

Canada – India Environmental Institutional Strengthening Project

Project IN / 29021

Final Implementation Report - Sub-components Air Quality Monitoring & LPG Conversion of Autorickshaws

March, 2006

BACKGROUND

Canada – India Environmental Institutional Strengthening Project was Five-year project funded by Canadian International Development Agency (CIDA) with assistance grant of Canadian Dollar 4.73 million (Revised Budget Canadian Dollar 3.983 million by virtue of Interdepartmental Administrative Agreement signed by Environment Canada and CIDA during year 2000.

The implementation of the project was initiated during March, 2001 with the approval of project implementation programme (PIP) and Annual Work Plan formulated as a follow up in consultation with Project Steering Committee comprising representatives from Canada (Environment Canada, CIDA; Canadian High Commissions, New Delhi) and India (Ministry of Environment & Forests and Department of Economic Affairs, Govt. of India). The duration of the project was for 5 years. The project completion, which was initially due in September, 2005 has been extended upto March, 2006. The Project has been completed in March 2006.

The Environment Canada's, Environmental Technology Advancement Directorate (ETAD) has implemented the project in association with MoEF, Govt. of India. The project has been mandated to promote environmentally sound development and strengthening of institutional capacity of Ministry of Environment & Forests to address national and global environmental issues. The project sub-components – Air Emission Monitoring and Control and LPG Conversion of Autorickshaws have been implemented by Central Pollution Control Board, Delhi. The project contributed to capacity building of the Central Pollution Control Board in Air quality monitoring through:

- (a) Training of Indian scientists and laboratory personnel in Canada and India, in sampling methodologies and analysis of Hazardous Air Pollutants (HAPs) including Poly-aromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs) and Semi-VOCs, and Quality Assurance / Quality Control; and
- (b) Carrying out a demonstration programme involving the conversion of four-stroke and two-stroke autorickshaws to operate on Liquefied Petroleum Gas (LPG) and their field-testing in Kolkata and Bangalore, which supports Environment Canada's commitment to promoting the development and deployment of environmentally sound technologies.

PROJECT SUMMARY OF ACTIVITIES AND ACHIEVEMENT

The activities undertaken for implementation of sub component Air Emission Monitoring and Control and LPG Conversion of Autorickshaws and activities undertaken in the sub-components, their outputs are presented ahead:

Output 101 - Air Quality Monitoring

Output 101.1 and 101.2: Training on VOC's Monitoring and Training on Calibration at Canada

The project facilitated training of scientists from Central Pollution Control Board at Canada for monitoring and analysis of Air Toxics such as Volatile Organic Compounds (VOCs) , Semi-VOCs, Poly-aromatic Hydrocarbons (PAHs) and Quality Assurance and Quality Control and calibration of instruments. During the project period 12 CPCB scientists in three batches of 4 officials each had undertaken training at Canada as detailed below:

1 st Batch	2 nd Batch	3 rd Batch
Course-I: Volatile and Semi-volatile Organic Compound Monitoring Course-II: Calibration and Auditing of Laboratory Instruments	Course: Training of CPCB Personnel on Sampling and Analysis of Volatile Organic Compounds (VOC's) and Polycyclic Aromatic Hydrocarbons (PAH's) in Ambient Air	Course: Training of CPCB Personnel on Sampling and Analysis of Volatile Organic Compounds (VOC's) and Polycyclic Aromatic Hydrocarbons (PAH's) in Ambient Air
Period: 18 th January, 2001 to 14 th February, 2001	Period: 10 th November, 2002 to 10 th December, 2002	Period: 10 th May, 2003 to 11 th June, 2003
Official Attended: 1. Sh. Sanjay Kumar, Sc. `B`, CPCB HQs Instt. Lab 2. Sh. Abhijit Pathak, SSA, CPCB HQs Air Lab 3. Dr. R. C. Shrivastava, Sc. `B` CPCB HQs Delhi 4. Sh. T. K. R. Balaji, Sc. `B` CPCB Zonal Office - Bangalore	Official Attended: 1. Dr. D. P. Mukhopadhyay, Sc. `C` CPCB Zonal Office – Kolkata 2. Dr. S. K. Tyagi, Sc. `C`, CPCB HQs, Air Lab 3. Sh. R. C. Rajput, SSA, CPCB HQs Delhi 4. Sh. A. Gnanvelu, JSA, CPCB Zonal Office – Vadodara	Official Attended: 1. Dr.(Mrs.) Rita Saha, Sc. `B`, CPCB Zonal Office – Kolkata 2. Mrs. Namita Mishra, SSA, CPCB Zonal Office – Lucknow 3. Dr. S. Philip, Sc.`B`, CPCB HQs (Resigned) 4. Sh. S. Jeyapaul, SSA, CPCB Zonal Office – Bangalore
4 Officials	4 Officials	4 Officials

During training, the CPCB officials had got exposure on following instruments employed for monitoring of particulate and gaseous pollutants:

- Canister sampling assembly – Sampling of VOCs
- TEOM Sampler and BAM Samplers – Particulate matter (PM_{2.5}) monitoring
- Online instruments for measurement of criteria pollutants (CO, SO₂, NO_x and O₃)
- Sequential and Dichotomous samplers for particulate matter (PM₁₀ and PM_{2.5})
- PAH Sampler (having the provision to collect gaseous and particulate PAH)

CPCB officials acquired skills in sampling of VOCs and PAH in ambient air and its further analysis with the help of GC-MST, GC-MS, GC-HRMS and HPLC. The sampling technique in measurement of particulate matter PM_{2.5} and PM₁₀ using different air quality monitors, their principles handling and installation etc. were learned by CPCB scientists. They are trained in the measurement of VOCs by Canister sampling method followed by quantification on Gas Chromatograph with Mass Spectrometer Detector (GC-MSD) using US EPA method TO-14 and TO-15. VOCs are being measured in CPCB by conventional methods viz; Passive Method, Automatic Monitoring and Active monitoring. Straight chain Particulate phase PAHs are being regularly measured by CPCB employing Gas Chromatograph – Flame Ionization Method. Sophisticated instruments like High Resolution Gas Chromatograph Mass Spectrometer (HRGCMS), High Pressure Liquid Chromatograph (HPLC), Extraction Unit and PAH Sampler are also being acquired for the measurement of Gas phase PAHs and Nitro-PAHs. Participants from CPCB were trained on the operation of Tapered Element Oscillating Microbalance, Beta Attenuation Monitor, Manual PM_{2.5} sampler,

Sequential Sampler and Speciation Sampler for the measurement of Fine Particulate Matter. Facilities for monitoring FPM are now being further developed by CPCB.

The trained scientists with gained knowledge and skills in carrying out the analysis of air samples has enhanced the technical knowledge of officials to carry out the mandate of CPCB. The training undertaken by the CPCB officials at ETC has been found useful and relevant. The CPCB has made and implemented appropriate plans to transfer the acquired knowledge and skills to other officials.

These project outputs, which are successfully delivered are improving the Indian government's capacity to understand, monitor and control emissions from mobile and stationary sources, which will bring direct health benefits to local population as well as contributing to reduced emissions of toxic and hazardous substances.

Output 101.3: External Validation of Training

During the project period Environment Canada maintained regular contacts with CPCB to monitor the contribution of project activities related to improvement in air quality monitoring. The Environment Canada scientists visited regularly for validation of various programmes almost every year to discuss the impact of training imparted to Indian scientists and its impact on their job output. The external validation of activities in the project was held by Environment Canada Mr. Peter Hoffman, Geospatial International, Salasan Operating Division and Dr. S. Mudgal, Expert during February, 2004.

As the trained CPCB scientists have been assigned duties consistence with their training and simultaneously the CPCB also acquired various monitoring equipments on its own, which together contributed to improvement in air quality monitoring and data collection. The quality of air analysis and reliability of the data generated by CPCB laboratories are commended by the experts nationally as well as internationally.

Output 101.4: Training in India

In order to provide more focussed approach for training of Indian scientists at Central Pollution Control Board and various State Pollution Control Boards in the country, series of training workshops were held in various cities in India involving Environment Canada's experts as resource persons. The knowledge and skills acquired by Indian scientists during their training at Canada were also shared with other officials during the workshops. The details of various training workshop organized in India are as below:

◆ Training Workshops Measurement of VOC's, SVOC's, HAP's and POP's in Air:

Vadodara	:	January 16-17, 2003
Kolkata	:	January 20-21, 2003
New Delhi	:	January 23-24, 2003

Environment Canada Faculty: Dr. Richard Turle; Mr. Daniel Wang; Ms. Mylaine Tardiff
Ms. Pierrette Blanchard

◆ Training Workshops `Quality Assurance for Laboratories engaged in Air Quality Testing`:

Mumbai	:	February 9-10, 2004
Chennai	:	February 12-13, 2004
Bangalore	:	February 16-17, 2004

Environment Canada Faculty: Dr. Richard Turle; Ms. Viera Balgava; Ms. Pat Falletta

◆ Training of Laboratory Managers in Laboratory Management & Quality Control:

New Delhi	:	January 24-25, 2005
Hyderabad	:	January 27-28, 2005

Environment Canada Faculty: Dr. Richard Turle; Mr. Bryan Wakeford; Ms. Mylaine Tardiff

During the workshops, the participants were provided the participant kit comprising technical work book having detailed technical lecture notes. The workshops held under aegis of Canada – India Environmental Institutional Strengthening Project and organized by Central Pollution Control Board were successful with high degree of positive feedback from the participants comprising SPCB's and CPCB officials.

Output 101.5: Installation of PM_{2.5} & PM₁₀ Monitoring Equipment

PM_{2.5} & PM₁₀ particulate matter are recognized as toxic substances as these can be inhaled deep into lung and reaching to the areas where cells replenish the blood with oxygen. In order to understand the nature and sources of these particulate substances and to develop control strategy, temporal data and effective monitor system is required which can maintain its accuracy for the period of time.

In order to provide facilities for monitoring of PM_{2.5} and PM₁₀ particulate matter with minimal maintenance, the equipments as below have been provided under the project by Environment Canada. The contribution agreement was signed between Environment Canada and CPCB to procure and install these monitoring equipments at Delhi and Agra:

S. No.	Equipment/Accessories	Quantity
CPCB PROJECT OFFICE - AGRA		
1.	BAM 1020 Ambient PM _{2.5} Monitoring System constituting Inlet System with Support bracket, PM ₁₀ Sampling head, PM _{2.5} Sharp cut Cyclone, Volumetric Flow Control Option, Ambient Temperature Sensor, Humidity Sensor, Controlled Inlet Heater Sample Pump (220 VAC/50 Hz), Power Supply 220 VAC/50 Hz, Manual & Calibration Certificate	One Set
2.	Flow Pressure & Temperature Calibrator	One Set
3.	BAM 1020 Weatherproof Enclosure	One No.
4.	BAM 1020 Filter Papers	9 Packets
5.	BAM-1020 Data Acquisition & Display Programme	One No.
6.	Plasma Screen with Stand Sony Plasma Monitor Model No.: PFM 42 x 1 Stand Model: SU PW 2	One Set
7.	APS Smart UPS Online 5000 VA with power chute and software SURT 5000 UX with batteries (16 nos.) Martech Corporation Office	One Set
AIR LABORATORY, CPCB HQs DELHI		
1.	R & P Partisol FRM PM _{2.5} (PM ₁₀ /PM _{2.5} SCC Inlet Combination) Sampler 220 V. 50 Hz S/N 200 FB 206070309	One set
2.	Support Stand for Partisol FRM PM _{2.5}	One
3.	R & P FRM Filter Cassettes Pkg/5	One set
4.	R & P Teflon Filter 2.0 µm	One
5.	BAM 1020 Ambient PM _{2.5} Monitoring System constituting Inlet System with Support bracket, PM ₁₀ Sampling head, PM _{2.5} Sharp cut Cyclone, Volumetric Flow Control Option, Ambient Temperature Sensor, Humidity Sensor, Controlled Inlet Heater Sample Pump (220 VAC/50 Hz), Power Supply 220 VAC/50 Hz, Manual & Calibration Certificate	One Set
6.	Flow Pressure & Temperature Calibrator	One Set
7.	BAM 1020 Filter Papers	9 Packets

The Environment Canada has also provided auxiliary attachment to BAM continuous monitor in order to undertake continuous monitoring of PM₁₀ at Agra. The Environment Canada on the request of CPCB has undertaken procurement of Computer Plasma Screen for display and Uninterrupted Power Supply System from India itself and provided for use at Monitoring Station Agra Tajmahal for which the Contribution Agreement was amended. Environment Canada also arranged onsite training of Indian scientists at Delhi and Agra covering operation and maintenance aspect of the instruments at the time of installation of equipments. Environment Canada experts have visited Agra and Delhi from time to time and reported that the equipments are performing satisfactorily with trouble shooting from time to time.

Output 101.6: Stack Sampling and Analysis Training

The objective of the training was to impart practical skills to CPCB scientists to carry out stack emission testing for industries using internationally accepted method. Environment Canada had designed the training programme to provide CPCB scientists the practical and theoretical information required to plan and execute the stack sampling programme and to knowledgeably manage air quality issues within the industries. Six CPCB officials, as detailed below undertaken training in stack sampling at Canada between 30th May, 2004 to 12th June, 2004:

- Sh. D. C. Jakhwal, Assistant Technical Officer, CPCB HQs
- Sh. Aditya Sharma, Assistant Environmental Engineer, CPCB HQs
- Sh. S. B. Lahot, Technical Supervisor, CPCB HQs
- Sh. K. N. Nandi, Senior Scientific Assistant, CPCB Zonal Office – Kolkata
- Sh. M. Mushtaque Alam, Senior Technical Supervisor, CPCB Zonal Office – Vadodara
- Sh. P. Krishna Murthy, Junior Scientific Assistant, CPCB Zonal Office – Bangalore

The officials undertook one week classroom training at Dillon Stack Sampling School operated by a certified Canadian Company, M/s Cleghorn & Associates Ltd., Ontario, Canada, which has arranged similar training programmes for Canadian Officials in the past. The 2nd week of training included practical exposure provided by certified Canadian stack sampling company at a fertilizer plant. During the training CPCB officials got exposure about the use of modern stack sampling equipments and practiced sample collection according to internationally recognized procedure.

Output 101.7: Laboratory Management Training and Quality Control

Environmental Laboratories play an important role in monitoring emission recommended by Environment Quality Guidelines and standards, promoting planning and enforcement the capacity of environmental laboratory in producing reliable testing results and data on consistence basis is important for public awareness. The mission of five CPCB laboratory managers as follows, participated in two weeks training on Laboratory Management in Canada from 29th May, 2004 to 13th June, 2004:

- Dr. C. S. Sharma, Senior Scientist, CPCB, HQs Delhi
- Sh. A. Manoharan, Scientist `C`, CPCB, HQs Delhi
- Dr. Dipankar Saha, Scientist `C`, CPCB Project Office – Agra
- Dr. Utpal Mukherjee, Scientist `C`, CPCB Zonal Office – Vadodara.
- Sh. V. Pattuswamy, Scientist `C`, CPCB Zonal Office - Bangalore

The Laboratory managers have got the opportunity to study the Canadian Laboratory Management System including private laboratories during the visit to Canada. The mission of officials visited Environment Canada's and the Government of Ontario's Laboratories

involved in environmental monitoring, research and methods development. The officials also received training at Canadian Association of Environmental & Analytical Laboratories involved in proficiency testing and accreditation of private and public sector environmental laboratories and got opportunity to interact with experts and Canadian Laboratory Managers to share major issues, which are faced by Indian laboratories.

The laboratory managers, who have attended the course has participated actively in the discussions and shared the knowledge with other middle level laboratory managers during the training seminar workshops organized at New Delhi and Hyderabad during January, 2005 in association with Environment Canada. The workshops evaluation undertaken by CPCB indicated that workshops have received high ratings from the participants.

Output 101.8: Stack Sampling Validation Training in India

To validate utility of Stack Sampling Training programme undertaken by CPCB scientists in Canada, Mr. Mike Denomme from M/s Lehder Environmental Services Ltd., Canada visited India. The Canadian expert has undertaken consultation with CPCB scientists, their supervisors and colleagues to determine the capability and extend the applicability and usefulness of training programme, conducted at Canada. The Canadian expert also provided hands on training to Indian scientists at coal fired Rajghat Thermal Power Plant, Delhi for stack sampling technique and reviewed the stack monitoring equipment used by CPCB in order to provide recommendation for upgrading the equipment. The CPCB scientists who have received training at Canada has adjudged the training as useful and provided practical feed back on limitations resulting from traditional sampling methods and equipments. Environment Canada has provided specifications and estimated cost of the Advanced stack sampling equipment in order to its procurement by CPCB.

Output 101.9: Quality Control and Quality Assurance Training in India

The programme has been undertaken for upgradation of quality assurance and quality control in environmental laboratories in India. Three Environment Canada experts visited India during January, 2005. The Canadian scientist Mr. Bryan Wakeford from the Canadian Wildlife Service was involved as one of the faculty in training workshops for laboratory managers of SPCBs and CPCB to draw the link of impact of pollution on wildlife including species at risk. During Laboratory Management and Quality Control workshop held at New Delhi on 24-25 January, 2005 approximately 30 scientists from CPCB Zonal Offices and various SPCBs participated. The workshop was also attended by representatives from Custom Revenue Laboratory, New Delhi as quality assurance and quality techniques are equally applicable to them.

During the workshop, the CPCB and SPCBs officials have received expert advise on the application of QA/QC concept, which help in improving the capacity of scientists to generate reliable data for decision making to promote sustainable development.

Output 101.10: Stack Sampling and Analysis Training Focusing on Coal Fired Power Plants

The Indian coal are of low quality with low sulphur and traces of mercury but higher ash contents. The coal fired power plants pose significant threat to the local environment. Because of it, the Project Steering Committee has recommended to organize two weeks training for six CPCB scientists at Canada to receive hands on stack sampling and analysis training at coal fired power plant and to analysis of various emission parameters such as CO, CO₂, NO_x, Particulate matter and Mercury. The exposure on technologies and practices employed in Canada to reduce the emission of these pollutants was proposed to be provided to the CPCB Scientists. The training was immensely needed to create the core group of

scientist at CPCB, which are familiar with the requirement of taking Thermal Power Plants Emissions samples following internationally accepted methods.

The training to Indian scientist, which was planned in Project Implementation Plan 2005-2006 during October, 2005 could not be organized and the activity remained uncompleted.

Output 101.11: Study Tour Focusing on Environmental Technologies

Advance technologies play a key role in detecting and reducing the adverse health and environmental impact of human activities and mitigating the adverse impacts. However technologies need a conducive regulatory and policy regime, a set of favourable economic instruments and consistent application of enforcement measures to be developed and deployed by the industry. Therefore, the project work plan included the study tour for food processing, petroleum refinery, incineration, waste disposal and the destruction of persistent organic pollutants (POPs) such as PCBs and electronic wastes in order to study Canada standards for significant pollutants, including POPs, PCBs, CO/CO₂, NOX, Mercury etc.

The study tour has been organized by Environment Canada under the purview of the project during January, 2006 and the Mission of officials from Ministry of Environment & Forests, Central Pollution Control Board, Delhi, The Energy Research Institute and selected Indian industries visited Canada as planned.

Output 101.12: Provision of Mercury Monitoring Equipment

The element mercury is toxic heavy metal, which may be released in various forms depending on the sources and their effects. The volatile mercury is of global concern since it is bio-accumulated and may transfer to food chain leading to human beings. The combustion of coal, chloralkali plant and the disposal of electrical/electronic and medical instruments are significant sources of mercury emissions in India. There were the provisions in the project to provide continuous mercury vapour analyzer to facilitate CPCB to monitor the level of mercury in ambient air in various parts of the country.

The mercury vapour monitoring equipment was not provided to CPCB in spite of repeated follow up and the activity remained uncompleted.

Output 102: LPG Conversion of Autorickshaw

LPG conversion & demonstration study for in-use three wheelers in Kolkata and Bangalore is an important project component under the project. LPG is now an approved auto-fuel and few three wheeler-LPG conversion kits are available in India however so far, no real life feasibility and assessment studies have been carried out in India with these kits retrofitted on on-road three wheelers. As such, we are in dark regarding the efficacy of these kits when put to real use and particularly their remains concerns with regard to performance, durability and emission benefits of these kits for the older in-use two stroke three wheelers.

To address all these concerns and to generate a database on real life performance of retrofitted LPG three wheelers, the above field demonstration and research study has been taken up. Importantly, this study also involves measuring comparative exhaust emissions from on-road three wheelers fitted with Canadian LPG kits, existing LPG kits and also from conventional gasoline three wheelers plying in Kolkata and Bangalore city roads. In-use emissions to be tested on rota-dynamometer testing facilities specially imported from Canada for this purpose. This demonstration study and in-use emission testing facility shall help us in fine tuning and configuring the LPG three wheelers for optimizing there emission performances and such a field study is being conducted for the first time in India.

Study Objectives & Tasks

The main aim of this study is development, field-testing and optimization of low cost LPG conversion system for in-use three wheelers with special reference to older two stroke technology vehicles. Under sub component of project, Environment Canada has engaged M/s. Yugo Tech, a Canadian firm expert in gaseous-fuelled vehicles, to develop prototype LPG conversion system for Indian three wheelers. The various activities for accomplishing the objectives include the followings:

- Development of appropriate LPG conversion system for in-use three wheelers (25 nos. each for Kolkata & Bangalore),
- Emission testing, performance evaluation, necessary configuration and optimization of the developed kits in Canadian laboratories on the 03 in-use Bajaj three wheelers sent to Canada for this purpose,
- Supply of 50 LPG kits to India (25 each for Kolkata & Bangalore), 02 rota-dynamometer emission test facilities along with software (01 each for Kolkata & Bangalore) and other necessary parts, catalysts, etc.
- Training of CPCB, SPCB and ARAI officials for testing, monitoring and evaluation of LPG kits,
- Necessary clearances from Indian agencies (CCOE, ARAI, etc.), emission testing and installation checking at ARAI before trial run of retrofitted three wheelers in Kolkata and Bangalore; and
- Demonstration and trial run of 25 each, LPG retrofitted in-use three wheelers in Kolkata and Bangalore for a period of six months.

Execution of the Study

CPCB has been identified as the main partner for executing and coordinating this study. This project involves critical tasks like sourcing and shipping of Indian three wheelers (01 new & 02 older in-use vehicles) to Environment Canada Labs, securing necessary clearances from the department of Explosives, Nagpur for this research initiative involving trial run of LPG vehicles in Kolkata and Bangalore, emission testing at ARAI, etc. For executing this study, CPCB has constituted a national level "Technical Advisory Committee" (TAC) under the Chairmanship of Prof. H.B. Mathur with members from different organizations like Ministry of Road Transport, Petroleum Ministry, ARAI, IITs, etc.

Overcoming the initial delays due to logistics involved in sourcing and dispatch of 03 three wheelers to Canada, all tasks from development of prototype LPG kits to securing clearances for trial run and emission testing at ARAI have been successfully completed. Six months trial run of vehicles started in Bangalore and Kolkata w.e.f. 28/08/2005 and 05/09/2005 respectively. The retrofitted vehicles are being run in Kolkata and Bangalore presently to make up for some discontinuations faced due to LPG supply and instrument malfunctioning in Kolkata and Bangalore during the trial period.

Emission Testing in Canada

As required, Environment Canada has conducted mass emission tests for Indian three wheelers retrofitted with the developed LPG kit following Indian test protocols as suggested by ARAI, Pune. Initial results without any modification or engine tuning or configuration show reductions in emissions as compared to conventional gasoline three wheelers. However, the results show substantial improvements after optimization and tuning of the engines. Initial results as reported by Environment Canada are outlined below:

Initial Emission Test Results reported by Environment Canada

Vehicle	CO	CO2	NOx	THC	NMHC
Bajaj RE 2-stroke-Gasoline	1.97	80	0.29	7.99	-
Bajaj RE 2-stroke-LPG	1.28	83	0.03	0.42	0.41

Conclusions

- ◆ The study has been successfully carried out and many inputs have been collected in course of the study for optimization of the LPG conversion kits for 3-wheelers. It also demonstrated that older 2-stroke 3-wheelers can achieve better emissions by using optimized LPG kits with catalytic converters. However, some issues and regulatory needs as identified by ARAI and the Department of Explosives are required to be attended to if in case these LPG kits are recommended for commercial use. The kit manufacturers and Environment Canada have been provided with the comments and issues that need to be addressed and have also been informed that this was only a research study and in any case for commercialization, the manufacturers must secure approvals from ARAI, DOE and others as per Indian regulations.
- ◆ Two sophisticated roto-dynamometer emission measurement systems have been supplied by Canada in this project. The systems are first of its kind in India and Canadian experts recently visited India and attended initial problems as reported by Kolkata and Bangalore. The machines are now running fine and actual 3-wheelers emission data are being recorded. Canadian experts have imparted necessary training and demonstration to field staffs for operation of the systems. These systems can measure emission from any on-road three-wheelers and as decided by the Project Technical Advisory Committee (TAC), one each of the systems have been handed over to Kolkata and Bangalore State Pollution Control Board for regular use and generation of actual data.
- ◆ Many State Boards like Tamil Nadu, Tripura, etc. have shown interest and requested to conduct such trial studies in their respective cities. We may also take up such studies for LPG and CNG vehicles in different states in future with possible funding from various sources.