

National Air Quality Status Report 2016-2018



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Message from the Director of the Environmental Management Bureau



On behalf of the Environmental Management Bureau Department of Environment and Natural Resources (EMB-DENR), we are pleased to present the National Air Quality Status Report, covering the years 2016 to 2018. Achieving a clean, safe, and healthy air is one step to achieving a cleaner, safer, and healthier environment. That is why one of the major environmental laws that we have in the Philippines is Republic Act 8749. The DENR, through the EMB, is the primary agency mandated to lead the implementation of this Act. That is why Clean Air is included in our mandates, in the same manner that it is also part of the Ten Priority Programs of the Department. The National Air Quality Status Report contains a summary of the extent of air pollution in the country, an analysis and evaluation of the current state of air quality in the country, and trends and projections of air pollution. Likewise, the Report also contains the status of ambient air quality monitoring nationwide, the status of activities on air quality policy development, best practices on airshed

management from different regions, nationwide emission inventory, and initiatives of various sectors on air quality management and way forward. We at the Environmental Management Bureau will continue to uphold our commitment to protect and advance the right of the people to clean air, while at the same time, making our vision of a nation empowered to protect our finite natural resources, attuned to the pursuit of sustainable development, for a clean and healthy environment, come true.



ENGR. WILLIAM P. CUÑADO

Preface

The National Air Quality Status Report is prepared by Department of Environment and Natural Resources that contains the summary of the extent of air pollution in the country, per type of pollutant per type of source. It also contains the analysis and evaluation of the current state, trends and projections of air pollution, as well as the identification of critical areas, activities or projects which will need closer monitoring or regulation. The report also contains actions and initiatives from the government agencies and stakeholders, with recommendations for necessary executive and legislative action. Pertinent qualitative and quantitative information concerning the extent of air pollution and the air quality performance rating of industries in the country is also covered. Upon the approval of the Secretary of the Department, the National Air Quality Status Report shall be submitted to the office of the President and to Congress on or before March 31 of every year and shall cover the preceding calendar year.

-DAO 2000-81-2 Part V Rule XIV Section 4

Executive Summary

The Philippine government continues to uphold its declaration of basic principles to protect and advance the right of the people to clean air. Through the stewardship of the Department of Environment and Natural Resources- Environmental Management Bureau, the air quality management is facilitated through institutional mechanisms on policies, administration, finances, and operation. From ~4.5M in 2016, the Air Quality Management Fund has increased its revenues to ~100M in 2018. These were used in the activation and sustenance of the activities of its 22 airshed nationwide.

The monitoring capacity remains to be ~100 stations nationwide, and a major challenge is the nearing obsolescence of some of the equipment. Although emissions from mobile sources increased from 65% in 2015 to 74% in 2018, the contributions from stationary sources decreased by 20% in the past three years, reflective of the larger coverage and management of stationary sources (including MSEs and standard generation sets).

Considering the qualified data sets across the country, from 2016 to 2018, the geometric mean of PM₁₀ (39 µg/NCM, 41 µg/NCM, 39 µg/NCM, respectively) and PM_{2.5} (20 µg/NCM, 21 µg/NCM, 20 µg/NCM, respectively) remain within the limits set by the National Ambient Air Quality Guideline Values for long-term monitoring, reflecting the effectiveness of recent policies in place (e.g., implementation of Euro 4 standards).

Meanwhile, the Total Suspended Particulates (TSP) has been declining thru the years, remain below the guidelines in 2016 (89 µg/NCM), although went beyond the guidelines in 2017 (119 µg/NCM) and 2018 (97 µg/NCM), most probably due to a combination of natural and anthropogenic factors related to development (e.g. build-build-build program).

The regional agencies has never been more are becoming more involved in the air quality management, as reflected in the completion of emissions inventories and regional monitoring results. The regions of NCR, Region 1, Region 5, Region 6, Region 7, Region 8, Region 9, Region 11 and Region 13 have complete annual monitoring values of PM₁₀ from 2016 to 2018. Long term monitoring from 2012-2018 for NCR, Region 1, Region 7, Region 12 are in place. The NCR has been reporting PM_{2.5} since 2013. The Regions 1, 4A, 5, and 13 have complete the annual monitoring values of PM_{2.5} from 2016 to 2018.

Initiatives from the agencies (DoE and DTI on the standards for fuels and additives, DoTr on the Euro 4 standards for fuels and engines, DoH on the implementing guidelines of IACEH), health (Lung Center of the Philippines and WHO on the assistance on the PM_{2.5} breakpoints, academic (UP Diliman, DLSU and local and international academic's contribution to aerosol characterization research) and non-governmental organizations (assistance in measurement and action plans).

The airsheds and its stakeholders has never been more participatory and more visible in air quality management as reflected in the best practices:

- ✓ Benchmarking the Metro Cebu ASGB
- ✓ Davao City as "Clean Air City" due to the various air-related local ordinances in the Davao City Airshed
- ✓ Implementation of Car-less day by the BLISST ASGB
- ✓ Intensive policy review of Cagayan de Oro ASGB
- ✓ Maximum attendance in the Agusan del Norte Butuan City ASGB
- ✓ Metro Iloilo ASGB supporting Transition to Euro 4
- ✓ NCR ASGB sharing Best practices with Region 8
- ✓ No to Open burning policies of the Bulacan-Pampanga-Bataan ASGB
- ✓ Partnership with Academe of Region 13,
- ✓ Willingness to pay for Clean Air of the Northwestern Pangasinan ASGB.

Despite these consolidated efforts to improve air quality status, there are still remaining challenges and needed actions in air quality management and way forward:

Summary of challenges	Strategic Actions	Indicative Year
Lack of Air Quality Index (AQI) Breakpoints for PM 2.5	Development of PM 2.5 AQI Breakpoints. Review of Ambient Quality Standards Guideline Values.	2020
The need to review Ambient Quality Standards and Guideline Values (HAZAP). Review of Stationary Source Emission Standards to Mass Emission Rate Standards (MERS)	Review of Hazardous Ambient Quality Standards and Guideline Values. Review of Stationary Source Emission Standards to Mass Emission Rate Standards (MERS).	2020-2025
Lack of siting criteria for air quality monitoring stations	Development of EMB Procedural Manual for Siting Criteria of Air Quality Monitoring Stations.	2020 - 2021
Lack of Data Handling Guidelines for Ambient Air Quality Monitoring Data	Development of EMB Procedural Manual for Data Handling Guidelines for Criteria Air Pollutants.	2020 - 2021
Lack of Online Platform for Stack Sampling Conducted by EMB Accredited 3 rd Party Stack Sampling Firms	Development of Online-Stack Sampling Platform/System.	2020 - 2021
Dependence on expensive reference/equivalent AQM equipment	Collaborate with DOST-ITDI and DTI-BPS on setting up the guidelines for testing and validating some medium to low-cost air quality measurement devices through the environment technology verification. Development of Environmental Technology Verification policy for low cost and locally made technologies.	2021-2023
The need to Review procedure in Designation of Attainment and Non-Attainment Areas in existing airsheds.	Formulation of checklist in determining operational status of existing airsheds. Development of a uniform process in designating Attainment and Non-Attainment Areas in existing airsheds. Identification of New /potential airsheds including industrial airsheds subject Emission Quota.	2020-2025
Existing Air Pollution Source Installations are not required to conduct Sulfur Dioxide (SO ₂) Stack Emission Test	Revocation of Memorandum from the Secretary of the DENR dated 02 March 2009.	2019
Lack of an On-Line Real Time Data Acquisition System in monitoring Large Industrial Facilities with Continuous Emission/ Opacity Monitoring Systems (CEMS/COMS)	Development of an On line Data Acquisition System in monitoring Large Industrial Facilities with Continuous Emission/ Opacity Monitoring Systems (CEMS/COMS).	2020-2022

Summary of challenges	Strategic Actions	Indicative Year
Lack of Online System for the Issuance of Permit to Operate (PTO) for Air Pollution Source Installation (APSI)	Development of Online Permitting and Monitoring System for the issuance of Permit to Operate (OPMS-PTO).	2020 - 2021
Decreasing the uncertainties in emissions inventory	Come up with a database of local emission factors for use in emission estimates for sources representative of the Philippine settings. Update the guidelines for emissions inventory, in collaboration with the academic sector. Utilize the certificate of conformity data as reference in developing emission factors for new vehicles. Capacitate the regions on mobile emissions inventory at the airshed level.	2021 onwards
Unable to capture the 75% data capture rate	Pilot-test one (1) monitoring station that is outsourced to a service provider at service-level contract. Document the best practices and lessons learned and study its viability as the future air quality monitoring strategy. For Estimate for Brand New Monitoring Stations (Existing and Highly Urbanized Cities (HUC)/ Metro Areas).	2021 onwards
Assessment of air quality and its health impact at the regional level	Review and suggest a revised air quality index (AQI) breakpoint correlated to health impacts. Set-up guidelines on reporting air quality and health using area served and people served approaches.	2019-2021
Assessment and addressing the needs in air pollution research	EMB to synergize its air quality management road-map with the Air Research Road Map of DOST.	2019-2023
Harmonizing the Policies at the airshed level	Review and document the existing policies at the LGU level Airshed governing board to actively promulgate resolutions in air quality management.	2020
Weak inter-agency participation on the air quality and health actions	Synergize agency mandates and action plans under RA 8749 and EO56 (IACEH). Set up implementing guidelines and action plans for the air quality and health under the NEHAP.	2018-onwards
Management of mobile emissions sources	Review the impact of the implementation of Euro 4 standards on the LGU-level air quality. DENR to coordinate with DoTr to assess the effectiveness of the implementation of the MVIC to pre-Euro/non-Euro motor vehicles.	2021

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List of Abbreviations

AAQS	Ambient Air Quality Standards
ADB	Asian Development Bank
AGV	Annual Guideline Value
ALS	Alternative Learning System
APR&D	Air Pollution Research and Development
APER	Action Plans on Emissions Reduction
AQMgtS	Air Quality Management System
AQMF	Air Quality Management Fund
AQ MIS	Air Quality Management Information System
AQG	Air Quality Guideline
AQI	Air quality index
AQMF	Air Quality Management Fund
AQMS	Air Quality Management Section
ASGB	Airshed Governing Board
ASBU	Anti-Smoke Belching Units
ATM	Air Traffic Management
BAM	Beta Attenuation Monitor
BLISTT ASGB	Baguio-La Trinidad-Itogon-Sablan-Tuba-Tublay Air shed Governing Board
BPB ASGB	Bulacan Pampanga Bataan Airshed Governing Board
BPS	Bureau of Philippine Standards
BRT	Bus Rapid Transit
CAA	Clean Air Act
CAAP	Civil Aviation Authority of the Philippines
CAR	Cordillera Administrative Region
CDTA	Capacity Development Technical Assistance
CEMS	Continuous Emission Monitoring System
CWMMP	Contractors Environmental Management and Monitoring Plan
CENRO	City Environment & Natural Resources Office
CHED	Commission Higher Education
CME	Coco-Methyl Ester
CNG	Compressed natural gas
CO	Carbon monoxide
CO	City ordinance
CO ₂	Carbon dioxide
COC	Certificate of conformity
COPD	Chronic obstructive pulmonary disease
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
DA	Department of Agriculture
DAO	Department Administrative Order
DepEd	Department of Education
DENR	Department of Environment and Natural Resources
DILG	Department of Interior and Local Government
DLSU	De La Salle University
DOAS	Dedicated Outdoor Air Systems
DOE	Department of Energy
DOF	Department of Finance
DOH	Department of Health
DOTr	Department of Transportation
DOST	Department of Science and Technology
DPWH	Department of Public Works and Highways
DTI	Department of Trade and Industry
EANET	Acid Deposition Monitoring Network in East Asia
EbA	Ecosystem-Based Adaptation
ECC	Environmental Compliance Certificate

EEID	Environmental Education and Information Division
EGF	Environmental Guarantee Fund
EMB	Environmental Management Bureau
ENRO	Environment and Natural Resources Office
EST	Environmentally Sustainable Transport
EU	European Union
GDP	Gross Domestic Product
GMS	Gaseous Monitoring Systems
GNI	Gross National Income
Hg	Mercury
H ₂ S	Hydrogen sulfide
HPAP	Health and Pollution Action Plan
IARC	International Agency for Research on Cancer
IACEH	Inter-Agency Committee on Environmental Health
ICAO	International Civil Aviation Organization
IEC	Information, Education and Communication
IG	Implementing Guidelines
IRR	Implementing Rules and Regulations
IT	Interim targets
JAO	Joint Administrative Orders
LGU	Local Government Unit
LPG	Liquefied petroleum gas
LRT	Light Rail Transit
Lpm	liters per minute
LTFRB	Land Transportation Franchising and Regulatory Board
LTO	Land Transportation Office
MBM	market based measures
MC	Memorandum circular
MIAA	Manila International Airport Authority
MO	Memorandum Order
MOOE	Maintenance, operations and other expenses
MV	Motor vehicles
MVIC	Motor Vehicle Inspection Centers
MVIS	Motor Vehicle Inspection System
NAQSR	National Air Quality Status Report
NAAQGV	National Ambient Air Quality Guideline Value
NCR	National Capital Region
NDIR	Non-Dispersive Infrared Radiation
NEDA	National Economic and Development Authority
NEPA	Northeastern Pangasinan Airshed
NEHAP	National Environmental Health Action Plan
NESSAP	National Emission Standards for Sources Specific Air Pollution
NGA	Non-government agencies
NGO	Non-government organizations
NO ₂	Nitrogen dioxide
NOV	Notice of violation
NO _x	Nitrogen oxides
NRDP	National Research and Development Program
NSCB	National Statistical and Coordination Board
NSO	National Statistics Office
O ₃	Ozone
PAB	Pollution Adjudication Board
PAB	Philippine Accreditation Bureau
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Service Administration
Pb	Lead

PCA	Partnership for Clean Air
PCO	Pollution control officer
PETC	Private Emission Testing Center
PIA	Philippine Information Agency
PM	Particulate matter
PM ₁₀	Particulate matter with aerodynamic diameter less than 10 microns
PM _{2.5}	Particulate matter with diameter less than 2.5 microns
PMS	Particulate Matter Monitoring System
PNRI	Philippine Nuclear Research Institute
PITX	Paranaque Integrated Terminal Exchange
PTO	Permit to operate
PUB	Public utility bus
PUV	Public utility vehicle
QA/QC	Quality Assurance/Quality Control
RA	Republic Act
RCM	Rotary Club of Makati
RO	Regional Office
SO ₂	Sulfur dioxide
SO _x	Sulfur oxides
SUV	Sports utility vehicle
SVPCF	Special Vehicle Pollution Control Fund
TC	Tricycle
TEOM	Tapered Element Oscillating Microbalance
THC	Total Hydrocarbons
TOD	Transit-Oriented Development
TSP	Total suspended particulates
UP-IESM	University of the Philippines-Institute of Environmental Science and Meteorology
US EPA	United States Environmental Protection Agency
UV	Utility vehicle
UNIDO	United Nations Industrial Development Organization
VOC	Volatile organic compound
WBG-IFC EHS	World Bank Group International Finance Corporation Environmental, Health and Safety
WHO	World Health Organization

Overview of the Philippines

General

Country Name	Republic of the Philippines
Capital City	Manila
Largest City	Quezon City
Language	Filipino, English, 19 recognized regional Languages)

Geography

Land Area	300,000 km ²
Regions	17

People¹

Population (2017)	103.5 M
Fertility rate (2017)	3.1
Life expectancy (2017), years	66 (Male), 73.1(Female)
Educational Attainment(2017), years	9.6
Religion	92% Christian (81% Roman Catholic), 6% Muslim, 2% Anitism

Economy

GDP per capita (2017): USD 7,426 (125th)

¹ <http://www.healthdata.org/philippines>

Institutional Mechanisms



Basic Legal and Regulatory Framework

RA 8749: Philippine Clean Air Act of 1999

The Philippine Clean Air Act of 1999 aims to achieve and maintain healthy air for all. It contains the legal mandate of governmental agencies in managing the outdoor air quality in the Philippines, listing all potential sources of outdoor air pollution while providing ambient air quality guidelines and standards for emissions. Its implementation is a multi-sectoral undertaking, led by the Department of Environment and Natural Resources.

The Department of Environment and Natural Resources (DENR)- Environmental Management Bureau (EMB) is the mandated lead agency in the implementation of RA 8749. Mainly tasked to monitor the outdoor air pollution; prepare a National Air Quality Status Report which shall be used as a basis in formulating the Integrated Air Quality Improvement Framework; issue rules and regulations in the implementation of the Act. The lead agency in the implementation of RA 8749, the Environmental Management Bureau (EMB): oversees the ambient air quality monitoring and to prepare annual National Air Quality Status Reports; design and develop, (together with the PSA) an information network for data storage, retrieval and exchange, which will serve as the central depository of all data and information related to air quality; issue and, from time to time, revise information on air pollution control techniques upon consultation with the appropriate committees, government agencies and local government units (LGUs); review and/or revise and publish annually a list of hazardous air pollutants with corresponding ambient guidelines values and/or standards necessary to protect public health and safety, and general welfare; design, impose on and collect regular emission fees from industrial dischargers as part of the emissions permitting system based on environmental techniques; review, or as the need therefore arises, and revise and publish emission standards to further improve the emission standards for stationary sources of air pollution as well as emission standards for motor vehicles; develop, implement and monitor the functioning of ^[11] permitting system as it may determine necessary for the prevention and abatement of air pollution by stationary sources. The EMB is also tasked to monitor compliance with emission standards for stationary sources, and to require any person who owns or operates any emission source. (See Annex 1: Detailed role of the DENR, as per RA 8749)

Administrative Functions and Operations in the Air Quality Management

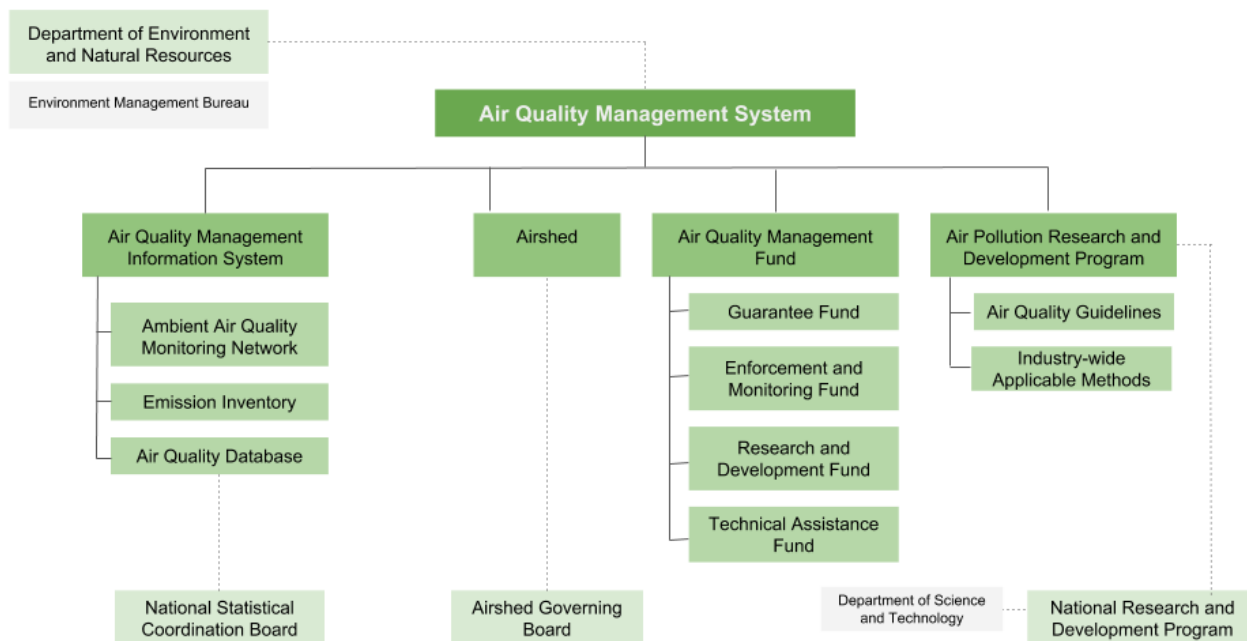


Figure 1 The Air Quality Management System and the Agencies involved in the operations

Based on RA 8749, the Air Quality Management System (AQMgtS) is directly under the responsibility of the DENR, and generally, but not limited, through the EMB. The system is divided into four major areas: Air Quality Management Information System (AQ MIS), Airshed and Non-attainment Area Management through the Airshed Governing Board (ASG), Air Quality Management Fund (AQMF), Air Pollution Research and Development (APR&D) Program (Figure 1). The DENR EMB being the lead agency in promulgating the provisions of RA 8749, are also the lead air quality managers. Aside from the administrative component, the RA 8749 has both monitoring and research components. It is important to note that the monitoring component of air quality management is tasked to the Environmental Quality Division-Air Quality Monitoring Section (DENR-EMB-AQMS). On the other hand, the research component of air quality management is tasked to the Environmental Research and Laboratory Services Division (DENR-EMB-ERLSD), has functions to generate good quality, scientific data and information to support formulation of environmental policies, standards, rules and regulations on existing and anticipated environmental issues. The ERLSD can also lead in formulating developing, coordinating and implementing short-term and long-term research programs at the national and regional level. The ERLSD can also provide assistance in the implementation of environmental pollution control laws and the conduct of environmental research programs.

Other Agency Roles and Responsibilities in the Air Quality Management (RA 8749)

The **Department of Transportation (DoTr)** is mandated to implement the emission standards for motor vehicle (Section 21), impose the fines and penalties for violation of these standards (Section 25) and conduct emission testing and apprehensions (Section 46). The DoTr is also mandated to establish roadside motor

vehicle inspection system (Section 46), contribute towards the establishment of the Motor Vehicle Inspection system (MVIS), authorize private emission testing centers and contribute in the related training programs.

Under Section 21, the **Department of Trade and Industry (DTI)** is mandated to participate in the formulation of an Action Plan for the control and management of air pollution from motor vehicles, contribute towards the establishment of procedures for inspection of motor vehicles, assist in the formulation and implementation of the National Motor Vehicle Inspection and Maintenance Program, accredit private emission testing centers develop and implement standards and procedures for the certification of training institutions, instructors and facilities and licensing of qualified private service centers and their technicians, prescribe regulations requiring the disclosure of odometer readings and use of tamper-resistant odometers, including tamper resistant fuel management systems. Under Section 22, the DTI shall promulgate the necessary regulations prescribing the useful life of vehicles and engines including devices in order to ensure that such vehicles will conform to the emissions which they were certified to meet. These regulations shall include provisions for ensuring the durability of emission devices. Under Section 26 (on Fuels and Additives), the Bureau of Product Standards (BPS) of the DT shall be consulted on the set specifications for all types of fuel and fuel-related products, to improve fuel composition for increased efficiency and reduced emissions: Provided, however, That the specifications for all types of fuel and fuel-related products set-forth pursuant to this section shall be adopted by the BPS as Philippine National Standards (PNS). On the Violation of Standards for Motor Vehicles (Section 46) the DTI shall contribute on the related training program. In the IRR, Rule XXXII, Sec 2 The DTI through the Bureau of Import Services (BIS) shall formulate regulations and guidelines that will ensure rebuilt and imported second hand motor vehicles and engines will satisfy the emission standards for rebuilt and imported second hand motor vehicles.

*The **Department of Energy (DoE)** shall consultatively* shall set specifications for all types of fuel and fuel-related products, to improve fuel composition for increased efficiency and reduced emissions (*Section 26*). The DOE, shall also specify the allowable content of additives in all types of fuels and fuel-related products. Such standards shall be based primarily on threshold levels of health and research studies. On the basis of such specifications, the DOE shall likewise limit the content or begin the phase-out of additives in all types of fuels and fuel-related products as it may deem necessary. Other agencies involved in the performance of this function shall be required to coordinate with the DOE and transfer all documents and information necessary for the implementation of this provision.

The **Department of Science and Technology (DOST)** shall be coordinated by the DENR on the establishment of a National Research and Development Program for the prevention and control of air pollution, with special emphasis to research on and the development of improved methods having industry-wide application for the prevention and control of air pollution (Section 15). Such a research and development program shall develop air quality guideline values and standards in addition to internationally-accepted standards. It shall also consider the socio-cultural, political and economic implications of air quality management and pollution control (Section 22). The DOST shall also be consulted on the Air Quality Framework (Section 26). The DOST's PNRI *shall regulate all projects that will involve Radioactive Emissions (Section 33)*, while the DOST's PAGASA shall regularly monitor meteorological factors affecting environmental conditions including ozone depletion and greenhouse gases and coordinate with the DENR in order to effectively guide air pollution monitoring and standard- setting activities (Section 31). The JAO 2006-01 on Environment Technology Verification processes is the lone Joint Administrative Order of DOST with DENR, but opens several connections on air quality management, such as developing the guidelines on air pollution control technologies, as well as developing the ETV procedures for testing aerosol measurement technologies. In relation to this, the ETV is also needed for the control technologies to address the end-of-life disposal of lighting products and control the dispersion of toxic substances into the environment, as stated in the Department of Energy (DOE) and the Department of Environment and Natural Resources (DENR) Joint Administrative Order (JAO) No. 2013-09-200.

With the DENR, the **Philippine Statistics Authority (PSA)** shall design the Air Quality Database which shall be computerized and stored in a manner accessible to the public and shall contain data collected from the Ambient Air Monitoring Network and the Emissions Inventory (IRR, Part V, Section 3).

Consistent with Sections 8 and 10, and with the assistance of the DENR, the **Local Government Units (LGUs)** are mandated to: prepare and develop an action plan consistent with the Integrated Air Quality Framework to attain and maintain the ambient of air quality standards within their respective airsheds; prepare and implement a program for designation of non-attainment areas; develop and submit to the DENR through the Bureau a procedure for carrying out the action plan for their jurisdiction, provided that the Department through the Bureau shall maintain its authority to independently inspect the enforcement procedure adopted. In accordance to Section 24, the LGUs are also to implement the prohibition of Pollution from Smoking. The LGU also share the responsibility in the management and maintenance of air quality within their jurisdiction (Section 36), and (Section 37) establish an Environment and Natural Resources Office (ENRO) in accordance with the provisions of Section 484 of the R. A. 7160

Following Section 39- Public Education and Information Campaign, a continuing air quality information and education campaign shall be promoted by the DENR, the Department of Education (DepEd), the Department of the Interior and Local Government (DILG), the Department of Agriculture (DA) and the Philippine Information Agency (PIA). Consistent with Section 7 of this Act, such campaign shall encourage the participation of other government agencies and the private sector including NGOs, POs, the academe, environmental groups and other private entities in a multi-sectoral information campaign.

Relevant Agency Policy on Air Quality

The **RA 9729 (Climate Change Act of 2009)** mandates relevant government agencies to mainstream the Climate Change into Government policy formulations, establishing the framework strategy and Program on Climate Change, creating for this purpose the Climate Change Commission and for other purposes. Under Section 15, the DENR shall oversee the establishment and maintenance of a climate change information management system and network, including on climate change risk, activities and investments, in collaboration with other national government agencies, institutions and LGUs.

The **Executive Order No. 489 Series of 1991 "Institutionalizing the Inter-agency committee on environmental health (IACEH)** by President Corazon Cojuangco Aquino, primarily to formulate policies, promulgate guidelines and develop programs for environmental health protection. The IACEH is Chaired by the Secretary of Health, while the Secretary of the DENR is the Vice Chair. Underway is the implementing guidelines for EO 489, by President Rodrigo Roa Duterte in which seven (7) sectoral groups of environmental health priorities are tasked to lead in formulating and updating the NEHAP plans. Air quality and health is one of the sector, Chaired by the DENR, and co-chaired by the Department of Transportation.

The **Executive Order No. 26 "Providing for the establishment of smoke-free environments in public and enclosed spaces"** by President Rodrigo Roa Duterte. Enacted to fortify the State's duty to instill health consciousness among the people and to protect and promote their right to health as provided in the 1987 Constitution. The statute is also in line with the State's duty under the Philippine Clean Air Act to ensure that every citizen is secured in his right to breathe clean air.

The **"Executive Order No. 28 "Providing For The Regulation and Control of the Use of Firecrackers And Other Pyrotechnic Devices,"** by President Rodrigo Roa Duterte The formulation of the Implementing Rules and Regulations (IRR) of this law shall be spearheaded by the Philippine National Police (PNP) in coordination with the DOH, Department of Interior and Local Government (DILG), Department of the Environment and Natural Resources (DENR), and the Bureau of Fire Protection (BFP), after public consultations. The EO provides that "such rules and regulations shall form an integral part of the IRR of a previously enacted law banning firecrackers.

Below are a compilation of policies relevant to the implementation of the Clean Air Act of 1999, enacted and implemented by the mandated administrative agencies.

AGENCY Relevant Policies on Air Quality












DoH	 Implementing rules and regulations of chapter xx: pollution of the environment of the code on sanitation of the Philippines (PD 856)		
	 Administrative order 2017-0023: guidelines in the effective implementation and enforcement of executive order (EO) no. 26: providing for the establishment of smoke free environments in public and enclosed place		
	 Administrative order 2007-0004: national tobacco prevention and control program		
DoTr ²	 Memorandum Circular No.2018-2132 - Strict Implementation Of Procedures For The Inspection Of Motor Vehicles And Confiscation Of A Motor Vehicle's (Front) License Plates Upon A Failed Inspection		
	 Memorandum Circular No.2018-2158: Guidelines for the Authorization of Private Motor Vehicle Inspection Centers (PMVICs)		
DPWH	 Department Order No. 05 Series of 2018 (Preventive Maintenance Manual for DPWH Most Commonly Used Equipment and Service Vehicles)		
	 Department Order No. 11 Series of 2016 (Routine Maintenance for Service Vehicles and Most Commonly Used Equipment Manual)		
	 Department Order No. 52 Series of 1989 (Anti-Smoke Belching Campaign)		
	 Department Order No. 57 Series of 2016 (Environmental Impact Assessment (EIA) for the DPWH Infrastructure Projects and Tree Cutting Permit Application)		
	 Department Order No. 245 Series of 2003 (Implementation of the Social and Environmental Management System Operations Manual)		
	 Department Order No. 224 Series of 2003 (Creation of Regional Environmental Impact Assessment Offices)		
	 Department Order No. 220 Series of 1999(Strengthening the Environmental Impact Assessment Project Office)		
	 Department Order No. 111 Series of 1993 (Total Ban on the burning of Rubber Tires in Public Lots and Roadways)		
	DoE	<i>Downstream Oil Industry Deregulation Act (RA 8479)³</i>	 Fuel quality standards for Kerosene
 <i>Biofuels Act of 2006 (R.A. 9367)⁴</i>		 PNS/DOE QS 009:2007 (24 August 2007)	
 Fuel quality standards for Industrial Fuel Oil		 L. Aviation Gasoline Grade 100L	
 PNS/DOE QS 008:2018 (for promulgation)		 PNS/DOEASTM D910:2010 (2010)	
 Fuel quality standards for Residual Marine Fuel		 Fuel quality standards for Two-stroke (2T) Lubricating Oil	
 PNS/DOE QS 004:2017 (for promulgation)		 PNS/DOE QS 003:2003 (6 May 2004)	
 Fuel quality standards for E-Gasoline		 For facility standards: Retail Outlet Health, Safety and Environment,	
 PNS/DOE QS 008:2018 (May 2018)		 Underground Storage Tank., Piping System, Dispensing Pumps (PNS/DOE FS 1-4:2005)	
 Fuel quality standards for CME-blended Automotive Diesel Oil (ADOB2)		 Storing and Handling of E-Gasoline in Retail Outlets (PNS/DOE FS 6:2011);	
 PNS/DOE QS 004:2017 (18 December 2017)		 Storing and Handling of B5 in Retail Outlet (PNS/DOE FS: 7:2011);	
 Fuel quality standards for CME-blended Industrial Diesel Oil (IDOB2)		 LPG Refilling Plant-General Requirement (PNS/DOE FS 2:2006);	
 PNS/DOE QS 013:2017 (18 December 2017)		 Auto LPG Dispensing Station (Revision) (PNS/DOE FS 3:2013);	
		 Liquid Petroleum Product Depot (PNS/DOE FS 4:2007):	

² Visit Appendix 2 for the list of DoTr Administrative orders and Circulars older than 2016.

³ Ensure a competitive market for petroleum products under a regime of fair price, adequate and continuous supply of environmentally, clean and high quality petroleum product and use of clean and safe (environment and worker-benign) technologies





⁴ Establish technical fuel quality standards for biofuels and biofuel-blend gasoline and diesel which comply with the PNS (Section 7c)

AGENCY Relevant Policies on Air Quality

	 Fuel quality standards for Anhydrous Bioethanol & Bioethanol Fuel (E100 & E98) <ul style="list-style-type: none">○ PNS/DOE QS 007:2014 (29 January 2014)○ DC No. 2015-07-0012 (29 June 2015)	<ul style="list-style-type: none">○ Storing and Handling of CME and CME-Blends in LPP Depot (PNS/DOE FS:5-2009);○ Transportation of Petroleum Product by Pipeline (PNS/DOE FS:8:2013);○ Code of Safety Practice in Auto-LPG Dispensing Station (PNS/DOE FS 9:2016);○ Code of Safety Practices for LPP in Retail Outlet (PNS/DOE FS 10-2017).
	 Fuel quality standards for Coconut Methyl Ester (B100) <ul style="list-style-type: none">○ PNS/DOE QS 002:2015 (27 November 2015)○ DC No. 2016-05-006 (2 May 2016)	 Department Circular No. 2007-02-0001 and RA 6969
	 Fuel quality standards for High FAME Blended Diesel Oils (B5) <ul style="list-style-type: none">○ PNS/DOE QS 004:2017 (27 November 2015)	 RA 11234: Establishment of the Energy Virtual One stop shop for the purpose of streamlining the permitting process of power generation, transmission and distribution projects.
	 Fuel quality standards for Liquefied Petroleum Gases (LPG) as Non-Motor Fuel <ul style="list-style-type: none">○ PNS/DOE QS 005:2016 (22 December 2016)	 Implementation of Euro 4 fuel standards on June 2015.
	 Fuel quality standards for Liquefied Petroleum Gases (LPG) as Motor Fuel <ul style="list-style-type: none">○ PNS/DOE QS 012:2016 (22 December 2016)	
DOST	 Harmonized National R&D Agenda (HNRDA) 2017-2022	
	 Joint Circular No. 1, Series of 2013: Rules and Regulations on the Grant of Compensation-Related Magna Carta Benefits to Scientists, Engineers, Researchers, and other Science and Technology (S & T) Personnel	
PSA	 M.O 2, Series Of 2014, Establishing The Interagency Committee On Environment And Natural Resources Statistics	

Relevant LGU Policy on Air Quality

**LGU
Metro
Cagayan
de Oro****Relevant Policies on Air Quality**

-  Resolution No. 003-2016 - Recommending to The DENR Secretary Thru EMB On the Formulation and Adoption of Standard on Emission Testing of Marine Vessels Thru the Supervision of The Department of Transportation and Communication (DOTC)
-  Resolution No. 009-2016 - Urging Local Government Units Within the Metro Cagayan Airshed To Enact Ordinance Requiring Construction Firms, Ports and Harbors for The Emission Testing of Off-road Vehicles and Construction Machineries/Equipment as One of The Post Requirement in The Business Permit
-  Resolution No. 011-2016 - Urging the Secretary of The Department of Transportation and Communications Thru the Land Transportation Office to Undertake Emission Testing of Off-road Vehicles and Construction Machineries/Equipment in Ports and Harbors Including Construction Firms.
-  Resolution No. 013-2016 - Proliferation Of "Takal-takal" Or The Illegal Peddling, Selling And Distribution Of Fuel Substances In The Cities And Municipalities In The Metro Cagayan De Oro Airshed

Status of Air Quality Management



Status of Development of Policies on Air Quality

In December 2015 (reported in 2016) a DAO on the 'Establishment of Standard for Ambient Hazardous Air Pollutants' has been endorsed to DENR. However, it was not approved, since the industries were still opposing the established standards set in the DAO. A revised final draft of the DAO has been submitted to the DENR for further review/evaluation of the Undersecretaries and Assistant Secretaries. In 2017, a DAO on 'Noise Emission Standards/Limits for Motorcycle, Tricycle and Moped' has been developed, and submitted to the DENR-EMB legal Division for review.

In 2016-2017, There were two policies/guidelines reviewed, including a DAO on 'Establishing the Air Quality Index (AQI) Breakpoint values for DAO 2013-13 Provisional National Ambient Air Quality Guideline Values for Particulate Matter_{2.5}' and a DAO on the 'Guidelines for the Accreditation of Third Party Provider for the conduct of test audits of continuous emission Monitoring Systems (CEMS) and Continuous Opacity Monitoring Systems (COMS)'.

No. of Policies Developed in relation to AQ Management, 2016-2018

Clean Air		2016 ⁵			2017 ⁶			2018 ⁷		
		Target	Actual	Performance	Target	Actual	Performance	Target	Actual	Performance
Formulation/Development of policies on Air Quality	No. of final draft prepared	1	1	100 %	1	1	100 %	5	5	100 %
	No. of policies/guidelines reviewed	2	2	100 %	2	2	100 %	300	615	205 %

⁵ BARNO1ASOFDECEMBER2016FINAL_2017_1.pdf

⁶ BAR1ASOFDECEMBER2017.pdf

⁷ Bar-1-as-of-December-2018-Updated.pdf

Status of Activities on Air Quality and Climate Change

The Climate Change Division and the Climate Change Service of the DENR-EMB are doing capacity building, data gathering, and building a database on greenhouse gas emissions. The Climate Change Service is also doing the monitoring of a number of Clean Development Mechanism Projects activities since 2016.

		2016 ⁸			2017 ⁹			2018 ¹⁰		
		Target	Actual	Performance	Target	Actual	Performance	Target	Actual	Performance
Climate Change										
Updating of GHG Inventory Database and information system	No. of database updates and information system maintained	16	16	100 %	3	3	100 %	3	3	100 %
Capacity development of Climate Change	Capability Building Conducted	2	3	150 %	3	3	100 %	16	16	100 %
Monitoring of CDM project activities	CDM Project activities monitored	2	3	150 %	7	7	100 %	4	7	175 %

⁸ BARNO1ASOFDECEMBER2016FINAL_2017_1.pdf

⁹ BAR1ASOFDECEMBER2017.pdf

¹⁰ Bar-1-as-of-December-2018-Updated.pdf

Status of Air Quality Management Fund

In 2016, the Air Quality Management Fund¹¹ (AQMF), formerly labeled Fund 155 was changed to fund 337 due to UACS revised chart of accounts. The fund collections reported here includes supervision and regulation enforcement fees, other service income, other gains, LTP fines and Penalties.

The Air Quality Management fund has been the source of funds of the 22 Airshed governing Board of the Philippines, nationwide. From 2016-2018, the variance in the actual *versus* target of the collections and remittances has either decreased (from -27% in 2016 to -7% in 2018) or increased at 234% in 2017.

	2016 ¹²		2017 ¹³		2018 ¹⁴	
AQMF	Target	Actual	Target	Actual	Target	Actual
Supervision and regulation Enforcement Fees	₱ 43,900,000.00	₱ 33,940,810.74	₱ 26,463,000.00	₱ 103,589,720.88	₱ 108,770,000.00	₱ 100,238,885.23
Other Service Income	₱ 2,584,000.00	₱ 59,375.00	₱ 4,550,000.00	₱ 22,130.00	₱ 23,000.00	₱ 572,840.00
Other Gains	₱ -	₱ 1,430.00	₱ -	₱ -	₱ -	₱ 5,960.00
LTO fines and Penalties		₱ 85,000.00	₱ 157,650.00*			
Total	₱ 46,484,000.00	₱ 34,086,615.74	₱ 31,013,000.00	₱ 103,611,850.88	₱ 108,793,000.00	₱ 100,817,685.23
Variance (Actual vs Target)		-27%		234%		-7%

Status of Management of Air Pollution Sources

Air Pollution Management Programs of the DENR-EMB-AQMS increases in performance from 2016 to 2018. Sources are categorized as Stationary, mobile and area. (Definition in the CAA)

There are two programs in the management of stationary sources.

- The *Linis Hangin* (Clean Air) Program has two monitoring activities: (1) the issuance of Certificate of Conformity (Euro 4)¹⁵ to industries, and the (2) Bantay Tsimeneya (Stack Monitoring) that take charge in the issuance of permit to operate¹⁶ (PO) for air, whether these are new application or renewal.
- The Industrial Compliance Monitoring Program surveys the firms within the CAMANAVA area, major urban centers and the rest of the Philippines

In the Management of mobile sources, the DENR-EMB-AQMS monitors the Private emission Testing Centers (PETCs) nationwide and requires them to submit an annual report.

¹¹ <https://emb.gov.ph/transparency-seal-2/>

¹² FARNO5ASOFDEC2016

¹³ FAR5ASOFDECEMBER2017

¹⁴ FAR-5-as-of-December-2019

¹⁵ Definition under the CAA

¹⁶ Definition of PO in the CAA

Management of Stationary Sources

			2016 ¹⁷			2017 ¹⁸			2018 ¹⁹		
			Target	Actual	Performance	Target	Actual	Performance	Target	Actual	Performance
Linis Hangin Program (Stationary)	Bantay Tsimineya	Total Number of PO for Air issued	8,379	11,946	143%	8,635	12,742	148%	8,742	14,332	164%
		No. of (NEW) Permit to Operate for Air	2,168	3,522	162%	1,932	4,264	221%	1,959	5,173	264%
		No. of (RENEWAL) Permit to Operate for Air	5,871	7,836	133%	6,703	8,478	126%	6,783	9,159	135%
		No. additional Valid Permits	340	588	173%						
Industrial Compliance Monitoring	SMR, CMR	No. Firms monitored within CAMANAVA/ other major urban centers	13,780	15,189	110%	13,791	15,871	115%	2,721	4,159	153%
		No. of Firms surveyed	2,244	3,180	142%	1,956	3,374	172%	15,732	17,547	112%

In 2018, the performance increased by 53% due to the intensified survey conducted in compliance with the instruction of DENR Secretary to conduct survey and inspection of all establishment located in the beaches/recreational waterbodies. This larger coverage of permit to operate has led to major improvement in the stationary emissions which decreased to 20% since 2015 inventory.

Management of Mobile Sources

The DENR-EMB monitors the operations on the Private emission testing centers (PETCs), on the issuance of certificate of conformity to new vehicles for registration. Since the number of motor vehicles registered in the country increases through the years (Figure 2), the actual number of COCs issued is also expected to increase. In fact, the issued COC in 2016 (332) increased by more than 50% the following year (504), exceeding the years' targets.

Mobile sources remain the largest source of emissions, 'due to various factors, such as continuous operation of old and non-compliant (to emission standards) motor vehicles, traffic congestion, and the continuous increase of motor vehicles operating on the roads, among others'.²⁰

¹⁷ BARNO1ASOFDECEMBER2016FINAL_2017_1.pdf

¹⁸ BAR1ASOFDECEMBER2017.pdf

¹⁹ Bar-1-as-of-December-2018-Updated.pdf

²⁰ Official communication of Undersecretary Ruben Reinoso Jr (DoTr Planning and Project Development) to DENR-EMB-CO OIC-Director William Cuñado dated July 2, 2020

No. of PETCs monitored and report submitted

Linis Hangin Program (New vehicles)	Issuance of COC	2016 ²¹			2017 ²²			2018 ²³		
		Target	Actual	Performance	Target	Actual	Performance	Target	Actual	Performance
		300	332	111%	300	504	168%			
Monitoring of Private Emissions Testing Centers (PETCs)	No. of PETC monitored and report submitted	528	578	109%	524	673	128%	552	637	115%

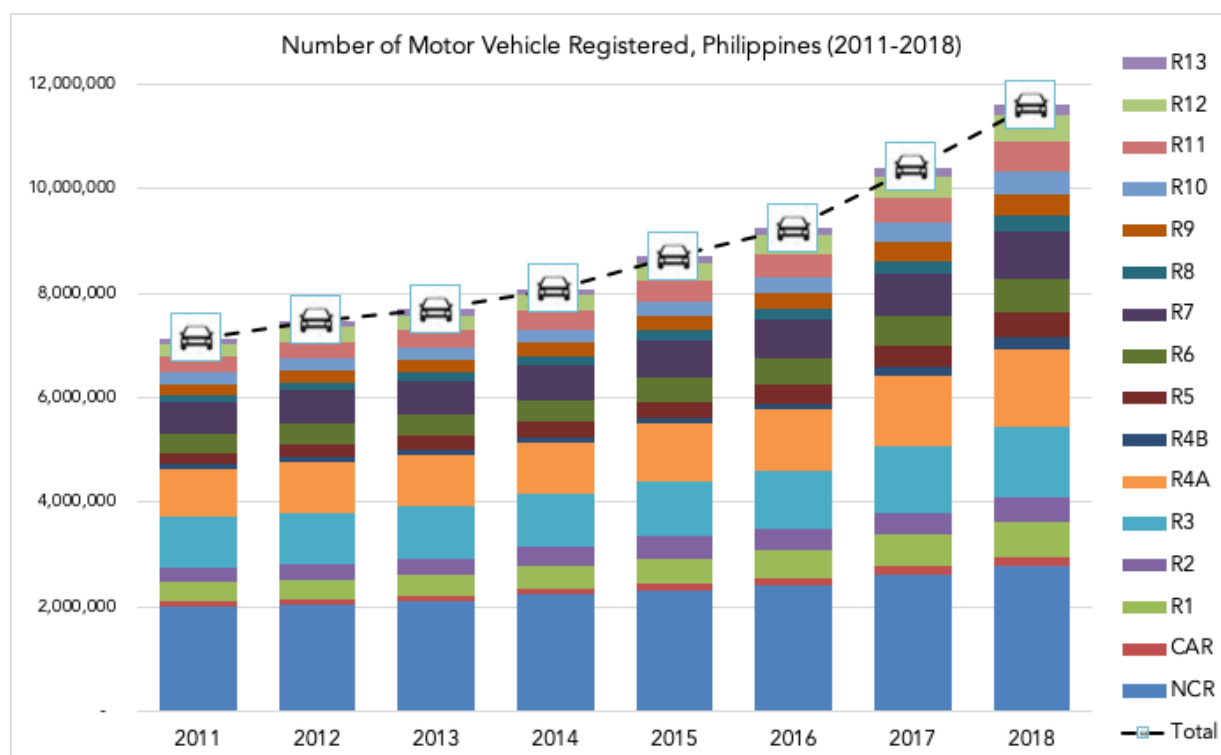


Figure 2 Number of motor vehicle registered through the years: new+renewal. (source: LTO official website)

²¹ BARNO1ASOFDECEMBER2016FINAL_2017_1.pdf

²² BAR1ASOFDECEMBER2017.pdf

²³ Bar-1-as-of-December-2018-Updated.pdf

Status of Emissions Inventory

At the National level, the contribution of emissions from mobile sources increased from 65% in 2015 to 74% in 2018; its levels also exhibited increasing trend from 2002 to 2018, at a rate of two million tons per year. The stationary source, has shown to decrease by 20% since its 2015 value, while area source decreased by 5% from its 2015 inventory.

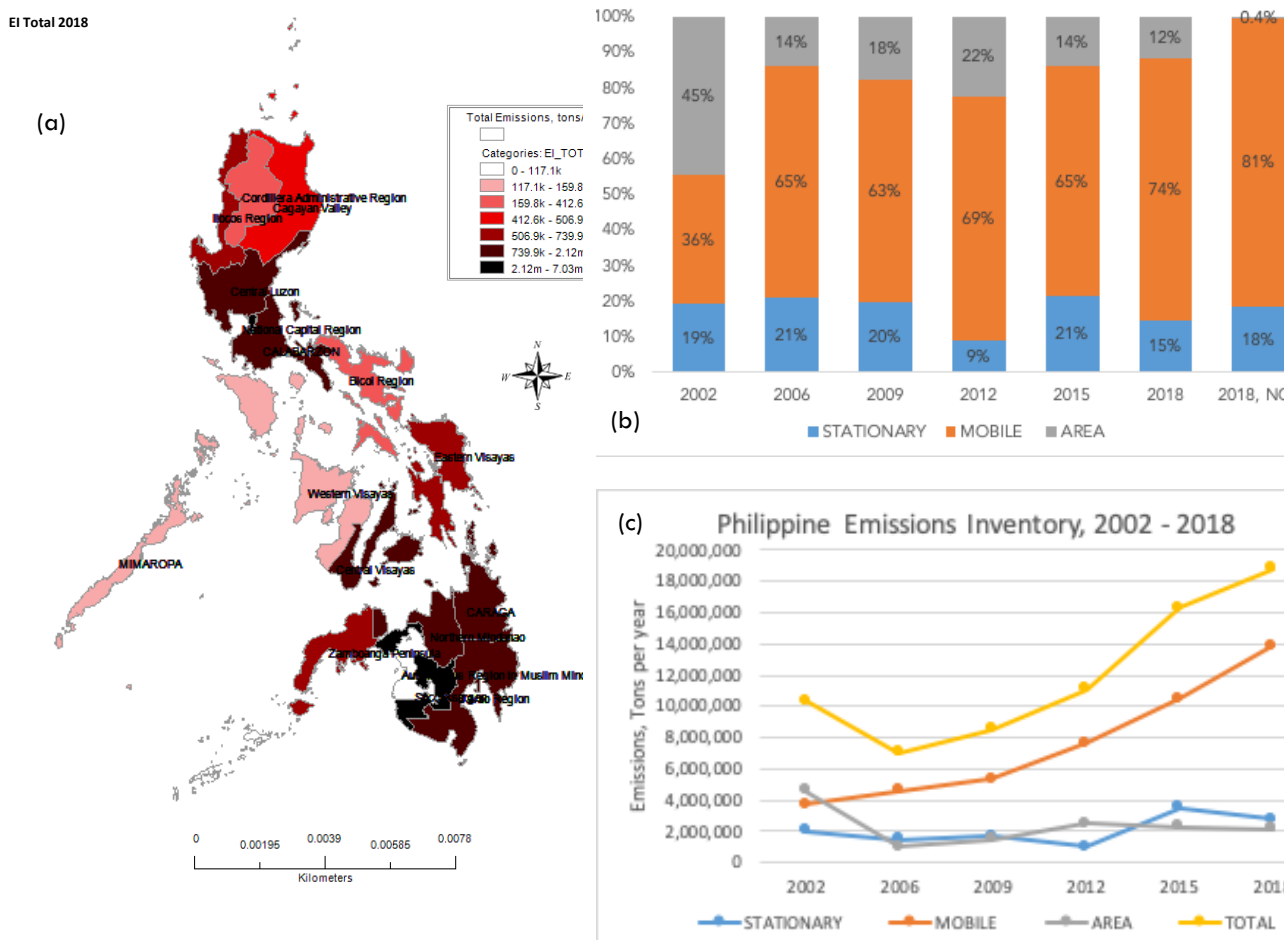
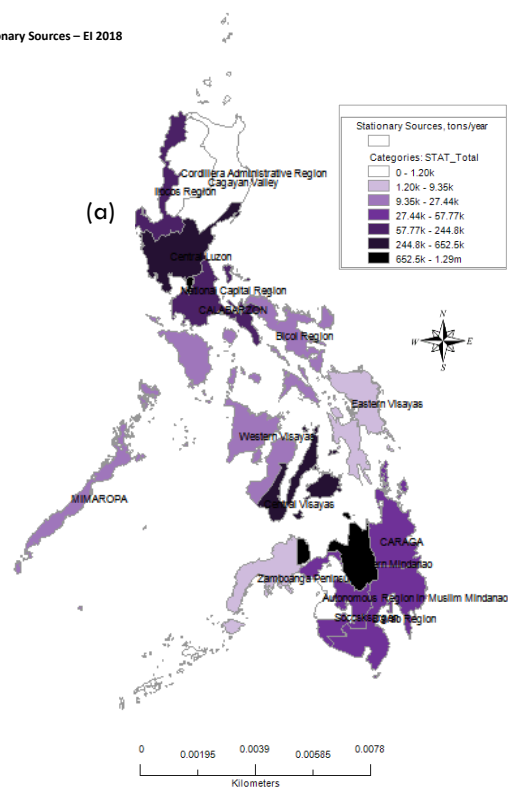
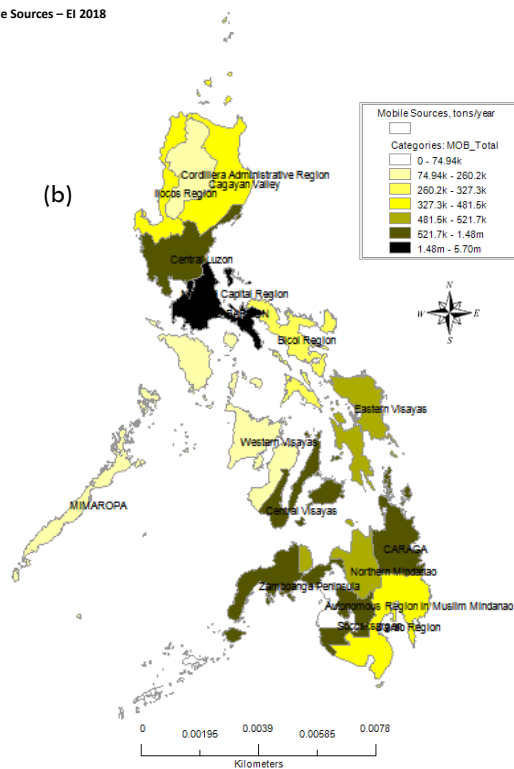


Figure 3 (a) Total Emissions in 2018 and (b) Six-year comparative Emissions inventory (%) (c) Six-year comparative Emissions inventory per source in tons per year

Stationary Sources – EI 2018



Mobile Sources – EI 2018



Area Sources – EI 2018

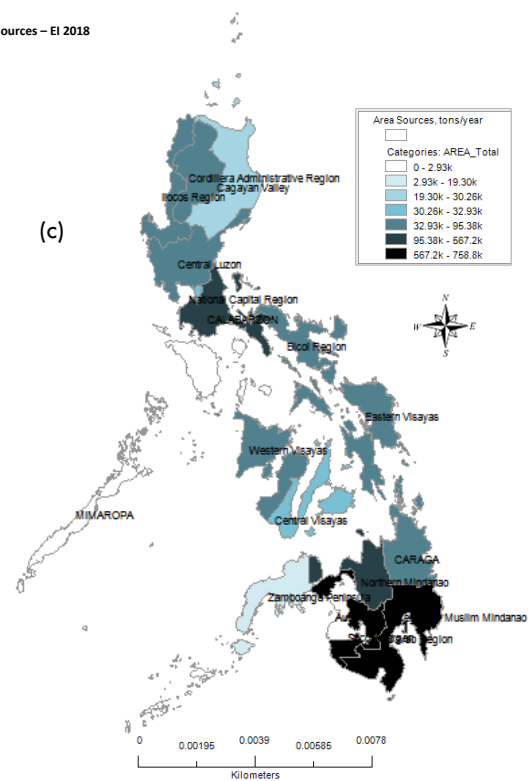
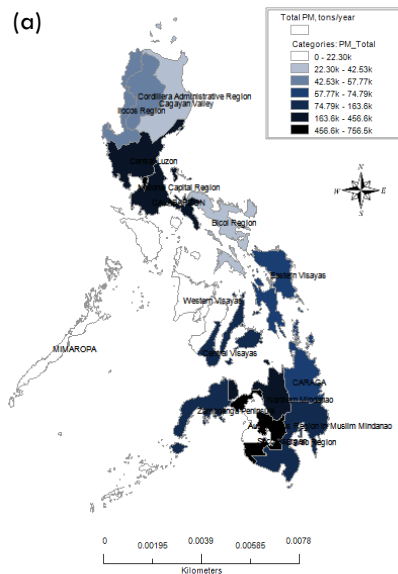
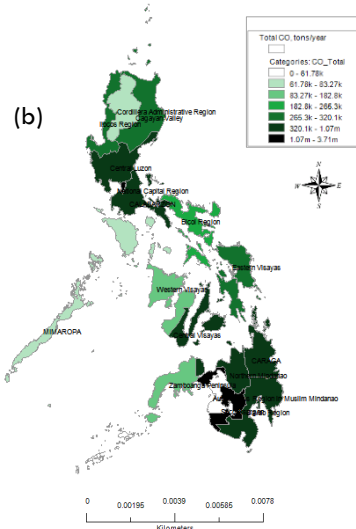


Figure 4 Total Emissions in 2018 in tons per year per source (a) Stationary (b) Mobile (c) Area

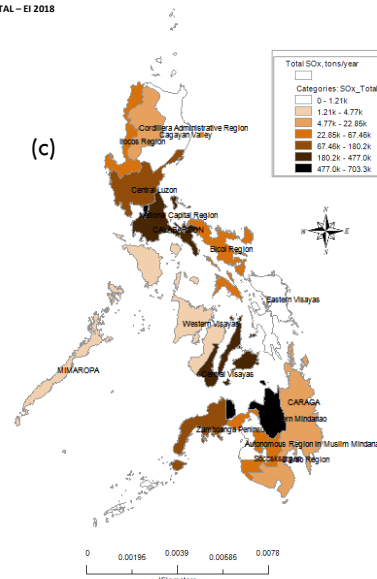
PM TOTAL – EI 2018



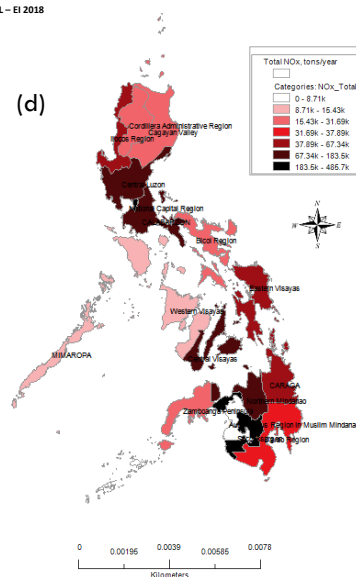
CO TOTAL – EI 2018



SOx TOTAL – EI 2018



NOx TOTAL – EI 2018



VOC TOTAL – EI 2018

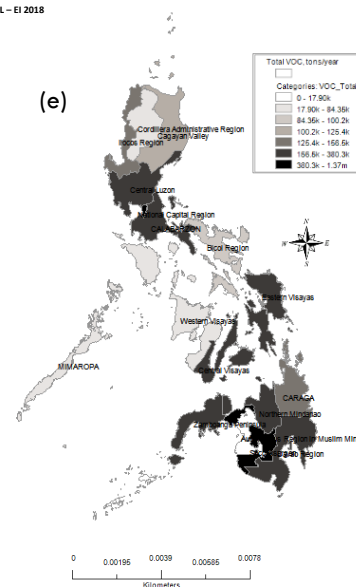


Figure 5 Total Emissions in 2018 per pollutant (a) Particulate matter (b) Carbon Monoxide (c) SOx (d) NOx (e) VOCs

Status of Ambient Air Quality Monitoring

Ambient Air Quality Monitoring Capability of EMB

The purpose of having a prescribed monitoring equipment and technology is to provide safeguard to the DENR-EMB in reporting reliable data - to ensure that any data released is with satisfactory quality, and at par with national and international standards. This safeguard results to the DENR-EMB becoming restrictive in the choice of monitoring equipment and technology, which is both an advantage and a disadvantage to them. Currently, the DENR-EMB monitoring network is references on the USEPA requirements based on 40 CFR Part 58, Appendix d and 40 CFR Part 58 Appendix E, with considerations also given to the local conditions and data availability, such as population, economic activities/ development and land uses. Required equipment technology of the DENR-EMB-CO is restrictive because its monitoring objective is mainly for compliance.

From 2016-2018, there are two kinds of Air Quality Monitoring Stations (AQMS) installed throughout the Philippines, an **Continuous Ambient Air Quality Monitoring Station** and a **Manual Monitoring Station**

I. Continuous Ambient Air Quality Monitoring Station

1. Continuous Open-Path Monitoring Station

Is using the following instruments:

- **Differential Optical Absorption Spectroscopy (DOAS)** - is an equivalent method used for measuring the concentration of Ozone, Sulfur Oxides, Nitrogen Oxides, Benzene, Toluene, p-Xylene in the air. Calibration Requirement: Reference and Span: O₃, SO_x, NO_x, Benzene, Toluene, p-Xylene (BTX)
- **Non-Dispersive InfraRed (NDIR)**- is a USEPA reference method for measuring the concentration of Carbon Monoxide (CO) pollutants in the air. Calibration Requirement: Zero and Span: CO.
- **Tapered Element Oscillating Microbalance (TEOM)** - a USEPA equivalent method used for measuring Particulate Matter 10 (PM₁₀) and Particulate Matter 2.5 (PM_{2.5}), which uses the gravimetric principle using a standard flow rate of the following: 3.00 liters per minute (lpm) for PM_{2.5}, 1.67 lpm for PM Coarse, and 12.00 lpm for Bypass Flowrate, for a total flow rate of 16.67 lpm. Calibration Requirement: Flow Rate, Ambient Temperature and Pressure
- **Meteorological Instruments (MET)** - composed on sensors to monitor Temperature, Pressure, Relative Humidity, Global Radiation, Rain Fall, Wind Speed and Wind Direction. Calibration Requirement: Span values as per manufacturer's specification.

2. Particulate Monitoring System (PMS)

Is using the following instruments:

- **Beta Attenuation Monitor (BAM)** - is a USEPA equivalent method which measures the particulate matter (PM 10 and PM 2.5) in the air. Calibration Requirement: Mass Foil, Flow Rate, Ambient Temperature and Pressure.
- **Meteorological Instruments (MET)** - composed on sensors to monitor Temperature, Pressure, Relative Humidity, Global Radiation, Rain Fall, Wind Speed and Wind Direction. Calibration Requirement: Span values as per manufacturer's specification.

3. Conventional Monitoring Stations (CMS)

Is using various USEPA equivalent methods monitoring instruments for the continuous measurements of Sulfur Dioxide (SO₂), Nitrogen Dioxide (NO₂) and Ozone (O₃).

II. Manual Monitoring Stations

Is using USEPA reference method monitoring instruments particularly the gravimetric method for the measurements of Total Suspended Particulates (TSP), PM₁₀ and PM_{2.5}. The frequency of sampling for this kind of station is once every six (6) days, pursuant to the provisions under the section 12 of the RA8749.

Calibration

In view of the conduct calibration and training on the CAAQMS and Manual Monitoring station of EMB Regional Offices, EMB Central Office AQMS conduct calibration and training annually provided with calibration certificate using NIST traceable Flowrate Transfer Standard (FTS) with S/N: M150801 and was calibrated last March 28, 2019 with one year validity.

Ambient Air Quality Monitoring Capacity of EMB

Under the 'Strengthening the Ambient Air Monitoring' program, the EMB has been maintaining almost 100 air quality monitoring stations nationwide.

No. Sampling Stations Maintained and Monitored	2016 ²⁴			2017 ^{25, 26}			2018 ²⁷		
	Target	Actual	Performance	Target	Actual	Performance	Target	Actual	Performance
	98	98	100%	101	98	97%	98	98	100%

Table 1 Number and type of monitoring stations per region

Region	No. of Stations	Type of Monitoring Stations
NCR	32	Manual Stations, Continuous Open-Path Monitoring Station, CMS and Continuous PMS
CAR	3	Manual Stations and Continuous PMS
Region 1	6	Manual Stations, Continuous Open-Path Monitoring Station and Continuous PMS
Region 2²⁸	4	Manual Stations, Continuous Open-Path Monitoring Station, CMS and Continuous PMS
Region 3	7	Manual Stations, Continuous Open-Path Monitoring Station and Continuous PMS & Mercury Wet Deposition
Region 4A	5	Manual Stations, Continuous Open-Path Monitoring Station, CMS and Continuous PMS
Region 4B	3	Manual Stations and Continuous PMS
Region 5	4	Manual Stations, Continuous Open-Path Monitoring Station and Continuous PMS
Region 6	6	Manual Stations and Continuous PMS
Region 7	5	Manual Stations and Continuous PMS
Region 8	1	Manual Station
Region 9	5	Manual Stations, Continuous Open-Path Monitoring Station and Continuous PMS

²⁴ BARNO1ASOFDECEMBER2016FINAL_2017_1.pdf

²⁵ 3 stations are not functional: NCR (1) equipment is not functioning (Makati)

R2 (2 stations) damaged due to typhoon Lawin in 2016

²⁶ BAR1ASOFDECEMBER2017.pdf

²⁷ Additional targets were included:

Capacity building for air quality monitoring: No. of capacity building/training conducted 10/10

Operationalization of Airshed: Airshed action plan formulated/updated and monitored 22/22

²⁸ 1 DOAS station at St. Louis (SO₂, NO₂, PM₁₀) – damaged by typhoon Lawin in 2016

1 High volume sampler at Santiago City (PM₁₀)

1 PMS at EMB regional office and (PM₁₀, PM_{2.5}) – damaged by typhoon Lawin in 2016

1 Partisol sampler at St. Paul University (PM₁₀)

Region 10	4	Manual Stations and Continuous PMS
Region 11	6	Manual Stations, Continuous Open-Path Monitoring Station and Continuous PMS
Region 12	3	Manual Stations, Continuous Open-Path Monitoring Station and Continuous PMS
Region 13	4	Manual Stations, Continuous Open-Path Monitoring Station and Continuous PMS
Total	98	

EMB Monitoring Stations Nationwide

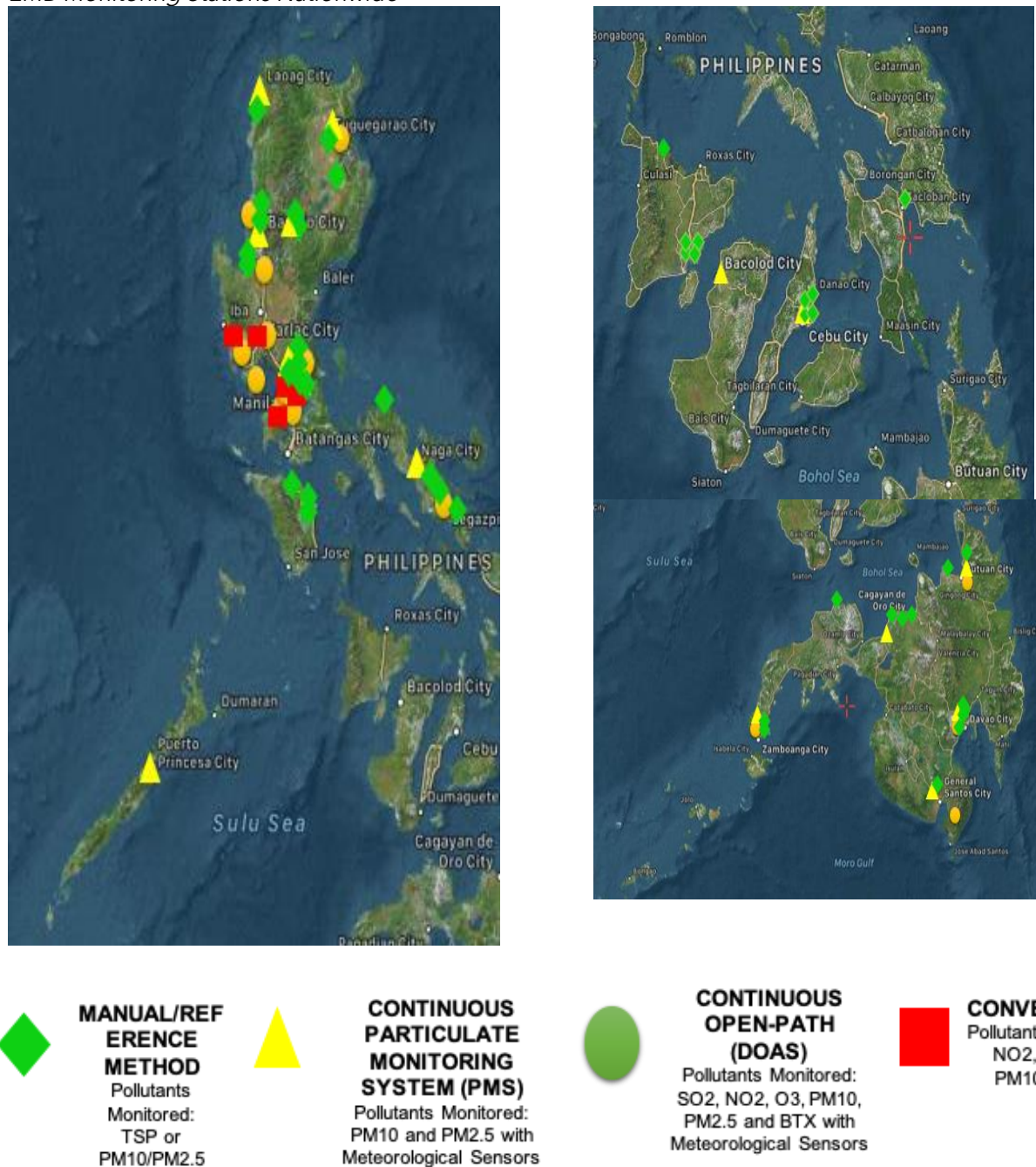


Figure 6 Location map of the Air Quality Monitoring Stations

Proposed Ambient Air Quality Monitoring Stations

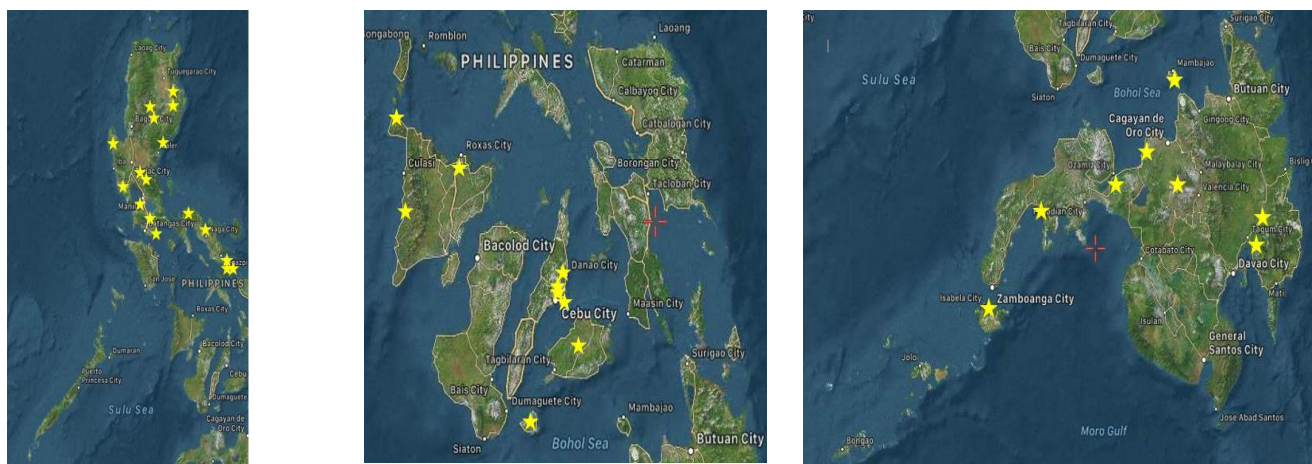


Figure 7 Location map of the proposed ambient Air Quality Monitoring Stations

Ambient Air Quality Monitoring Results

The annual geometric mean were calculated per region by using the annual averages from the monitoring stations with qualified number of data. The criteria is that in order to be included in the regional geometric average, the data capture rate in the station must not be less than 75%. Hence, data cells that are grey in color does not necessarily mean that there is no measurement value, but rather, the annual average has not reached 75% data capture rate, as deemed necessary in obtaining the geometric average per region.

It is important to note that the station data, when averaged, may not entirely represent the air pollution in the whole region, because of the confounding factors of land-use, topography and meteorology, that tends to differentiate the air quality from one place to another in a certain region. Nevertheless, the annual average of the data from stations used in averaging are detailed in Appendix 2, for transparency and for reference.

Among the regions, NCR, Region 5 and Region 13 has complete annual monitoring values of TSP since 2004 up to 2018. On the other hand, Regions 6 and Region 7 completed the monitoring from 2016 to 2018 (See Appendix 2).

The regions of NCR, Region 1, Region 5, Region 6, Region 7, Region 8, Region 9, Region 11 and Region 13 have complete annual monitoring values of PM₁₀ from 2016 to 2018. Long term monitoring from 2012-2018 for NCR, Region 1, Region 7, Region 12 are in place (See Appendix 2). The annual PM₁₀ nationwide geometric means complied the guideline of 60 µg/NCM in 2016-2018.

The NCR has been monitoring PM_{2.5} since 2013. The Regions 1, 4A, 5, and 13 have complete the annual monitoring values of PM_{2.5} from 2016 to 2018 (See appendix 2). The Philippine annual PM_{2.5} nationwide geometric mean is also within the guideline of 35 µg/NCM in 2018.

Table 2 Long term Monitoring of TSP, PM₁₀, and PM_{2.5} from annual Geometric Mean of qualified stations, µg/NCM

Year	TSP ²⁹ (AGV ³⁰ : 90 µg/NCM)		PM ₁₀ ³¹ (AGV: 60µg/NCM)		PM _{2.5} ³² AGV: 35 ug/NCM (until 2015) 25 ug/NCM (starting 2016)		
	NCR	Nationwide Average	NCR	Nationwide Average	NCR	Nationwide Average	
'04	163	144					
'05	156	122					
'06	140	112					
'07	131	117					
'08	134	101					
'09	130	107					
'10	150	104					
'11	118	99					
'12	119	103	70	60			
'13	118	87	69	51			29
'14	118	89	51	52			50
'15	102	116	50	46	27	23	
'16	108	89	46	39	27	20	
'17	111	119	53	41	36	21	
'18	99	97	47	39	20	20	

²⁹ Details of qualified stations in Appendix 3A

³⁰ AGV: Annual Guideline Value

³¹ Details of qualified stations in Appendix 3B

³² No monitoring conducted from 2013-2015 in Regions 1-13 from 2013-2014.

Best Practices and Challenges in Airshed Management



Best practices in the Management of Airshed

	NCR	<ul style="list-style-type: none"> ✓ Air Quality data REAL TIME UPDATES <ul style="list-style-type: none"> ○ Established OpCen (Operations Center) ○ Mobile Application - AirQ-met ○ Online Braodcast - www.screenleap.com/embncr_airqmet ○ Text Blast - Every 8am & 4 PM daily ✓ Maintenance and Calibration of Air Quality Monitoring Equipment and Stations <ul style="list-style-type: none"> ○ Sustainability Plan Prepared and Submitted ✓ Emission Inventory in Malabon ✓ Emission Inventory in Pateros ✓ Emission Inventory Marikina city - with CAI Asia ✓ Benchmarking, sharing of Best Practices with Region 8 Airshed ✓ Programs of LGU <ul style="list-style-type: none"> ○ Strengthening smoke belching Apprehension in LGU with ordinance - trained by EMB NCR personnel ○ Promotion of using bicycles ○ Promoting of using E-vehicles - E-trike, Bus ○ Carless Sunday, Green Landscapes and Tree Planting
	CAR	<ul style="list-style-type: none"> ✓ The implementation of the "CARLESS DAY" within the BLISTT Airshed started in 2017 and has been in effect up to this day. The CARLESS Day mandates all vehicle owners of DENR CAR employees and clientele not to use their cars every first Thursday of the month except the following: <ul style="list-style-type: none"> ○ Senior Citizens, pregnant women and differently abled persons ○ Caterers or individuals who carry heavy load shall be on a pick up and drop of load only. ✓ To date, Municipality of La Trinidad Benguet, LGU Baguio City, University of the Philippines Baguio and Benguet State University had adopted every first Thursday of the month as their Carless Day. ✓ Reports are done during BLISTT Airshed Governing Board meetings on their compliance. ✓ The establishment of Green Buffer Zone in areas in the BLISTT as one way of reducing air pollutants. To date, we have a pilot area along Saint Louis University wherein plants that absorbs air pollutants were used in the pocket garden that they have done. Industries likewise were encouraged to use pocket garden inside their buildings. ✓ To date, La Trinidad is the next project in which SB Resolution of La Trinidad, Benguet had been passed waiting for implementation. ✓ The on - going Roadside Inspection and Monitoring Team (RITMT) of Baguio City wherein in the apprehend smoke belchers with the corresponding fines and penalties. ✓ The training of smoke belching Task Force wherein members of LGUs in the BLISTT will be trained to compose as one team. ✓ The establishment of additional sampling station at PEZA (industrial zone) and another in BSU College of Forestry (general ambient) as called for under Air Dispersion Modeling in the BLISTT. ✓ Conducted the initial study on "Willingness to pay for Ecotourism Services in the BLISTT Areas" ✓ The implementation of the number coding scheme at Baguio City in being done to ease traffic congestion thus reducing the air pollutants <p>LGU Initiatives</p> <ul style="list-style-type: none"> ✓ La Trinidad <ul style="list-style-type: none"> ○ Passed Environmental Code of La Trinidad last December 2019 incorporate Air Quality Management.

		<ul style="list-style-type: none"> o Project of ADB and Clean Air Asia called "Strengthening Knowledge and Actions for Air Quality Improvements" Baguio <p>✓ Baguio City</p> <ul style="list-style-type: none"> o Passed a City Ordinance in 2008 (CO 61) entitled Clean Air Ordinance of the City of Baguio o Subjects flagged vehicles to their Roadside Inspection, Testing and Monitoring Team's roadside testing o Monthly multi - sector meeting of the Clean Air Monitoring Unit are performed o Continuous training of RITMT members, enforcers, operators and owner are done. o Participated in projects with the BLISTT Governing Board and Saint Louis University
	Region 1	<p>Regional Agency Best Practices</p> <ul style="list-style-type: none"> ✓ (2016) Forum on Climate Change and Clean Air from various National Government Agencies of Region 1 and Representatives from the different division offices of Department of Education Region 1 ✓ (2016) Ecosystem-Based Adaptation (EbA) Orientation-Workshop from various agencies in Region I and Cordillera Administrative Region in partnership of EMB Central Office Climate Change Division. ✓ (2017) "Travel Green Program" in partnership with Land Transportation Office Region 1 - Monitoring of all Major Bus Terminals in Dagupan City to ensure compliance with the environmental laws ✓ (2017) Seminar-workshop in strengthening the capability building of the 108 Local Government Units in Region 1 on Emission Inventory ✓ (2017) Orientation-Training workshop on mainstreaming Ecosystem-based adaptation and Entity level GHG inventory and management program for LGUs and National Government Agencies in Region 1 ✓ (2018) "Travel Green Program" in partnership with Land Transportation Office Region 1 - Monitoring of all Major Bus Terminals in Dagupan City to ensure compliance with the environmental laws ✓ (2018) Orientation-Training workshop on mainstreaming Ecosystem-based adaptation and Entity level GHG inventory and management program for LGUs in Region 1 <p>Northeastern Pangasinan (NEPA) Airshed Best Practices</p> <ul style="list-style-type: none"> ✓ (2016) Orientation of the Transport Group on the provision of the Philippine Clean Air Act (RA 8749), sources and health impacts of Air Pollution for the transport groups from LGU Dagupan City, Binmaley, and Lingayen. ✓ (2016) Seminar-workshop for the 18 Local Government Units within the NEPA Airshed on Emission Inventory ✓ (2016) Roadside Anti-smoke Belching Campaign in the Northeastern Pangasinan Airshed (Urdaneta City, San Carlos City, Sta. Barbara and Dagupan City) ✓ (2016) Mangrove Planting Activity in accordance with the celebration of the Earth Day 2016 in partnership with the NEPA Governing Board, EXECOM and Technical Working Group, and partners from the Private Sector. ✓ (2017) Capacity Building for the Transport Groups on the Salient Features of the Philippine Clean Air Act (RA 8749) and Vehicle Emission Control from LGU San Carlos City, Urdaneta City, Calasiao, and Sta. Barbara. ✓ (2017) Seminar-workshop in strengthening the capability building of the 18 Local Government Units within the NEPA Airshed on Emission Inventory and Clean Air Scorecard Tool ✓ (2017) Continuous Anti-smoke Belching Operation and apprehension within the Northeastern Pangasinan Airshed (Urdaneta City, San Carlos City, Sta. Barbara and Dagupan City) ✓ (2017) Collaboration with Pangasinan State University to conduct a research study entitled "Northeastern Pangasinan (NEPA) Airshed Air Quality Profiling" ✓ (2017) Training of Motor Vehicle Emission Control Technician course for technical personnel from EMB Region 1, Urdaneta City, Dagupan City and San Carlos City I in partnership with TESDA Region

		<ul style="list-style-type: none"> ✓ (2018) Capacity Building for the Transport Groups on the Salient Features of the Philippine Clean Air Act (RA 8749) and Vehicle Emission Control in partnership with TESDA Region 1 and LTO Region 1 for the LGUs of San Jacinto, Manaoag, Mangaldan, Binmaley, and Urdaneta City. ✓ (2018) Roadside Anti-smoke Belching Monitoring and Apprehension Operations and Garage Emission Testing on Urdaneta City, San Carlos City, Sta. Barbara and Dagupan City. ✓ (2018) Seminar-workshop to strengthen the capability building of the 126 Local Government Units in Region 1 on Emission Inventory ✓ (2018) Development of the Northeastern Pangasinan (NEPA) Airshed Air Quality Profiling - <ul style="list-style-type: none"> ○ Chapter 1 Introduction ○ Chapter 2 NEPA AIRSHED Brief Description ○ Chapter 3 Legal Framework for Air Quality Management ○ Chapter 4 State of the Air in the NEPA Airshed ○ Chapter 5 NEPA AIRSHED Studies <ul style="list-style-type: none"> ○ Description, Exposure and Effects of Air Pollution Among Males and Females of The Different Sectors in The Northeastern Pangasinan Airshed (NEPA ○ Awareness and Response to Air Quality Information Among Males and Females of the Different Sectors In The Northeastern Pangasinan Airshed ○ Attitude Towards Air Quality and Lifestyle Among Males and Females of the Different Sectors in the Northeastern Pangasinan Airshed ✓ Willingness to Pay for a Clean Air Among Males and Females of the Different Sectors in the Northeastern Pangasinan Airshed
	Region 2	<ul style="list-style-type: none"> ✓ Color coding scheme was implemented to all tricycles in Tuguegarao City by LGU's to lessen traffic and emissions ✓ Conduct of Anti-smoke Belching Operations monthly through LTO Region 02 and AGB ✓ Radio guesting for advocacy ✓ <i>Kampo kalikasan para sa Kabataan 2017</i> ✓ Posting of Air Quality status in Tuguegarao City
	Region 3	<ul style="list-style-type: none"> ✓ Installed one unit LED display inside the lobby of the Office for public viewing of the daily AQI from the stations. ✓ Established a mini operational center which has (4) monitors or display to check and monitor the stations daily AQI and one monitor is intended for the real-time monitoring of a Coal fired Power Plant's Stack. ✓ Installed an ENVIDAS server in which industries with CEMS/COMS have already connected to us in compliance with the MC 2020-003. ✓ On-going Air Dispersion Modeling and Carrying Capacity Determination on the BPB-Airshed. Target submission of the proposal for Attainment and Non-Attainment Areas is on October 2020. (schedule date was moved because of the COVID-Pandemic) ✓ Incorporated most of our (6) Continuous Ambient Air Quality Monitoring Stations (CAAQMS) to our Data Acquisition and Handling System (DAHS) and its still ongoing ✓ Partnership with Private consultants and academe <p>LGU and Airshed Bulacan-Pampanga-Bataan Airshed Governing Board</p> <ul style="list-style-type: none"> ✓ BPB ASGB and LGU's have established ordinances for "No Open Burning" and "No smoking" on public places. ✓ LGU-City of San Fernando has established Anti Smoke Belching Unit (ASBU) Operations. ✓ LGU- City of San Fernando has established e-jeepneys (modernized jeepney) with routes within the City.
	Region 4A	<ul style="list-style-type: none"> ✓ On-going processing for securing for a sub airshed with limited coverage area for Laguna province. ✓ Utilize sensor-based air quality monitoring to create a greater coverage. These sensors shall be monitored and validated frequently. ✓ Creation of airshed in areas where coal fired power plants are located

	Region 4B	<ul style="list-style-type: none"> ✓ Development of localized IEC for Airshed Area in CY 2016 ✓ EMB MIMAROPA has its own stack emission testing team ✓ LGUs have their own anti-open burning, smoking, and anti-firecracker ordinances
	Region 5	<ul style="list-style-type: none"> ✓ Formulation of holistic programs in air pollution management which will be implemented through proper delegation and effective coordination of function and activities. ✓ The establishment of the three (3) Airsheds (Legazpi City Airshed, Naga City Airshed, and Bacon-Manito Geothermal Airshed) wherein, together with the LGUs, NGOs, Pos, the Academe and other concerned entities from the private sector, the DENR-EMB V will continue to formulate and implement the Integrated Air Quality Improvement Framework for a comprehensive air pollution management and control program. ✓ The real-time result of H₂S reading for the Bacman-Manito Airshed at Energy Development Corporation (EDC) is linked and can be found at the EMB 5 official website. ✓ The weekly results for the Air Quality Monitoring is posted at the EMB 5 official website. ✓ Updated Emission Inventory CY 2015-2018 for Region 5. ✓ Established additional three (3) Air Quality Monitoring Stations located at Sorsogon City, Masbate City and Daet, Camarines Norte
	Region 6	<p>Management of Mobile Sources</p> <ul style="list-style-type: none"> ✓ The creation of the Metro Iloilo Airshed Anti-Smoke Belching Unit (MIA-ASBU) Enforcement & IEC Team is a proactive approach to achieve and maintain healthful air. The MIA-ASBU Enforcement and IEC Team conducted roadside Inspection and Apprehension with IEC activities. The main objective of the activity is to instill discipline among the members of the transport sector to adhere to the mandate of Clean Air Act and to determine the efficacy of the series of smoke emission testing activities. ✓ The Southern Oton Jeepney Operators and Drivers Association (SOJODA) Transport Group based in Brgy. Cabanbanan, Oton, Iloilo is the most active transport group of Metro Iloilo Airshed. The group regularly attends MIAGB meetings. As a MIA-ASBU member, they are consistently present during the conduct of Roadside or Garage Smoke Emission Testing, IEC activities, roadside inspection, and apprehension activities. One of the best practices being implemented by the group to lessen air pollution is the mandatory coding wherein 15 units are not plying the usual routes daily. Approximately 9,000 liters in a month is saved and for 12 months, around 108,000 liters of fuel were not utilized and exhausted to the air as pollutants. With this practice, their engines were given time to rest and were cleaned and repaired. This ultimately prolonged engine life and hence, helped our environment. ✓ The Metro Iloilo Airshed Governing Board supports the transition to Euro 4 to lessen the particulate concentration emitted by vehicles. Jeepney driver organizations under the MIAGB have started to transition to Euro 4 engines and established transport cooperatives as compliance to the phase out. Other actions include the IEC Campaign to jeepney drivers and operators on engine maintenance and proper fuel use. Implementation of the Regular Ordinance that limits the entry of provincial PUVs in the major thoroughfares of Iloilo City, relocation of large commercial establishments to a wider spread of distribution in the city suburbs, and Information and Education Campaigns such as Ozone Month and Clean Air Month celebrations. <p>Management of Area Sources and Related Aspects</p> <ul style="list-style-type: none"> ✓ Attempts are started to identify and monitor open burning of agricultural waste materials from crop by-products, agricultural wastes, and other combustible materials. Several policy recommendations were made by the Metro Iloilo Airshed Governing Board. One of these recommendations include the issuance of board resolutions endorsing and enjoining local chief executives to enact an ordinance prohibiting open burning in their respective localities and endorsing mitigating measures of air pollution on road and building constructions. A template ordinance was crafted by MIAGB for reference of the LGU and was formally adopted as an ordinance by the Municipality of Oton under Municipal Ordinance 2018-326 An Ordinance Prohibiting Open Burning and Other Related Activities on October CY 2018 <p>Private Sectors, NGO's Local Government Initiatives</p>

		<ul style="list-style-type: none"> ✓ Iloilo City's Anti-Smoking Ordinance. The Iloilo City Government passed the Anti-Smoking Ordinance. The Iloilo City Anti-Smoking Task Force (ICAST) is stringently implementing the amended ordinance, ordering a total ban on smoking in all establishments. Under the amended ordinance, Regulation Ordinance No. 2006-150 or The Comprehensive Anti-Smoking Ordinance of Iloilo City, establishments are prohibited to put up smoking areas for smokers. Violators will be fined of the following: Php 1,500 for the first offense, Php 2,500 for the second offense, and Php 5,000 and one-week closure for the third and succeeding offenses. ✓ Oton-LGU's Stricter Enforcement of Zoning Sanitation and other environmental ordinances. The local government unit of Oton, Iloilo has issued Executive Order (EO) No. 6, also known as "An Order Directing the Municipal Environment and Natural Resources Office (MENRO) to Issue Environmental Clearance to Applicants with Business Establishments that Qualify with the Standard Sanitation." Under this EO, business permits of all applicants shall be subject to assessment and evaluation in order to qualify for the issuance of Environmental Sanitation Clearance from the MENRO. After such approval, their environmental application can be further directed to the concerned Agency. ✓ The Pavia P4MP Farmers Association based in Pavia, Iloilo conducts Farmer's Field School on Climate Change Adaptation and Mitigation in order to educate their farmer and seven (7) DOLE registered Farmers Association under the organization. The group also advocates and practices no burning of rice straw to avoid the emission carbon dioxide, carbon monoxide, nitrogen dioxide and sulphur dioxide that causes air pollution. ✓ The Kabataang Diyuna Comprehensive Youth Organization (KDCYO) also advocates clean air through educating the youth. The organization practices their weekly Community Clean-up Drives and encourages their members to plant fruit trees to help the environment. ✓ The Iloilo City Alliance of Drivers Association (ICADA), currently a member of Metro Iloilo Transport Service Cooperative, participates in the phase-out for the modernization program. <p>Public Awareness. Environmental Education, IEC Forums, Materials and Advocacies</p> <ul style="list-style-type: none"> ✓ Garage SET and IEC to the different Transport Groups including LGU Unit within MIA. ✓ Prior to Garage SET activities, the ASBU-IEC team gave lectures on health effects, impacts to the environment, and operators' and drivers' proper maintenance of their vehicles. The team also distributed IEC materials like "<i>Maayos na Makina, Sa Kalusugang Maganda.</i>" The MIA-ASBU Team also discussed about awareness to transport associations, private and government vehicle owners, and MIA member LGUs. Members of the MIA are all encouraged to be compliant with the DENR-EMB Emission Standards to serve as models for other government and private offices and transport groups. ✓ EMB 6 also intensified its public information campaign yearly through IEC, forums, and advocacy campaigns like <i>Bisita Baranggay</i>, Clean Air Summit Student Forums and etc., with regards to Clean Air Act. ✓ EMB 6, through the MIA-Governing Board, prepared modules and IEC material like "Backyard Burning," and "<i>Maaso nga Tambutso Magasto Sa Krudo</i>". The material was prepared and printed as brochures and posters and distributed during seminars, forums, garage testing and other related activities. <p>Mangrove Tree Planting Activity</p> <ul style="list-style-type: none"> ✓ In celebration of the Earth month the Environmental Management Bureau Region 6 and the Metro Iloilo Airshed Governing Board in collaboration with the Local Government Unit of Leganes, with the participation of representatives from the National Government Agencies (NGAs), Non-Government Organizations (NGOs), Local Government Units of Pavia, Oton, San Miguel, municipal officials, employees of LGU-Leganes, barangay officials and residents of Barangay Bigke and other neighboring barangays conduct yearly Mangrove tree planting at the one (1) adopted mangrove area of MIAGB at Barangay Bigke, Leganes Iloilo.
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	Region 7	<ul style="list-style-type: none"> ✓ Online submission of Self - Monitoring Report ✓ Centralized Data Acquisition System from Continuous Emission Monitoring Stations from Industries ✓ Mandatory Installation of Closed Circuit Television Cameras (CCTVs) Focusing the Smoke Emission from Stack ✓ EMB VII & Asian Development Bank (ADB) Capacity Development Technical Assistance (CDTA) Agreement <ul style="list-style-type: none"> ○ Monitor ambient air quality and improve air quality management in the City of Naga, Cebu where a cement plant and a power plant (partly financed by ADB) located; ○ ADB funded and installed two (2) CAAQMS-DOAS last 2016 for the monitoring of ambient air quality in the area; ○ Conduct air dispersion modeling study to determine point sources receptor areas and other air pollution sources; ○ Propose mitigating measures to reduce levels of pollutants emitted in the area; ○ Report (including air dispersion modeling) was done by a third-party consultant; draft to be submitted not later than 2020. ✓ Benchmarking / Capacity Building on Metro Cebu Airshed Members ✓ Establishment of Anti-Smoke Belching Unit per member Local Government Units within Metro Cebu Airshed; ✓ Donation of Opacity meter to LGU-Talisay City (member LGU of Metro Cebu Airshed);
	Region 8	
	Region 9	
	Region 10	<ul style="list-style-type: none"> ✓ AIR QUALITY MANAGEMENT ACTION PLANNING WORKSHOP: The purpose of the AQM Action Planning Workshop is to provide technical assistance to LGU in fulfilling their mandate to prepare and develop an action plan to attain and maintain the ambient air quality standards within the airsheds as provided in Section 8 & 9 of Republic Act 8749. The development of air quality management plan aims to identify existing and potential air quality issues and concern in the locality and institute short and long term interventions that is tangible and quantifiable to determine compliance and efficiency of policies and programs implemented by the LGUs in the airshed to prevent and reduce the impact of air pollution to human health and the environment. The accomplished air quality management action plan has been endorsed by the Governing Board through a resolution to each airshed LGUs for adoption and implementation subject for evaluation of the Board. ✓ POLICY REVIEW ON GREY AREAS OF THE CLEAN AIR ACT: The Metro Cagayan de Oro Airshed Governing Board recognizes the various policy gaps and grey areas of RA 8749 based on observations and situations that were raised during Board Meetings. The identified policy gaps are embodied in a form of approved Board Resolutions. <p>OTHER NOTABLE AIRSHED ACTIVITIES</p> <ul style="list-style-type: none"> ✓ Anti-Smoke Belching Campaign: The Airshed Governing Board has advocated for the regulation of smoke-belching vehicle in partnership with the Airshed-Member LGUs. A Board Resolution with an Ordinance Template was endorsed to the LGUs in the Airshed for them to approve and implement. LGU's Cagayan de Oro and Villanueva, Misamis Oriental has passed ordinance on Anti-Smoke Belching. Regular Anti-Smoke Belching activities has been conducted by the Airshed Board and partner LGUs monthly. ✓ LTO Agent Deputation Seminar: LTO Resource Speakers were invited to conduct the training seminar to satisfy the requirement for LTO Deputation for the Anti-Smoke belching Campaign of the Airshed. ✓ Capability Building Plant Tour: Conducted in 2018, the plant tour was intended to orient the airshed members on the day to day operation of industries that contributes to air pollution and the various technologies in air pollution control and prevention. ✓ Environmental Management Seminar : An IEC program of the Airshed Board through the EMB Regional Office which aimed to orient various stakeholders on the salient features of environmental laws implemented by EMB and another environment related topic. Target audiences were the following:

		<ul style="list-style-type: none"> ○ For Barangay Local Government Unit (Lgu) Officials ○ DepEd Public School Teachers ○ Private School Teacher ○ PUV Drivers and Operators <p>✓ Tree Growing Project : The Airshed Governing Board adopted a one- hectare reforestation site in Brgy. Pagalungan, Cagayan de Oro City embodied in MCA Resolution No. 001-2017. The Tree Growing initiative has been participated by Airshed Governing Board Members and EMB-10 Personnel</p> <p>✓ Private Emission Testing Center- Joint Monitoring Activity: The activity is conducted pursuant to Joint DENR-DTI-DOTC AO 01 -2003 last November 27, 2018 with representatives from the LTO-10, DTI-10, TESDA-10. Oro Transport Service Cooperative (OROTSCO), CLENRO-Cagayan de Oro City and El Salvador City</p>
	Region 11	<p>✓ Air Dispersion Modeling Study for Davao City Airshed, including Carrying Capacity and Assimilation Assessment initiated by the airshed governing board through the Air Quality Management Fund (AQMF).</p> <p>✓ The anti-smoking in public places ordinance of Davao City was the first to be implemented in the country. Every time a commercial plane touches down, all passengers are reminded by the airline regarding this ordinance. This made Davao City known to other parts of the country and to foreign visitors. This is further strengthened by the Civil Service Commission issuing Memorandum Circular No. 17, Series of 2009 wherein government personnel are banned from smoking within the premises of government offices.</p> <p>✓ Banana industries located within the airshed are now using boom spray to minimize direct contamination of the environment and the general public with pesticides and other harmful chemicals.</p> <p>✓ Holcim Philippines-Davao Cement Plant is now using fine coco charcoal collected from the wastewater treatment facilities of activated carbon manufacturers, rice hulls from rice mills and used oil on their kiln operation as alternative fuels and raw materials (AFR).</p> <p>✓ San Miguel Brewery Inc. is currently using methane produced from their MUR Activated Sludge WTF to fuel their Anderson Boiler. The plant utilizes the Anderson Boiler as the complimentary boiler of their bunker-fired boiler to minimize air emissions.</p> <p>✓ All fuel refilling stations are now dispensing a bio-diesel blend of 1% since 2008 and bio-ethanol blend of 10% since 2009.</p> <p>✓ EMB-XI has a dedicated technical team for the conduct of source emission testing for stationary sources within the Region. EMB-XI has implemented a policy that all source emission testing within the Region shall only be conducted by the dedicated technical team of EMB-XI.</p> <p>✓ For cases in which the current available equipment of EMB-XI is not capable of conducting a source emission test for a certain stationary source, a third-party sampler duly accredited by EMB-XI is allowed to conduct the source emission test, but with the supervision and overlook of EMB-XI technical personnel.</p> <p>✓ Therma South, Inc. (TSI), San Miguel Consolidated Power Corporation (SMCPC) and Holcim Philippines, Inc., have installed a Continuous Emission Monitoring System (CEMS), a technology which allows for real-time and continuous monitoring of the emission from stationary sources.</p> <p>✓ Therma South, Inc., operated a 2x150MW Coal-Fired Power planned to plant trees in a 1,000 hectares land under the Carbon Sink Management Project (CSMP) of the company.</p> <p>✓ Large industries are currently being required to install a Closed-Circuit Television Camera (CCTV) with night vision capabilities for all medium to large stationary sources, connected through on-line to the system of EMB-XI, with a direct line of vision to the smoke stack. This grants EMB-XI an access for real-time visual monitoring of the emission of industries, anytime, anywhere, provided an internet connection is available at Air Quality Management Operation Center.</p> <p>✓ Davao Central Chemical Corp. (DCCC) has used the Cerallec technology to recycle excess heat from its kerosene-fired furnaces to further provide heat to the other furnaces. This innovative approach reduces the fuel consumption of the industry per unit time of production and operation, which in turn equates to less emission of combustion gases.</p> <p>✓ Davao City received its honor when it has been declared by the Clean Air Philippines</p>

		<p>Movement, Inc. as Clean Air City and Mayor Inday Sara Duterte-Carpio as Clean Air Champion. Davao City as "Clean Air City" due to the various air-related local ordinances, such as the Anti-Smoke Belching Ordinance, Firecracker Ban, No Open Burning and Comprehensive Anti-Smoking Ordinance amongst others, that were strictly implemented in the city. Mayor Inday Sara Duterte-Carpio was awarded as the Clean Air Champion by the Clean Air Philippines Movement, Inc. (CAPMI), a non-profit organization. Dr. Michael A. Aragon, Chairperson of CAPMI, presented the award to the honorable City Mayor for her strong political will to fight for clean and breathable air for all Davaoeneos. He also pointed out that in a survey conducted across the major cities of the country, Davao City have the cleanest air despite rapid industrialization and urbanization. Mayor Inday Sara, she extended her appeal to do the part of the all Davaoeneos to maintain the clean air and not to degradation either to air and water</p>
	Region 12	<ul style="list-style-type: none"> ✓ Conduct of Roadside emission testing in coordination with the Land Transportation Office (LTO) and/or other governing agencies ✓ Tree Planting and clean-up activities conducted under Airshed Area with Contribution of Emission based on emission inventory conducted ✓ Intensive Private Emission Testing Center (PETC) Monitoring
	Region 13	<ul style="list-style-type: none"> ✓ Cohesive partnership with the Local Government Unit (LGUs) within the Airshed. <ul style="list-style-type: none"> ○ Maximum attendance during meetings of the Agusan del Norte Butuan City Airshed Governing Board Meetings and very active participation and support from the members of the GB during activities relating to Clean Air. ✓ Partnership with Academic Institution (Caraga State University) <ul style="list-style-type: none"> ○ Installation of the Continuous Ambient Monitoring Stations for the appreciation of the students. Data is made available to both for undergraduate and post-graduate students who are having their thesis. ✓ Very active Anti Smoke Belching Unit (ASBU) of the LGU of Butuan City <ul style="list-style-type: none"> ○ Regular roadside emission testing is being conducted at the strategic locations within Butuan City to check compliance of the vehicles to mobile emission standards. ○ Non complying vehicles/vehicle owners are issued with citation tickets.

Challenges in the Management of Airshed

Despite the effort and accomplishments in activating the airshed governing board nationwide, there remains some challenges in managing the air quality at the regional level. For example, the seasonal long-range transported pollutants from neighboring Asian regions are affecting the pristine air of some rural Philippines in the Northwest Luzon (Bagtasa et al, 2017) and Southwest Philippines (Chen, 2018). The increasing ozone concentrations during summer in the central Luzon region. Studies using clinical records from Brunei, Indonesia, Malaysia and Singapore has shown that seasonal haze events have been causing acute psychological, respiratory, cardiovascular, and neurological morbidity and mortality (Cheong, 2019, Rocha, 2020). Hence, air quality management solutions based on aerosol characterization and source apportionment studies are gaining interest in the region, in order to address public health impacts.

Biomass burning from rural Philippines are also being observed from anecdotal evidences in Region 3, and there's a need to consolidate the regional data on criteria gases pollutants (NO₂, O₃) in order to determine the extent of its impacts.

The challenge of creating a single airshed governing board in a broad region of provinces like Cavite, Laguna, Rizal and Batangas is reflected on the output of the airshed governing board. In these provinces, the stationary source locators are also in organized industrial zones, hence may be an opportunity for a more specific air quality management strategy, not to mention the high cost of maintaining the stationary air quality monitoring stations. Natural sources of air pollution from volcanic eruption are inevitable challenge to Region 5, hence, the need for more sustainable and spatially resolved continuous air quality monitoring to respond to emergency situations.

Managing mobile sources for emerging megacities are also becoming a challenge, due to the dependence on motorized modes of transportation, and availability of more affordable motor-vehicles. For example, Region 6 identifies the lack of equipment to monitor vehicular smoke belching especially for Gasoline as an opportunity to capacitate the region in emissions monitoring from mobile sources. Some envisioned results of putting up of Anti-Smoke Belching Unit (ASBU) with multi-sectoral participation is mitigating emissions from mobile sources, particularly public transport vehicles that are economically hindered from changing old and inefficient engines into ones that meet the Clean Air Standards. Promoting non-motorized means of transportation and constructing infrastructure to make them work is also a viable alternative to commuters in need of cleaner mobility options. On top of that is the challenge imposed by the PUJ/PUV modernization program, in which the guidelines on route rationalization and devolving registration in the LGU is still underway.

A number of regions also has difficulty in winning the cooperation and collaboration of local government chief executives whose priority program lists do not include the implementation of the Clean Air Act. Region 6 added that establishing efficient and collaborative partnership with all involved government agencies, LGUs, and the academe, as well as social mobilization and capacity building for organizations can affect behavior change and create an impact on the pursuing the outcomes of the Clean Air Act. In emission inventory, challenges exists in the inadequate database system both from LGUs, National Government Agencies and Private industries needed for area and mobile sources particularly on fuel consumptions, both domestic and agricultural activities. Improving the current practice in the acquisition of data necessary for status assessment, planning, evaluation, emission inventory may address the gaps encountered in the planning and implementation of the policies and programs to improve air quality within the regions. In reporting of air quality data the challenge has always been to maintain a data capture rate of not less than 75%.

Agency Actions and Sectoral Initiatives on Air Quality Management



Agency Actions in the management of Air Quality

Agency	Actions and Initiatives on Air Quality
DoH	<ul style="list-style-type: none"> ✓ Main agency proponent in the observance of the “world environmental health day” in the Philippines every September 26, (eventually approved as Presidential Proclamation 595 in 2019 and Memorandum Circular 2019-007) ✓ Main agency supporting the updating/finalization of the AQI breakpoints and guideline values and AQ action plan, with assistance from WHO, and in generating baselines (pilot areas) on air quality health risks (with LCP and DOH Hospitals) ✓ Development of the National Environmental Health Action Plan (NEHAP) for 2017-2022 with activities such as <ul style="list-style-type: none"> ○ Improvement of national air quality standards ○ Development of the health-based standards for indoor air quality ○ Review and revise criteria for determining number and location of air quality monitoring systems ○ Develop data management systems ○ Workshop and meetings to strengthen emission laws and standards ✓ Convening the Inter-Agency Committee on Environmental Health (IACEH), and the technical working group (TWG) on Air Quality and Health, with discussions on issues and resolution relevant to Manila Declaration and NEHAP, development and lobbying of Relevant Policies on Air Pollution and Health. ✓ Support or develop advocacy/IEC programs on air quality exposure and its health risks, through orientation and training on the use of greener and more cost-efficient cooking technologies (Clean Energy for Cooking Project -EcoSafe Kalan) in 2017 with the following output: <ul style="list-style-type: none"> ○ Educated communities an adverse effects of indoor air pollution ○ Encourage to switch from using open-fire cooking to more fuel efficient and environment-friendly cooking technologies. ✓ Served as an informal preparatory meeting of leaders: <ul style="list-style-type: none"> ○ For the UN Secretary- General’s Climate Action Summit on 23 September 2019; ○ For the 15th ASEAN +3 Environment Ministers Meeting in September in Cambodia; and ○ As a stepping stone to the High- Level Officials Meeting (HLOM) of the Asia- Pacific Regional Forum on Health and Environment, chaired by the Philippines ✓ Chairship of the Asia- Pacific Regional Forum on Health and Environment (APRFHE) in 2017-2019, that included a thematic Working Group on Air Quality and Health with the corresponding activities and outputs: <ul style="list-style-type: none"> ○ Meetings and workshops on environmental health (EH), including air quality and health SDG-related initiatives ○ Communications advocacy ○ Manila Declaration on Health and Environment
	Road sector:
DOTr	<ul style="list-style-type: none"> ✓ Implementation of the Euro 4/IV emissions and fuel standards ✓ Launching of the PUV modernization Program in 2017 ✓ Various Railway and Bus Rapid Transit (BRT) projects ✓ Issuance of policy for the authorization of private motor vehicle inspection centers nationwide ✓ Construction of the Paranaque Integrated Terminal Exchange (PITX) ✓ Introduction of High-Quality transport services, such as Point-to-point bus and Premium Airport Bus Service ✓ DOTr spearheading the decongestion of Metro Manila by transferring to Clark, Pampanga
	Rail Sector
	<ul style="list-style-type: none"> ✓ Ensure that all rail infrastructure projects³³ secure an ECC prior to project implementation;

³³ Rail infrastructure Projects include the North-South Commuter Railway Project and the Metro-Manila Subway Project

Agency	Actions and Initiatives on Air Quality
	<ul style="list-style-type: none"> ✓ Designates Environmental Units which include Pollution Control Officers, across all infrastructure Projects, in order to facilitate its compliance with the conditions of the ECC; ✓ Engagement of Third-Party Monitoring Auditors to assess the compliance of each project to its Environmental Management Plan; ✓ Requires all rail infrastructure projects to regularly conduct ambient air quality monitoring and source emission testing in compliance with RA 8749, along with regular noise and vibration monitoring compliance with NPCC Memorandum Circular No. 002, Series of 1980, and World Bank Group International Finance Corporation Environmental, Health and Safety (WBG-IFC EHS) Guidelines, all of which to be conducted from construction phase until operation phase; ✓ Ensures that each rail infrastructure project prepares feasibility and detailed design studies with considerations to air quality impact identification, assessment, and mitigation; ✓ Ensures that its contractors comply with its submitted Contractors Environmental Management and Monitoring Plan (CEMMP); ✓ Provision of Environmental Guarantee Fund (EGF) allocated as fund source for the indemnification of damages caused by the Project and immediate rehabilitation and/or restoration of affected ecosystems; ✓ Conducts tree planting activities for the implementation of reforestation and climate change adaptation program for GHG emission reduction program; ✓ Ensures designs for Railway Rolling Stock and E&M Systems are optimized to consume the minimal amount of energy. Example of which is the addition of regenerative braking system in trains to efficiently use electrical energy supplied thus reducing carbon footprint; ✓ Conduct of Information, Education and Communication (IEC) Program to disseminate information to stakeholders regarding environmental impacts of the Projects and their respective mitigating measures; ✓ Implementation of Transit-Oriented Development (TOD), e.g., pedestrianization³⁴ and rationalized transport systems in the Railway System Design to reduce carbon emission. ✓ Provision of green spaces in the railway project right-of-way; and ✓ Provision of geothermal cooling system in select railway stations which uses renewable energy.
	<p>Aviation Sector - thru the Civil Aviation Authority of the Philippines (CAAP), in coordination with the International Civil Aviation Organization's (ICAO), the Philippines being a member state:</p> <ul style="list-style-type: none"> ✓ CAAP voluntarily submitted the country's Action Plans on Emissions Reduction (APER); ✓ As part of the State Action Plan³⁵, CAAP coordinates with ICAO in gearing up for the implementation of Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)³⁶
DPWH	<ul style="list-style-type: none"> ✓ Directs and orients all the heavy equipment operators and drivers to ensure that all equipment and service vehicles are properly serviced and maintained, following the D.O. 5 s. 2018 (Preventive Maintenance Manual) and the D.O. 11 s. 2016 (Routine Maintenance for Service Vehicles and Most Commonly Used Equipment Manual). ✓ The Department adheres to the CSC-MC No. 17 s, 2009 and RA 8749 s, 1999 by undertaking the following activities: <ul style="list-style-type: none"> ○ Signs, posters on smoking prohibition are posted within the building premises of the DPWH nationwide. ○ Signs, posters on no unnecessary idling are posted within the building premises of the DPWH nationwide. ○ Conduct Tree Planting Activity in celebration of Arbor Day in pursuant to the Republic Act No. 10176 ✓ D.O. 57 s. 2016 require all the Implementing Offices of the Department to prepare an environmental document and secure ECC from the DENR for infrastructure projects that can significantly affect the Environment (e.g. degradation of air quality during Construction phase). ✓ D.O. 245 s. 2003 contains a manual that is use by the Department as a guide for the preparation and implementation of social and environmental impact assessment, environmental monitoring of infrastructure projects and other environmental-related activities of the Department such as the determination of the impact of construction/operations on concentrations of dust and vehicular

³⁴ Proposed to be done by use of vegetation in urban design, better urban design such as walkable cities, hence, reliance on motorized vehicles may be lessened, more efficient public transportation, promoting the usage of bicycles and public transportation by gearing up for more bike parking and interconnecting PUV terminals, respectively.

³⁵ Includes all other mitigation measures such as aircraft technology, alternative fuels, improved air traffic management (ATM) system, more efficient operations, economic market based measures (MBM), regulatory measures and airport movements.

³⁶ Focuses on airline operations (AOs)

Agency	Actions and Initiatives on Air Quality
	<p>emissions (sulphur dioxide and nitrogen dioxide) used for the preparation of Ambient Air Quality Measurement Report.</p> <ul style="list-style-type: none"> ✓ D.O. 224 s. 2003 and D.O. 220 s. 1999 creates the Environmental Office of the Department in the Central Office and Regional Offices Nationwide which is responsible to conduct EIA, prepare environmental reports and conduct environmental monitoring. Further, an Environmental Focal Person (EFP) is designated in the District Engineering Offices Nationwide to act as the counterpart of the environmental officers from the central and the regional offices.
DoE	<ul style="list-style-type: none"> ✓ Establishment of Technical Committee on Petroleum Products & Additives (TCPPA) ✓ Establishment of Standard Development Process ✓ Establishment of Philippine National Standard for petroleum products ✓ Harmonization of standards in downstream petroleum industry ✓ Establishment of Technical Committee on Petroleum Facilities and Processes (TCPPF) ✓ Ongoing standards development include emulsified fuel/ bunker oil and kerosene for fuel quality standards and review/ update of DPNS/FS 2:2017 - LPG Refilling Plant for facility standards. ✓ Development of fuel quality roadmap ✓ Implementation and enforcement of Philippine National Standards on Fuel Quality ✓ Drafting the implementation guidelines for fuel quality towards a D.C.
MMDA	<ul style="list-style-type: none"> ✓ On-going roadside apprehension ✓ Bus service management system ✓ Regulation of traffic ✓ Establishment of 15 AQ monitoring sites along EDSA, C5 and Roxas Blvd, using low-cost devices, in partnership with a private sector ✓ On-going traffic statistics reported as annual average daily traffic counts
DOST	<ul style="list-style-type: none"> ✓ Prepared the Harmonized National R&D Agenda (HNRDA) 2017-2022 to ensure that results of S&T, articulates our national priorities including an air research agenda road-map consultation activities by the Philippine Council for Industry, Energy and Emerging Technology Research and Development (PCIEERD) since 2017. The output is an Air Research Road map, 2021-2023 ✓ The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) is mandated to continue on monitoring meteorological- related factors that affects the environment such as rainfall, surface pressure, surface winds, temperature, humidity and visibility. ✓ The Philippine Nuclear Research Institute (PNRI) conducted the study entitled Assessment of respirable air particulate pollution sources in Metro Manila and receptor modelling from July 2016 to Feb 2017 (Valenzuela City, MMDA (EDSA), Makati City and NAMRIA, Taguig City)
PIA	<ul style="list-style-type: none"> ✓ Assist in communications by dissemination of data and announcement of pronouncements on health risks, based on the DOH and DENR.

Sectoral initiatives in Air Quality Information

Health Sector

Institution	Name of Project	Period Covered and location of Implementation	Activity	Output	Aspect addressed
Lung Center of the Philippines	Air Pollution Monitoring Project	Aug 2015 to present	Installation and operation of PM ₁₀ and PM _{2.5} analysers (near-equivalent method as per US EPA CFR Part 58 Appendix E) with meteorological sensors for continuous monitoring of air pollution	Real-time air quality information and warning system through www.airtoday.ph	Information
		LCP compound, Quezon City			Policy
World Health Organization-Philippine Country Office	Assessment of Air Quality and Health Monitoring Systems in Metro Manila and Addressing Health Impact	2016	Desk work, interviews	Phase 1 Assessment Report	Information
	Improving the Air Quality and Health Monitoring System in Metro Manila	2016-2018	Desk-work, interviews, focus-group discussions	Phase 2 Assessment report Method for determination of AQI breakpoints	Information Policy

Academic Sector

Title of Publication	First Author, (Year), Universities involved	Period Covered and of Location Implementation	Type of Manuscript
Aerosol particle mixing state, refractory particle number size distributions and emission factors in a polluted urban environment: Case study of Metro Manila, Philippines	Kecorius,S., et al (2017) Ateneo de Manila De Lasalle University Taft Leibniz Institute for Tropospheric Research University of the Philippines-Diliman	2015, Taft Ave., Manila City	Journal Publication
Spatial estimation of air PM _{2.5} emissions using activity data, local emission factors and land cover derived from satellite imagery	Gibe, H. P. and Cayetano, M. G, 2017 University of the Philippines-Diliman Gwangju Institute of Science and Technology, South Korea	2016, Cabanatuan City, Nueva Ecija	Journal Article
Spatial Characterization of Black Carbon Mass Concentration in the Atmosphere of a Southeast Asian Megacity: An Air Quality Case Study for Metro Manila, Philippines	Alas, H. et al 2018 Ateneo de Manila De Lasalle University Taft Leibniz Institute for Tropospheric Research University of the Philippines-Diliman	2015 Manila City Quezon City	Journal Article
Activity Pattern of School/University Tenants and their Family Members in Metro Manila - Philippines	Kecorius,S., et al. (2017) Ateneo de Manila De Lasalle University Taft Leibniz Institute for Tropospheric Research University of the Philippines-Diliman	2015 Manila City Quezon City	Journal Article
Seasonal variation and chemical characterization of PM _{2.5} in northwestern Philippines	Bagtasa, G. et al. 2017 University of the Philippines-Diliman National Sun-Yat Sen University, Kaoshiung, Taiwan	2016 Burgos, Ilocos Norte	Journal Article
Oxidative potential of fine ambient particles in various environments.	Borlaza, L., et al. 2018 University of the Philippines-Diliman Gwangju Institute of Science and Technology, South Korea	2016 Quezon City	Journal Article
PM ₁₀ and Surface dust source characterization in Baguio City-Central Business District Philippines	Hagad and Cayetano, 2019 University of the Philippines-Diliman Gwangju Institute of Science and Technology, South Korea	2015-2017 Baguio City	Journal Article
Respiratory tract deposition of inhaled roadside ultrafine refractory particles in a polluted megacity of South-East Asia	Kecorius,S., et al. (2017) Ateneo de Manila De Lasalle University Taft Leibniz Institute for Tropospheric Research University of the Philippines-Diliman	2015 Manila City	Journal Article

Title of Publication	First Author, (Year), Universities involved	Period Covered and of Location Implementation	Type of Manuscript
Aerosol Particle article and Black Carbon Emission factors of vehicular fleet in Manila, Philippines	Madueño, L., et al. (2019) Ateneo de Manila De Lasalle University Taft Leibniz Institute for Tropospheric Research University of the Philippines-Diliman	2015 Manila City	Journal Article
Long-range transport of aerosols from East and Southeast Asia to northern Philippines and its direct radiative forcing effect	Bagtasa, G. et al. 2019 University of the Philippines-Diliman National Sun-Yat Sen University, Kaoshiung, Taiwan	2017 Burgos, Ilocos Norte	Journal Article
Size-resolved composition and morphology of particulate matter during the southwest monsoon in Metro Manila, Philippines	Templonuevo-Cruz, et al. 2019 Ateneo de Manila Manila Observatory	2018-2019, Quezon City	Journal Article
An annual time series of weekly size-resolved aerosol properties in the megacity of Metro Manila, Philippines	Stahl, et al. 2020 Ateneo de Manila Manila Observatory	2018-2019, Quezon City	Journal Article
Correlation of Aerosol Optical Properties with Surface Meteorological Parameters over Manila	Vergara, R., et al, 2017 De Lasalle University Taft	2016, Manila City	Journal Article
Spectral-Temporal Variations of Aerosol Ångström Exponent Over Manila, Philippines	Plando, F.R., et al, 2017 De Lasalle University Taft	2016, Manila City	Journal Article
Low Cost Air Quality Monitoring Sensor (AQMS) for Particulate Matter Measurement of Light Emitting Diode LiDAR System	Galvez, MCD, et al, 2019 De Lasalle University Taft	2016-2017, Manila City	Journal Article
Investigating the Effect of Urbanization on Weather Using the Weather Research and Forecasting (WRF) Model: A Case of Metro Manila, Philippines	Oliveros, j. 2019 De Lasalle University Taft	2016-2017 Metro Manila	Journal Article
Application of the WRF/Chem v. 3.6.1 on the reanalysis of criteria pollutants over Metro Manila	Garcia, J.A., et al, 2019 De Lasalle University Taft University of the Philippines-Diliman	2016-2018, Metro Manila	Journal Article
Air Particulate Matter, Black Carbon, and Elemental Concentrations and Source Apportionment in Calaca, Batangas	Tuso, C. et al.,	2018-2019, Calaca, Batangas	Journal Article
Effects Of Aerosol Optical Properties, Variations And Dynamics On The Radiative Forcing: Focus On Metro Manila	Madalipay, JT and Perez, GJ University of the Philippines-Diliman	2003-2017, Metro Manila	Thesis Manuscript
Effects Of Diurnal Wind Reversal On The	Manding, KV and Cayetano, MG	2016-2017, NCR	Thesis Manuscript

Title of Publication	First Author, (Year), Universities involved	Period Covered and Location of Implementation	Type of Manuscript
Air Quality Of The National Capital Region (NCR), Philippines	University of the Philippines-Diliman		
Spatial And Temporal Variations Of Roadsides Particulate Matter Concentrations In National Capital Region, Philippines In 2016-2017	Perdigones, B and Cayetano, MG University of the Philippines-Diliman	2016-2017, NCR	Thesis Manuscript
The Influence Of Planetary Boundary Layer Height On Particulate Matter Concentration Over Quezon City	Baldomero, M and Cayetano, MG University of the Philippines-Diliman	2015-2017, NCR	Thesis Manuscript

Non-governmental Sector

Organization	Name of Project	Period Covered and Location of Implementation	Activity	Output	Aspect addressed
Clean Air Asia	"Integrated Better Air Quality Programme in Asia" (IBAQ Programme) funded by the Ministry of Environment of Japan and implemented by Clean Air Asia in collaboration with Marikina City Environmental Management Office	2016-2019 Marikina City	The project implementation in Marikina City involved the conduct of short-term air quality monitoring, bottom-up emissions inventory, spatial mapping of air pollution-related incidences and stakeholder engagement workshops to develop a "Clean Air Action Plan for Marikina City, Philippines."	Emissions Inventory Report and Clean Air Action Plan for Marikina City, Philippines (2020-2030)	Monitoring, Emission inventory Air Pollution and Health Information/Dissemination Policy
	Experiential Learning and Environmental Program" funded by UPS and implemented by Clean Air Asia in collaboration with Parañaque City Environment and Natural Resources Office	2016 - 2018 Parañaque City	The project organized learning sessions for local communities and transport groups to educate them on the issue of air pollution, its impacts to health and environment as well as ways that they can help reduce air pollution. The project was also able to monitor changes in attitude and behavior among its participants up to two months after the learning session.	Training materials for community-based sessions and information, education and communication materials targeting community and transport drivers	Information/Dissemination (Awareness raising)
Partnership for Clean Air	Clean air and fleet management training and seminar	May 22-23, 2017	A two day training seminar on clean air and fleet management was conducted to address issues and concerns regarding how to manage the existing problem on fleet management and how to improve and better the air quality in	The training seminar enhanced the ability for cost-effective approach in improving air quality and fleet management in some polluted areas of the city	Information/Dissemination

Organization	Name of Project	Period Covered and Location of Implementation	Activity	Output	Aspect addressed
			Makati City considered as the most urbanized business center in National Capital Region, Philippines	which involved identification of emission sources; assessment of extent of contribution of these sources on ambient environment; prioritizing the sources that need to be tackled; evaluate various options for controlling the sources with regard to feasibility and economic viability and formulation and implementation of most appropriate action plans.	
	Assessment of respirable air particulate pollution sources in Metro Manila and receptor modelling (source apportionment)	July 2016 to February 2017 Metro Manila (Valenzuela City, MMDA(EDSA), Makati City and NAMRIA, Taguig City	Collection of samples to determine PM ₁₀ and PM _{2.5} levels across the three Metro Manila sites	Reports, presentations	Information/Dissemination
	Annual Clean Air Forum	2016-2018	Presentations on Stakeholder initiatives on air quality management	Forum reports	Information/Dissemination
Researchers for Clean Air	The Manila Aerosol Characterization Experiment (MACE) 2015	Mar 2015 - June 2015 Taft Ave, Manila Katipunan Ave, Quezon City	Installation and operation of aerosol analyzers and samplers for intensive characterization of air pollution	Journal publication Research report (Thesis)	Information
Rotary Club of Makati	Air Quality Monitoring & Reporting System Project (RCM-AQMS Project)	2016- present Ayala Ave., Makati City UST, Manila City EDSA Muñoz, Quezon City	Installation and operation of PM ₁₀ and PM _{2.5} analysers (near-equivalent method as per US EPA CFR Part 58 Appendix E) with meteorological sensors for continuous monitoring of air pollution	Real-time air quality information and warning system through www.airtoday.ph	Information/Dissemination
UNIDO	Development of the HPAP Technical Assistance in the development of the Implementing Guidelines for EO 51 (IACEH)	2017-2019	Technical assistance in the drafting and Consultations for the development of HPAP for the Philippines	Health and Pollution Action Plan for the Philippines Implementing Guidelines for the EO 58 Concept notes on Mitigating Pollution from The Transport sector to reduce Health Risk to people	Policy Air Quality Plans Air Quality Management

Summary and Way forward



Summary

The Air Quality Management in the Philippines from 2016-2018 has shown available institutional mechanisms, thru the continuing basis on the legal and regulatory framework, administrative functions and operations by the national governmental agencies, led by the DENR-EMB. Air Quality Status of the regions were in place, emissions are inventoried long-term, and regions with remaining needs for air quality and emissions management were identified. Most of the Regions have activated the airshed governing board, and management is being sustained using the Air Quality Management Fund.

The activities of the regional EMB offices, as well as the airshed governing board has been visible in the past 2016-2018, and is reflected in their best practices and way-forward. There remains a need for capacitating the regions on mobile source emissions inventory and management, as this source remains to be the highest contribution in based on the 2018 emissions inventory report.

As the transport sector (mobile sources) is identified to be one of the major contributor to the overall emissions due to various factors, the DOTr is suggesting to tap the agencies with capabilities to assess air quality parameters using remote sensing technologies, empower citizens' participation through establishment of channels/platforms where they can easily and directly report violators of RA 8749 to DENR, strengthening the multi-sectoral review committee to regularly review the existing policies and recommend revisions as necessary; and harmonize and update local standards for noise and vibration with international standards.

Way Forward (Regional Agencies)

NCR	<ul style="list-style-type: none">» Full implementation of the Sustainability Plan for Metro Manila Ambient Air Quality Monitoring Program to sustain the continuous monitoring of air quality [Particulate Matter (PM) and Gases] in Metro Manila utilizing the existing air quality monitoring equipment.» Professional trainings and certifications for the inspectors to add efficiency in performing related tasks in monitoring and inspection of the equipment (CAMS)» Continue trainings on data gathering and tool development process on Emission Inventory(EI) for the 17 LGUs (piloted in 2 LGUs- Pateros and Malabon)» Additional manpower to monitor the deviation and light levels to be able to perform the necessary procedures in the validation of data.» Strengthened monitoring of Private Emission Testing Centers (<i>PETCs</i>) and <i>intensified emission testing</i> prior to LTO registration renewal thru private emission testing centers (PETCs)» Stricter monitoring of stationary sources of pollution including the major industries.» Intensified IEC and public awareness campaign/communicate air quality status to the public using appropriate communication channels with the help of media partners.» Purchase consumables, calibrating Equipment and gas to guarantee the functionality of the equipment and to ensure that the data presented are valid.» Designation of attainment and non-attainment areas for NCR Airshed
CAR	
Region 1	<ul style="list-style-type: none">» Operationalization of NEPA Airshed» Development of Northeastern Pangasinan (NEPA) Airshed Air Dispersion Modelling» Designation of NEPA Airsheds Attainment and Non-Attainment Areas» Continuous regional information dissemination on the Ambient Air Quality Results

	<ul style="list-style-type: none"> » Additional establishment of air quality monitoring in the region » Annual conduct of Regional Emission Inventory » Conduct Seminar- Workshop on the Development of Climate Change Communication Plan on Local Government Units » Conduct Seminar- Workshop on the Entity and Community Level GHG Inventory from various agencies, LGUs, Private Sectors etc. » Conduct of Ecosystem-Based Adaptation (EbA) Ecosystem-Based Adaptation (EbA) Orientation-Workshop and proposals.
Region 2	
Region 3	<ul style="list-style-type: none"> » Report the results of monitoring gases parameters such as Ozone and NOx due to higher Ozone readings in the region especially on summer season. » Establish a centralized/uniform Operational Center using our Central DAHS (server) for CEMS/COMS incorporating our Air Monitoring Stations as well as our real time water quality monitoring stations. » Possibility of using air quality monitoring sensors to replace or augment our CAAQMS because our existing CAAQMS have high maintenance cost and difficult to maintain and operate. » Consider shifting to sub-contracting the operation and maintenance of our CAAQMS to reliable and qualified third party contractors just like other countries in South East Asia. The EMB may check and validate the performance and activities done by the hired contractor for the operation and maintenance of our CAAQMS. The challenge is that DOAS cannot attain data capture, leaving significant invalid data.
Region 4A	<ul style="list-style-type: none"> » On-going process for securing for a sub airshed with limited coverage area for Laguna province. » Utilize sensor-based air quality monitoring to create a greater coverage. These sensors shall be monitored and validated frequently. » Creation of airshed in areas where coal fired power plants are located.
Region 4B	
Region 5	<ul style="list-style-type: none"> » Plan to establish four (4) additional Air Quality Monitoring Stations to be located at Pili, Camarines Sur, Daraga and Tabaco, Albay, and Virac, Cataduanes » Formulation of resolutions to help improve the air quality within the Airsheds in the Bicol Region. » Conduct monthly and quarterly Anti-Smoke Belching Operation and free emission testing. » Conduct of regular Air Quality Monitoring to determine attainment and non-attainment areas to manage the factors that can affect the air quality within the region. » Proper dissemination of Information, Education, and Communication (IECs) in air pollution management and control. » Promotion of public information and education to encourage the participation of an informed and active community in air quality planning and monitoring. » Provide assistance in preparing and developing action plan to attain and maintain the Ambient Air Quality.
Region 6	<ul style="list-style-type: none"> » Plan to have additional monitoring station once the Manual siting criteria will be approved. Currently, the EMB Region VI has two (2) Ambient Air monitoring equipment's not yet installed intended for Metro Iloilo Airshed Areas. Equipment Parameters to be Monitored Met One Instruments E-Bam Plus Automatic Sampler PM10 and PM2.5 Met- One Instruments E-FRM Manual Sampler PM10 and PM2.5 » Creation of Anti-Smoke Belching Unit in the Province of Guimaras. The Memorandum of Agreement was drafted and is subject for approval » Designation of Airshed in Negros Occidental to be known as Metro Bacolod Airshed <p>Recommendations for Necessary Executive and Legislative Action</p> <ul style="list-style-type: none"> » Provide additional funds for the purchase of ambient air monitoring, such as Continuous Ambient Air Monitoring (CAAMS) to improve air quality results and monitoring within MIA; » EMB Central Office to provide extensive training on air quality modeling to Regional Offices to be used in policy making; » Strongly support the LGUs on the creation of Municipal Environment and Natural Resources Office (MENRO) in order to provide sustainability and easier accessibility to any environment related issues and concerns; » Formulate emission factors for locally assembled motor vehicles using surplus engines and other local stationary sources using alternative fuels; » Establish and follow the correct process of project planning, monitoring, and evaluation that will ensure implementation of evidence based projects in response to real needs in air quality management;

	<ul style="list-style-type: none"> » Link with working organizations that have experience and competence in social mobilization, community capacity building, and information campaign and networking with people's organizations, the academe, and other interest-sectors; and » Make a study on incentive mechanisms that can ensure active participation in the activities of multi-sectoral planning bodies and authorities.
Region 7	<ul style="list-style-type: none"> » On-going process in the commitment to finance the real-time ambient air quality monitoring stations to be installed within Metro Cebu Airshed and in their respective areas of jurisdiction (EMB VII / THERMA VISAYAS INC. / ABOITIZ GROUP OF COMPANIES (commitment)
Region 8	
Region 9	<ul style="list-style-type: none"> » Plan of expanding our IEC of daily reporting of PM_{2.5} & PM₁₀ results by collaborating with the LGU Zamboanga City in tapping the usage of their Light Emitting Diode Wall Monitors situated in the strategic areas throughout the city to further the reach of information dissemination.
Region 10	<ul style="list-style-type: none"> » Support for the establishment of additional air monitoring stations to be operated in every major cities and municipalities in the region. » Further study on the best approach in the maintenance and technical support of existing and to be establish air quality monitoring equipment where only few EMB Technical Personnel are capable. The maintenance of the air monitoring stations maybe privately outsourced.
Region 11	<ul style="list-style-type: none"> » Intensify ambient air quality monitoring in order to gather enough data to protect public health from the acute and chronic health effects of air pollution. The LGUs should take part in the responsibility of managing the air quality by establishing sampling stations located at strategic locations where public will be exposed to vehicular emissions for a longer period of time. » Reduction of carbon emissions "to near zero" may be doable such as planting more trees to replace fossil fuels with low carbon power sources like solar, wind and nuclear energy as per the latest report by the Intergovernmental Panel on Climate Change. Promoting the development, utilization, commercialization of renewable energy resources. » Issuance of guidelines for proper implementation of correction of particulate matter monitoring at standard operating (or combustion) conditions such as 12% correction factor. » Purchase of ambient air sampling equipment to monitor the air quality in those areas where people are exposed to vehicular emissions for more than eight (8) hours. » Intensify the Anti-Smoke Belching campaign of both the Land Transportation Office and Local Government Units. » Intensify the Private Emission Testing Center monitoring of both the Land Transportation Office, Department of Trade and Industry, Technical Education and Skills Development Authority and Environmental Management Bureau. » Department of Energy to intensify monitoring of fuel products as to the critical fuel properties under Clean Air Act. » EMB XI to intensify emission inventory on area sources by including in the next emission inventory the fuel depot in order to know how big is its VOC emissions. (VOC is a precursor pollutant in the formation of ozone with the presence of sunlight.) » Intensify monitoring of open burning of solid waste through LGU-Davao City, to include bakeries using wood as fuel. » Source apportionment study should be undertaken to quantify and determine the source of particulate matter.
Region 12	<ul style="list-style-type: none"> » Update Emission Factor all Area Sources and Use of EURO-4 emission factor » Improvements on government restrictions and regulations on emission sources such as mobile vehicles » Intensify Data Base of Ambient Air Quality Management Monitoring
Region 13	<ul style="list-style-type: none"> » Capacity building/refresher course on Emission Inventory. Hopefully, with manual.

References

- Oanh, N.K., Upadhyay, N., Zhuang, Y.H., Hao, Z.P., Murthy, D.V.S., Lestari, P., Villarin, J.T., Chengchua, K., Co, H.X., Dung, N.T., Lindgren, E.S., 2006. Particulate air pollution in six Asian cities: spatial and temporal distributions, and associated sources. *Atmos. Environ.* 40 (18), 3367e3380.
- Srimuruganandam, B., & Shiva Nagendra, S. M. (2010). Analysis and interpretation of particulate matter – PM10, PM2.5 and PM1 emissions from the heterogeneous traffic near an urban roadway. *Atmospheric Pollution Research*, 1(3), 184-194. <https://doi.org/10.5094/APR.2010.024>
- Kecorius, S., Madueño, L., Vallar, E., Honey Alas, H., Betito, G., Birmili, W., Cambaliza, M. O., Catipay, G., Gonzaga-Cayetano, M., Galvez, M. C., Lorenzo, G., Müller, T., Simpás, J. B., Tamayo, E. G., Wiedensohler, A. (2017). Aerosol particle mixing state, refractory particle number size distributions and emission factors in a polluted urban environment: Case study of Metro Manila, Philippines. *Atmospheric Environment*, 170, Pages 169-183.
- Gibe, H. P. and Cayetano, M. G.: Spatial estimation of air PM2.5 emissions using activity data, local emission factors and land cover derived from satellite imagery, *Atmos. Meas. Tech.*, *Atmos. Meas. Tech.*, 10, 3313-3323, <https://doi.org/10.5194/amt-10-3313-2017>, 2017
- Honey Dawn Alas, Thomas Müller, Wolfram Birmili, Simonas Kecorius, Maria Obiminda Cambaliza, James Bernard B. Simpás, Mylene Cayetano, Kay Weinhold, Edgar Vallar, Maria Cecilia Galvez, Alfred Wiedensohler: 2018 Spatial Characterization of Black Carbon Mass Concentration in the Atmosphere of a Southeast Asian Megacity: An Air Quality Case Study for Metro Manila, Philippines. *Aerosol and Air Quality Research*, x: 1-17, xxxx Copyright © Taiwan Association for Aerosol Research ISSN: 1680-8584 print / 2071-1409 online. doi: 10.4209/aaqr.2017.08.0281
- Simonas Kecorius, Everlyn Gayle Tamayo, Maria Cecilia Galvez, Leizel Madueño, Grace Betito, Mylene Gonzaga-Cayetano, Edgar Vallar, Alfred Wiedensohler Activity Pattern of School/University Tenants and their Family Members in Metro Manila – Philippines *Aerosol and Air Quality Research*, 10.4209/aaqr.2018.02.0069
- Bagtasa, G., Cayetano, M. G., and Yuan, C.-S.: Seasonal variation and chemical characterization of PM_{2.5} in northwestern Philippines, *Atmos. Chem. Phys.*, 18, 4965-4980, <https://doi.org/10.5194/acp-18-4965-2018>, 2018
- Lucille Joanna S. Borlaza, Enrique Mikhael R. Cosep, Sejong Kim, Kwangyul Lee, Hungsoo Joo, Minhan Park, Daphne Bate, Mylene G. Cayetano, Kihong Park. Oxidative potential of fine ambient particles in various environments. (2018) *Environmental Pollution* (IF 4.358) DOI: [10.1016/j.envpol.2018.09.074](https://doi.org/10.1016/j.envpol.2018.09.074)
- Hilda R. Hagad and Mylene G. Cayetano, PM 10 and Surface dust source characterization in Baguio City-Central Business District Philippines (2018) *Environmental Geochemistry and Health* DOI :10.1007/s10653-018-0208-7
- Simonas Kecorius, Leizel Madueño, Jakob Löndahl, Edgar Vallar, Maria Cecilia Galvez, Luisito F. Idolor, Mylene Gonzaga-Cayetano, Thomas Müller, Wolfram Birmili, Alfred Wiedensohler, Respiratory tract deposition of inhaled roadside ultrafine refractory particles in a polluted megacity of South-East Asia, *Science of The Total Environment*, Volume 663, 2019, Pages 265-274, ISSN 0048-9697, <https://doi.org/10.1016/j.scitotenv.2019.01.338>.
- Leizel Madueño, Simonas Kecorius Wolfram Birmili, Thomas Müller, James Simpás, Edgar Vallar, Maria Cecilia Galvez, Mylene Cayetano and Alfred Wiedensohler Aerosol Particle article and Black Carbon Emission factors of vehicular fleet in Manila, Philippines, MDPI, *Atmosphere*, 2019, 10 603
- Gerry Bagtasa, Mylene G. Cayetano, Chung-Shin Yuan, Osamu Uchino, Tetsu Sakai, Toshiharu Izumi, Isamu Morino, Tomohiro Nagai, Ronald C. Macatangay, Voltaire A. Velazco, Long-range transport of aerosols from East and Southeast Asia to northern Philippines and its direct radiative forcing effect, *Atmospheric Environment*, Volume 218, 2019, 117007, ISSN 1352-2310, <https://doi.org/10.1016/j.atmosenv.2019.117007>.
- .Garcia, J.A., Vallar, E., Galvez, M.C.D., Bagtasa, G. (2019). Application of the WRF/Chem v. 3.6.1 on the reanalysis of criteria pollutants over Metro Manila. *Sustainable Environment Research*, 29 (1), 38.
- Oliveros, J., Vallar, E., and Galvez, M.C.D. (2019). Investigating the Effect of Urbanization on Weather Using the Weather Research and Forecasting (WRF) Model: A Case of Metro Manila, Philippines. *Environments*, 6(2).
- Galvez, M.C.D., Vallar, E. A., Tipan, D. P. V., Valera, A. A. (2019). Low Cost Air Quality Monitoring Sensor (AQMS) for Particulate Matter Measurement of Light Emitting Diode LiDAR System. *Proceedings of the 37th Laser Sensing Symposium*, pp. 117-118.
- Plando, F.R., Castilla, R., Vallar, E., and Galvez, M.C.D. (2017). Spectral-Temporal Variations of Aerosol Ångström Exponent Over Manila, Philippines. *Advanced Science Letters*, 1456-1460.
- Tusó, Christian & Magtaas, Remjohn Aron & Punzalan, Jervée & Yee, Jhon Robin & Bautista VII, Angel & Pabroa, Preciosa Corazon. (2019). Air Particulate Matter, Black Carbon, and Elemental Concentrations and Source Apportionment in Calaca, Batangas. *Philippine Journal of Science*. 149. 117-127
- Vergara, R., Macalalad, E., Bagtasa, G., Vallar, E., Galvez, M.C.D., and Francisco, R. (2017). Correlation of Aerosol Optical Properties with Surface Meteorological Parameters over Manila. *Advanced Science Letters*, 1448-1451.

APPENDIX



Appendix 1. National Air Quality Guideline Values, Air Quality Index Breakpoints and precautionary Advise

Parameter	Averaging Time	NAAQGV($\mu\text{g}/\text{NCM}$)
TSP	annual	90
	24-hour	230
PM ₁₀	annual	60
	24-hour	150
PM _{2.5}	annual	35 (Until 31 Dec, 2015), 25 (By 1 January, 2016)
	24-hour	75 (Until 31 Dec, 2015), 50 (By 1 January, 2016)
Sulfur Dioxide (SO ₂)	annual	80
	24-hour	180
Nitrogen Dioxide (NO ₂)	annual	-
	1-hour	-
	24-hour	150
Ozone (O ₃)	8-hour	60
	1-hour	140
Carbon Monoxide (CO)	8-hour	10
	1-hour	35
Lead (Pb)	annual	1
	3 months	1.5

Notes:

*NCM stands for 'normal cubic meter', assuming that the samples were collected under 'normal' conditions or at standard temperature and pressure

-SO₂ and Suspended Particulate matter (TSP and PM) are sampled once every six days when using the manual methods. A minimum of twelve sampling days per quarter or forty-eight sampling days each year is required for these methods. Daily sampling may be done in the future once continuous analyzers are procured and become available.

-For short term values, maximum limits represented by ninety-eight percentile (98%) values not to exceed more than once a year.

-Annual values of TSP and PM₁₀ are reported as Geometric Mean. *Geometric mean is used because the annual mean pollutant level in a year is dependent of the pollutant level from the previous year.

-Evaluation of the guideline for Lead is carried out for 24-hour averaging time and averaged over three moving calendar months. The monitored average value for any three months shall not exceed the guideline value.

Table 3 Air Quality Index breakpoints, Annex of IRR

Pollutant	Unit, Averaging Time	Good	Fair	Unhealthy for sensitive groups	Very unhealthy	Acutely unhealthy	Emergency
TSP	µg/Nm ³ , 24-hr	0 - 80	81 - 230	231 - 349	350 - 599	600 - 899	900 and greater
PM₁₀	µg/Nm ³ , 24-hr	0 - 54	55 - 154	155 - 254	255 - 354	355 - 424	425 - 504
SO₂	ppm, 24-hr	0.000 - 0.034	0.035 - 0.144	0.145 - 0.224	0.225 - 0.304	0.305 - 0.604	0.605 - 0.804
O₃	ppm, 8-hr	0.000 - 0.064	0.065 - 0.084	0.085 - 0.104	0.105 - 0.124	0.125 - 0.374	^a
	ppm, 1-hr	-	-	0.125 - 0.164	0.165 - 0.204	0.205 - 0.404	0.405 - 0.504
CO	ppm, 8-hr	0.0 - 4.4	4.5 - 9.4	9.5 - 12.4	12.5 - 15.4	15.5 - 30.4	30.5 - 40.4
NO₂	ppm, 1-hr	^b	^b	^b	^b	0.65 - 1.24	1.25 - 1.64

^aWhen 8-hour O₃ concentrations exceed 0.374 ppm, AQI values of 301 or higher must be calculated with 1-hour O₃ concentrations.

^bNO₂ has no 1-hour term NAAQGV

Table 4 Summary Matrix of Pollutant-Specific Cautionary Statements for the General Public

Caution	TSP, PM ₁₀ , SO ₂ , Ozone and NO ₂		CO	
None	GOOD	FAIR	GOOD	FAIR
People with respiratory disease, such as asthma, should limit outdoor exertion.	Unhealthy for sensitive groups			
Pedestrians should avoid heavy traffic areas.	Very unhealthy			
People with heart or respiratory disease, such as asthma, should stay indoors and rest as much as possible.	Very unhealthy	Acutely unhealthy	Very unhealthy	
Unnecessary trips should be postponed.			Very unhealthy	Acutely unhealthy
People should voluntarily restrict the use of vehicles.				
People should limit outdoor exertion.				
People with heart or respiratory disease, such as asthma, should stay indoors and rest as much as possible.				
Motor vehicle use may be restricted	Acutely unhealthy		Acutely unhealthy	
Industrial activities may be curtailed.				
Everyone should remain indoors, (keeping windows and doors closed unless heat stress is possible).	Emergency			
Motor vehicle use should be prohibited except for emergency situations.				
Industrial activities, except that which is vital for public safety and health, should be curtailed.				
People with cardiovascular disease, such as angina, should limit heavy exertion and avoid sources of CO, such as heavy traffic.			Unhealthy for sensitive groups	Acutely unhealthy
Smokers should refrain from smoking.			Very unhealthy	
Everyone should avoid exertion and sources of CO, such as heavy traffic; and should stay indoors and rest as much as possible.			Emergency	

Appendix 2. Annual Average Criteria Pollutant concentration per station Nationwide

REGION	MONITORING STATION LOCATION, TSP ³⁷	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
NATIONAL CAPITAL REGION (NCR)	Makati Bureau of Fire Cmpd., Ayala Avenue cor., Buendia St., Belair, Makati City	211	183	153	146	134	145	160	128	135	--	130*	111	122	140	125
	Valenzuela Municipal Hall, Pamantasan ng Lungsod ng Valenzuela, Valenzuela City	206	152	157	146	156	164	162	121	123	143	122	86	97	127	93
	EDSA EAST Avenue BFD Compound East Avenue Q. C.	170	129	104	102	107	90	105	74	72	92	96	97	138	136	120
	NCR-EDSA NPO Q.C	164	163	138	125	144	89	152	103	96	112	97*	--	--	--	--
	ATENEO Manila Observatory, Ateneo University	105	87	72	65	74	62	79	58	62	70	50	48	44	55	57
	Mandaluyong City Hall, Maycilo Circle, Plainview, Mandaluyong City	133	124	121	134	125	104	138	136	148	--	143	158	144	126	110
	Dept. of Health , San Lazaro St., Rizal Avenue	134	138	111	110	103	103	132	101	114	115	105*	109	107	99	95
	LLDA Compound Pasig, City Hall	109	106	90	92	85	126	--	--	--	--	--	--	--	--	--
	Marikina Sports Complex, Sumulong Highway, Sto. Niño, Marikina City	--	--	--	--	--	--	125	125	108	97	81	104	107	95	92
	MRT-Taft Avenue Station EDSA Cor. Taft Avenue, Malibay, Pasay City	236	323	316	257	282	283	294	219	213	197	216	--	--	--	--

³⁷ * <75% data captured; -- NO DATA; TSP National Ambient Air Quality Guideline Values for : 1-year (Long-term) 90µg/Ncm

REGION	MONITORING STATION LOCATION, TSP ³⁷	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Cordillera Administrative Region (CAR)	CAR-Plaza Garden	229	170	155	201	--	--	--	--	--	--	--	--	--	--	--
REGION 1	Alaminos City, Province of Pangasinan, Infront of Nepo Mart	312	179	153	159	133	132	125	--	--	--	--	--	--	--	--
	Vigan City, Ilocos Sur	--	--	--	--	--	--	--	--	--	--	127	145	--	--	--
	San Fernando City, Beside Francisco Ortega Monument, Province of La Union	183	--	155	148	--	--	130	117	--	--	--	--	--	--	--
REGION 2	Tug. Station Brgy. 10, Tufuegarao City	59	102	84	98	--	77	94	108	87	--	--	--	--	--	--
REGION 3	Saluysoy Station, Meycauyan, Bulacan	190	309	186	116	106	124	61	21	14	6	41*	--	--	--	--
	Mel-Vi Bldg., OG Road, Dolores, City of San Fernando, Pampanga	--	--	--	215	--	--	--	128	243	--	202*	180	316*	217	106
	Biay Station-Sta.Cruz, Zambales	--	--	--	457	--	--	--	--	--	--	--	68	70*	41	44
	Intercity Station, Intercity, Wakas, Bocaue, Bulacan	--	--	--	--	--	--	--	344	277	--	482*	244	396*	412	293
Region 4-A	Batangas Station	144	140	46	49	50	19	22	--	--	--	--	--	--	--	--
	Cavite Station	84	62	59	46	--	--	--	--	--	--	--	--	--	--	--
REGION 4-B	Capitol Site, PGENRO, Capitol Site, Calapan City, Oriental Mindoro	217	86	110	--	--	--	--	159	--	--	--	--	--	--	--
	Calapan City Public Market, Calapan City, Oriental Mindoro	--	--	--	--	--	--	--	--	--	--	--	67*	--	--	--
	Municipal Hall, Municipality of Baco, Oriental Mindoro	--	--	--	--	--	--	--	--	--	--	--	46*	--	--	20
	Municipal Environment and Natural Resources Office (MENRO), Naujan, Oriental Mindoro	--	--	--	--	--	--	--	--	--	--	--	6*	--	--	--
REGION 5	Barriada, Legaspi City	72	72	125	84	46	80	48	34	40	35	40	37	41	105	71
	San Nicolas, Iriga City	108	88	95	76	72	164	57	52	108	78	55	50	57	112	60

REGION	MONITORING STATION LOCATION, TSP ³⁷	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
	Panganiban Drive, Diversion road, Naga City	84	83	101	105	84	157	102	69	101	96	72	72	78	108	124
REGION 6	Jaro Police Station Cmpd., Iloilo City	182	141	68	67	80	78	51	--	--	--	--	--	--	--	--
	Lapaz Plaza, Iloilo City	104	81	87	110	135	66	50	88	--	56	40	232	115	83	90
	Oton, Iloilo City	--	--	--	--	--	--	--	100	--	65	54	213			
REGION 7	DENR-7, Greenplains Subd., Banilad, Mandaue City	--	88	87	80	--	--	--	69	75	71	78	94	61	60	59
	Cornilla Lao Residence Boundary of Barangays Inuburan & Langtad, City of Naga	--	--	159	137	--	--	--	110	124	121	106	94	64	75	84
	Cebu Business Park, Cebu City	--	--	--	--	--	--	--	32	--	--	--	--	--	--	--
Region 8	P&M Bldg. DENR Cpd., Sto. Niño Extn., Tacloban City	73	45	--	--	--	--	--	--	--	--	--	--	--	--	--
REGION 9	Zamboanga City Medical Center, Dr. Evangelista St., Zamboanga City	220	154	155	128	135	165	141	137	--	--	--	--	--	--	--
	Barangay Sto. Nino, San Jose Road, Zamboanga City	209	161	149	105	119	135	113	124	--	--	--	--	--	--	--
	Phil. Int. Dev't Inc.(PHIDCO), Baliwasan Seaside Zamboanga City	218	170	126	110	140	181	174	139	--	--	--	--	--	--	--
REGION 11	Davao memorial park, phase II, Mc Arthur highway, Davao City.	56	44	44	87	81	99	44	41	40	--	--	--	--	--	--
	Las Palmeras Apartele Open Compound, Quimpo Blvd., Davao City	--	--	63	63	56	60	83	--	61	--	--	--	--	--	--
	Dacoville Subdivision, phase II, Mc arthur highway, dumoy, toril, Davao city	64	63	66	36	31	58	65	44	35	--	--	--	--	--	--

REGION	MONITORING STATION LOCATION, TSP ³⁷	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
	Toril Open Park Area, Agton st., Toril Poblacion, Davao City	91	66	66	40	34	58	150	--	92	--	--	--	--	--	--
REGION 12	Reg 12- Station 1Infront of Palomolog South Cotobato	135	81	86	90	86	75	73	58	--	--	--	--	--	--	--
	Reg 12-Station 2 Infront of Mun. Hall Suralla Cotobato City	92	80	86	87	83	75	73	55	--	--	--	--	--	--	--
	Reg 12-Station 3 Infron t of Mun. Hall , Isulan Sultan Kudarat	91	78	85	87	83	75	73	53	--	--	--	--	--	--	--
REGION 13	New Asia, Butuan city	83	81	70	71	63	63	49	55	54	--	--	--	--	--	--
	Station Petron Nasipit Depot, Nasipit Agusan Del Norte, Butuan City	--	--	--	--	--	--	--	--	--	68	68	93	76	84	115
	Central Butuan, District 1 Ground, Butuan City	--	--	--	--	--	--	--	50	43	61	71	94	--	--	--
	Cabadbaran City Hall, Cabadbaran City	--	--	--	--	--	--	--	--	--	--	--	--	--	65	93

REGION	TYPE OF STATION	LOCATION PM ₁₀ ³⁸	2012	2013	2014	2015	2016	2017	2018
NCR	Manual/Reference Method	National Printing Office Cmpd. EDSA Diliman, Quezon City	61	73	89	67	69	70	56
	Manual/Reference Method	Marikina Sports Complex Cmpd. Sumulong Highway Brgy. Sto Nino, Marikina City	67	62	47	61	63	52	52
	Manual/Reference Method	DOH Cmpd. Rizal Avenue Sta Cruz, Manila	51	69	--	60	59	62	62
	Manual/Reference Method	MMDA Building Cmpd. Orense St. cor. EDSA Guadalupe, Makati City	54	67	52	42	40	36	43
	Manual/Reference Method	Pasay Rotonda Station EDSA cor. Taft Avenue Malibay, Pasay City	110	105	--	--	--	--	--
	Manual/Reference Method	National Bilibid Prison, Muntinlupa	--	25	36	25	24	24	23
	Manual/Reference Method	Rizal Avenue Exit, Caloocan	151	150	--	--	--	--	--
	Continuous Monitoring	Commonwealth Ave., Quezon City	--	--	57	--	--	--	--
	Continuous Monitoring	DLSU, Taft, Manila	--	29	27	31	31*	--	--
	Continuous Monitoring	DPWH, Timog EDSA, Quezon City	--	44*	66	46	51*	*	--
	Continuous Monitoring	Pamantasan ng Lungsod ng Valenzuela, Valenzuela City	--	--	33	58*	44	40*	--
	Continuous Monitoring	Manila Observatory, Ateneo De Manila University, Quezon City	38	50	*	--	--	--	--
	Continuous Monitoring	Valenzuela - Radio ng Bayan, Valenzuela City	58	74	53	--	--	--	--
	Continuous Monitoring	NAMRIA, Lawton Avenue, Fort Andres Bonifacio, Taguig City	43	54	--	--	--	--	--
	Continuous Monitoring	Andrews Avenue, Pasay City	--	--	--	78*	--	66*	75*
	Continuous Monitoring	Navotas City Hall, M. Naval St. Navotas City	--	--	--	72	66	94	54*
	Continuous Monitoring	Rohm and Hass Property, Las Piñas City	--	--	--	35	27	41	27*
	Continuous Monitoring	Polytechnic Institute, City of Malabon	--	--	--	45	--	*	41*
	Continuous Monitoring	North Caloocan City Hall - Zapote Street, Barangay 177, Caloocan City	--	--	--	54	--	*	56
	Continuous Monitoring	Don Bosco Barangay Hall, Better Living Subdivision, Paranaque City	--	--	--	52	33	*	45
	Continuous Monitoring	Makati Park, Dr. Jose P. Rizal Extension, East Rembo, Makati City	--	--	--	44*	*	*	--
	Continuous Monitoring	Pateros Elementary School, Pateros City	--	--	--	52	--	66	55
	Continuous Monitoring	Pinaglabanan Shrine, San Juan City	--	--	--	18*	48	46	33
	Continuous Monitoring	Bureau of Corrections, New Bilibid Prison Reservation, Muntinlupa City	--	--	--	31	24	*	--
	Continuous Monitoring	Technological University of the Philippines-Taguig Campus, Taguig City	--	--	--	66	45	*	53*

³⁸ * < 75% data captured; -- NO DATA; + Arithmetic Mean; ** 2012 - 2014 Manual/Reference Method, 2015-2018 Continuous Monitoring

REGION	TYPE OF STATION	LOCATION PM ₁₀ ³⁸	2012	2013	2014	2015	2016	2017	2018
CAR	Continuous Monitoring	Hardin ng Pagasa, Mandaluyong City Hall, Plainview, Mandaluyong City	--	--	--	63*		49	47*
	Continuous Monitoring	Brgy. Oranbo, Pasig	--	--	--	69*	50	42	40*
	Continuous Monitoring	Parking Area of Marikina Justice Hall, Marikina City	--	--	--	56	55	51	45*
	Manual/Reference Method	Plaza Garden Park, Central Business District, Lower Session Road, Baguio City	72	69	--	--	--	79	66
	Continuous Monitoring	Burnham park, Baguio City	35*	--	--	--	--	40	27
R1	Manual/Reference Method	City Hall Compound Urdaneta City, Pangasinan	--	40	--	--	--	--	--
	Manual/Reference Method	West Central Elementary School, Dagupan City, Pangasinan	46	47	59	68	--	--	--
	Manual/Reference Method	City Plaza San Fernando City, La Union	--	--	81	73*	--	--	--
	Manual/Reference Method	City Plaza San Carlos City, Pangasinan	--	--	83	75*	72	46	--
	Manual/Reference Method	Plaze Burgos, Ilocos Sur, Vigan City	--	--	--	--	75	51	63
	Continuous Monitoring	Brgy., Parian, San Fernando City, La Union	--	--	--	--	28	12	3
	Continuous Monitoring	Barangay. Anonas, Urdaneta City, Pangasinan	--	--	--	47*	17*	12	23
	Continuous Monitoring	Mariano Marcos State University, Batac, Ilocos Norte	--	--	--	24*	23*	24	22
R2	Manual/Reference Method	Tuguegarao City Monitoring, St. Paul University Philippines, Mabini Street, Tuguegarao City	--	--	29	--	--	--	27*
	Manual/Reference Method	City Hall Grounds, Santiago City	--	--	--	--			11*
R3	Continuous Monitoring	Meycauayan City Hall, Meycauayan, Bulacan	--	--	--	45	42	38*	43
	Continuous Monitoring	City Government of Balanga, Balangay City Hall, Poblacion, Balanga City, Bataan	--	--	--	--	8	36*	34*
	Continuous Monitoring	Subic Bay Metropolitan Authority Bldg., 229, Waterfront Road, Subic Free port zone	--	--	--	--	7	*	--
	Continuous Monitoring	Heroes hall, San Fernando, City of San Fernando, Pampanga	--	--	--	29	10	*	11*
R4A		Ynares Center Compound, Antipolo City	--	--	--	--	--	--	22
	Continuous Monitoring	City of Biñan, San Pablo St., Biñan City, Laguna	--	--	--	22*	30	--	14
	Continuous Monitoring	Cavite State University, Indang Cavite	--	32	--	--	--	--	--
	Continuous Monitoring	Brgy. Bolbok, Batangas City	--	29	--	--	--	--	--
	Continuous Monitoring	(Near) City Hall of Santa Rosa, City Government Center, J.P. Rizal Blvd. Santa Rosa, Laguna	--	--	--	--	*	30	34
R4B	Continuous Monitoring	Palawan State University, Tiniguiban Heights, Puerto Princesa, Palawan	--	--	--	26	20	22*	*
	Manual/Reference Method	Municipal Hall, Municipality of Baco, Oriental Mindoro	41	--	--	60*	--	*	6*
	Manual/Reference Method	Provincial Capitol Complex, Oriental Mindoro, Calapan City	--	--	--	--	--	--	15
	Manual/Reference Method	Naujan, Oreintal Mindoro	--	--	--	--	--	*	14

REGION	TYPE OF STATION	LOCATION PM ₁₀ ³⁸	2012	2013	2014	2015	2016	2017	2018
R5	Manual/Reference Method	Barraida, Legaspi City	--	32	39	38	36	39	36
	Continuous Monitoring	Naga City PENRO, Naga City	--	--	--	29	25	26	26
	Continuous Monitoring	EMB Region 5 Office, Regional Center Office, Rawis, Legaspi City	--	--	--	--	21	26	35
R6	Manual/Reference Method	Central Philippine University campus, Jaro, iloilo city	21	--	19	--	--	--	--
	Manual/Reference Method	University of San Agustin, General Luna Street, Iloilo City	--	--	--	43*	28*	7	22*
	Manual/Reference Method	Leganes Municipal Grounds, Poblacion, leganes, Iloilo City	--	--	--	51	--	--	--
	Manual/Reference Method	Oton National Elementary School, Oton, Iloilo City	--	--	--	--	38	57	81
	Continuous Monitoring	City Hall of Bacolod, New Government Center, Bacolod City	--	--	--	28	*	*	58
R7	Manual/Reference Method	Mabolo, Cebu City	77	73	58	52	50	--	--
	Manual/Reference Method	Cebu Business Park, Cebu city	36	33	20	34	26	--	--
	Continuous Monitoring	City Hall of Talisay, Tabunok, Talisay, Cebu	--	--	--	--	--	--	*
	Manual/Reference Method	Consolacion Municipal Hall, Consolacion, Cebu	--	--	--	--	--	49	47
	Manual/Reference Method	Cordova Municipal Hall, Cordova, Cebu	--	--	--	--	--	41	39
R8	Manual/Reference Method	Robinsons Place, Tacloban	--	--	--	64+	61	54	45
R9	Continuous Monitoring	Western Mindanao State University, Normal Road, Zamboanga City	--	--	--	11*	12	10	21*
	Continuous Monitoring	Ateneo De Zamboanga University, La Purisima Street, Zamboanga City	--	--	--	20	17	5	*
	Manual/Reference Method	Zamboanga City Medical Center. Compound, Dr. Evangelista Street Corners Veterans Ave., & Gov. Lim Ave., Zamboanga City	--	52	52	32	57	59	52
	Manual/Reference Method	EMB - 9 Compound, Lantawan, Pasonanca, Zamboanga City (Started 2013)	--	34	41	45	39	38	39
	Manual/Reference Method	Philippine International Development Incorporated (PHIDCO), Baliwasan Seaside Zamboanga City Zamboanga del Sur	--	44	52	60	51	71	47
R10	Continuous Monitoring	Iligan Medical Center College, San Miguel Village, Pala-o, Iligan City, Lanao del Norte	--	--	--	49	50	--	--
R11	Manual/Reference Method	Approx. 70m from Amparo St. And 300m from Davao-Agusan National Highway	--	19	16*	35*	--	49	48

REGION	TYPE OF STATION	LOCATION PM ₁₀ ³⁸	2012	2013	2014	2015	2016	2017	2018
	Manual/Reference Method	Brgy. 12-B, Mapa St. Corner J.P Laurel Ave., Davao City (Fronting Brgy. Hall)	--	21	21*	45*	--	56	42
	Manual/Reference Method	Approx. 800m DMPI main gate, Davao Memorial Park Phase2, McArthur Highway, Matina, Davao City	--	14	15*	34	33	36	31
	Manual/Reference Method	Approximately 50m from Agton St. Open Park in front of Toril District Hall, Agton St., Davao City	--	27	30*	57	57	57	63
	Continuous Monitoring	Calinan National High School, Quirino Avenue, Davao City	--	--	--	36	61*	57	34
	Continuous Monitoring	Davao International Airport, Catitipan, Buhangin District, Davao City	--	--	--	73+	54*	40	46*
R12	Manual/Reference Method	In front of Municipal Hall Tupi, South Cotabato	54	50	56		25	24	--
	Continuous Monitoring	**City of Koronadal, General Santos Drive, Koronadal City	57	51	64	49	39	31	42*
	Manual/Reference Method	Municipal Hall of Midsayap	51	63	75	--	--	--	--
	Continuous Monitoring	Pedro Acharon Sports Complex, Brgy. Calumpang, General Santos City	--	--	--	35	38	19	--
R13	Manual/Reference Method	Central Butuan, District 1 Ground, Butuan City	--	--	--	58	--	--	--
		Cabadbaran City Hall, Cabadbaran City	--	--	--	--	--	22	30
	Manual/Reference Method	Petron Nasipit Depot, Nasipit Agusan Del Norte, Butuan City	--	--	--	55	17	17	*
	Continuous Monitoring	Caraga State University, Ampayon, Butuan City	--	--	--	37*	*	19	6
	Continuous Monitoring	Butuan City Local Government Unit (Compound of City Environment Office)	--	--	--	35	29	28	28

REGION	TYPE OF STATION	LOCATION, PM _{2.5} ³⁹	2013	2014	2015	2016	2017	2018
NCR	Continuous Monitoring	Commonwealth Ave, Q.C	--	50	--	--	--	--
	Continuous Monitoring	Pamantasan ng Lungsod ng Valenzuela, Valenzuela City	29	29	27*	20	30	--
	Continuous Monitoring	DLSU, 2401 Taft Ave., Manila	21	19	17	29	29	--
	Continuous Monitoring	Andrews Avenue, Pasay City	--	--	31*	22	--	--
	Continuous Monitoring	DPWH, Edsa, Nia Road	36	43	26	46	67	--
	Continuous Monitoring	Navotas City Hall, M. Naval St. Navotas City	--	--	43	45	46	--
	Continuous Monitoring	Rohm and Hass Property, Las Piñas City	--	--	29	19	*	--
	Continuous Monitoring	Polytechnic Institute, City of Malabon	--	--	34	*	--	--
	Continuous Monitoring	North Caloocan City Hall - Zapote Street, Caloocan City	--	--	32	--	*	--
	Continuous Monitoring	Don Bosco Barangay Hall, Better Living Subdivision, Paranaque City	--	--	16	20	*	--
	Continuous Monitoring	Makati Park, Dr. Jose P. Rizal Extension, East Rembo, Makati City	--	--	26*	*	--	--
	Continuous Monitoring	Pateros Elementary School, Pateros City	--	--	32	--	*	--
	Continuous Monitoring	Pinaglabanan Shrine, San Juan City	--	--	7*	*	22	24
	Continuous Monitoring	Bureau of Corrections, New Bilibid Prison Reservation, Muntinlupa City	--	--	17	15	*	--
	Continuous Monitoring	Technological University of the Philippines-Taguig Campus, Taguig City	--	--	32*	*	*	--
	Continuous Monitoring	Hardin ng Pagasa, Mandaluyong City Hall, Plainview, Mandaluyong City	--	--	31*	*	*	--
	Continuous Monitoring	Brgy. Oranbo, Pasig	--	--	50*	34	24	22
	Continuous Monitoring	Parking Area of Marikina Justice Hall, Marikina City	--	--	33*	31	*	--
	Continuous Monitoring	UE-Caloocan Campus, Samson Road, Caloocan City	--	--	--	--	*	14
	Continuous Monitoring	Manila Observatory, Ateneo de Manila University, Quezon City	--	--	--	18	--	--
	Continuous Monitoring	NAMRIA, Lawton Avenue, Fort Andres Bonifacio, Taguig	--	--	--	23	--	--
CAR	Continuous Monitoring	Burnham park, Baguio City	--	--	23*	*	15	16

³⁹ Ncm - Normal cubic meter; Annual Guideline values: Particulate Matter 2.5 (PM_{2.5}) = 25 ug/Ncm (Starting 2016); -- No Data; * Less than 75% data capture rate.

REGION	TYPE OF STATION	LOCATION, PM _{2.5} ³⁹	2013	2014	2015	2016	2017	2018
REGION1	Continuous Monitoring	Mariano Marcos State University, Batac, Ilocos Norte	--	--	17+	16	21	16*
	Continuous Monitoring	Barangay. Anonas, Urdaneta City, Pangasinan	--	--	42*	2*	12	14
	Continuous Monitoring	Brgy., Parian, San Fernando City, La Union	--	--	--	12	8	2
	Manual/Reference Method	City Plaza, San Carlos City, Pangasinan	--	--	--	--	--	49
	Manual/Reference Method	Dagupan City, Province of Pangasinan, western Central Elementary School	--	--	--	31	38*	37
REGION3	Continuous Monitoring	Heroes hall, San Fernando, City of San Fernando, Pampanga	--	--	24	6	*	15*
	Continuous Monitoring	City Government of Balanga, Balangay City Hall, Poblacion, Balanga City, Bataan	--	--	--	5	22*	37*
	Continuous Monitoring	Subic Bay Metropolitan Authority Bldg., 229, Waterfront Road, Subic Free port zone	--	--	--	11*	5*	--
	Continuous Monitoring	Meycauayan City Hall, Meycauayan, Bulacan	--	--	28	26*	--	28
REGION4A	Continuous Monitoring	City of Biñan, Biñan, Laguna	--	--	11	17	--	9
	Continuous Monitoring	Ynares Center Compound, Antipolo City	--	--	--	--	--	17
	Continuous Monitoring	(Near) City Hall of Santa Rosa, City Government Center, J.P. Rizal Blvd. Santa Rosa, Laguna	--	--	--	19*	29.6	27
REGION4B	Continuous Monitoring	Palawan State University, Tiniguiban Heights, Puerto Princesa, Palawan	--	--	14	*	--	*
REGION5	Continuous Monitoring	Naga City PENRO, Naga City	--	--	18	14	17	16
	Continuous Monitoring	EMB Region 5 Office, Regional Center Office, Rawis, Legaspi City	--	--	--	10	13	9
REGION 6	Continuous Monitoring	City Hall of Bacolod, New Government Center, Bacolod City	--	--	14	*	*	40
	Manual/Reference Method	University of San Agustin, General Luna Street, Iloilo City	--	--	26*	21	5	9*
REGION7	Continuous Monitoring	City Hall of Talisay, Tabunok, Talisay, Cebu	--	--	--	--	*	*
REGION9	Continuous Monitoring	Western Mindanao State University, Normal Road, Zamboanga City	--	--	4*	10.57	10	14*

REGION	TYPE OF STATION	LOCATION, PM _{2.5} ³⁹	2013	2014	2015	2016	2017	2018
	Continuous Monitoring	Ateneo De Zamboanga University, La Purisima Street, Zamboanga City	--	--	17	14.82	5	5*
REGION10	Continuous Monitoring	Iligan Medical Center College, San Miguel Village, Pala-o, Iligan City, Lanao del Norte	--	--	21	26*	21*	--
	Manual/Reference Method	El Salvador City School, Zone 2, Tuburan Brgy. Poblacion, Misamis Oriental	--	--	--	--	*	17*
	Manual/Reference Method	DENR Compound, Brgy. Macabalan, Cagayan De Oro	--	--	--	--	*	24
	Manual/Reference Method	Balacanas Elementary School, Balacanas, Villanueva, Misamis Oriental	--	--	--	--	*	17*
REGION11	Continuous Monitoring	DC Station 16: Calinan National High School, Quirino Avenue, Davao City	--	--	21	26*	21*	21
	Continuous Monitoring	DC Station 15: Davao International Airport, Catitipan, Buhangin District, Davao City	--	--	33+	32*	23	23*
REGION12	Continuous Monitoring	Pedro Acharon Sports Complex, Brgy. Calumpang, General Santos City	--	--	17	17	16	--
	Continuous Monitoring	City of Koronadal, General Santos Drive, Koronadal City	--	--	31	19	18	22*
REGION13	Continuous Monitoring	Butuan City Local Government Unit (Compound of City Environment Office), Barangay Doongan, Butuan City, Agusan Del Norte	--	--	19	15	16	15
	Continuous Monitoring	Caraga State University, Ampayon, Butuan City	--	--	20*	*	10	3

Appendix 3. Compilation of DAOs linked to RA 8749

Department (s)/Agencies	Type	Series (Year)	Order No.	Title/Description	Reference Articles/Section in RA 8749
DENR	DAO	2000	81	Implementing Rules and regulations for RA 8749	C2A1S6
DENR	DAO	2000	82	Integrated Air Quality Improvement Framework- Air Quality Control Action Plan	C2A1S7
DOTC	DO	2001	31	Authorization of Private Emission Testing Centers	C2A2S23
DTI-DOTC	JAO	2001	01	Guidelines for Accreditation and Authorization of Motor Vehicle Emission Testing Centers	C2A2S23
DENR	MC	2002	03	Interim Guidelines for the Designation of an Airshed	C2A1S9
DTI-DOTC	JAO	2002	01	Clarification on the Implementation of the Procedure on the Accreditation and Authorization of Motor Vehicle Emission Testing Center (PETC)	C2A2S23 (mobile sources)
DENR	DAO	2003	52	Revised Emission Standards for In-Use Motor Vehicles equipped with Spark Ignition and Compression ignition Engines	airshed
DENR	DAO	2003	47	Designation of the Members of the Zamboanga City Airshed and its Governing Board	
DENR	DAO	2003	45	Designation of Members of the Governing Board for Metro Cagayan De Oro Airshed, Province of Misamis Oriental Region X	
DENR	DAO	2003	33	Designation of the Members of the Naga City Airshed Governing Board Located in the Province of Camarines Sur, Bicol Region	
DENR	DAO	2003	27	Amending DAO 26, DAO 29 and DAO 2000-81 among others on the preparation and submission of Self Monitoring Report (SMR)	
DENR	DAO	2003	25	Hydrocarbon Standards for Motorcycle	
DENR	DAO	2003	16	Designation of the members of Agusan del Norte Airshed Governing Board	
DENR	DAO	2003	04	Initial Designation of BLIST Airshed and the Creation of its Interim Governing Board	
DENR-PAB	Resolution	2003	04	establishing the fine rating system for stationary sources for exceedance of any pollution or air quality standards set under RA 8749 and its IRR	
DENR	DAO	2004	26	Amending Rule XIX of DAO 2000-81 (Implementing Rules and Regulations of RA 8749) which integrates the Authority to Construct requirement and extends the validity period of Permit to Operate for five years, regarding air pollution permits/clearances	directs the LTFRB to issue franchises exclusive for
DENR	DAO	2004	53	Guidelines to implement the Tax Incentives provision under Section 13 of RA 8749	
DENR	DAO	2004	13	Designation of North Cotabato Geothermal Airshed and its Governing Board	
DENR	DAO	2004	12	Designation of Leyte Geothermal Airshed and its Governing Board	
DENR	DAO	2004	11	Designation of Bacon-Manito Geothermal Airshed and its Governing Board	
DENR	DAO	2004	07	Establishment of Northeastern Pangasinan Airshed and its Governing Board	
DENR	DAO	2004	05	Establishment of Metro Tuguegarao (PIESTTA) Airshed and its Governing Board	
DENR	SO	2004	867	Creating a Special Review Committee within EMB to review project proposals for eligible funding to the AQMF	
DENR-DBM	Joint MC	2004	01	Implementing Guidelines on Operationalization of the Air Quality Management Fund under the Republic Act 8749	
DOTC	DO	2004	01	Rules and Regulations Concerning the Issuance of DOTC/LTO Authorization of Motor Vehicle Private Emission Testing Centers (PETCs)	
DOTC	DO	2004	34	An Order Promoting the Operation of Compressed Natural Gas (CNG) Buses in the Country	

Department (s)/Agencies	Type	Series (Year)	Order No.	Title/Description	Reference Articles/Section in RA 8749
DENR	MC	2005	13	Guidelines for designation of Attainment & Non-Attainment Areas	CNG bus operation
DENR	MC	2005	10	Guidelines on the selection of qualified projects and activities eligible for funding under the AQMF	
DOTC	DO	2005		Amendment of Section 7.5 (IT Requirement) of Department Order No. 2004-01 Prescribing the Rules and Regulations Concerning the Issuance of DOTC/LTO Authorization of Motor Vehicle Private Emission Testing Centers (PETCs)	
DENR	DAO	2006	03	Guidelines for DENR Accreditation of Third Party Source Emission Testing Firms	
DENR-DOST	Joint MC	2006	01	Adopting Environmental Technology Verification Protocol (ETVP)	
DENR	DAO	2007	25	(revision of DAO-2006-03)Guidelines for DENR Accreditation of Third Party Source Emission Testing Firms	
DENR	DAO	2007	22	Guidelines on the installation of Continuous Emission Monitoring Systems (CEMS) Guidelines on the Requirements for Continuous Emission Monitoring Systems (CEMS) and other Acceptable Protocols, Thereby Modifying and Clarifying Certain Provisions of Sections 5, Rule X of DAO 2000-81 and other related Provisions	
DENR	DAO	2007	27	Revised Emission Standards for Motor Vehicles Equipped with Compression-Ignition and Spark-	
DENR	MC	2007	03	ANNEX 1: Policy on Compliance and Permitting for Industrial Facilities Relating to Air Quality	
DENR-DTI-DOTC	JAO	2007	01	Amended Guidelines and Procedures for the Monitoring of Accredited and Authorized Private Emission Testing Centers (PETCs) and LTO Emission Testing Activities	
DENR	DAO	2010	23	Revised Emission Standards for Motor Vehicles Equipped with Spark Ignition and Compression Engine Excluding Motorcycles/Tricycles	
DENR	DAO	2010	24	Revised Emission Standards for Motorcycles/Three Wheeled Vehicles and Mopeds	
DENR	MC	2011	04	Clarificatory Guideline o DAO 2000-81, Part VI, Rule XIX, Section 13 (IRR of RA 8749)	
DENR	DAO	2013	13	Establishing the Provisional National Ambient Air Quality Guideline Values for PM _{2.5}	
DENR	DAO	2013	26	Revised Guidelines for DENR Accreditation of Third Party Source Emission Testing firms	
DOTC	DO	2013	03	Reconstitution of the Vehicle Control Fund Committee (VPCFC)	
DENR	DAO	2014	14	Designation of Southern Negros Geothermal Airshed and its Governing Board	
DOE	DC (Department Circular)	--	--		
DAO	DAO	2016	23	EURO 4	

Appendix 4: Detailed Roles and Responsibilities Roles and Responsibilities in the Air Quality Management Administration

Department of Environment and Natural Resources

Act as overall of the lead agencies; prepare a National Air Quality Status Report which shall be used as a basis in formulating the Integrated Air Quality Improvement Framework; issue rules and regulations in the implementation of the Act.

Lead agency in the implementation of RA 8749: Environmental Management Bureau (EMB)

Functions of the EMB:

- To oversee ambient air quality monitoring and to prepare annual National Air Quality Status Reports pursuant to Section 6 of the CAA
- To design and develop, in cooperation with the National Statistical Coordination Board (NCSB), an information network for data storage, retrieval and exchange, which will serve as the central depository of all data and information related to air quality;
- To issue and, from time to time, revise information on air pollution control techniques upon consultation with the appropriate committees, government agencies and local government units (LGUs);
- To, in coordination with other concerned agencies, review and/or revise and publish annually a list of hazardous air pollutants with corresponding ambient guidelines values and/or standards necessary to protect public health and safety, and general welfare;
- To design, impose on and collect regular emission fees from industrial dischargers as part of the emissions permitting system based on environmental techniques;
- To review, or as the need therefore arises, and revise and publish emission standards to further improve the emission standards for stationary sources of air pollution as well as emission standards for motor vehicles;
- To develop, implement and monitor the functioning of [SEP] permitting system as it may determine necessary for the prevention and abatement of air pollution by stationary sources, which amongst other addresses the need for program and project proponents to put up financial guarantee mechanisms to finance the needs for emergency response, clean-up or rehabilitation of areas that may be damaged during the program or project's actual implementation;
- To monitor compliance with emission standards for stationary sources. EMB has the right of entry or access to any premises including documents and relevant materials; to inspect any pollution or waste source, control device monitoring equipment or method required; and to test any emission;
- To require any person who owns or operates any emission source or who is subject to any requirement of the CAA to (i) establish and maintain relevant records; (ii) make relevant reports; (iii) install, use and maintain monitoring equipment or methods; (iv) sample emission, in accordance with the methods, locations, intervals, and manner prescribed by the DENR; and (v) keep records;
- To exercise such other powers and functions as provided by the law, the CAA and its IRR.

Department of Transportation

Section 15- Air Pollution Research and Development Program

The Department, in coordination with the Department of Science and Technology (DOST), other agencies, the private sector, the academe, NGOs and POs, shall establish a National Research and Development Program for the prevention and control of air pollution. The Department shall give special emphasis to research on and the development of improved methods having industry-wide application for the prevention and control of air pollution. Such a research and development program shall develop air quality guideline values and standards in addition to internationally-accepted standards. It shall also consider the socio-cultural, political and economic implications of air quality management and pollution control.

Section 21- Pollution from Motor Vehicles

- Implement the emission standards for motor vehicles pursuant to and as provided in the Act;
- Participate in the formulation of an Action Plan for the control and management of air pollution from motor vehicles;
- Contribute towards the establishment of procedures for inspection of motor vehicles, assist in the formulation and implementation of the National Motor Vehicle Inspection and Maintenance Program;
- Authorize private emission testing centers (duly accredited by DTI)

Section 25- Pollution from Other Mobile Sources

- The DENR, in coordination with appropriate agencies, shall formulate and establish the necessary standards for all mobile sources other than those referred to in Section 21 of this Act. The imposition of the appropriate fines and penalties from these sources for any violation of emission standards shall be under the jurisdiction of the DOTr.

Section 46- Violation of Standards for Motor Vehicles

- Establish a roadside inspection system;
- All law enforcement officials and deputized agents accredited to conduct vehicle emissions testing and apprehensions shall undergo a mandatory training on emission standards and regulations. For this purpose, the Department, together with the DOTr, DTI, DOST, Philippine National Police (PNP) and other concerned agencies and private entities shall design a training program.

Department of Trade and Industry - Bureau of Philippine Standards (DTI-BPS) and Board of Investors (DTI-BOI)

Section 21- Pollution from Motor Vehicles

- Participate in the formulation of an Action Plan for the control and management of air pollution from motor vehicles;
- Contribute towards the establishment of procedures for inspection of motor vehicles, assist in the formulation and implementation of the National Motor Vehicle Inspection and Maintenance Program;
- Accredite private emission testing centers (duly authorized by the DOTr);
- Develop and implement standards and procedures for the certification of training institutions, instructors and facilities and licensing of qualified private service centers and their technicians;
- Prescribe regulations requiring the disclosure of odometer readings and use of tamper-resistant odometers, including tamper resistant fuel management systems

Section 22- Regulation of All Motor Vehicles and Engines

- The DTI shall promulgate the necessary regulations prescribing the useful life of vehicles and engines including devices in order to ensure that such vehicles will conform to the emissions which they were certified to meet. These regulations shall include provisions for ensuring the durability of emission devices.

Section 26- Fuels and Additives

- Pursuant to the Air Quality Framework to be established under Section 7 of this Act, the DOE, co-chaired by the DENR, in consultation with the Bureau of Product Standards (BPS) of the DTI, the DOST, the representatives of the fuel and automotive industries, academe and the consumers shall set specifications for all types of fuel and fuel-related products, to improve fuel composition for increased

efficiency and reduced emissions: Provided, however, That the specifications for all types of fuel and fuel-related products set-forth pursuant to this section shall be adopted by the BPS as Philippine National Standards (PNS).

Section 46- Violation of Standards for Motor Vehicles

- All law enforcement officials and deputized agents accredited to conduct vehicle emissions testing and apprehensions shall undergo a mandatory training on emission standards and regulations. For this purpose, the Department, together with the DOTr, DTI, DOST, Philippine National Police (PNP) and other concerned agencies and private entities shall design a training program.

IRR, Rule XXXII, Sec 2

- The DTI through the Bureau of Import Services (BIS) shall formulate regulations and guidelines that will ensure rebuilt and imported second hand motor vehicles and engines will satisfy the emission standards for rebuilt and imported second hand motor vehicles as provided in these Implementing Rules and Regulations.

Department of Energy

Section 26- Fuels and Additives

- Pursuant to the Air Quality Framework to be established under Section 7 of this Act, the DOE, co-chaired by the DENR, in consultation with the Bureau of Product Standards (BPS) of the DTI, the DOST, the representatives of the fuel and automotive industries, academe and the consumers shall set specifications for all types of fuel and fuel-related products, to improve fuel composition for increased efficiency and reduced emissions: Provided, however, That the specifications for all types of fuel and fuel related products set-forth pursuant to this section shall be adopted by the BPS as Philippine National Standards (PNS).
- The DOE, shall also specify the allowable content of additives in all types of fuels and fuel-related products. Such standards shall be based primarily on threshold levels of health and research studies. On the basis of such specifications, the DOE shall likewise limit the content or begin the phase-out of additives in all types of fuels and fuel-related products as it may deem necessary. Other agencies involved in the performance of this function shall be required to coordinate with the DOE and transfer all documents and information necessary for the implementation of this provision.

Department of Interior and Local Government

Section 39- Public Education and Information Campaign

- A continuing air quality information and education campaign shall be promoted by the DENR, the Department of Education, Culture and Sports (DECS), the Department of the Interior and Local Government (DILG), the Department of Agriculture (DA) and the Philippine Information Agency (PIA). Consistent with Section 7 of this Act, such campaign shall encourage the participation of other government agencies and the private sector including NGOs, POs, the academe, environmental groups and other private entities in a multi-sectoral information campaign.

Department of Science and Technology -

(PNRI)

Section 26- Fuels and Additives

- Pursuant to the Air Quality Framework to be established under Section 7 of this Act, the DOE, co-chaired by the DENR, in consultation with the Bureau of Product Standards (BPS) of the DTI, the DOST, the

representatives of the fuel and automotive industries, academe and the consumers shall set specifications for all types of fuel and fuel-related products, to improve fuel composition for increased efficiency and reduced emissions: Provided, however, That the specifications for all types of fuel and fuel related products set-forth pursuant to this section shall be adopted by the BPS as Philippine National Standards (PNS).

Section 33- Radioactive Emissions

- All projects which will involve the use of atomic and/or nuclear energy, and will entail release and emission of radioactive substances into the environment, incident to the establishment or possession of nuclear energy facilities and radioactive materials, handling, transport, production, storage, and use of radioactive materials, shall be regulated in the interest of public health and welfare by the PNRI, in coordination with the DENR and other appropriate government agencies.

(PAGASA)

Section 31- Greenhouse Gases

- Shall regularly monitor meteorological factors affecting environmental conditions including ozone depletion and greenhouse gases and coordinate with the DENR in order to effectively guide air pollution monitoring and standard- setting activities.

Implementing Rules and Regulations
IRR section 22 (Air Quality Research)

Philippine Statistics Authority

IRR, Part V, Section 3

Air Quality Database. - The Bureau and the National Statistical Coordination Board (now PSA) shall design the Air Quality Database which shall be computerized and stored in a manner accessible to the public and shall contain data collected from the Ambient Air Monitoring Network and the Emissions Inventory.
Local Government Units

Section 8. Air Quality Control Action Plan

- To prepare and develop, with the assistance from the Department, an action plan consistent with the Integrated Air Quality Framework to attain and maintain the ambient of air quality standards within their respective airsheds as provided in Section 9 of the Act

Section 10- Designation of Non-attainment Areas

- To prepare and implement a program and other measures including relocation, whenever necessary, to protect the health and welfare of residents in the area
- To develop and submit to the DENR through the Bureau a procedure for carrying out the action plan for their jurisdiction, provided that the Department through the Bureau shall maintain its authority to independently inspect the enforcement procedure adopted

Section 24- Pollution from Smoking

- Smoking inside a public building or an enclosed public place including public vehicles and other means of transport or in any enclosed area outside of one's private residence, private place of work or any duly

designated smoking area is hereby prohibited under this Act. This provision shall be implemented by the LGUs.

Section 36- Role of Local Government Units

- Local government units (LGUs) shall share the responsibility in the management and maintenance of air quality within their territorial jurisdiction. Consistent with Sections 7, 8 and 9 of this Act, LGUs shall implement air quality standards set by the Board in areas within their jurisdiction; Provided, however, that in case where the Board has not been duly constituted and has not promulgated its standards, the standards set forth in this Act shall apply.

Section 37- Environment and Natural Resources Office

- To establish an Environment and Natural Resources Office (ENRO) in every province, city, or municipality which shall be headed by the environment and natural resources officer appointed by the chief executive of every province, city or municipality in accordance with the provisions of Section 484 of the R. A. 7160

Philippine Information Agency

Section 39- Public Education and Information Campaign

- A continuing air quality information and education campaign shall be promoted by the DENR, the Department of Education, Culture and Sports (DECS), the Department of the Interior and Local Government (DILG), the Department of Agriculture (DA) and the Philippine Information Agency (PIA). Consistent with Section 7 of this Act, such campaign shall encourage the participation of other government agencies and the private sector including NGOs, POs, the academe, environmental groups and other private entities in a multi-sectoral information campaign.

Acknowledgements

National Air Quality Status Report 2016-2018

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**Department of Environment and Natural Resources
Environmental Management Bureau
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