

- 4.29 **“Study of Plant Diversity of Udaipur wetland of West Champaran and its water quality with Conservation being the objective”** by Dr. R.N.Yadava, Head Botany Department, Ram Lakhan Singh Yadav College, Patna (Bihar) (F.No. 14/25/2013-RE)

Project Details: The project was started on 13<sup>th</sup> February, 2014 for a period of 3 years with a total cost of Rs. 15,75,000/-. Tenure of the project was over on 12<sup>th</sup> February, 2017. A total of Rs 8,12,000/- has been released so far out of approved project cost of Rs 15,75,000/-. FTR & other documents are awaited. PI was invited to present the progress report before the PAC (EcRP) in the 15<sup>th</sup> meeting held on 29<sup>th</sup> February and 1<sup>st</sup> March, 2016 and in the 17<sup>th</sup> meeting held on 6<sup>th</sup> October, 2016, but PI has never attended the meeting of PAC (EcRP) for review of ongoing research project and has not sought more funds. Letters and Emails have been sent on 08.05.2015, 17.02.2016, 16.09.2016, 13.06.2017 and 02.11.2017, 03.11.2017, 28.02.2018 for ES & UC, Progress Report and other documents, but PI has not submitted so far.

- 4.30 **“In vitro Multiplication and eco-restoration of *Habenaria Panchganiensis*-Critically Endangered Orchid”** by Dr. Nitin Manohar Dongarwar, Department of Botany, Nagpur University, Nagpur (F.No. 14/12/2012-ERS/RE)

Project Details: The project was started on 17<sup>th</sup> June, 2013 for a period of 3 years with a total cost of Rs. 21,12,500/-. Tenure of the project was over on 16<sup>th</sup> June, 2016. A total of Rs. 9,51,000/- has been released so far out of approved project cost of Rs 21,12,500/-. FTR & other documents are awaited. The progress of the project was evaluated in the 15<sup>th</sup> meeting of the PAC (EcRP) held on 29<sup>th</sup> February and 1<sup>st</sup> March, 2016. Letters were sent on 16.07.2015/17.02.2016/13.06.2017/07.11.2017/28.02.2018 for ES, UC, FTR and other documents, which are awaited.

- 4.31 **“Diversity and Ecological Mapping on Lepidoptera (Insecta) of Shola forests of Kerala”** by Dr. R. Sheik Mohammed Shamsudeen, Department of Zoology, Sir Syed College, Kannur University, Taliparamba (Kerala) (F.No. 14/95/2013-ERS/RE)

Project Details: The project was started on 1<sup>st</sup> April, 2015 for a period of 3 years with a total cost of Rs. 20,55,900/-. Tenure of the project was over on 31<sup>st</sup> March, 2018. A total of Rs 10,84,800/- has been released so far out of approved project cost of Rs 20,55,900/-. The progress of the project was evaluated in the 17<sup>th</sup> meeting of the PAC (EcRP) held on 6<sup>th</sup>-7<sup>th</sup> October, 2016. Letters were sent on 25.11.2016/13.08.2017/03.11.2017/20.12.2017/02.02.2018/27.02.2018 for ES & UC, progress report, FTR and other documents but no response from PI so far.

- 4.32 **“Impact of anthropogenic activities on the benthic biodiversity along the Tamil Nadu coast: Biotic indices approach”** by Dr. P Murugesan, CAB in Marine Biology, Annamalai University, Parangipettai (Tamilnadu) (F.No. 19-56/2014-RE)

Project Details: This project has not started so far. 1<sup>st</sup> sanction was issued on 17.05.2016 for FY 2016-17 but funds could not be released due to pending UCs of the institution. Letters were sent on 14.07.2016/29.08.2016/12.09.2016/04.09.2017 for wants of pending UCs. All pending UCs have been furnished now. However, decision needs to be taken whether the project should be at all taken up as the Scheme has ended as on 31<sup>st</sup> March 2017.

- 4.33 **“An Application-oriented study of the Social and Traditional Customs and Practices having far-reaching Implications/solutions for the Protection of the Environment and Ecosystems”** by Dr. M.P.A Lakshmithathachar, R&D Head & President Samskriti Foundation, Mysore (F.No. 24-38/2013-RE)

Project Details: This is an NGO. Proposal was submitted on 20.12.2012. Project cost was Rs. 25,56,000/- for 2 years. Apex committee approved in its 6<sup>th</sup> meeting held on 11.02.2015 for Rs. 24,06,000/-. This project has not started so far. No funds released so far.

Advisor, RE briefed Shri AK Mehta, Chairperson of the Steering Committee about the presentations made by the Project Investigators in the forenoon and afternoon sessions and outcomes thereof. The Committee was of the view that a Workshop should be organised showcasing the most important findings of key projects which could be adopted/implemented by various stakeholders leading to conservation of biodiversity, prevention and abatement of pollution, minimisation of wastes, reducing carbon emissions, etc.

The Committee after deliberations ended the meeting with a Vote of Thanks to the Chair.

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**ANNEXURE-1****LIST OF PARTICIPANTS OF THE THIRD MEETING OF STEERING COMMITTEE ON R&D SCHEME HELD ON 30<sup>TH</sup> AUGUST 2018**

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| 1. Shri A. K. Mehta, Addl. Secretary, MoEFCC   | Chairperson      |
| 2. Dr. K. C. Gopi, Addl. Director, Zoological Survey of India<br>representing Director, Zoological Survey of India | Member           |
| 3. Shri V.P.Yadav, Additional Director,<br>representing Chairman, Central Pollution Control Board, New Delhi       | Member           |
| 4. Dr. T. Chandini, Advisor, MoEFCC  | Member-Secretary |

**MOEFCC (RE Division)**

1. Shri S. P. Singh, US, MoEFCC
2. Shri B. K. Haldar, SO, MoEFCC
3. Shri Chaitanya P. Sharma, RO, MoEFCC
4. Mrs. Akanksha Sachan, ASO, MoEFCC

**PROJECT INVESTIGATORS**

1. Dr. Pradeep Kumar Sharma, Assistant Professor, Department of Environmental Science, Graphic Era University, Dehradun-248 002, Uttarakhand.
2. Dr. P. Jegathambal, Professor & Coordinator, Karunya Institute of Technology and Sciences, Karunya University, Karunya Nagar, Coimbatore- 641 114, Tamil Nadu
3. Dr. V. Alexander, Professor, Department of Chemistry, Loyola College, Chennai-600034, Tamil Nadu
4. Dr. Manish Mudgal, Principal Scientist & Section Head, Advanced Radiation Shielding and Cement Free Concrete Group, CSIR-Advanced Materials and Process Research Institute (AMPRI), Hoshangabad Road, Near Habibganj Naka, Bhopal- 462026, Madhya Pradesh
5. Dr. Alok Sinha, Centre of Mining Environment, Indian School of Mines, Dhanbad, 826004, Jharkhand
6. Dr. P. Thangavel, Assistant Professor, Department of Environmental Science, Periyar University, Periyar Palkalai Nagar, Salem – 636 011, Tamilnadu
7. Dr. P. Shanmugam, Senior Principal Scientist, Central Leather Research Institute, Adyar, Chennai – 600 020, Tamil nadu
8. Dr. Dharendra Singhal, Professor, Department of Civil Engineering, Deenbandhu Chhotu Ram University of Science & Technology, Murthal-131039, Sonapat, Haryana
9. Dr. P. Balakrishnan, Division of Conservation Biology, Jawaharlal Nehru Tropical Botanic Garden & Research Institute, Palode, Thiruvananthapuram-695562, Kerala
10. Dr. Sanjay Keshari Das, Assistant Professor, University School of Environment Management, Guru Gobind Singh Indraprastha University, Sector – 16C, Dwarka, New Delhi-110078
11. Dr. (Mrs.) Ashalatadevi, Assistant Professor, Dept. of Environment Science, Tezpur University, Napaam, Tezpur, Assam 784 028
12. Dr. S. Sambath, Central Zone Regional Centre, Zoological Survey of India, Scheme No.05, Plot No.169, Vijay Nagar, Jabalpur, Madhya Pradesh- 482002
13. Dr. R. C. Sundriyal, Centre Head, CSED, G. B. Pant Institute of Himalayan Environment & Development, Kosi- Katarmal, Almora – 263643, Uttarakhand
14. Dr. Anil kumar C, Senior Scientist & PI, Conservation Biology Division, Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI), Palode, Thiruvananthapuram, -995 562, Kerala.

**ANNEXURE-2****LIST OF PROJECTS FOR CONSIDERTION IN THE 3<sup>rd</sup> MEETING OF STEERING COMMITTEE ON R&D SCHEME HELD ON 30.08.2018**

<b>S. N</b>	<b>File No. &amp; Title of the Project</b>	<b>Thematic Area</b>
1.	19-72/2014-RE Dr. Pradeep Kumar Sharma "Dairy Wastewater treatment using pilot-scale hybrid sub-surface Constructed Wetland systems operating under different recirculation rates"	Pollution
2.	19-183/2013-RE Dr. P. Jegathambal "Nano Bio Remediation of Textile Industrial Effluent in Tirupur District Tamil Nadu"	Pollution
3.	19-112/2013-RE Dr. T. Vijaya "Genetic diversity of heavy metal resistant endophytic fungi from Eastern Ghats and their application for restoration of contaminated sites".	Hazardous Wastes/ Pollution
4.	19-250/2013-RE Dr. S. Murugesan "Insecticidal potential and biological Activity of <i>Semecarpusanacardium</i> against Defoliators".	Hazardous Substances
5.	19-68/2012-RE Dr. V. Alexander "Development of Hybrid Nanomaterials – based water filters for affordable potable water".	Environmental Health
6.	19-339/2013-RE Dr. S. S. Amritphale "Bulk Utilisation of Red Mud for Making Advanced Ligno-Silico Aluminous(LSA) Geopolymeric Materials"	Hazardous Substances/ Pollution
7.	19-142/2014-RE Dr.Ramakant "Evaluation of Toxic Agrochemicals Effect on Recurrence of Algal Biodiversity"	Hazardous Substances
8.	F.No.19-59/2008-RE Dr. Nalini Sanakararamakrishnan "Development of viable technology for mercury remediation from Industrial and dental hospital wastewaters using polymer nanocomposites"	Hazardous Substances
9.	F.No.19-79/2013-RE Dr. Alok Sinha "Remediation of Ground Water Contaminated with Hexavalent Chromium in Sukinda Valley, Odisha, Using Nano Zero Valent Iron (n-ZVI) Technology".	Hazardous Substances/ Pollution
10.	19-150/2014-RE Dr. P. Thangavel "Phytoremedial Assessment of Metal Tolerant Flora in the Vicinity of Metal Based Industrial Clusters of Western Tamil Nadu"	Hazardous Substances/ Pollution
11.	19-78/2009-RE Dr. K. Byrappa "Metal Oxides Based Advanced Oxidation Technology for Industrial Pollution Control"	Pollution

12.	19-112/2010-RE Dr. P. Shanmugam "Sequential Production of Bio-diesel, Ethanol, Hydrogen and Methane as a "Biorefinary" Concept using Leather Solid Wastes and Effluent Treatment Sludges".	Pollution
13.	19-60/2013-RE Prof. Arif Ali "Comparative study of ESBL producing and PMQR <i>E.coli</i> and <i>K.pneumoniae</i> from purified tap water and unpurified samples of Yamuna".	Pollution
14.	19-22/2014-RE Dr. Kumud Dubey "Bioremediation of Bauxite Residue (Red mud), a waste product generated in Alumina industry through Integrated Biosolid Microbe (IBM) Combinations"	Hazardous Wastes/ Pollution
15.	19-59/2013-RE Dr. Virendra Kumar Mishra "Identification of Potential Risk from Ecologically Relevant Toxicants on Narmada River and Evaluation of its Health Using Aquatic Macro Invertebrates".	Pollution
16.	19-86/2009-RE Dr. K. Kumar "Development of efficient processes for biomethanation and bioremediation of cassava sago effluent by nitrogen amendments and <i>Spirulina</i> cultivation under HRAP system for safe recycling"	Pollution
17.	F.No.19-342/2013-RE Prof. Alok Satapathy "Utilization of Red Mud as Particulate filler in Polymer Composites".	Pollution
18.	F.No.19-224/2014-RE Dr. Kavita Shah "To Investigate the Toxicology and Biomagnifications of Nano ZVI Present in Consumer Products and Released after Use in the Environment"	Pollution
19.	19-38/2014-RE Dr. Dharendra Singhal "Design Production and Durability of Geo-polymer Concrete"	
20.	No.14/15/2010-ERS/RE Dr. A.A. Shah "Studies on Ecology and Diversity of Nematodes of Pir Panjal Range in Jammu & Kashmir	Biodiversity
21.	No.14/9/2011-ERS/RE Dr. M. Bhubaneshwari Devi "A study of diversity of Insect Fauna in Loktak Lake of Manipur"	Biodiversity
22.	14/30/2008-ERS/RE Dr. Geeta Asthana "Assessment of Biodiversity in Uttarakhand, Western Himalaya"	Biodiversity
23.	F.No.14/34/2014-ERS/RE Dr. P. Balakrishnan "Patterns of tree cavity occurrence and use by vertebrates in tropical forests of the Western Ghats: a community web approach and its implications in forest management"	Ecology
24.	F.No.14/259/2015-RE Dr. Sanjay Keshari Das "Spider diversity in the Eastern Ghats of Odisha"	Biodiversity

25.	F. No. 14/8/2014-RE Dr. (Mrs.) Ashalata Devi Exploration of Biodiversity and Conservation issues of Talley Valley Wildlife Sanctuary, Arunachal Pradesh with reference to wildlife species distribution along climate and topographical gradients	Biodiversity
26.	F.No.14/41/2014-RE Dr. S. Sambath Studies on the moth fauna of Pachmarhi Biosphere Reserve – an assessment of the species richness, relative abundance and distribution as environmental indicators	Biodiversity
27.	F. No. 14/222/2014-ERS/RE Dr.R.C.Sundriyal Ecosystem Services in changing biodiversity state: A comparative study of Western and Eastern Himalayan forest stands	Ecology
28.	F.No.23/23/2012-RE Dr. Anilkumar C Conservation of seven RET medicinal Plants of the Western Ghats through standardization of seed and seedling Identification, Germination, Species Restoration, Seed and Field Gene Banking	Biodiversity
29.	F.No.14/25/2013-RE Dr.R.N.Yadava “Study of Plant Diversity of Udaipur wetland of West Champaran and its water quality with Conservation being the objective”	Ecology
30.	F.No.14/12/2012-ERS/RE Dr.Nitin Manohar Dongarwar “ <i>In vitro</i> Multiplication and eco-restoration of <i>Habenaria Panchganiensis</i> - Critically Endangered Orchid “	Biodiversity
31.	No.14/95/2013-ERS/RE Dr. R. Sheik Mohammed Shamsudeen “Diversity and Ecological Mapping on Lepidoptera (Insecta) of Shola forests of Kerala”	Biodiversity
32.	19-56/2014-RE Dr. P Murugesan “Impact of anthropogenic activities on the benthic biodiversity along the Tamil Nadu coast: Biotic indices approach”	Biodiversity
33.	F.No.24-38/2013-RE Dr. M.P.A Lakshmithathachar “An Application-oriented study of the Social and Traditional Customs and Practices having far-reaching Implications/solutions for the Protection of the Environment and Ecosystems”.	Sustainable Development