

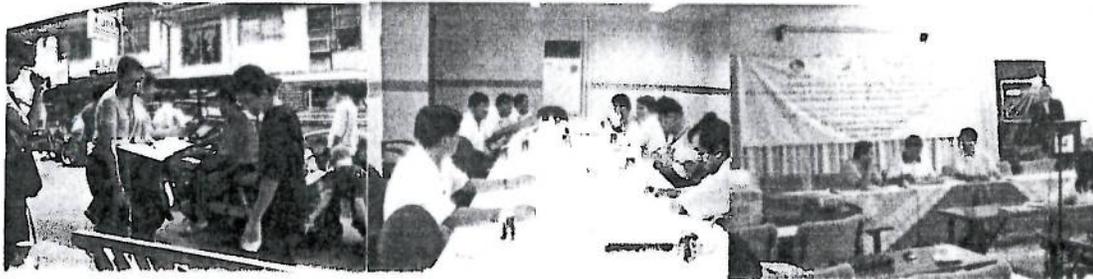


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**Environmental Management Bureau
Department of Environment and Natural Resources
(DENR-EMB)
United States Agency for International Development
United States-Asia Environmental Partnership
(USAID-USAEP)**

**Development of
Carbon Monoxide (CO) and Hydrocarbon (HC)
Emission Standards for
Motorcycles and Tricycles
TSSC Grant No. G2005-27**



FINAL REPORT

12 October 2005

Prepared by:



**U.P. National Center for Transportation Studies Foundation, Inc.
(UP-NCTSFI)**

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1. Introduction

Republic Act No. 8749, known as the Philippine Clean Air Act (CAA) was enacted in 1999 and its Implementing Rules and Regulations (IRR) were issued in 2000. The Department of Environment and Natural Resources (DENR) was designated as the lead implementing agency

Under the law, from January 1, 2003, in-use, new, rebuilt and imported second-hand motor vehicles were required to comply with the emission standards prior to registration. All in-use vehicles will only be allowed to renew their registration upon submission of certificate of compliance to emission standards (CCES). The Department of Transportation and Communications (DOTC) and the Land Transportation Office (DOTC-LTO) were authorized to test vehicles at the Motor Vehicle Inspection Station (MVIS) or through authorized private emission testing centers (PETC).

The IRR in 2000 through the DENR Department Administrative Order (DAO) No. 2000-81 specified in-use motorcycle emission standards for carbon monoxide (CO) only. The Environmental Management Bureau (DENR-EMB) constituted an inter-agency committee called "Technical Working Group for the Establishment of Emission Standards for Motorcycles/Tricycles" in February 2003 to establish emission standards for hydrocarbons (HC) for motorcycles. The technical working group collected in-use tricycle CO and HC emission concentration (idle) in Metro Manila from February to March of the same year. Several meetings had been held to discuss the collected emission data and its analysis using statistical methods. A portion of the data indicated that 21% of the tested tricycles did not comply with the idle HC emission standard and 14% did not comply with the idle CO emission standard. On June 30, 2003, the Department Administrative Order No. 2003-25 was issued that ordered the implementation of the HC emission standard for motorcycles. The Order stipulated that emission standards will take effect for 3 years which shall include review and evaluation every 2 years by the DENR through the EMB in coordination with DOTC/LTO for possible modification in the 3rd year. In summary, the existing emission standards for in-use motorcycles (which also covers tricycles or three-wheelers) are shown in Table 1.

Table 1. Emission Standards for In-Use Motorcycles, 2003

	CO (% by volume)	HC (ppm)*
Registered for the first time on or before December 31, 2002 (At Idle)	6.0	7,800 (urban area)
Registered for the first time on or after January 1, 2003 (At Idle)	4.5	10,000 (rural area)

*HC standard issued in June 30, 2003 through DENR DAO No. 2003-25 (Hydrocarbon Standards for Motorcycles)

2. Establishment of the Technical Working Group in June 2005

The USAID-US-AEP, as part of its FY 2005 Work Plan, provided assistance to the DENR-EMB in its emission standard-setting activity specifically to develop a procedure for setting carbon monoxide (CO) and hydrocarbon (HC) standards for in-use motorcycles and tricycles

The kick-off meeting of DENR-EMB, U.P. National Center for Transportation Studies and the United States-Asia Environmental Partnership (USAID-USAEP) on June 10, 2005 introduced the project to the implementing agency, the DENR-EMB and started preparations for the creation of the "Inter-Agency Technical Working Group (TWG) for the Development of Carbon Monoxide and Hydrocarbon Emission Standards for Motorcycles and Tricycles". The Joint TWG Secretariat consisting of staff of the Air Quality Management Section (AQMS) of the

DENR-EMB and the UP-NCTS was also created. The TWG was established in its 1st meeting held on June 24, 2005 at the Air Quality Management Training Center (AQMTC) Conference Room at the DENR Compound in Quezon City. Details of the meeting are shown in Minutes 1 shown later in this report.

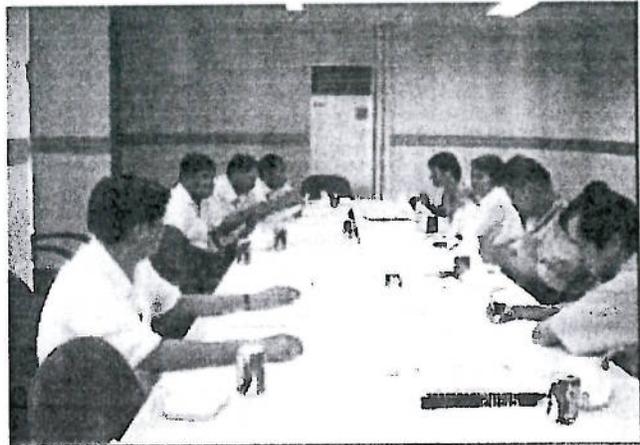


Figure 1. Meeting of the Inter-Agency TWG

The Inter-Agency Technical Working Group for the Development of Carbon Monoxide and Hydrocarbon Emission Standards for Motorcycles and Tricycles is composed of agencies and organizations as follows.

Chair: Environmental Management Bureau (DENR-EMB)
Co-Chair: National Center for Transportation Studies (UP-NCTS)

Members:

- 1) Department of Transportation and Communications (DOTC)
- 2) Land Transportation Office (DOTC-LTO)
- 3) Philippine Council for Industry and Energy Research and Development (DOST-PCIERD)
- 4) League of Cities of the Philippines (LCP)
- 5) League of Municipalities of the Philippines (LMP)
- 6) Department of Energy (DOE)
- 7) Bureau of Product Standards (DTI-BPS)
- 8) USAID Energy and Clean Air Program (USAID-ECAP)

Secretariat:

- 1) Environmental Management Bureau (DENR-EMB)
- 2) National Center for Transportation Studies (UP-NCTS)

Cooperating Agency:

- 1) USAID Asia-Environmental Partnership (USAID-USAEP)

DENR Special Order No. 2005-787 (Constitution of the Inter-Agency Technical Working Group (TWG) for the Development of Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for Motorcycles and Tricycles), signed by DENR Secretary Michael T. Defensor, formally created the TWG and directed it to assist the DENR in the review of existing emission standards of motorcycles and tricycles and establish new standards. The Special Order is shown in Annex A.

3. Tricycle Emissions Survey

Surveys consisting of interviews of tricycle drivers and tailpipe emission measurements of idle CO and HC concentration of in-use tricycles were conducted in 9 sites in Quezon City, 1 site in Pasig City and a site in Baras (Rizal) in April-September 2005. Table 2 and Figure 2 show the details of the tricycle surveys conducted in Metro Manila in 2005.

The survey questionnaire is shown in Annex B.

Surveys in District 3 in Quezon City were facilitated by the Office of Councilor Dante M. De Guzman (Figures 3 to 5). The rural area survey was also facilitated by the Office of Councilor De Guzman in cooperation with Councilor Matignas (Figure 6).

The survey in Pasig City in September 1 was facilitated by the City Environment and Natural Resources Office (CENRO) of Pasig City. The CENRO staff provided assistance during the conduct of the tricycle survey.

Table 2. Number of Tricycles Surveyed by Location, 2005

General Location (Dates of Survey)	Specific Locations	Number of Tricycles Surveyed
Districts I, II and IV Quezon City (April 15, 18, 21 and May 2, 2005)	Maligaya-Camarin, Batasan, Don Antonio, Bago Bantay (SM North), Philcoa, Philcoa (Mayaman), UP Teachers Village (UPTV)	130
District III Quezon City (July 8, 11, 15, 2005)	Socorro (Liberty-15th Ave.) Loyola-Pansol (E. Abada) Imperial-Aurora	190
Pasig City (September 1, 2005)	Market Avenue, Pasig City	53
Rizal Province (August 3, 2005)	Baras Municipal Hall, Rizal	52
Total Number of Tricycles Surveyed		425

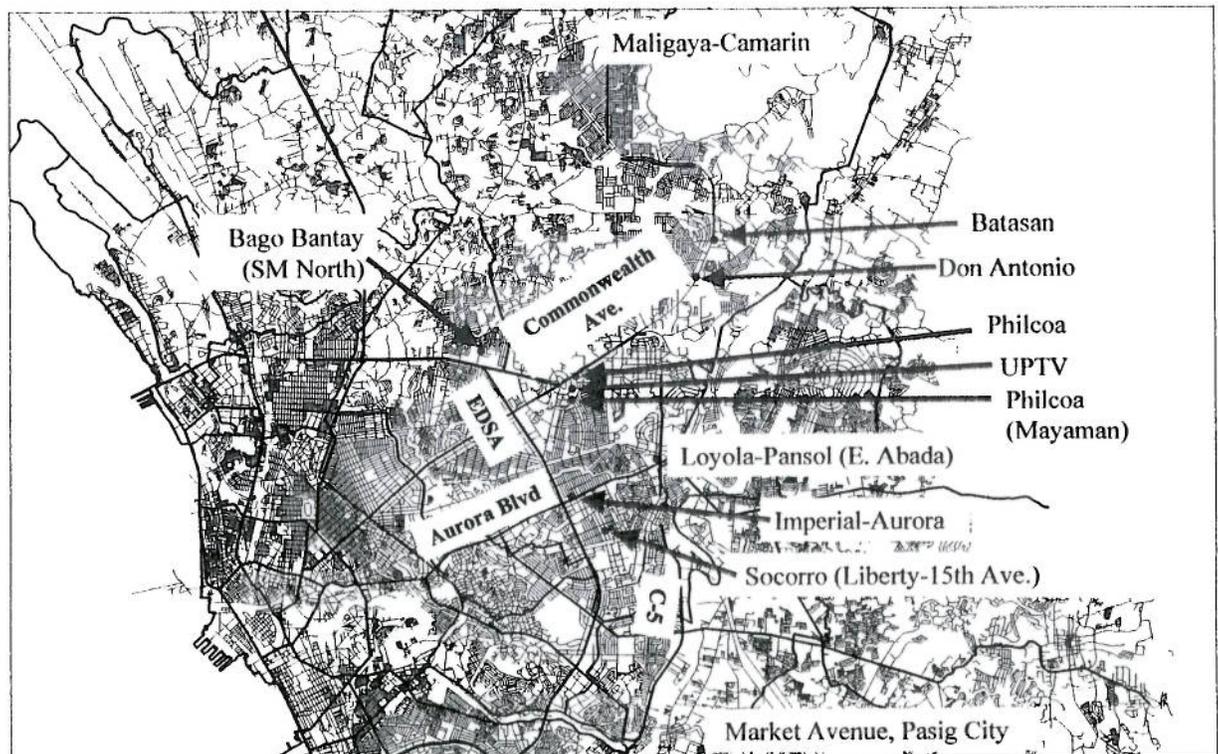


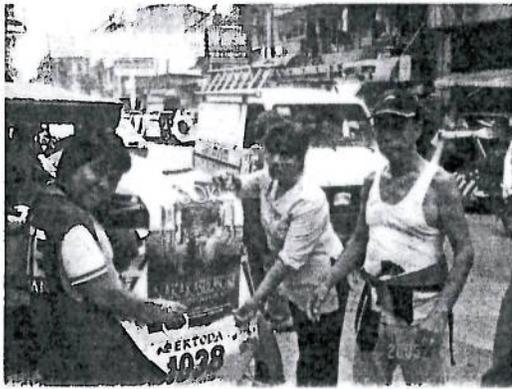
Figure 2. Tricycle Survey Sites in Metro Manila, April-September 2005



**Figure 3. Tricycle Survey on 8 July 2005:
Liberty Ave. cor. 15th Avenue,
Barangay Socorro, Quezon City
with Councilor De Guzman**



**Figure 4. Tricycle Survey on 11 July 2005:
Loyola-Pansol, E. Abada,
Loyola Heights, Quezon City**



**Figure 5. Tricycle Survey on 15 July 2005:
Imperial Street Corner Aurora Boulevard,
Cubao, Quezon City**



**Figure 6. Tricycle Survey on 3 August 2005:
Baras Municipal Hall, Rizal**

Aside from the new emission data that were gathered, the TWG also reviewed and used data gathered in USAID-USAEP activities in: a) Puerto Princesa City (Palawan), b) San Fernando City (La Union) and c) Mandaue City (Cebu).

4. Meetings and Workshop of the Inter-Agency Technical Working Group Meetings and Stakeholders' Consultation Meeting

After the kick-off meeting at EMB on June 10, 2005, the TWG held the first 3 meetings at the Air Quality Management Training Center (AQMTC), DENR, Quezon City at the following dates: June 24, August 8 and September 16. The 4th meeting was held on October 7, 2005 at the National Center for Transportation Studies, University of the Philippines, Diliman, Quezon City a week after the stakeholders' consultation meeting.

In the first meeting of the TWG, the technical assistance of USAID-USAEP to DENR-EMB on its emission standard-setting activity was explained to the members. The activities conducted by the previous technical working group that formulated the HC emission standards in 2003 were also revisited. In the meeting, UP-NCTS formally presented 2 of its researches on three-wheelers to the DENR-EMB. Finally, the TWG planned for the fieldwork of DENR-EMB and UP-NCTS consisting of tricycle driver interview and tricycle emission test surveys on July 8, July 11 and July 15 in three sites in Quezon City. UP-NCTS volunteered its portable automotive

exhaust emission analyzer (Horiba) for gasoline engines to be used in the survey. Details of this meeting are shown in Minutes 2.

In the second meeting of the TWG, UP-NCTS and DENR-EMB reported that on July, surveys were conducted in 3 sites in District 3 of Quezon City assisted by Councilor Dante M. De Guzman. The rural area survey was also conducted in Baras, Rizal on August 3 also facilitated by Councilor De Guzman and Councilor Matignas. It was also decided in the meeting that another fieldwork be conducted in Pasig City. USAID-ECAP informed the DENR-EMB that they may request for funding of other consultation meetings in centers outside Metro Manila. Details of this meeting are shown in Minutes 3.

In the third meeting of the TWG, results of tricycle surveys conducted in 4 urban areas in Metro Manila and 1 rural area were presented and preliminary analysis of data was discussed. Five scenarios for emission standard setting were also presented and discussed. The tasking for the preparation of the holding of the stakeholders' consultation meeting scheduled on September 26 was also discussed. Details of this meeting are shown in Minutes 4.

A workshop on tricycle survey data analysis and procedures for the development of emission standards for motorcycles and tricycles was organized by UP-NCTS and the DENR-EMB for its staff and TWG members and guests on 11-12 August 2005 in San Mateo, Rizal. A background on transportation and the environment, research outputs of UP-NCTS on three-wheelers and analysis of recently collected tricycle survey data were presented by UP-NCTS and the technical advisor. Clean air programs in Puerto Princesa City, San Fernando City and Mandaue City were presented by USAID-USAEP while MDPPA presented the concepts of two-stroke and 4-stroke engines. The workshop participants also were able to understand the recent survey data and how statistical modeling of emissions as a function of various factors such as type of engine, engine displacement, fuel-oil mix ratio, frequency of maintenance is being done. Details of the workshop and the discussions are shown in Workshop Minutes.

The stakeholders' consultation meeting was conducted on September 26, 2005 at the National Center for Transportation Studies in the University of the Philippines, Diliman, Quezon City. There were 45 participants who attended coming from 17 organizations and agencies in addition to agencies represented in the TWG. Activities of the TWG, the procedure for emission standard setting and discussion of tricycle survey data were explained to the stakeholders. The Draft DENR Administrative Order (DAO) on the proposed CO and HC emission standards for motorcycles and tricycle was also presented. An open forum that discussed the draft DAO was also held. It was agreed that in the finalization of emission standards, the TWG would involve the motorcycle manufacturers and the tricycle operators and drivers associations. Details of the consultation meeting are shown in the Stakeholders' Consultation Meeting Summary.

In the fourth meeting of the TWG held on October 7, 2005, presentations in the Stakeholders' Consultation Meeting in September 26 were reviewed and a revised DENR Administrative Order (DAO) on CO and HC emission standards were presented to the TWG and representatives of the manufacturers, tricycle operators and drivers associations and local government unit organizations. There were issues on the strictness and timing of emission standards raised by associations of motorcycle manufacturers and tricycle operators and drivers which were discussed with the TWG during the open forum. It was agreed that the organizations would submit their written comments on the draft emission standards to the TWG Chair/EMB on or before October 21, 2005. Details of the fourth TWG meeting are shown in Minutes 5.

The detailed minutes and proceedings of the TWG meetings, TWG workshop and stakeholders' consultation meeting are shown in sections 4.1 to 4.7.

**4.1 Minutes 1 – Meeting No. 1 (10 June 2005): Kick-Off Meeting of UP-NCTS,
AQMS-EMB-DENR and USAID-USAEP**

Attendance:

Engr. Cesar S. Siador Jr.
Chief, Air Quality Management Section (AQMS), Environmental Management Bureau,
Department of Environment and Natural Resources (DENR-EMB)

Dr. Karl N. Vergel
Head, Transportation and the Environment Group
National Center for Transportation Studies, University of the Philippines (UP-NCTS) and
Project Manager, UPNCTS Foundation Inc.

Manuel Jose D. Camagay
Project Consultant/Technical Advisor
Transportation and the Environment Group
National Center for Transportation Studies, University of the Philippines (UP-NCTS)

Ninette P. Ramirez
Environment Specialist
United States-Asia Environmental Partnership (USAID-USAEP)

Edmundo L. Escubio
Engineer II
Air Quality Management Section (AQMS), Environmental Management Bureau
Department of Environment and Natural Resources (EMB-DENR)

Voltaire L. Acosta
Program Manager, Environment Unit
League of Cities of the Philippines (LCP)

Date: 8 August 2005

Time: 2:00 PM

Venue: Office of the Chief of Air Quality Management Section
Environmental Management Bureau (EMB-DENR)

Agenda:

1. Introduction of the Project to the Stakeholders and Implementing Agency
2. Creation of the Technical Working Group (TWG) and the TWG Joint Secretariat Between
EMB and UP-NCTS
3. Task Assignment

Minutes:

Ms. Ninette P. Ramirez, Environment Specialist of the United States-Asia Environmental Partnership (USAID-USAEP), Manuel Jose D. Camagay (Consultant and Technical Advisor) and Karl N. Vergel of the U.P. National Center for Transportation Studies (UP-NCTS) discussed the project details assisting the Philippine Department of Environment and Natural Resources (DENR) in the Development of Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for Motorcycles and Tricycles with Engr. Cesar S. Siador Jr, Chief of the Air Quality Management Section (AQMS) of the Environmental Management Bureau (DENR-EMB). Engr. Camagay presented the 3-month timetable (June-August 2005) containing the schedule of activities for the Development of Carbon Monoxide (CO) and Hydrocarbon Emission Standards for Motorcycles and Tricycles.

The creation of the Inter-Agency Technical Working Group (TWG) was also discussed and enumerated several agencies that will be included in the TWG. It was also decided to establish a TWG Secretariat at the AQMS-EMB consisting of 4 technical staff. The TWG is expected to consist of 15 persons including the Secretariat.

With respect to the sites of where the emission testing of tricycles will be held, the 3rd District of Quezon City in cooperation with Councilor Dante De Guzman, Makati City and Sta. Maria, Bulacan were initially considered.

The EMB expects that the output of the TWG will be a Department Administrative Order (DAO) updating the current emission standards of motorcycles and tricycles.

The next meeting which will be the first meeting of the TWG was set on June 17 or June 24, 2005.

4.2 Minutes 2 – Meeting No. 2 (24 June 2005): First Meeting of the Inter-Agency Technical Working Group (TWG) for the Development of Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for Motorcycles and Tricycles

Attendance:

Engr. Cesar S. Siador Jr.
Chair, Technical Working Group
Chief, Air Quality Management Section (AQMS), Environmental Management Bureau
Department of Environment and Natural Resources (DENR-EMB)

Dr. Karl N. Vergel
Co-Chair, Technical Working Group
Head, Transportation and the Environment Group
National Center for Transportation Studies, University of the Philippines (UP-NCTS) and
Project Manager, UPNCTS Foundation Inc.

Manuel Jose D. Camagay
Project Consultant/Technical Advisor
Transportation and the Environment Group
National Center for Transportation Studies, University of the Philippines (UP-NCTS)

Ninette P. Ramirez
Environment Specialist
United States-Asia Environmental Partnership (USAID-USAEP)

Ricardo S. Infante
Senior Science Research Specialist
Oil Industry Management Bureau
Department of Energy (DOE)

Blademir L. Mancenido
League of Municipalities of the Philippines (LMP)

Donato S. De la Cruz
Managing Consultant
USAID Energy and Clean Air Program (USAID-ECAP)

Secretariat:

Arturo Bongco, Senior Environment Management Specialist
Jundy T. Del Socorro, Engineer III
Edmundo L. Escubio, Engineer II
Myrna M. Fortu, Science Research Specialist II
Air Quality Management Section (AQMS), Environmental Management Bureau
Department of Environment and Natural Resources (DENR-EMB)

Alorna A. Abao
National Center for Transportation Studies, University of the Philippines (UP-NCTS) and
Technical Assistant, UPNCTS Foundation Inc.

Date: 24 June 2005
Time: 2:00 PM
Venue: Conference Room
Air Quality Management Training Center
Environmental Management Bureau (DENR-EMB)

Agenda:

1. Formal Introduction of the TWG Members
2. Presentation of the Project
3. Presentation of the Last TWG Procedure on Emission Standards (CY 2003)
4. Presentation of Recent Tricycle Researches
5. Planning for the Next Meeting
6. Other Matters

Minutes:

The first meeting of the Inter-Agency Technical Working Group for the Development of Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for Motorcycles and Tricycles was chaired by Engr. Cesar S. Siador, Jr., Chief of the Air Quality Management Section of the Environmental Management Bureau (EMB) of the Department of Environment and Natural Resources (DENR). The meeting started at 2:30 PM. Background information was provided regarding the subject and the members were welcomed to the meeting.

1. Formal Introduction of the TWG Members

The participants introduced themselves and the agencies they were representing. Among the participating agencies are the UP-NCTS, USAID-USAEP, the League of Municipalities of the Philippines, DOE, USAID-ECAP and EMB-DENR. DOTC-LTO, DTI-BPS, DOST-PCIERD and the League of Cities of the Philippines were not able to attend the meeting.

The TWG members were furnished with an advance copy of the draft Special Order constituting the inter-agency technical working group for their comments and information.

2. Presentation of the Project

Ms. Ninette Ramirez of the USAID-USAEP, provided background information on Puerto Princesa City's Clean Air Program focusing on tricycles implemented in 2004. She discussed the components of the project which consisted of 1) public awareness; 2) vehicular traffic management; 3) use of more efficient engines; 4) inspection and enforcement; 5) legislation; and, 6) maintenance.. The Motorcycle Development Program Participants Association (MDPPA) also developed modules on maintenance and assisted the pre- and post-maintenance emission tests.

She also shared the experience of San Fernando City, La Union in the phasing-out of tricycles with two-stroke engine. The modules developed in Puerto Princesa City were also used in this city. She added that the USAID-USAEP had requested MDPPA to develop a proposal to standardize and develop modules on maintenance for local government units.

Thus, the need to provide motor vehicle emission standards on carbon monoxide and hydrocarbon to strengthen the CAA implementation. Assistance was therefore provided by USAID-USAEP to assist the DENR in the review of existing standards for motorcycles and tricycles and recommend the proper approach in setting the emission standards.

Mr. Ricardo Infante of the DOE inquired if there were emissions measurements conducted in the 2 cities. Ms. Ramirez explained that there were emission tests conducted in Puerto Princesa City.

3. Presentation of the Last TWG Procedure on Emission Standards (CY 2003)

Engr. Siador presented the procedure of setting the HC emission standards as conducted by the previous technical working group. The EMB and the MDPPA with members of the TWG, conducted idle emission tests in Metro Manila and summarized the idle emission concentration data consisting of 557 samples and with the help of Dr. Barrios, a statistician, estimated that with 20% that will be affected when the idle HC emission standard of 7, 800 ppm in urban areas is set. For rural areas, a maximum of 10,000 ppm was set as standard taking into consideration the meteorological conditions. He said that there was understanding with the TODA groups that the standards will be applicable for 2 years (2003-2005). He informed the TWG that compared to Asia and Europe, the Philippines has the highest maximum allowable idle emission for CO.

Dr. Donato S. De la Cruz of USAID-ECAP suggested that in coming up with the standards, it is assumed that tricycles should be maintained and recommended the revision of the standards at least after every two years of validity.

Engr. Siador said that another important issue is the harmonization of standards with other Asian countries.

Engr. Del Socorro further explained that the basis of the standards formulated by the DENR-EMB was representatively done based on data from 5-year-old, 10-year-old and 15-year-old vehicles.

4. Presentation of Recent Tricycle Researches

Engr. Manuel Jose D. Camagay presented the summary of recent studies on the tricycles and emphasized the role of UP-NCTS in empowering the DENR to come up with the needed standards.

Engr. Siador suggested that the data collection should reflect the engine type/technology (2-stroke or 4-stroke).

UP-NCTS formally submitted to Engr. Siador the following studies related to tricycles:

- 1) "Development of Engine Performance and Emission Testing Procedures and Sidecar Design Prototype for Tricycles" by Dr. Ricardo G. Sigua, Dr. Karl B. N. Vergel, Dr. Aura C. Matias, Engr. Manuel Jose D. Camagay and Engr. Louis Angelo M. Danao, UP-NCTS Discussion Paper No. 19 (January 2005)
- 2) "Development of Drive Cycle and Emission Models for in-Use Tricycles in Metro Manila" by Engr. Anabel A. Abuzo, Dr. Ricardo G. Sigua and Dr. Karl N. Vergel, Draft Paper for the Philippine Engineering Journal

Mr. Ricardo Infante of the Department of Energy (DOE) asked if the recent emission data collected by UP-NCTS included running or idling tricycles. Engr. Camagay clarified that the recent data were all idle emissions although measurements of emission concentrations have also been conducted while the tricycles were running on-road and on the chassis dynamometer in earlier studies.

5. Planning for the Next Meeting

The fieldwork consisting of tricycle driver interview and tricycle emission test surveys was scheduled on July 8 (Friday), July 11 (Monday) and July 15 (Friday), 2005 in three sites in Quezon City. With respect to the emission testing equipment, UP-NCTS has one unit and another unit is needed.

The EMB will prepare the letter of invitation and letter of request to the MDPPA to participate and to borrow their emission testing equipment to be used for the fieldwork.

6. Other Matters

The draft Special Order constituting the inter-agency technical working group was corrected by the members of the TWG and was finalized.

Meeting was adjourned at 5:30 PM.

ANNEXES

Annex C – Attendance of the First Meeting of the Inter-Agency Technical Working Group

4.3 Minutes 3 – Meeting No. 3 (8 August 2005): Second Meeting of the of the Inter-Agency Technical Working Group (TWG) for the Development of Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for Motorcycles and Tricycles

Attendance:

Engr. Cesar S. Siador Jr.
Chair, Technical Working Group
Chief, Air Quality Management Section (AQMS), Environmental Management Bureau
Department of Environment and Natural Resources (DENR-EMB)

Dr. Karl N. Vergel
Co-Chair, Technical Working Group
Head, Transportation and the Environment Group
National Center for Transportation Studies, University of the Philippines (UP-NCTS) and
Project Manager, UPNCTS Foundation Inc.

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Transportation and the Environment Group
National Center for Transportation Studies, University of the Philippines (UP-NCTS)

Arturo Bongco, Senior Environment Management Specialist
Jundy T. Del Socorro, Engineer III
Edmundo L. Escubio, Engineer II
Air Quality Management Section (AQMS), Environmental Management Bureau
Department of Environment and Natural Resources (DENR-EMB)

Ricardo S. Infante
Senior Science Research Specialist
Oil Industry Management Bureau
Department of Energy (DOE)

Voltaire L. Acosta
Program Manager, Environment Unit
League of Cities of the Philippines (LCP)

Alorna A. Abao
National Center for Transportation Studies, University of the Philippines (UP-NCTS) and
Technical Assistant, UPNCTS Foundation Inc.

Evan Dispo-Emerenciana
Activity Manager-Clean Air
USAID Energy and Clean Air Program (USAID-ECAP)

Date: 8 August 2005

Time: 2:00 PM

Venue: Conference Room
Air Quality Management Training Center
Environmental Management Bureau (DENR-EMB)

Agenda:

1. Updates on the Technical Working Group
2. Presentation of UP-NCTS on the Emission Testing of Tricycles in 3 Urban Areas in Metro Manila and 1 Rural Area Outside Metro Manila
3. Other Matters

Minutes:**1. Updates on the Technical Working Group**

The meeting started at 3:07 PM. The status of the Special Order (SO) for the creation of the TWG was reported by Engr. Siador. He said that the document is currently with the Office of the Secretary. Other updates related to the TWG included clarification that USAID-ECAP will be a cooperating agency in the TWG and the nomination of LTO MVIS staff by Ms. Creus to represent LTO in the TWG.

2. Presentation of UP-NCTS on the Emission Testing of Tricycles in 3 Urban Areas in Metro Manila and 1 Rural Area Outside Metro Manila

On the matter of tricycle emission data collected in the Quezon City and Baras surveys, Mr. Camagay explained that the results will be discussed in the workshop which will be held on 11-12 August 2005. He explained that EMB will be given several approaches and procedures in setting emission standards during the workshop.

3. Other Matters**3.1 Workshop**

Engr. Siador said that signed invitation letters to the workshop will be sent soon and EMB has already sent an invitation letter to MDPPA.

3.2 Schedule of Project

Mr. Camagay explained the revised schedule of the project and inquired if a recommendation can be made by the end of September 2005. Engr. Siador asked if how many more samples are needed and proposed to have a fieldwork on August 22 either in Caloocan or Pasig. He also said that he will draft an Administrative Order for the revised emission standards and then adjust after the workshop and consultation.

3.3 Consultation Meeting

Ms. Emerenciana of USAID-ECAP clarified if there is only one consultation meeting. The USAID-USAEP assistance provides only for one consultation meeting. Engr. Siador asked if there is possibility that USAID-ECAP fund the other consultation meetings in regional centers outside Metro Manila. Ms. Emerenciana replied that a letter of request may be submitted to them. Engr. Siador requested Mr. Escubio to write a proposal to request USAID-ECAP to support a consultation meeting in Cebu.

4.4 Minutes 4 – Meeting No. 4 (16 September 2005): Third Meeting of the Inter-Agency Technical Working Group (TWG) for the Development of Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for Motorcycles and Tricycles

Attendance:

Engr. Cesar S. Siador Jr.
Chair, Technical Working Group
Chief, Air Quality Management Section (AQMS)
Environmental Management Bureau
Department of Environment and Natural Resources (DENR-EMB)

Dr. Karl N. Vergel
Co-Chair, Technical Working Group
Head, Transportation and the Environment Group
National Center for Transportation Studies, University of the Philippines (UP-NCTS) and
Project Manager, UPNCTS Foundation Inc.

Manuel Jose D. Camagay
Project Consultant/Technical Advisor
Transportation and the Environment Group
National Center for Transportation Studies, University of the Philippines (UP-NCTS)

Reynaldo T. Gatchalian
Lemar L. Jimenez
Road Transportation Planning Division
Department of Transportation and Communications

Guests:

Marvin Aquino
Motorcycle Development Program Participants Association/Suzuki Philippines Inc.

Julius G. Argana
Motorcycle Development Program Participants Association/Kawasaki

Secretariat:

Alorna A. Abao
National Center for Transportation Studies, University of the Philippines (UP-NCTS) and
Technical Assistant, UPNCTS Foundation Inc.

Date: 16 September 2005

Time: 2:00 PM

Venue: Conference Room
Air Quality Management Training Center
Environmental Management Bureau (DENR-EMB)

Agenda:

1. Discussion of the results of field testing conducted in 3 urban areas in Metro Manila and 1 rural area
2. Preparation regarding the Public Consultation in the development of standards for motorcycles and tricycles
3. Other matters

Minutes:

1. Introduction

The meeting started at 3:37 PM. Engr. Siador, Chair of the TWG, chaired the meeting and explained to the group that emission standards will be amended. The standard for CO in the Philippines (6.0%) is quite relaxed compared to other countries in Asia such as China where the standard is 4.0% and in India where the standard is 4.5% and the scheduled phase-in implementation of Euro 2 emission standards.

2. Discussion of the Results of Field Testing Conducted in 3 Urban Areas in Metro Manila and 1 Rural Area

Mr. Camagay, technical advisor, presented the results of the tricycle emissions survey conducted in 10 locations in Metro Manila (9 in Quezon City and 1 in Pasig City) and in Baras, Rizal in the period of May to September 2005 as well as data from clean air programs in Puerto Princesa City, San Fernando City and Mandaue City. He also presented the requirements as well as 5 scenarios in setting the emission standards:

Scenario A: Simplified Standards for All Engine Types

Scenario B: Separate Standards for 4-Stroke Engines

Scenario C: Separate Standards for Rural Areas

Scenario D: Separate Standards for Areas and Engine Types

Scenario E: Set Failure Rate to be 20% (India Model)

The presentation materials are shown in Annex D.

Utilizing the emissions data collected from Quezon City, Pasig City, Baras and cities such as Puerto Princesa (Palawan) and San Fernando (La Union), Dr. Vergel of UP-NCTS presented the regression model for HC, comparison of CO emission by engine displacement, comparison of emissions by engine technology and by area and the effect of maintenance on emissions. The presentation materials are shown in Annex E.

Engr. Siador noted that in the survey of the TWG in 2003, 25% failed the HC emission standard of 7,800 ppm and in 2005 it had risen to 34% indicating that there is a problem in the attainment of tricycles.

Mr. Argana of the MDPPA asked what would be the equivalent of 3.5%-4.5% CO by volume in terms of mass-based emission of CO in g/km and commented that the standards that would be set might be too stringent. It was also raised that regular fuel (low RON) is still being sold especially in the provinces.

Mr. Jimenez of the DOTC stressed the need for the accuracy of the emission test procedure for motorcycles especially when done on emission testing centers. Engr. Siador said that adaptors are needed when the probe cannot be fully inserted into the tailpipe.

On the issue of maintenance, Mr. Jimenez suggested to specify maintenance for each type of pollutant and regulate the vehicle registration to ensure that the auto-lube system is working properly to reduce emissions. Mr. Aquino of the MDPPA showed the TWG a sticker that they attach to motorcycles indicating the vehicle emission control information and related specifications and instructions. Engr. Siador informed the group that there is already a Philippine National Standard for lubricants issued by the Department of Energy.

3. Preparation Regarding the Public Consultation in the Development of Standards for Motorcycles and Tricycles

The initial invitation list was shown to the TWG Chair. Engr. Siador said that the invitation to officials will taken cared of by the EMB while the rest will be handled by UP-NCTS. The draft program of the consultation meeting scheduled on September 26, 2005 was also discussed.

The meeting adjourned at 5:50 PM.

ANNEXES

Annex D – Results of Field Testing Conducted in 3 Urban Areas in Metro Manila and 1 Rural Area and Emission Standard Setting

Annex E – Regression Model for HC, Comparison of CO Emission by Displacement, Comparison of Emissions by Engine Type and by Area and Effect of Maintenance on Emission

Annex F – Attendance of the Third Meeting of the Inter-Agency Technical Working Group

4.5 Minutes 5 – Meeting No. 5 (7 October 2005): Fourth Meeting of the Inter-Agency Technical Working Group (TWG) for the Development of Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for Motorcycles and Tricycles

Attendance:

Engr. Cesar S. Siador Jr.
Chair, Technical Working Group
Chief, Air Quality Management Section (AQMS)
Environmental Management Bureau Department of Environment and Natural Resources
(DENR-EMB)

Dr. Karl N. Vergel
Co-Chair, Technical Working Group
Head, Transportation and the Environment Group
National Center for Transportation Studies, University of the Philippines (UP-NCTS) and
Project Manager, UPNCTS Foundation Inc.

Manuel Jose D. Camagay
Project Consultant/Technical Advisor
Transportation and the Environment Group
National Center for Transportation Studies, University of the Philippines (UP-NCTS)

Darwin M. Rosales
Chief Science Research Specialist
Energy, Utilities and Systems Technology Development Division (EUSTDD)
Philippine Council for Industry and Energy Research and Development
Department of Science and Technology (PCIERD-DOST)

Bartolome Augustus O. Sesperes
Motor Vehicle Inspection Station
Land Transportation Office (MVIS-LTO)
Department of Transportation and Communications (DOTC)

Ninette P. Ramirez
Environment Specialist
United States-Asia Environmental Partnership (USAID-USAEP)

Voltaire L. Acosta
Program Manager, Environment Unit
League of Cities of the Philippines (LCP)

Donato S. De la Cruz
Consultant
USAID Energy and Clean Air Program (USAID-ECAP)

Evan Dispo-Emerenciana
Activity Manager-Clean Air
USAID Energy and Clean Air Program (USAID-ECAP)

Secretariat:

Arturo Bongco, Senior Environment Management Specialist
Jundy T. Del Socorro, Engineer III
Edmundo L. Escubio, Engineer II
Myrna M. Fortu, Science Research Specialist II
Raphael C. Miranda
Christopher Ongose
Air Quality Management Section (AQMS), Environmental Management Bureau
Department of Environment and Natural Resources (DENR-EMB)

Alorna A. Abao
National Center for Transportation Studies, University of the Philippines (UP-NCTS) and
Technical Assistant, UPNCTS Foundation Inc.

Guests:

Rolando Cruz
President
Motorcycle Development Program Participants Association (MDPPA)

Alfredo B. Alarcon
Chairman, Technical Committee
Motorcycle Development Program Participants Association (MDPPA)

Romy Calabag
Secretary-General
National Confederation of Tricycle Operators and
Drivers Associations of the Philippines (NACTODAP)

Igmedio Laycano Jr.
Ruth Jimenez
Vice Mayors' League of the Philippines (VMLP)

Marvin Aquino
Motorcycle Development Program Participants Association/Suzuki Philippines Inc.

Julius G. Argana
Motorcycle Development Program Participants Association/Kawasaki

Chris Capistrano
Honda Philippines Inc.

Daisy D. Garcia
Consultant
Asian Development Bank (ADB)

Edgar Ignacio
Office of the Vice Mayor
City of Mandaluyong

Date: 7 October 2005 (Friday)

Time: 2:00 PM

Venue: Seminar Rooms A&B
National Center for Transportation Studies
University of the Philippines, Diliman, Quezon City

Agenda:

1. Review and Finalization of the Proposed Standards in the Development of CO and HC Emission Standards for Motorcycles and Tricycles
2. Other Matters.

Minutes:

The meeting started at 3:25 PM and was presided by the Chair of the TWG, Engr. Cesar S. Siador Jr., Chief of the Air Quality Management Section of the Environmental Management Bureau. Members of the TWG and invited guests introduced themselves in the meeting.

1. Activities of the TWG and Presentation of Emission Standard Setting Procedure

Dr. Karl N. Vergel, Co-Chair of the TWG and Head of Transportation and the Environment Group of UP-NCTS presented the activities of the TWG for the benefit of those who were not able to attend the September 26 Stakeholders' Consultation Meeting. Mr. Manuel Jose D. Camagay, technical advisor from UP-NCTS, presented the emission standard setting procedure and analysis of tricycle emission data with additional slides on the developed regression model of HC emission. Engr. Siador presented the 1995 emissions inventory of the EMB where 87% of the HC emissions and 92% of the CO emissions were attributed to gasoline-fed vehicles. Tricycles ranked third in terms of HC emissions. He also reported that as of 2004, there were 290,000 motorcycles/tricycles registered in Metro Manila according to the LTO data where most of these are three-wheelers.

2. Presentation of the Revised Draft DENR Administrative Order on In-Use Motorcycle Emission Standards

Engr. Siador presented the Draft DAO amending DENR Administrative Order No. 2003-25 and establishing new carbon monoxide (CO) and hydrocarbon (HC) standards for motorcycles (Annex G). Compared to the Draft DAO presented in September 26, emission standards for motorcycles first registered on or after December 31, 2007 are proposed to take effect in 2008, as shown in Table 3.

Table 3. Proposed Emission Standards for Motorcycles in 2006 and 2008

Registration	HC (ppm)	CO (% by volume)
For motorcycles first registered on or before December 31, 2005	4,500	4.5
For motorcycles first registered on or after December 31, 2007	3,500	3.0

3. Open Forum and Discussion on the Proposed In-Use Motorcycle Emission Standards

Mr. Romy Calabag, Secretary-General of NACTODAP, presented the sentiments of the tricycle operators and drivers and were summarized by Ms. Ramirez of USAID-USAEP in terms of 3 major points:

- a) why the government is focusing only on the tricycle;
- b) emission standards are too strict on tricycles; and,
- c) the tricycle operators and drivers groups were not consulted.

Engr. Siador of the EMB replied that the government is also tackling motor vehicles in another technical working group. The CO and HC standards on in-use motor vehicles are stricter than motorcycles and tricycles. He also explained that a procedure for setting of emission standards was developed and data collection has also been conducted and this is the stage where tricycle groups are being consulted on the formulated standards.

Mr. Calabag also raised the problem of the lack of public emission testing centers in Metro Manila and requested that the government help them find solutions to their problems.

Mr. Darwin M. Rosales of DOST-PCIERD asked Mr. Calabag on their membership and the driver's daily income. Mr. Calabag answered that NACTODAP has 2.8 million members and the average lease ("boundary") of the driver for the tricycle is about PhP150 leaving a net income of about PhP150 per day. He also asked the manufacturers on the general trend of sales of motorcycles in the past 5 years. Mr. Alfredo Alarcon of MDPPA informed the group that compared to 5 years ago, the sales of motorcycles for 'solo' use have increased while the sales for tricycle use have decreased. Mr. Rolando Cruz, President of MDPPA, corrected the wrong perception that emission standards for motorcycles are too relaxed compared to motor vehicles. He explained that motor vehicles have higher engine displacements compared to motorcycles and thus emission standards are not directly comparable.

Mr. Cruz of the MDPPA requested that the government seriously implement the standards by implementing the motor vehicle inspection system (MVIS) and then monitor the ambient air quality. After implementation then only targets can be set. Even when standards have already been set, the manufacturers cannot follow in just 3 months. The lead time required is at least 1.5 years since they have to change tooling and design and if not, they will be needing to develop a new model which may require more time.

Dr. Donato S. De la Cruz of USAID-ECAP asked the MDPPA on what would be the emission of a well-maintained tricycle, for example, a tricycle powered by a 125-cc 2-stroke engine. He said that this information will help the TWG a lot in terms of setting the standards.

Dr. Vergel of UP-NCTS explained to Mr. Calabag that the government has several programs for the tricycle such as the DOST-PCIERD-funded basic study on standards for the tricycles and the DTI-BPS Sub-Committee 28 where the tricycle is also being standardized as a vehicle. All of these programs intend to elevate the vehicle standards for the tricycle.

Mr. Calabag of NACTODAP explained that there are many products that reduce emissions and suggested that the government implement these on the tricycles.

Mr. Evan Dispo-Emerenciana of USAID-ECAP asked if the implementation of full maintenance would increase the passing rate to 75%.

Mr. Chris Capistrano of Honda Philippines Inc. recalled that the Philippines was first in the ASEAN region to reduce to 30% tariff for imported vehicles while neighboring countries developed their local automotive industries and at the same time the local industry deteriorated. He emphasized that "3 Es" are important (education, enforcement and engineering). He asked what were the experiences of Asian countries in setting their emission standards. He cautioned that if standards become too strict, prices of motorcycles will go up, demand will drop and consequently manufacturers will close shop. He said that there are about PhP3 billion in investments by motorcycle manufacturers and tax revenues of around PhP1 billion and a direct employment of 15,000 not to mention the related industries.

Ms. Ninette P. Ramirez (USAID-USAEP) explained that there were 6 components of the Puerto Princesa Clean Air Program supported by USAID-USAEP that included education, enforcement and engineering. Mr. Camagay, technical advisor, explained that the tricycle industry is big and that it includes not only tricycle operators and drivers associations and motorcycle manufacturers, but also parts makers, sidecar makers and support industries. He added that there is the 4th "E" which is enactment.

Ms. Daisy Garcia of the Asian Development Bank commented that she could not see the net income of tricycle drivers as a function of emissions since revenue is a function of the number of trips made and expenses as a function of fuel and oil consumption and lease ("boundary") paid by the driver to the operator. She said that the bottomline is that a study was done and there is basis for the setting of the emission standard. Although the main justification would be the carrying capacity of the environment, however, in the absence of data and study on this, targets are set instead and limits are set which do not focus on tricycles only.

Ms. Ramirez summarized the comments and questions made previously as follows: a) how the 4,500 ppm value was arrived at; b) there are also other factors other than emissions that affect net income of tricycle drivers; and, c) a working model exists.

According to Mr. Cruz of the MDPPA, in other countries, it took them at least 5 years to implement emission standards and stated that if 4,500 ppm HC emission standard is implemented, manufacturers will close their factories since motorcycle components imported from Thailand, the standards that they follow there are still at the 10,000 ppm HC level. In response to Ms. Emerenciana's question on why not implement full maintenance, Mr. Cruz replied that it would be engine overhaul which is too costly. He added that if there are limitations in the current engine model, they would need at least 1.5 years to adjust and the lead time for importation is at least 6 months. He also informed the group that the on-going harmonization of automotive standards in the ASEAN region would require Euro 2 standards in 2008 so it would still be too early to implement Euro 2-equivalent standards by 2006.

Mr. Voltaire L. Acosta of the League of Cities of the Philippines (LCP) informed that they already have some programs for tricycles and cited the Puerto Princesa experience where the local government put a cap on the number of franchises for tricycle and the "50-50" scheme where half of the number of tricycles could not go out on certain days of the week that resulted to higher net incomes. He also mentioned that the economic unit of the LCP is now drafting a proposal to convert TODAs into cooperatives.

Mr. Igmedio Laycano Jr. of the Vice Mayors League of the Philippines (VMLP) said that they will study all the materials and data provided to them and will relay to their superiors on the developments and will put into writing their comments on the proposed emission standards.

Ms. Ramirez wrapped up the discussion and said that with respect to the emission standards, it was common to all parties that health effects of pollution are important but this was not done due to complexity of the analysis and modeling process as well as the lack of data. With respect to the issue of time frame of the implementation of the standards, it would be best to put in writing comments and positions of the respective organizations on the proposed standard. Engr. Siador announced that the deadline for the submission of the written comments to the EMB will be within 2 weeks or until October 21, 2005.

The meeting adjourned at 5:40 PM.

ANNEXES

Annex G – Draft Department Administrative Order (DAO) Amending DENR Administrative Order No. 2003-25 and Establishment of New Carbon Monoxide (CO) and Hydrocarbon (HC) Standards for Motorcycles -- October 7, 2005 Version

Annex H – Attendance of the Third Meeting of the Inter-Agency Technical Working Group

4.6 Workshop Minutes: Workshop on the Development of Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for Motorcycles and Tricycles (11-12 August 2005)

Date: August 11 (Thursday) – August 12 (Friday), 2005

Venue: Ciudad Christhia, San Mateo, Rizal

1. Participating Organizations

The 2-day workshop was held at a seminar room of Ciudad Christhia, San Mateo, Rizal on 11-12 August 2005. There were 24 participants to the workshop that included technical staff of the Air Quality Management Section of the Environmental Management Bureau, staff and researchers from UP-NCTS, TWG members from the DOE, DTI-BPS, PCIERD-DOST, LTO-MVIS, League of Cities, USAID-USAEP and USAID-ECAP and other organizations such as the ADB, Quezon City and MDPPA. The program of the workshop (actual proceedings) is shown in Annex I and the photos are shown in Annex J.

2. First Day of the Workshop

On Day 1 (August 11), an overview of urban transportation and the environment and research of UP-NCTS on 2 and 3-wheelers (tricycles) were presented. The Department Administrative Order (DAO) on the 2003 emission standards for motorcycles and tricycles was also discussed by Engr. Siador of the EMB. In the afternoon session, MDPPA compared the 2-stroke and 4-stroke engine technology in detail. Finally, the procedure for the development of the emission standard including profile of emission and other relevant data collected were presented.

The weight of the tricycle sidecar was mainly discussed after the presentation of the various research conducted on tricycles. Engr. Rosales of PCIERD suggested a reduction in the weight of the sidecar since it is the main contributor of load on the motorcycle engine. Aside from weight of the sidecar, the number of passengers contributes to the total load which in turn affects engine speed and emissions. Dr. Vergel of UP-NCTS explained that the research was limited to using the materials (such as galvanized iron) currently being used by sidecar manufacturers and the succeeding research will tackle different types of materials.

After the presentation of MDPPA in the afternoon session, it was clarified that there is no bias to 2-stroke or 4-stroke engine technology. Even if the engine of the tricycle is 2-stroke, it can also pass the stringent standards since the manufacturers can adjust or modify and this is why the industry always need information on the timetable of the implementation of standards. This is to give them lead time to prepare and make adjustments in production. Mr. Acosta of LCP asked the effect of 15 minutes warm up time on the emissions. Mr. Curamen of MDPPA informed the group that the motorcycle engine is air cooled in real-road conditions and engine temperature (oil temperature) must be at least 50 degrees Centigrade before conducting emission tests since colder engines have higher emissions. Engr. Bongco of the EMB asked the effect of engine speed (in rpm) on the engine technology and the comparative power of 2-stroke and 4-stroke engines. Mr. Curamen said that with respect to engine speed, the 2-stroke and 4-stroke engines do not behave differently. With respect to power, the 2-stroke engine has more power for engine sizes of 100cc and below. Comparing a 125-cc 2-stroke engine motorcycle and a 150-cc 4-stroke engine motorcycle, fuel consumption is higher for the 2-stroke engine due to technology and

some unburned fuel and oil. He also observed that some tricycle drivers do not like low speeds during break-in period so they enlarge the rear sprocket which is a wrong practice. A more efficient practice is to decrease the sprocket size at the engine. Mr. Bongco of the EMB asked what happens to the gasoline and lubricant during intake. Mr. Curamen explained that only the fuel is atomized and approximately 1% of the oil is burned, 1% carbonized and the rest becomes part of the exhaust. Mr. Acosta of LCP asked what is the effect of the use of CME-based 2T oil on the tricycle engine. Mr. Curamen replied that it is generally ok since it satisfied JASO standards although there were some issues raised such as lubricity and moisture of oil which has corrosive effect on the engine especially on aluminum casings etc. Ms. Hernandez of BPS-DTI remembered that in one of the meetings she attended that the DOTC plans to phase out 2-stroke tricycles and suggested that it may be good to explain the preceding discussion to the government. Engr. Del Socorro of the EMB asked if there is a gradual phase out in the production of 2-stroke motorcycles. Mr. Bongco observed that recently, manufacturers were getting COCs mostly for 4-stroke models. Mr. Curamen said that 2 years ago there was that trend but now sales of 2-stroke motorcycles are picking up due to the reason that drivers are used to 2-stroke motorcycles. When asked on the impact of implementation of Euro 2, Mr. Curamen said that some models will be affected but manufacturers have their own way to adjust. He also favors a uniform emission standard for 2-stroke and 4-stroke motorcycles.

After the presentation of the emission survey and interview data and the procedure for the development of emission standards by Engr. Camagay, Mr. Acosta suggested the use of normalized indicators such as fuel use per kilometer of travel.

3. Second Day of the Workshop

On Day 2 (August 12), the Clean Air Program of Puerto Princesa as implemented by the USAID-USAEP was presented along with similar on-going programs in San Fernando City, La Union, Calbayog City and Mandaue City. The workshop was also conducted consisting of understanding the emission and related data and using them for policy formulation. The participants were introduced to the nature of the data, preparation of the data for analysis such as descriptive statistical analysis, correlation and regression analysis. The possible approaches for setting emission standards were also discussed.

Ms. Ramirez of USAID-USAEP explained that the clean air programs in various cities had started generating data on emissions from tricycles. She explained that after the study tour in Bangkok joined by Mayor Hagedorn of Puerto Princesa, the Mayor formed a working group consisting of the city planning and development coordinator, city environment and natural resources office, traffic office, legal office and city information office. The launching of the clean air program in Puerto Princesa consisted of commitment signing by all sectors and was marked by a parade of tricycles which passed the emission tests. The program involved the youth, teachers, NGOs, provincial government officials and employees. The MDPPA brought in 10 mechanics and trained TODA representatives consisting of 4 modules on 2-stroke and 4-stroke engine technology and maintenance practice for a duration of 4 months. They also certified program for the trained mechanics dubbed as "Kuya sa Kalsada".

Ms. Garcia of the ADB informed the group that an ADB project for Puerto Princesa on the tricycles will be launched in September 2005 with the objective of not only environmental protection but also poverty reduction and thanked the USAID-USAEP for paving the way through the clean air program where the awareness of stakeholders was raised. She stressed the importance of the commitment of the local government unit. Mr. Acosta added that at least 10% of the cities will implement the clean air program.

Engr. Rosales of PCIERD said that the group might be focusing too much on the tricycles and suggested to do something on the riding public such as the introduction of alternative transport modes such as bicycles, electric bicycles and electric motorcycles. He also suggested to conduct ambient air quality monitoring to pinpoint the sources of air pollution. Engr. Siador of the EMB said that the responsibility of managing the air sheds is with LGUs with DENR as supervisory agency. Ms. Ramirez of USAID-USAEP said that LGUs can make regulations stricter than the national regulations and informed the group that USAEP is now developing the toolkit of the Clean Air Program which will be given to the League of Cities. Ms. Garcia of the ADB said that to complement the activities of the USAID-USAEP, ADB has developed a comprehensive plan and program including noise pollution.

Participants:

Engr. Cesar S. Siador Jr.
Chair, Technical Working Group
Chief, Air Quality Management Section (AQMS), Environmental Management Bureau
Department of Environment and Natural Resources (DENR-EMB)

Arturo Bongco, Senior Environment Management Specialist
Jundy T. Del Socorro, Engineer III
Edmundo L. Escubio, Engineer II
Myrna M. Fortu, Science Research Specialist II
Air Quality Management Section (AQMS), Environmental Management Bureau
Department of Environment and Natural Resources (DENR-EMB)

Dr. Karl N. Vergel
Co-Chair, Technical Working Group
Head, Transportation and the Environment Group
National Center for Transportation Studies, University of the Philippines (UP-NCTS) and
Project Manager, UPNCTS Foundation Inc.

Manuel Jose D. Camagay
Project Consultant/Technical Advisor
Transportation and the Environment Group
National Center for Transportation Studies, University of the Philippines (UP-NCTS)

Ninette P. Ramirez
Environment Specialist
United States-Asia Environmental Partnership (USAID-USAEP)

Alorna A. Abao
National Center for Transportation Studies, University of the Philippines (UP-NCTS)
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Bernadette M. Angeles
Osmundo Velasco
Joseph Vincent C. Bermejo
Erickson Bryan V. Que
National Center for Transportation Studies
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Ricardo S. Infante
Supervising Science Research Specialist
Oil Industry Management Bureau
Department of Energy (DOE)

Evan Dispo-Emerenciana
Activity Manager-Clean Air
USAID Energy and Clean Air Program (USAID-ECAP)

Voltaire L. Acosta
Program Manager, Environment Unit
League of Cities of the Philippines (LCP)

Daisy D. Garcia
Consultant
Asian Development Bank (ADB)

Norma C. Hernandez, Chief
Teresita G. Del Rosario, Trade and Industry Development Specialist
Standards Development Division
Bureau of Product Standards (BPS)
Department of Trade and Industry (DTI)

Bartolome Augustus O. Sesperes
Motor Vehicle Inspection Station
Land Transportation Office (MVIS-LTO)
Department of Transportation and Communications (DOTC)

Darwin M. Rosales
Chief Science Research Specialist
Energy, Utilities and Systems Technology Development Division (EUSTDD)
Philippine Council for Industry and Energy Research and Development
Department of Science and Technology (PCIERD-DOST)

Valentine P. Curamen
Vice Chairman, Technical Committee
Motorcycle Development Program Participants Association (MDPPA)

Merly F. Mancenido, Area Coordinator
Marilyn C. Cardines, District Coordinator
Office of Councilor Dante M. De Guzman, Quezon City

ANNEXES

Annex I – Workshop Program (Actual Time)
Annex J – Photos of the Workshop
Annex K – Workshop Attendance

4.7 Stakeholders' Consultation Meeting Summary: Stakeholders' Consultation Meeting on the Development of Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for Motorcycles and Tricycles (26 September 2005)

Date: 26 September 2005 (Monday)
Time: 2:00-5:00 PM
Venue: Seminar Rooms A&B
National Center for Transportation Studies
University of the Philippines
Diliman, Quezon City

1. Participating Organizations

The stakeholders' consultation meeting was held at Seminar Rooms A&B of the National Center for Transportation Studies (NCTS), University of the Philippines, Diliman, Quezon City on September 26, 2005 (Monday) from 2:30 PM to 5:30 PM. There were 45 participants who attended the consultation meeting from the following 17 organizations and institutions:

- 1) Las Piñas Motorized Federation of Tricycles
- 2) Makati Tricycle Federation (MATRIFED)
- 3) Pasay Mutual Benefit Operators' TODA (PAMBOTODA)
- 4) Loyola Heights Tricycle Operators and Drivers Association (LHTODA)
- 5) TLSTODA
- 6) Quezon City Tricycle Regulation Unit (Quezon City TRU)
- 7) Caloocan City Tricycle and Pedicab Regulatory Service (Caloocan City TPRS)
- 8) Motorcycle Development Program Participants Association (MDPPA)
- 9) Pasig City Environment and Natural Resources Office (Pasig CENRO)
- 10) Asian Institute of Petroleum Studies Inc. (AIPSI)
- 11) Miriam College Environmental Studies Institute (MC-ESI)
- 12) Board of Investments (BOI)
- 13) Asian Development Bank (ADB)
- 14) Chemrez Inc.
- 15) Enviroguard
- 16) Colorado State University (CSU)
- 17) Envirofit International, Inc.

The meeting was also attended by members of the Inter-Agency Technical Working Group (TWG) from the Philippine Council for Industry and Energy Research and Development (DOST-PCIERD), League of Municipalities of the Philippines (LMP), Department of Energy (DOE) and the Department of Transportation and Communications (DOTC) supported by the TWG Secretariat consisting of staff of the Air Quality Management Section (AQMS) of the Environmental Management Bureau (DENR-EMB) as well as staff of the National Center for Transportation Studies of the University of the Philippines (UP-NCTS) and the United States Agency for International Development (USAID) and the USAID United States-Asia Environmental Partnership (USAID-US-AEP). The Stakeholders' Consultation Meeting Program (Actual Time) is shown in Annex L and the attendance is shown in Annex Q.

2. Welcome Remarks and Introduction to the Project

2.1 Welcome Remarks

On behalf of Atty. Lolibeth R. Medrano, OIC Director of the Environmental Management Bureau, the Assistant Director, Atty. Fernandino Y. Concepcion, delivered the welcome remarks. He said that the challenge is the implementation of the emission standards. Compared to soil and water pollution, it is more difficult to tackle air pollution problems.

2.2 Overview of Technical Assistance from USAID-USAEP

Ms. Mary Joy A. Jochico, Country Program Manager of USAID, explained the Clean Air Program (CAP) implemented by the USAID-USAEP in Puerto Princesa City (Palawan) and San Fernando City (La Union) as well as other activities related to clean air such as the awareness raising by the Environmental Broadcasters' Circle (EBC) and the newly-initiated Energy and Clean Air Program (USAID-ECAP) with the purpose of assisting local governments in enforcing the standards in terms of formulation of local ordinances and institutionalization of supporting programs.

2.3 Introduction of the Project and the Inter-Agency Technical Working Group

Engr. Cesar S. Siador Jr., Chief of the Air Quality Management Section of the Environmental Management Bureau (DENR-EMB) and Chair of the Inter-Agency Technical Working Group on the Development of Carbon Monoxide and Hydrocarbon Emission Standards for Motorcycles and Tricycles, explained the nature of the project and recalled the clean air activities in Puerto Princesa City. He also enumerated the agencies involved in the Inter-Agency Technical Working Group.

3. Activities of the Inter-Agency Technical Working Group

Dr. Karl N. Vergel, the Inter-Agency Technical Working Group on the Development of Carbon Monoxide and Hydrocarbon Emission Standards for Motorcycles and Tricycles, Project Manager for U.P. National Center for Transportation Studies Foundation Inc. and Head of the Transportation and the Environment Group, National Center for Transportation Studies, University of the Philippines (UP-NCTS), presented the 2003 emission standards for motorcycles and tricycles and introduced the activities of the Inter-Agency Technical Working Group (TWG) such as TWG meetings and workshop on standards development as well as the surveys on tricycle drivers and tricycle emissions conducted in Quezon City, Pasig City and Baras, Rizal in June-September 2005. The presentation slides are shown in Annex M.

4. Emission Standard-Setting Procedure and Discussion of Tricycle Survey Results

Manuel Jose D. Camagay, Technical Advisor/Consultant and staff of the Transportation and the Environment Group, National Center for Transportation Studies, University of the Philippines (UP-NCTS), presented the procedure for the setting of the emission standards, level of attainment of tricycles with existing CO and HC emission standards in Metro Manila (Quezon City and Pasig City) and Mandaue City representing the urban areas and Baras, Rizal representing the rural area. He also presented the HC and CO compliance rates for varying emission standards regardless of the area whether it is urban or rural. He also presented two ways of setting emission standards:

- a) set the target emission standard and check the percentage of impact (or failure); and,
- b) set the percentage of impact (or failure) and check the emission standard.

Five scenarios of emission standards (Scenarios A to E) were presented to the stakeholders:

Scenario A: Simplified Standards for All Engine Types

Scenario B: Separate Standards for 4-Stroke Engines

Scenario C: Separate Standards for Rural Areas

Scenario D: Separate Standards for Areas and Engine Types

Scenario E: Set Failure Rate to be 20% (India Model)

Finally, it was recommended that it would be ideal to have a single value of the emission standards for 2 and 4-stroke engines and for rural and urban areas. The presentation slides are shown in Annex N.

5. Presentation of the Draft Department Administrative Order (DAO) on the Carbon Monoxide and Hydrocarbon Emission Standards for Motorcycles and Tricycles

Engr. Siador presented the draft DENR Department Administrative Order Amending DENR DAO 2003-25 and Establishment of New Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for Motorcycles where the following new emission standards are proposed to be implemented starting January 1, 2006:

HC 4,500 ppm
CO 4.5% by volume

The proposed standards shall cover all in-use motorcycles with 2-stroke and 4-stroke engines and shall apply in urban and rural areas. The Draft DAO is shown in Annex P.

It was based on the harmonization with emission standards for two-wheelers and three-wheelers in Asia (Annex O) and on the analysis of tricycle emissions survey data in Metro Manila, Mandaue City, Puerto Princesa City and San Fernando City.

6. Open Forum

The forum was moderated by Ms. Ramirez of the USAID-USAEP.

Ms. Oliva of Miriam College ESI clarified if it is true that around 72% will fail the proposed 4,500-ppm standard for HC based on the tricycle emission survey data and asked the EMB if it has a program to address this matter. Mr. Camagay (Technical Advisor) replied that if the drivers and operators would maintain their tricycles, the compliance rate with the emission standards would increase and the failure rate would be much lower than 72% which is based on the current situation where there is no regular maintenance. Engr. Siador of the EMB added that not only the DENR but other agencies such as DOE and DOST are working together with them in the use of cleaner and alternative fuels and gave the example that the Bureau is helping in the CME biodiesel program. Dr. Vergel of UP-NCTS explained that the failure rate will be 25% if the 4,500 ppm HC standard is implemented which is the difference of the failure rate (with maintenance) at 4,500 ppm level and the failure rate at 7,800 ppm level.

Mr. Cruz of MDPPA said that the setting of emission standards can be appreciated more if there is an emissions inventory especially indicating the share of emissions from tricycles so that

impacts can be understood. Engr. Siador answered that the EMB has conducted source emissions inventory for 3 times including mobile sources which were classified by type of vehicle. It was concluded that 70% of the came from motor vehicles where 16% of the emissions came from motorcycles/tricycles. Mr. Cruz suggested that emission standards must be discussed thoroughly followed by a period of education campaign.

Mr. Bautista of the Las Piñas Motorized Federation of Tricycles informed the group that they have 6,000 tricycles where 90% are powered by 2-stroke engines. He asked if all in-use tricycles could comply with the proposed emission standards. He also asked the MDPPA and the EMB on what would be the impact on the livelihood of the tricycle drivers of the implementation of the standards and if proper maintenance is enough. He also asked if rules had already been enforced on the use of recycled oil as lubricant for 2-stroke tricycles and if the existing lubricants in the market could comply with the standards. They have already realized the problem and they would like to know more about the solutions available to the tricycle sector. Engr. Siador replied that the DOE had already set the standards for the 2T oil and explained that the existing emission standards do not fit with the current conditions of the air environment. He said that 35% reduction in HC emission can be achieved if proper maintenance is conducted. He also said that the EMB will conduct information dissemination campaign on the solutions.

Mr. Alarcon of MDPPA explained that the failure rate would be from 72% to around 15% for the scenario of total maintenance and clarified that what was done in the clean air program in Puerto Princesa City was partial maintenance. There will be a lower failure rate if total maintenance can be implemented but this comes with cost for the drivers and operators.

Mr. Camagay said that there is still a need to fill in the information gap among TODAs, Tricycle Regulation Units (TRUs) and the MDPPA.

On the issue of tricycle standards, Mr. Rosales of DOST-PCIERD gave an example that 10 non-compliant tricycles are equivalent to 100 compliant tricycles in terms of overall ambient air quality.

Mr. Rivera of Enviroguard Inc. asked the government position on the private emission testing centers (PETCs) with respect to equipment performance. Mr. Gatchalian of the DOTC replied that the monitoring of the calibration of the equipment is being done by the DOTC with the inter-agency committee.

Ms. Ramirez wrapped up the discussion and formally closed the open forum. It was agreed that the emission standards will be finalized in the next TWG meeting which will include the manufacturers and the tricycle operators and drivers associations.

7. Presentation of Direct Injection Retrofit Technology for Two-Stroke Engines

Dr. Brian Wilson of the Colorado State University and Envirofit Inc. presented the technology that their group developed on direct injection retrofit for 2-stroke tricycles. They have conducted engine and emission tests on the dynamometer and road tests and have proven significant reductions in HC and CO emissions and improvements in fuel economy. Their group is planning to pilot test the technology in Vigan City, Ilocos Sur. At the initial stage, the cost of the retrofit is around 15,000 pesos and this may go down as the number of retrofits increases. They estimated a 1-year payback period considering the local drive cycle and fuel savings.

ANNEXES

Annex L – Stakeholders' Consultation Meeting Program (Actual Time)

Annex M – Activities of the Inter-Agency Technical Working Group (Presentation Slides)

Annex N – Emission Standard Setting Procedure and Discussion of Tricycle Survey Results
(Presentation Slides)

Annex O – Motorcycle Emission Standards in Asia

Annex P – Draft Department Administrative Order (DAO) Amending DENR Administrative
Order No. 2003-25 and Establishment of New Carbon Monoxide (CO) and
Hydrocarbon (HC) Standards for Motorcycles – September 26, 2005

Annex Q – Stakeholders' Consultation Meeting Attendance

Annex A – DENR Special Order 2005-787
Signed by
Secretary Michael T. Defensor

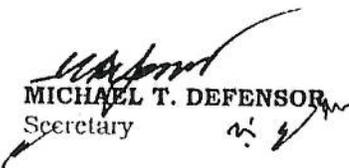
The Technical Working Group shall have the following functions:

1. Review and update existing emission standards and establish new carbon monoxide (CO) and Hydrocarbon (HC) emission standards for tricycles and motorcycles consistent with the provisions of RA 8749 and DAO 2000-81.
2. Preparation of DAO on the implementation of the new emission standards for tricycle/motorcycle.

The Committee, in establishing emission standards for tricycles and motorcycles, shall ensure that the process is participatory and will take into consideration the possibility of harmonizing national standards with international standards.

As such, the attendance of the Committee members to the meetings regarding this matter shall be on official time and all expenses that shall be incurred by them in the discharge of their functions shall be charged against the budget of their respective agencies/institutions.

This order shall take effect immediately and shall remain valid until the new emission standards for motorcycles and tricycles are established.


MICHAEL T. DEFENSOR
Secretary



Annex B – Tricycle Survey Questionnaire

**INTER-AGENCY TECHNICAL WORKING GROUP
DEVELOPMENT OF CARBON MONOXIDE (CO) AND HYDROCARBON (HC)
EMISSION STANDARDS FOR MOTORCYCLES AND TRICYCLES**

A USAID Funded Project



UP-NCTS



EMB-DENR



USAID
FROM THE AMERICAN PEOPLE

USAID

Ang Environmental Management Bureau ng Department of Environment and Natural Resources at National Center for Transportation Studies sa University of the Philippines, sa pakikipagtulungan ng Motorcycle Development Program Participants Association (MDPPA) at ni Hon. Dante M. De Guzman, Councilor, 3rd District Quezon City ay gumagawa ng pag-aaral tungkol sa exhaust emissions ng motorsiklo at traysikel. Kaugnay dito, magsasagawa po kami ng emission testing sa iba't ibang lugar. Ang inyong kooperasyon ay malaki po ang maitutulong sa industriya ng traysikel. Maraming salamat po.

SURVEYOR'S NAME	DAY / DATE	CONTROL NO.
		TWG-00-

A. TRICYCLE CHARACTERISTICS

ALL SHADED BOX HEADING PLS PUT CHECK IF APPLICABLE

CITY / MUNCL / TOWN	TODA NAME	PLATE NO.	BODY NO.	VEHICLE AGE

BRAND & MODEL	2-ST	4-ST	DISPLCMT	YEAR REGST'D	SILENCER		
					OK	NOT OK	NONE

B. OPERATIONAL CHARACTERISTICS

FUEL BRAND	FUEL GRADE	DAILY FUEL USED (lit.)	2T OIL BRAND	DAILY 2T OIL USED (lit.)	AUTOLUBE		MILEAGE READING (ODOMETER)
					FUNC-TIONAL	MIX IN TANK	

MAINTENANCE FREQUENCY						MAINT. COST	OIL CHANGE FREQ.	COST OIL CHANGE
WKLY	1X / MO	2X / MO.	QRTL	6 MOS.	1 YE AR	OTHER S	P	P

TYPE OF OPERATION	TAXI-LIKE	HUB & SPOKE	POINT-TO-POINT

NOTES: - 1 Trip means from origin to destination (a roundtrip means two trips)
- Daily Income means the total take home pay after the expenses
- Last Test / Maintenance means latest emission test or maintenance performed

	DAILY AVE. TRIPS	AVERAGE DISTANCE PER TRIP (KMS)	AVERAGE FARE PER TRIP (P)	CONCRETE / CEMENT	ASPHALT	ROUGH / DIRT ROAD
WEEK DAY						
WEEK END						

a. DO YOU ROAM AROUND IN LOOKING FOR PASSENGERS? YES NO

b. IF YES, WHAT IS THE AVERAGE ROVING TIME BEFORE GETTING A PASSENGER? _____

c. HOW OFTEN DO YOU EXPERIENCE THIS IN A DAY? _____

d. IF NOT SUCCESSFUL IN a., DO YOU GO BACK TO TERMINAL? _____

e. IF YES, AFTER HOW MANY MINUTES? YES NO

C. RESPONDENT'S CHARACTERISTICS (DRIVER / OPERATOR)

DRIVER	OPERATOR	AGE	NO. OF DEPENDENTS

AVERAGE DAILY HOURS WORK	NO. WORKING DAYS PER WEEK	DAILY INCOME (TAKE HOME PAY)	TOTAL FAMILY INCOME

D. EMISSION DATA (IDLE)

GAS	TEST 1	TEST 2	LAST EMISSION TEST / OR MAINTENANCE	REMARKS
HC(ppm)				
CO(%)				
WHITE SMOKE				

E. EMISSION STANDARDS (IDLE)

	TIMELINE	VALUE
CARBON MOMOXIDE (CO)	REGISTERED <i>BEFORE</i> JANUARY 2003	6.0%
	REGISTERED <i>FROM</i> JANUARY 2003	4.5%
HYDRO CARBON (HC)	URBAN AREA, starting June 2003	7,800ppm
	RURAL, starting June 2003	10,000ppm

NOTES: - Displacement means engine size (e.g. 125cc, 175cc, 110cc, 200cc...)
- Brand means Kawasaki, Honda, Yamaha, Suzuki, Lifan, Kymco, etc.
- Model means HDIII, HDII, HD-140, HDX, RS100, RXT135, X3, X4, BARAKO, SAMURAI
1. Point - to - Point: only 1 fixed route
2. Taxi-like: no terminal, roam-around operation, route is anywhere.
3. Hub & Spoke: 1 central terminal, many different routes, combination of 1 & 2.

**Annex C – Attendance of the First Meeting of
the Inter-Agency
Technical Working Group**

1st Technical Working Group (TWG) Meeting for the
 Development of Carbon Monoxide and Hydrocarbon Emission Standards
 for Motorcycles and Tricycles
 A US-AEP / USAID Assisted Project
 24 June 2005 / 2:00 PM

Committee Members:

	AGENCY / INSTITUTION	REPRESENTATIVE	CONTACT NUMBER/S	EMAIL ADDRESS	SIGNATURE
1	EMB - AQMS	Engr. Cesar A. Siador, Jr.	728-1185		
2	UP-NCTS	Dr. Karl N. Vergel	928-8305	karl.vergel@up.edu.ph	
3	UP-NCTS	Alorna A. Abao	9204403	alorna.abao@up.edu.ph	
4	UP-NCTS	Manuel J. D. Camagay	925-8305	mdcamagay@gmail.com	
5	US-AEP / USAID	Ms. Ninette P. Ramirez	216-6576 to 78	npramirez@me.com	
6	League of Cities (LCP)	Engr. Voltaire L. Acosta			
7	DOTC-LTO				
8	DTI-BPS				
9	DOST-PCIERD				
10	League of Municipalities (LMP)	BLADEMIR L. MANCENIDO	9135737/38	bladylm@yahoo.com	
11	DOE	Ricardo S. La Fuente	840-2155	ricardofl@up.edu.ph	
12	ECAP / USAID	DONATO S. DE LA CRUZ	914-1106608	natote.lacruz@yahoo.com	
13					
14	EMB - AQMS	EDMUNDO L. ESCUBIO	928-11-85		
15	EMB - AQMS	Myrna Fortu	928-1185	myrnafortu@yahoo.com	
16	EMB - AQMS	DEL CONJUNTO	928-1185		
17					
18					
19					
20					

**Annex D – Results of Field Testing Conducted
in 3 Urban Areas in Metro Manila
and 1 Rural Area and
Emission Standard Setting**

DEVELOPMENT OF HYDROCARBON (HC) and CARBON MONOXIDE (CO)
EMISSION STANDARDS FOR MOTORCYCLES and TRICYCLES



Results of Field Testing Conducted in 3 Urban Areas in Metro Manila and 1 Rural Area and Emission Standard Setting

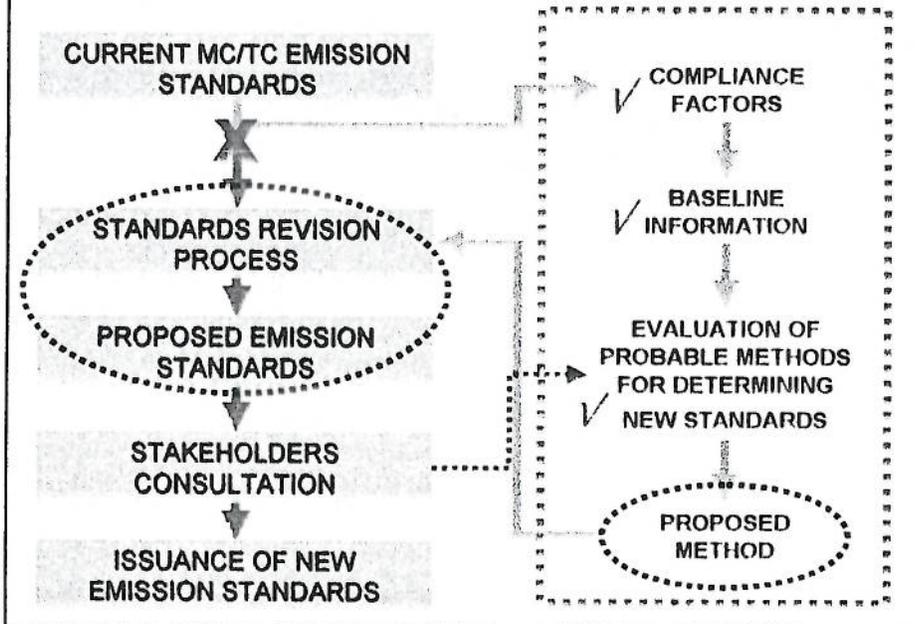
TECHNICAL WORKING GROUP MEETING

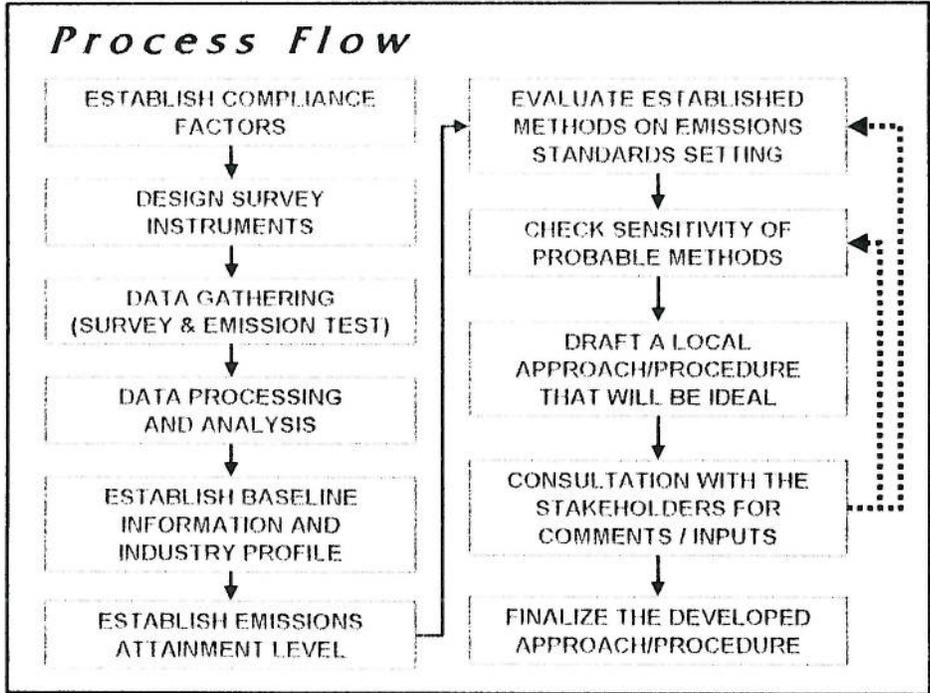
16 September 2005

Supported by:



Conceptual Procedure

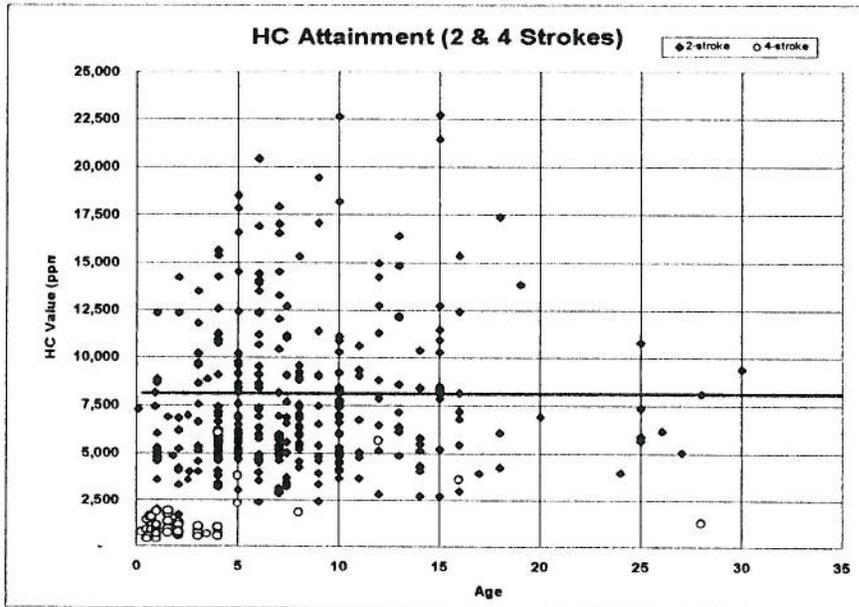




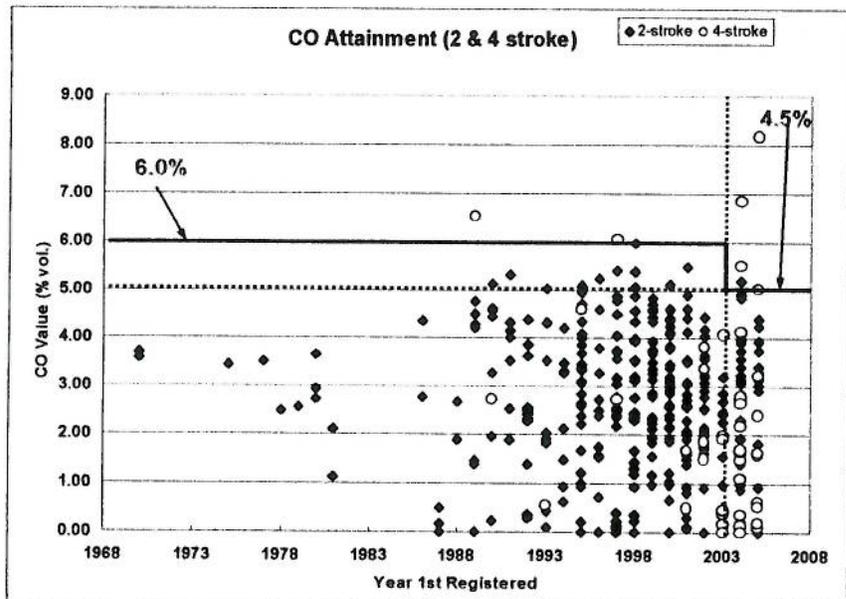
5 Major Survey Areas

Area	Samples	%
NCR (10 sites)	373	71%
Puerto Princesa City	43	8 %
Sn. Fernando, La Union	29	6 %
Mandaue	22	4 %
Sub-total	467	
Baras, Rizal	52	10 %
Total	519	

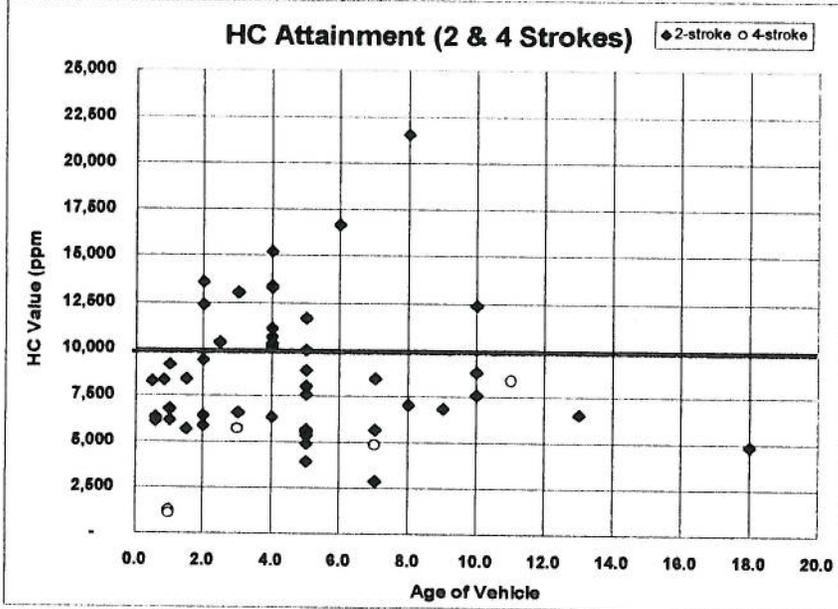
NCR + Mandaue (Urban)



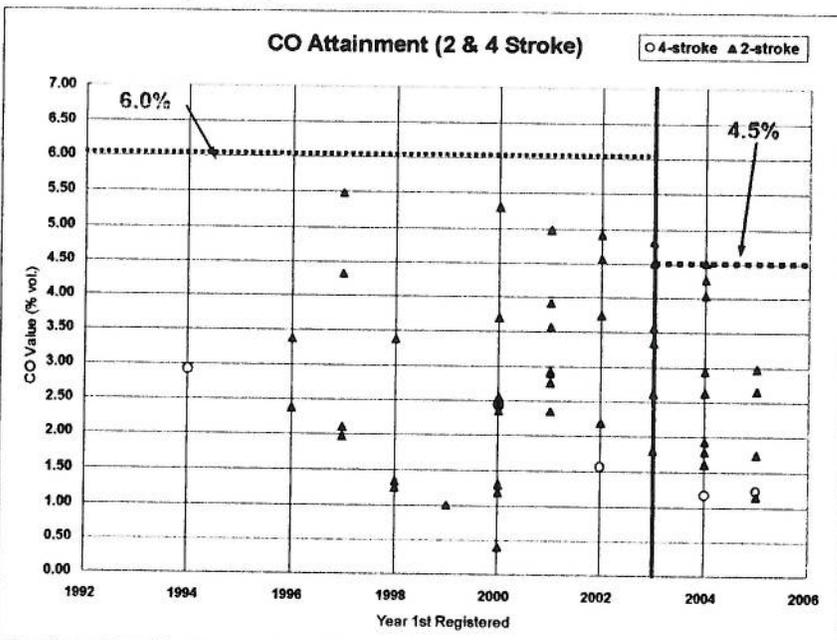
NCR + Mandaue (Urban)



Baras, Rizal (Rural)



Baras, Rizal (Rural)



Data Summary

Range	%	F
<1000	11.9%	62
1000-1999	4.8%	25
2000-2999	3.4%	18
3000-3999	5.0%	26
4000-4999	10.3%	54
5000-5999	12.8%	67
6000-6999	12.6%	66
>7,800	39.1%	204
	100.0%	522

Possible Target HC vs. Failure Rates

1,500	85.2%	445
2,500	81.2%	424
3,500	77.2%	403
4,500	71.8%	375
5,500	58.6%	306
6,500	45.0%	235
7,800	33.7%	176

Current Emission Standards for
2-stroke and 4-Stroke Motorcycle
Engines

CO (% vol.)		HC (ppm)	
1 st Regist'd Pre 2003	1 st Regist'd after 2003	Urban	Rural
6.0	4.5	7,800	10,000

What should the new standards be?

The new standards should be:

- *more stringent* – because the 2003 standards are relaxed due to absence of enough basis for justification;
- *simple* – in order to be understood easily achieve higher compliance rate
- *appropriate* with the current local attainment

Scenario A: Simplified Standards for All Engine Types

Simplified standards for both 2-stroke and 4-stroke motorcycle/tricycles means one (1) standard for each type of engine.

Coverage	CO (% vol.)	HC(ppm)
2-stroke and 4-stroke	4.5% vol.	7,800ppm

Values shall be finalized later

Rationale:

Both emission limits (above) are satisfied to a safe level in all the areas surveyed.

Estimated % Impact	CO	HC
	12%	32%

Pasig & Mandaue data excluded.

Scenario B: Separate Standards for 4-Stroke Engines

Separate standards means one (1) set of standards for 2-stroke engines (*same for urban & rural*) and a different set of standards for 4-stroke engines. Pasig & Mandaue data excluded.

Coverage	CO (% vol.)	HC(ppm)
2-stroke	4.5% vol.	7,800ppm
4-stroke	3.5% vol.	5,000ppm

Rationale:

Values shall be finalized later

4-stroke engines are approximately 79% and 16% lower in HC and CO, respectively. It is safe to follow a higher standard.

Estimated % Impact	CO		HC	
	2-Stroke	4-Stroke	2-Stroke	4-Stroke
	10%	17%	37%	0

Scenario C: Separate standards for Rural Areas

Common standards for 2 & 4 – stroke engine but separate limits for urban and rural areas. Pasig & Mandaue data excluded.

Coverage	CO (% vol.)		HC(ppm)	
	Urban	Rural	Urban	Rural
2-stroke and 4-stroke	4.5	3.5	5,000	7,000

Rationale:

Values shall be finalized later

Both emission limits (above) are satisfied to a safe level in all the areas surveyed.

Estimated % Impact	CO		HC	
	Urban	Rural	Urban	Rural
	10%	1%	37%	53%

Scenario D: Separate Standards for Areas & Engine Types

Specific standards for urban and rural areas vis-à-vis 2-stroke and 4-stroke engines in consideration of inadequate testing facilities in the rural areas.

Coverage	CO (% vol.)		HC(ppm)	
	Urban	Rural	Urban	Rural
2-stroke	3.5	4.5	7,800	10,000
4-stroke	3.0	4.0	5,000	7,000

Pas g & Mandaue data excluded.

Values shall be finalized later

Estimated % impact	CO		HC	
	Urban	Rural	Urban	Rural
2-stroke	10%	1%	37%	53%
4-stroke				

Scenario E: Set Failure Rate to be 20% (India Model)

Direct setting of estimated % impact translates into standards

Applied to Scenario A	Coverage	CO (% vol.)		HC(ppm)	
	2-stroke and 4-stroke	4.08		10,110	
Applied to Scenario B	Coverage	CO (% vol.)		HC(ppm)	
	2-stroke	4.06		10,800	
	4-stroke	3.94		1,600	
Applied to Scenario C	Coverage	CO (% vol.)		HC(ppm)	
	2-stroke & 4-stroke	Urban	Rural	Urban	Rural
		4.12	4.03	10,200	11,060
Applied to Scenario D	Coverage	CO (% vol.)		HC(ppm)	
	2-stroke	Urban	Rural	Urban	Rural
		4.06	4.26	10,800	11,640
	4-stroke	4.09	2.92	1,566	8,330

Effect: Too relaxed on HC, more stringent on CO.

Ideal Scenario: Single Standard

CO (% vol.)

HC (ppm)

**Annex E – Regression Model for HC,
Comparison of CO Emission
by Displacement,
Comparison of Emissions by
Engine Type and by Area and
Effect of Maintenance on Emission**

Regression Model for HC, Comparison of CO Emission by Displacement, Comparison of Emissions by Engine Type and by Area and Effect of Maintenance on Emissions

3rd Meeting of the Inter-Agency Technical Working Group on the Development of Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for Motorcycles and Tricycles

16 September 2005 (Friday), 2:00 PM
Air Quality Management Training Center (AQMTC) Conference Room

U.P. National Center for Transportation Studies Foundation Inc. (UP-NCTSFI)
for
Environmental Management Bureau (EMB)
Department of Environment and Natural Resources (DENR)

Funded by: United States Agency for International Development (USAID)
United States-Asia Environmental Partnership (USAEP)

1

Multiple Linear Regression Analysis
– Using 2005 Quezon City Tricycle Emission and Interview Data

N = 323 samples (286 two-stroke tricycles; 37 four-stroke tricycles)
 $r^2 = 0.6228$

Resulting regression model:

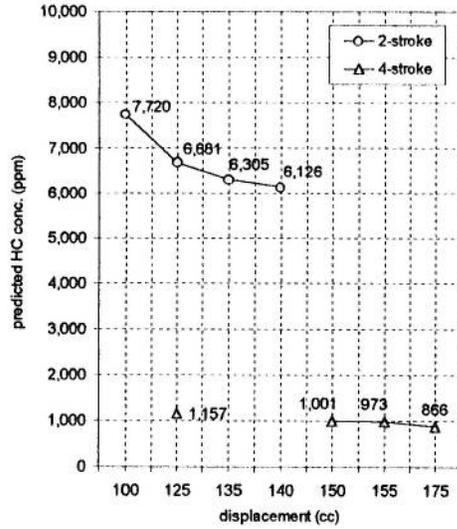
$$\ln(\text{HC}) = 9.5300 - 1.7535 * \text{ENGINE} - 0.0058 * \text{DISP}$$

where: HC = idle HC emission, ppm
ENGINE = type of engine: 0 (2-stroke), 1 (4-stroke)
DISP = engine displacement, cc

- type of engine and engine displacement are the significant factors that affect HC emissions
- regression model with CO as dependent variable → low correlation

2

Prediction of HC Emission Using Regression Model



- tricycles with 2-stroke engines have higher idle HC emissions than those with 4-stroke engines
- idle HC emissions decrease with the increase in engine displacement regardless of other factors such as frequency of maintenance and fuel-oil mix ratio

3

Comparison of Idle CO Emissions of 2-Stroke Tricycles by Engine Displacement – Quezon City 2005 Data

displacement	100cc	125 cc	140cc
mean CO (%)	3.19	2.54	2.40
standard dev.	1.27	1.25	1.27
N	132	125	4

- idle CO emission of 2-stroke tricycles with 100 cc displacement is significantly higher than those with 125 cc displacement
- few samples of tricycles with higher engine displacement were obtained

4

Comparison of Mean Idle Emissions –Quezon City 2005 Data

	2-stroke tricycle (N=286)	4-stroke tricycle (N=37)	Comparison (2-stroke vs. 4-stroke) at 5%
mean HC (ppm)	8,018	1,284	significantly different
mean CO (%)	2.89	2.51	no significant difference

- idle HC emissions are significantly different between 2-stroke and 4-stroke tricycles while idle CO emissions are not significantly different in urban area

5

Comparison of Mean Idle Emissions –Baras, Rizal 2005 Data

	2-stroke tricycle (N=49)	4-stroke tricycle (N=3)	Comparison (2-stroke vs. 4-stroke) at 5%
mean HC (ppm)	8,710	2,349	significantly different
mean CO (%)	2.89	1.61	no significant difference

- idle HC emissions of 2-stroke and 4-stroke tricycles are significantly different while idle CO emissions are not significantly different in a rural area
→ similar to the observation in an urban area (Quezon City)
- 2-stroke tricycles have higher idle HC emissions than emissions from 4-stroke tricycles while they do not differ with respect to idle CO emissions in urban and rural areas

6

**Comparison of Idle Emissions of 2-Stroke Tricycles
in Urban and Rural Areas**

	Quezon City (N=286)	Baras, Rizal (N=49)	Pasig City (N=50)	QC vs. Baras at 5%	Pasig vs. Baras at 5%
mean HC (ppm)	8,018	8,710	6,460	no significant difference	significantly different
mean CO (%)	2.89	2.89	2.40	no significant difference	significantly different

**Comparison of Idle Emissions of 4-Stroke Tricycles
in Urban and Rural Areas**

	Quezon City (N=37)	Baras, Rizal (N=3)	Pasig City (N=3)	QC vs. Baras at 5%	Pasig vs. Baras at 5%
mean HC (ppm)	1,284	2,349	2,987	no significant difference	no significant difference
mean CO (%)	2.51	1.61	1.38	no significant difference	no significant difference

7

**Comparison of Idle Emissions of Tricycles
in Urban and Rural Areas (2005 Data)**

- there is no significant difference in the idle HC and CO emissions of tricycles in Quezon City and Baras, Rizal
 - significantly lower idle HC and CO emissions of 2-stroke tricycles in Pasig City compared to Quezon City and Baras
 - no significant difference in idle HC and CO emissions of 4-stroke tricycles in Pasig City compared to Quezon City and Baras
- no significant difference in idle emissions of tricycles in urban and rural area
- it is possible to set the same emission standards in urban and rural areas

8

Effect of Maintenance on Idle Emissions

San Fernando City, La Union (Selected 2005 Emission Data)

	Pre-Maintenance		Post-Maintenance	
	2-stroke (N=6)	4-stroke (N=22)	2-stroke (N=6)	4-stroke (N=22)
mean HC (ppm)	9,510	910	9,483	732
mean CO (%)	3.37	3.48	3.31	1.73

	Percentage of Tricycles With Emission Reduction		Mean Idle Emission Reduction	
	2-stroke	4-stroke	2-stroke	4-stroke
HC (ppm)	33%	64%	0.24%	30%
CO (%)	83%	73%	0.87%	395%

9

Effect of Maintenance on Idle Emissions

Puerto Princesa City, Palawan (Selected 2004 Emission Data)

	Pre-Maintenance		Post-Maintenance	
	2-stroke (N=20)	4-stroke (N=23)	2-stroke (N=20)	4-stroke (N=23)
mean HC (ppm)	9,108	1,088	7,524	736
mean CO (%)	2.53	2.62	2.18	2.29

	Percentage of Tricycles With Emission Reduction		Mean Idle Emission Reduction	
	2-stroke	4-stroke	2-stroke	4-stroke
HC (ppm)	70%	65%	0.8%	9.1%
CO (%)	75%	74%	-2.9%	3.4%

10



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**Stakeholders' Consultation Meeting on the
Development of Carbon Monoxide (CO) and Hydrocarbon (HC)
Emission Standards for Motorcycles and Tricycles**

26 September 2005 (Monday)

**Seminar Rooms A&B, National Center for Transportation Studies
University of the Philippines, Diliman, Quezon City**

Environmental Management Bureau
Department of Environment and Natural Resources
(DENR-EMB)

in cooperation with the

National Center for Transportation Studies, University of the Philippines (UP-NCTS)
through the U.P. National Center for Transportation Studies Foundation Inc. (UPNCTSFI)

Supported by:

United States Agency for International Development
United States-Asia Environmental Partnership (USAID-USAEP)

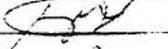
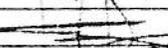
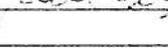
STAKEHOLDERS' CONSULTATION MEETING PROGRAM (ACTUAL TIME)

1:30 PM	Registration	
2:30 PM	Introduction	Manuel Jose D. Camagay Transportation & Environment Group NCTS, UP Diliman Technical Advisor
2:34 PM	Welcome Remarks	Atty. Bernardino Assistant Director, DENR-EMB
	Overview of Technical Assistance from USAID-USAEP	Ms. Mary Joy A. Jochico Country Program Manager, USAID
2:48 PM	Introduction of the Project and the Inter-Agency Technical Working Group	Engr. Cesar S. Siador Jr. Chief, AQMS, DENR-EMB Chair, TWG
3:04 PM	Activities of the Inter-Agency Technical Working Group	Dr. Karl N. Vergel Head, Transportation & Environment Group, NCTS, UP Diliman Co-Chair, TWG
3:25 PM	Emission Standard Setting Procedure and Discussion of Tricycle Survey Results	Manuel Jose D. Camagay
4:10 PM	Coffee Break	
4:25 PM	Presentation of the Draft Department Administrative Order on the Carbon Monoxide and Hydrocarbon Emission Standards for Motorcycles and Tricycles	Engr. Cesar S. Siador Jr.
4:28 PM	Open Forum	Ninette P. Ramirez Environment Specialist USAID-USAEP
5:26 PM	Closing Remarks	Engr. Cesar S. Siador Jr.

**Annex F – Attendance of the Third Meeting of
the Inter-Agency
Technical Working Group**

3rd Technical Working Group (TWG) Meeting for the
 Development of Carbon Monoxide and Hydrocarbon Emission Standards
 for Motorcycles and Tricycles
 A US-AEP/USAID Assisted Project
 16 September 2005/ 2:00 p.m.

Committee Members:

	AGENCY	REPRESENTATIVE	CONTACT NUMBER/S	EMAIL ADDRESS	SIGNATURE
1.	MAZDA SUZUKI	MARVIN AQUINO	671 57 22	marvin.aquino@SUZUKI.com.ph	
2.	MDPA - KAWASAKI	JULIUS G. ARGANA	842-3140	julius-kmp@corp.khi.co.jp	
3.	REYNOLDO CATALANAN				
4.	DOTC	REYNOLDO CATALANAN	727056		
5.	DOTC	Lemar L. Jimenez	-00-		
6.	IPACN	MARCO CENACION	028-8305	marco.cenacion@ipacn.com	
7.	EMIB	CESAR SIADOR JR.	278-1185	cesar.siador@emib.com	
8.	IP-NTS	CARL VERTEL	925-8305	carl.verte@ip-nts.edu.ph	
9.					
10.					
11.					
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**Annex G – Draft Department Administrative
Order (DAO) Amending
DENR Administrative Order
No. 2003-25 and
Establishment of New
Carbon Monoxide (CO) and
Hydrocarbon (HC) Standards
for Motorcycles – October 7, 2005**

**DENR Administrative Order
No. 2005 _____**

Subject : **Amending DENR Administrative Order No. 2003-25 and Establishment of New Carbon Monoxide (CO) and Hydrocarbon (HC) Standards for Motorcycles.**

Pursuant to Section 2, Rule XXXVI, Part IX of DAO 2000-81 of RA 8749, the Department of Environment and Natural Resources shall formulate and establish the necessary standards for other mobile sources, specifically on HC and CO for motorcycles.

Scope and Coverage:

These standards shall apply to all in-use motorcycles equipped with 2 stroke and 4 stroke engines.

Emission Standards:

Time of registration	HC (ppm)	CO (% by volume)
For Motorcycles first registered On or before December 31, 2005	4,500	4.5
For Motorcycles first registered On or after December 31, 2007	3,500	3.0

Review and Revision of Standards:

The review, evaluation and revision of the above standards shall be done every two years or as the need arises by DENR through the EMB, in coordination with other concerned agencies.

Effectivity:

This Order shall take effect after fifteen (15) day from its publication in a newspaper of general circulation or filing (in triplicate copies) with the University of the Philippines Law Center pursuant to Presidential Memorandum Circular No. 11 dated October 1992 and remain in force unless revoked or repealed in writing.

Approved:

MICHAEL T. DEFENSOR
Secretary

**Annex H – Attendance of the Fourth Meeting of
the Inter-Agency
Technical Working Group**



**Inter-Agency Technical Working Group (TWG) for the Development of
Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for
Motorcycles and Tricycles**

DENR-EMB • UP-NCTS • LTO • DOTC • DOST-PCIERD • DOE • DTI-BPS • LCP • LMP • USAID-ECAP

4TH Technical Working Group Meeting
7 October 2005 (Friday)
2:00-4:00 PM
NCTS Seminar Room A&B

NAME	AFFILIATION	CONTACT NUMBER/S (Telephone/Fax)	SIGNATURE
1. CESAR S. SIADOR, JR.	EMB-DENR	920-2265	
2. KARL N. VERGEL	UP-NCTS		
3. MANUEL JOSE D. CAMAGAY	UP-NCTS		
4. JOEL A. DONATO	LTO		
5. RAMON U. ABRENICA	LTO		
6. DARWIN M. ROSALES	PCIERD-DOST	2372935	
7. VOLTAIRE L. ACOSTA	League of Cities of the Philippines	521-6461	



**Inter-Agency Technical Working Group (TWG) for the Development of
Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for
Motorcycles and Tricycles**

DENR-EMB • UP-NCTS • LTO • DOTC • DOST-PCIERD • DOE • DTI-BPS • LCP • LMP • USAID-ECAP

4TH Technical Working Group Meeting
7 October 2005 (Friday)
2:00-4:00 PM
NCTS Seminar Room A&B

NAME	AFFILIATION	CONTACT NUMBER/S (Telephone/Fax)	SIGNATURE
8. BLADEMIR L. MANCENIDO	League of Municipalities of the Philippines		
9. RICARDO S. INFANTE	Department of Energy		
10. DONATO S. DELA CRUZ	ECAP-USAID	09175775089	<i>Donato de la Cruz</i>
11. NORMA HERNANDEZ	DTI-BPS		
12. TERESITA DEL ROSARIO	DTI-BPS		
13. JUNDY T. DEL SOCORRO	EMB-DENR	928/185	<i>Jundy T. Del Socorro</i>
14. EDMUNDO L. ESCUBIO	EMB-DENR		<i>Edmundo L. Escubio</i>



Inter-Agency Technical Working Group (TWG) for the Development of
Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for
Motorcycles and Tricycles

DENR-EMB • UP-NCTS • LTO • DOTC • DOST-PCIERD • DOE • DTI-BPS • LCP • LMP • USAID-ECAP

4TH Technical Working Group Meeting
7 October 2005 (Friday)
2:00-4:00 PM
NCTS Seminar Room A&B

NAME	AFFILIATION	CONTACT NUMBER/S (Telephone/Fax)	SIGNATURE
15. MYRNA M. FORTU	EMB-DENR	922 1155	
16. ALORNA A. ABAO	UP-NCTS		
17. NINETTE P. RAMIREZ	USAEP-USAID	816-6576	
18. MARY JOY A. JOCHICO	USAID		
19. EVAN DISPO	ECAP	914-1106	
20. MARVIN AQUINO	MIDPPA SUZUKI	671 9722	
21. BARUCOME FORTU J. SSI. DENE	LTO	922 9061 ext 258	
22. CHRISTOPHER ONGOSE	EMB	920 1195	
23. JULIUS ARGAÑA	MIDPPA - SUZUKI	872-3140	



Inter-Agency Technical Working Group (TWG) for the Development of
Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for
Motorcycles and Tricycles

DENR-EMB • UP-NCTS • LTO • DOTC • DOST-PCIERD • DOE • DTI-BPS • LCP • LMP • USAID-ECAP

4th Technical Working Group Meeting
7 October 2005 (Friday)
2:00-4:00 PM
NCTS Seminar Room A&B

	NAME	AFFILIATION	CONTACT NUMBER/S (Telephone/Fax)	SIGNATURE
24.	EDGAR IGNACIO	OFFICE OF THE VICE-MAYOR MADRALAYNA	742-34-48	
25.	CHRIS CASTRANO	HPI	0916292293	
26.	RAPHAEL C. MIRANDA	EMB-DENR	9281185	
27.	Darin Garcia	ADD	224444	
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Inter-Agency Technical Working Group (TWG) for the Development of
Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for
Motorcycles and Tricycles

DENR-EMB • UP-NCTS • LTO • DOTC • DOST-PCIBRD • DOE • DTI-BPS • LOP • LMP • USAID-ECAP

1st Technical Working Group Meeting
7 October 2006 (Friday)
2:00-4:00 PM
NCTS Seminar Room A&B

NAME	AFFILIATION	CONTACT NUMBER/S (Telephone/Fax)	SIGNATURE
1. EMMA ACEBEDO	Vice Mayor's League of the Philippines		
2. ALFREDO B. ALARCON	MDPPA		
3. ROMY CALABAG	NACTODAP (Secretary General)	09194012777	
4. ROLANDO CRUZ	MDPPA	091 9226	
5. RICARDO JIMENEZ	NACTODAP (President)		
6. RUTH JIMENEZ	Vice Mayor's League of the Philippines	091-7248	
7. JUANING JOSON	NACTODAP (Vice-President)		
8. IGMEPIO LAYCANG, JR.	Vice Mayor's League of the Philippines	091 2435	
9. LINO VILLARUZ	Office of Vice-Mayor (Jesse Cruz, Mandaluyong)		

Annex I – Workshop Program (Actual Time)



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WORKSHOP PROGRAM (ACTUAL TIME)
Workshop on the Development of Carbon Monoxide (CO) and
Hydrocarbon (HC) Emission Standards
for Motorcycles and Tricycles

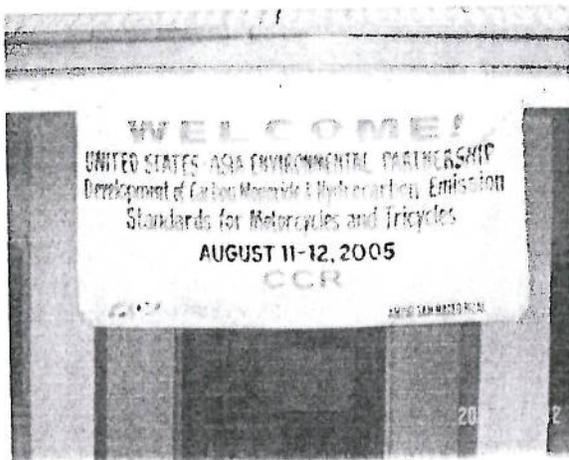
11 August 2005 (Thursday)	
10:10 – 10:20 AM	Overview of the Workshop Manuel Jose D. Camagay
10:20 – 11:40 AM	Overview of Urban Transport and the Environment <i>Karl N. Vergel</i> <i>Head, T&E Group, UP-NCTS</i> UP-NCTS Studies on 2 and 3-Wheelers <i>Karl N. Vergel</i> <i>Head, T&E Group, UP-NCTS</i> <ul style="list-style-type: none"> • Standards Development for Local Motorcycle/Tricycle Sector • Development of Drive Cycle and Emission Models for In-Use Tricycles in Metro Manila • Comparison of Mineral-Based and Coco-Methyl Ester – Based Lubricants on the HC and CO Emissions of Two-Stroke Engines • Assessment of the 2003 HC and CO Emission Standards for Motorcycles • Tricycle Emissions Inventory in Metro Manila
11:40 – 11:55 AM	Proposed Hydrocarbon and Carbon Monoxide Emission Standards for Motorcycles and Tricycles <i>Cesar S. Siador Jr.</i> <i>Chief, AQMS, EMB-DENR</i>
Lunch Break	
1:45 – 3:15 PM (with open forum)	Difference of 4-Stroke and 2-Stroke Motorcycle Engines <i>Valentine Curamen</i> <i>MDPPA</i>
3:50-4:45 PM (with open forum)	Presentation of Procedure for the Development of Carbon Monoxide (CO) and Hydrocarbon (HC) Emission Standards for Motorcycles and Tricycles <i>Manuel Jose D. Camagay</i> <i>Consultant/Technical Advisor</i> <ul style="list-style-type: none"> • Data and Profile of Tricycle Emissions • Present Attainment Level • Statistical Background • Statistical Analysis of New Data • Comparative Analysis with 1st TWG Emission Data

WORKSHOP PROGRAM (ACTUAL TIME)
 Workshop on the Development of Carbon Monoxide (CO) and
 Hydrocarbon (HC) Emission Standards
 for Motorcycles and Tricycles

12 August 2005 (Friday)	
10:10-11:30 AM (with open forum)	Presentation of the US-AEP Clean Air Program with LGUs in the Philippines Involving the Tricycle Sector – Puerto Princesa Clean Air Program (CAP) <i>Ninette P. Ramirez</i> <i>Environment Specialist, USAID-USAEP</i>
11:30 AM-12:30 PM	Workshop <i>Manuel Jose D. Camagay</i>
Lunch Break	
1:30-4:00 PM	Workshop <i>Manuel Jose D. Camagay</i>
4:00-4:30 PM	Closing Ceremonies and Distribution of Certificates <i>Cesar S. Siador Jr. (EMB-DENR) and</i> <i>Karl N. Vergel (UP-NCTS)</i>

Annex J – Photos of the Workshop

Photos of the Workshop



Workshop Venue at Ciudad Christia, San Mateo, Rizal



Overview of the workshop presented by Karl Vergel and Engr. Manny Camagay



Ms. Ninette Ramirez of US-AEP presented the Puerto Princesa Clean Air Program



A lecture on the difference of 4-stroke and 2-stroke motorcycle engines by Mr. Val Curamen of MDPPA



The Workshop Participants



Distribution of certificates of appreciation by Engr. Cesar Siador Jr. and Karl Vergel