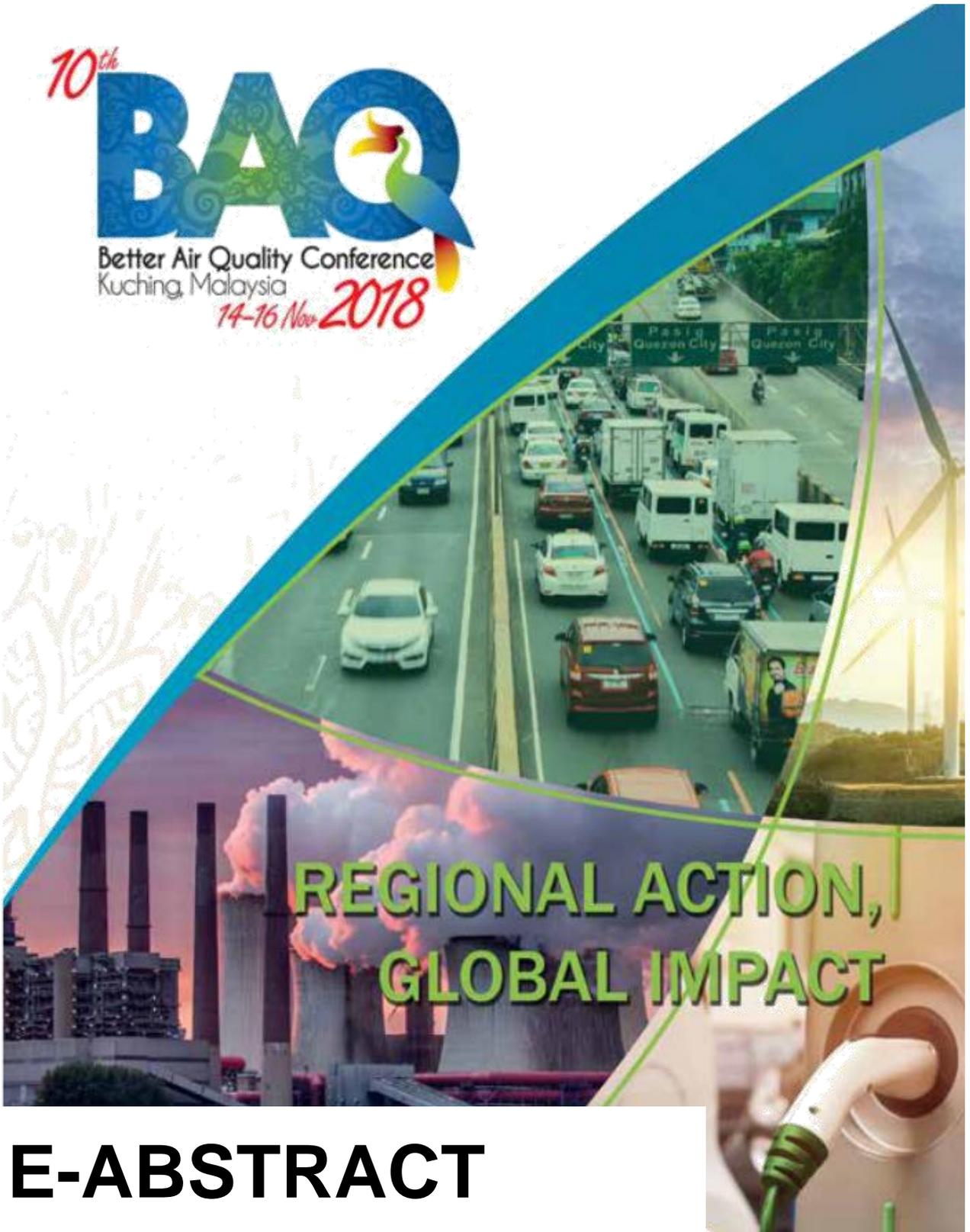


10th
BAQ
Better Air Quality Conference
Kuching, Malaysia
14-16 Nov 2018



**REGIONAL ACTION,
GLOBAL IMPACT**

E-ABSTRACT



Session:
MYCAS Plenary Session

Date & Time:
14 November 2018, 13:30-15:00

Chairperson:
Prof Zailina Hashim,
Universiti Putra Malaysia (UPM)
Email: zailinahas@hotmail.com

Session	MyCAS Plenary Session	
Venue	Room 13, BCKK	
Time	13:30 – 15:00	
Chairperson	Prof. Dr. Zailina Hashim, Universiti Putra Malaysia (Email: zailinahas@hotmail.com)	
Time Keeper	Nur Hazirah Hisamuddin	
13:30	Professor Dato' Dr. Nor Aieni binti Haji Mokhtar, <i>Vice Chancellor, Universiti Malaysia Terengganu</i>	An Analysis of Voluntary GHG Emissions Disclosure: Malaysian Evidence
14:00	Prof. Dr. Mohd Talib Latif, <i>Professor at School of Environmental and Natural Resource Science Deputy Dean (Postgraduate) at Faculty of Science and Technology Universiti Kebangsaan Malaysia</i>	Long-term Record of air Quality in Malaysia
14:30	Prof Peter Brimblecombe, <i>Hong Kong City University</i>	Heterogeneity of Urban Air Pollution

An Analysis of Greenhouse Gas Emissions Disclosure: Malaysian Evidence

Nor Aieni Mokhtar

Vice Chancellor, Universiti Malaysia Terengganu

ABSTRACT

Burning fossil fuels, cutting down rainforests and farming livestock are human activities of which increasingly influence the climate and the earth's temperature. In addition, as a result of rapid expansion of plantation industry, deforestation and the conversion of tropical peatland soil have also increased. These activities result in increasing the greenhouse effect and global warming, because they add immense amounts of greenhouse gases (GHG) to those naturally occurring in the atmosphere. The GHG emissions have caused Malaysia experiencing an increase trend of warming. While plantation industry contributes income to Malaysian economy, it is causing considerable environmental problem and influencing the climate change. In addition, aggressive economic development plans further exacerbating the issue. Climate change leads to natural disasters thus affects social and business environment. Malaysian economy is increasingly vulnerable to the impact of climate change thus businesses can no longer ignore the relevance of managing their GHG emissions. Moreover, concern for measurement and disclosure of GHG emissions by industries has increased among stakeholders. Particularly, business entities are increasingly pressured to measure, manage and report on their climate change performance. Thus, it is necessary for entities to understand and communicate their contribution to global warming resulting from carbon emissions. Consistent with Malaysian Government commitment towards reducing 45% of GHG emissions intensity of GDP by 2030 compared to the emissions intensity of GDP in 2005, Bursa Malaysia has just made mandatory requirements for all listed companies (implemented on a staggered basis based on market capitalisation) to disclose a narrative statement of their material economic, environmental and social (EES) matters in a Sustainability Statement. Implementation of the requirements to disclose sustainability statement demonstrates Bursa Malaysia's commitment towards combating climate change. Therefore, this study aims to explore the extent of the GHG emissions reporting among Malaysian publicly listed companies in the Plantation sector. GHG emission elements are part of environmental related matters that should be disclosed in a Sustainability Statements. Using legitimacy framework, this study investigates 43 annual reports and sustainability reports of plantation companies by establishing checklist based on Sustainability Reporting Guide (SRG) to determine the breadth and depth of GHG emissions disclosures. This study considers all aspects of GHG emissions disclosure as stipulated in SRG. Content analysis is undertaken to explore legitimacy strategies (substantive or symbolic) that are employed by the companies in conforming to the current listing requirements. The results show that out of 43 companies operating in the plantation sector there are only 20 companies that have made GHG emission reporting. From the 20 companies only 16 companies were required under the Listing Requirements (LR) to make sustainability-related disclosures while 4 companies voluntarily made reporting related to the sustainability matters. Although LR has made reference to SRG for items to be disclosed in the annual report, it was noted that some items are not disclosed in the company's disclosures. Further, the overall GHG emissions disclosure score are low even though the companies are complying with the LR in terms of disclosing the sustainability matters. Most of companies are tend to make symbolic disclosures instead of substantive disclosures. The results of this study show that only companies that are required to make sustainability related matters reporting have made GHG emissions disclosure. Furthermore, voluntary reporting of GHG emissions among Malaysian companies is still low. This study has practical implications as it provides current data on the capital market participation in reporting the GHG emissions. It is important to understand the capital market participation in combating the climate change issues. In addition, this study identifies the dimensions where GHG reporting quality needs to be improved i.e. reporting of quantitative data because limited companies provide disclosure on quantitative data of GHG emissions. With participation from

capital market, it helps the government to provide transparent actions to reduce GHG emissions.

Long-term Record of Air Quality in Malaysia

Mohd Talib Latif

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ABSTRACT

Air quality in Malaysia has been associated with various natural and anthropogenic sources and meteorological conditions. Pollutants that show seasonal variations and frequently exceed the Malaysia Ambient Air Quality Standard (MAAQS) are surface ozone (O_3) and particulate matter (PM), predominantly related to the monsoon seasons. Other air pollutants usually associated with daily activities particularly related to number of motor vehicles on roads, industrial activities and combustion processes. A high surface O_3 concentration is usually observed between January and April, while a low surface O_3 concentration is found between June and August every year. Analysis of daily variations in surface O_3 and its precursors indicate that the surface O_3 photochemistry exhibits a positive response to the intensity and wavelength in UVb while being influenced by the concentration of NO_x , particularly through tritration processes. Haze episode due to biomass burning has been recognised as a major source of particulate matter in Malaysia. Regional peat and biomass burning contributes to high concentration of fine particulate matter (PM) in the atmosphere. Strong haze episode in Southeast Asia such as in 1997 and 2015 also triggered from of El Niño phenomenon and long dry periods in this region. The long term-record of air quality data in Malaysia suggests the need of research coordination and collaboration to reduce the impact of air pollutants to environment and human health.

Heterogeneity of Urban Air Pollution

Peter Brimblecombe

School of Energy and Environment, City University of Hong Kong, Hong Kong^[1]

ABSTRACT

Although we frequently see rankings of air quality of important cities, it can be puzzling as to what this means when air pollution is unequally spread across urban areas. The distribution is uneven, but uneven on a range of scales. A gradual decline away from the centre of cities can be seen in terms of traffic derived pollutants as the road network becomes less dense. However, sometimes much sharper gradients, such as increases in ozone concentration, are apparent as we go from main roads to parallel back streets. Street canyons depth exerts an effect also and often promotes higher pollutant concentrations to the windward side of the canyon because of internal circulation. There are hot spots associated with industries, with areas of lower pollutant concentrations in parks and other open spaces. Traffic moves with a punctuated flow, such that pollution concentrations may be dramatically different at intersections, pedestrian crossings and bus stops. Street furniture such as bus shelters and overhead pedestrian walkways also create special environments. As pedestrians leave the street and move indoors they rapidly experience very different exposures. Additionally there seems a regulatory heterogeneity to the way in which legislation is applied, and heterogeneous structures to the populations exposed in various urban environments. This paper will explore the heterogeneity of urban air pollution with particular emphasis on our work in Hong Kong and draw conclusions about how this work may help in the provision of Better Air Quality.



ORAL PRESENTATIONS

Session:

Air Quality Management and Climate Change

Date & Time:

13 November 2018, 9:00-10:30

Chairperson:

**Dietrich Schwela,
Stockholm Environment Institute
Email: dietrich.schwela@york.ac.uk**

Session	Air Quality Management and Climate Change	
Venue	Rooms 2 & 3, BCKK	
Time	9:00-10:30	
Chairperson	Dietrich Schwela, Stockholm Environment Institute (Email: dietrich.schwela@york.ac.uk)	
Time Keeper	Nur Hazirah Hisamuddin	
9.00	Radin Diana R. Ahmad, <i>TNB Research Sdn. Bhd.</i>	Prediction and Analysis of Source Apportionment from Dust Dispersion
9.15	HDS. Premasiri, NKPM. Perera, PD. Liyanaarachchi <i>DMMR. Dissanayaka</i>	Effect of Climatic, Geographical and Other Factors on Trends of Ambient Air Quality in Major Cities in Sri Lanka
9.30	Dieter Schwela, <i>Stockholm Environment Institute</i>	Strengths and weaknesses of the WHO urban air pollutant database
9.45	Nandhakumar S K, <i>IIT Madras</i>	Effect of Climate Forcing Parameters on Coastal Regions Due to Marine Aerosols
10.00	Nasreen Farah, <i>Environmental Management Council Pakistan</i>	Soot emissions as a significant contributor to global warming

Prediction and Analysis of Source Apportionment from Dust Dispersion

Radin Diana R. Ahmad¹, Sazalina Zakaria¹, Ahmad Rosly Abbas¹, Nur Natasha Abdul Samat¹, Marzuki Ismail² and Samsuri Abdullah²

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ABSTRACT

Dust is a major constituent of air pollution from heavy industries and power plants. In Malaysia, regulatory dust consists of PM₁₀ and PM_{2.5}, each having different PNC. A comprehensive PM₁₀ and PM_{2.5} study was conducted that incorporate ambient measurement of dust for chemical characterization (ionic species), source apportionment, trajectory analysis and dispersion modelling. The objectives of this research were to determine source apportionment and correlate the dust with meteorological factors. Results indicated that the major sources of dust are from motor vehicle, fugitive dust, fly ash, quarry and biomass burning. Temperature and wind speed exhibit positive relationship whilst rainfall and humidity have inversely proportionate effect on dust dispersion. Through this study, correlation and source apportionment of ambient dust elements enable determination of various dust origin based on its chemical composition; whereas meteorological features greatly influenced its distribution.

Keywords: *Dust, Component Analysis, Chemical Species, Meteorological Factors*

Effect of Climatic, Geographical and Other Factors on Trends of Ambient Air Quality in Major Cities in Sri Lanka

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ABSTRACT

Air pollution in major cities has become a serious environmental issue in Sri Lanka. The motor vehicles on road and the fuel consumption have increased at a tremendous pace contributing to a major part of the air pollution in urban landscapes. Many studies show a close link between urban growth and increased air pollutants, which result in increased human health impacts, mainly respiratory and cardiovascular diseases. Due to the critical health risks associated, reducing atmospheric concentration of pollutants by emission control is a top priority in urban air quality management. This study was done to assess trends in ambient concentration of three main air pollutants (Sulfur Dioxide (SO₂), Nitrogen Dioxide (NO₂) and Particulate Matter (PM_{2.5})) in 8 major cities of Sri Lanka. These cities are in varied geographical, environmental settings in different urban pressures. Demographically, more than 50% of the country's population is concentrated in these cities, exposing widely to air pollution risk. Air sampling locations were strategically selected to represent both high traffic and low traffic areas. The results show high pollutant concentrations in congested city centres having high traffic and low concentrations in peripheral landscapes with low urban growth and traffic. The pollutant dispersion in each urban area is strongly influenced by the climatic and geographical factors in the area. The temporal pollutant concentration trends synchronize well with efforts on air pollution emission reduction, with a notable reduction in all cities. Nevertheless, subsequently increased concentrations of the two pollutants in 2016 & 2017 compared to that of 2015 show a clear link to increased traffic fleet, resulting from the reduction of fuel prices, removing tax reliefs on hybrid vehicles, and efforts on urban expansion with little regard to urban air quality management.

Keywords: *Urban air quality, annual average, vehicle emission*

Strengths and Weaknesses of the WHO Urban Air Pollutant Database

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ABSTRACT

The 2018 WHO database of 3,570 cities in 97 countries monitoring PM₁₀ and 2,628 cities in 81 countries monitoring PM_{2.5} is an impressive piece of data compilation. The database uses particulate matter data from established public air quality monitoring systems around the world. PM₁₀ and PM_{2.5} include pollutants such as sulphates, nitrates and black carbon, which penetrate deep into the lungs and into the cardiovascular system, posing the greatest risks to human health. Unsurprisingly, the WHO database reports relatively low levels of urban particulate matter pollution in high-income countries (e.g. in Western Europe, the Americas, the Western Pacific, and Oceania) and high levels in low-and middle-income (LMI) countries, so e.g. in Africa, Latin America, and Southeast Asia and even in high-income countries in Latin America. In LMI countries lack of funding and inadequate staffing are key barriers to effective air pollution reduction. This database may again people tempt to compare cities and draw at least inaccurate and misleading if not wrong conclusions, as it has happened in the case of WHO's 2016 city database. In this paper we investigate the strengths and weaknesses of the new database with respect to several criteria including selection of pollutants, completeness, spatial and temporal representativeness, data coverage, transboundary pollution, meteorological conditions, applied methodology, and quality assurance/quality control.

Keywords: *air pollutants, completeness, comparability, representativeness, data coverage*

Effect of Climate Forcing Parameters on Coastal Regions Due to Marine Aerosols

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ABSTRACT

In recent time, the weather pattern changes drastically when compare to the last few decades. It is truly attestation by increasing temperature about 1.5°C at present and it may rise around 4°C in 2100. Therefore, it is necessary to focus on the adaptation strategies on the climate change and attaining the climate stability by regulating the climate forcing parameters. There are about 40 percent of world population live in the coastal areas of the world within the distance of 100 nm. Particularly, in India, around 20 percentage of the population live in the coastal states since the vast coastline length about 8100 km. Moreover, the total marine trading is concentrated in the maritime states. Since they are the facilitated by the port and harbours for the marine transport. It is essential to provide the safety for the major population from the maritime aerosols which are coming from the ship and port emissions. An aerosol is a colloid of fine solid particles or liquid droplets, in air or another gas. The excessive range of aerosol in the particular region will affect the health of the living organism and affect the regional climate. Therefore, in-depth study on the aerosol over the coastal regions is pre-requisite in the climate change projections. The emissions of CO₂, NO_x and SO_x from atmospheric pollutant affect cloudiness, and accelerate climate impact 'Radiative Forcing' (RF). Positive RF produces warming and Negative RF produces cooling effect. They also indirectly affect weather patterns through the Cloud Condensation Nuclei (CCN) ability of cloud which shows a high impact on gases and particulates. The overall effect is Negative Radiative Force. Increase in Sulphur could result in reduced Negative RF.

Keywords: *aerosols, climate change, emission*

Soot Emissions as a Significant Contributor to Global Warming

Nasreen Farah

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ABSTRACT

Soot emissions have enormous environmental, health, local, regional and global impacts. Being a forcing agent for global warming comparable to the greenhouse gas methane, with wide range of positive and negative forcing variations, estimated by various scientists from the year 1990s to 2010 ($+0.25 \pm 1 \text{ W/m}^2$). Quantitative estimates of black carbon climate forcing study indicates that, the direct effects due to black carbon are nearly twice the number reported in the 2007 IPCC Fourth Assessment. Hence although an extensive wide range uncertainty exist, soot is found an extremely important atmospheric constituent for its remarkable global influence on climate and tropospheric chemistry. Black carbon, or soot, accelerates warming because the fine particles absorb heat when they are in the air and when they darken snow and ice. They also accelerate glacier melting and can disrupt regional weather patterns. It has been found through simulation of 12 identifiable effects of aerosols on the climate that any emission reduction of BC plus associated organic matter (i.e. soot) could slow global warming more than any emission reduction of CO_2 and CH_4 . Eliminating the short-lived fossil fuel particulates BC and organic matters could eliminate 20-45% of the net I warming within 3-5 years if no other changes occur. Scientists have estimated that because of soot ability to absorb and reradiate the sun's heat, it may be responsible for 15-30% of global warming. IPCC hence includes soot as one of the greenhouse emissions, making it mandatory for the countries to report its data in the IPCC's Greenhouse Gas Inventory.

Keywords: *soot emission, black carbon, global warming*



ORAL PRESENTATIONS

Session:
Air Quality and Its Impact on Health

Date & Time:
13 November 2018, 9:00-10:30

Chairperson:
Dr Vivian Pun,
Vital Strategies
Email: vpun@vitalstrategies.org

Session	Air Quality and its Impact on Health	
Venue	Room 12, BCKK	
Time	9:00-10:30	
Chairperson	Dr Vivian Pun, Vital Strategies (vpun@vitalstrategies.org)	
Time Keeper	Noor Haziqah Kamaludin	
9.00	Enkhjargal Altangerel, <i>Public Health Development and Innovation Institute</i>	Quality of life and air pollution in Ulaanbaatar, Mongolia
9.15	Noor Haziqah Kamaludin, <i>Universiti Putra Malaysia</i>	Cement Dust Exposure on Fractional Exhale Nitric Oxide (FENO) and Interleukin-8 (IL-8) in Airways Inflammation among Cement Workers
9.30	Noor Fatimah Bt. Mohamad Fandi, <i>Universiti Putra Malaysia</i>	<i>Health and Risk Carcinogenic Evaluation of BTEXs in Urban Workers in Klang Valley, Malaysia</i>
9.45	Noor Ashikin Sopian, <i>Universiti Putra Malaysia</i>	Industrial Particulate Pollution and Risk of Genetic Damage among Children
10.00	Ng Hon Wei, <i>Riverstone Environmental Sdn Bhd</i>	Streamlining the Process of Conducting Human Health Risk Assessments by Using a Combination of BREEZE AERMOD, Esri ArcGIS, and BREEZE Risk Analyst
10.15	Keiko Hirota, <i>Japan Automobile Research Insitute</i>	Environmental Policy Database 2018

Quality of Life and Air Pollution in Ulaanbaatar, Mongolia

A.Enkhjargal¹, B.Bolor¹, M.Oyunchimeg¹

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ABSTRACT

Air pollution is an increasingly serious problem in Mongolia and especially in capital city Ulaanbaatar and several other urban areas. The goal of the survey is to define relationship between air pollution and its quality of life impact in Ulaanbaatar, Mongolia. This is a cross-sectional survey. UB city residents and selected aimag population will be sampling area population. We used WHO Original WHOQOL-100. Ambient air PM₁₀ level was used the nearest to person's monitoring data of air quality station. Data were entered in to Excel program. All statistical data will be analysed by software SPSS version 21. One-way and two-way tables were generated to show the descriptive profile of the respondents. We had enrolled 2552 respondents of 3 biggest cities of Mongolia. 63.4% of them were female, 48.6% of them had at least Bachelor's degree, 72.4% of them were married, 52.9% of them had at least a child and 56.4% of them were living in the gar area either in a ger (28.9%) or private dwellings (27.5%). Median age of respondents are 32±10.37. During the cold reason (255.1 µg/m³) average level of ambient air PM10 was 3.46 times higher than the warm season (73.64 µg/m³). According to the quality of life index during warm season it was relatively high among Mongolian residents. Also residents of Darkhan, female, and apartment people's quality of index of all aspects are higher than others. Ambient air PM₁₀ level was reversely correlated with all domain of quality of life for Mongolian city residents (Rxy=0.01-0.157). As conclusion, air pollution is not only harmfully affect to the human health but also it is reversely influenced to human's quality of life in Mongolia.

Keywords: *air pollution, quality of life, Mongolia, PM₁₀*

Respirable Cement Dust Exposure on Fractional Exhale Nitric Oxide (FENO) and Interleukin-8 (IL-8) in Airways Inflammation among Workers

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ABSTRACT

Working exposure to cement dust presumed respiratory health response due to high level irritant-exposure causes the airways to overreact and become narrow. The aim of this study is to determine the relationship of respirable cement dust exposure and the risk of respiratory disease among cement workers. A cross sectional study was carried out among 179 cement workers and 173 schools' staff as the comparative group. Background information as well as respiratory symptoms and respiratory health history among the respondents was obtained thru distributed validated questionnaires. Personal Air Sampling Pump used to assess respirable cement dust exposure. Lung function performance obtained by using a Spirometer and NIOX MINO was conducted to assess Fractional Exhaled Nitric Oxide (FENO). Immunologic response of Interleukin-8 (IL-8) concentration was obtained by using nasopharyngeal swab and analyzed using ELISA test kit. The mean of personal respirable cement dust concentration on workers was 2.89 ± 3.21 mg/m³. The increasing exposure to respirable cement dust significantly reduce FVC% ($r = -0.270$, 95% CI = -0.401, -0.115) and FEV₁% ($r = -0.272$, 95% CI = -0.409, -0.140). Phlegm was reported the most likely to occur among cement workers (PR = 3.240, 95% CI = 1.594-6.588). After adjusting for smoking and tenure status, the prevalence of phlegm and cough are 30.2% and 21.2%. FENO were significantly associated with respirable dust ($\chi^2 = 4.561$, $p = 0.033$) and highly to occur among workers who exposed respirable cement dust (PR = 3.017, 95% CI = 1.067-8.534). IL-8 was significantly correlated with the exposure of respirable cement dust ($r = 0.526$, 95% CI = 0.439-0.605) among cement workers. Cement workers are highly risk of lung impairment by developing respiratory health symptoms, reducing lung function level and increasing high level of FENO cause of their exposure to respirable cement dust.

Keywords: *Cement industry, Fractional Exhaled Nitric Oxide (FENO), lung function, respirable cement dust, respiratory symptoms.*

Health Risk Carcinogenic and Non-Carcinogenic Evaluation of BTEXs in Urban Workers in Klang Valley, Malaysia

Noor Fatihah Mohamad Fandi¹, Juliana Jalaludin*¹ and Mohd Fairus Awang¹

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ABSTRACT

The urban air toxics concentrations of benzene, toluene, ethyl-benzene, *m,p*-xylene, *o*-xylene, and xylene (BTEXs) are at risk to cause possible health effects problems particularly among the urban workers. No safe exposure level can be recommended for benzene specifically by World Health Organization. This study aims to discover BTEXs concentration and health risk assessment by focusing the urban traffic policemen during they are controlling the traffic flows. The personal air samples were performed by using low flow personal sampler. BTEXs were analysed in GC-MS coupled with thermo-desorption. Cancer risk and non-cancer risk were determined by conventional measurement of LCR and HQ using benzene and ethyl-benzene for cancer risk and BTEXs for non-cancer risk markers. Average 4.5 hours of BTEXs personal air sampling among 115 urban traffic policemen found that the mean personal exposure concentration of BTEXs were 53.40 µg/m³, 178.79 µg/m³, 48.94 µg/m³, 77.03 µg/m³ (*m,p*-X), 73.17 µg/m³ (*o*-X), and 150.21 µg/m³ (xylene) respectively. The cancer risk calculated showed benzene was appears to be the most concerning pollutants with level of 1.5x10⁻⁵ followed by ethyl-benzene (2x10⁻⁶) which both are in unacceptable level. All hazard quotient values of toluene, ethyl-benzene, *m,p*-xylene, *o*-xylene for non-cancer risk were lower than 1 except for benzene and xylene. The result of cancer risk and non-cancer risk for high-concerning of benzene exceeds the acceptable level of 1x10⁻⁶ and 1 respectively. The estimated cancer risk suggests that prolonged benzene inhaled by traffic policemen placed them at more risk to adverse health effects. The urban toxics of BTEXs have become public-concerning compound in Malaysia particularly benzene as it is carcinogenic nature. The regulatory attention required by providing the baseline data to ascertain both general and occupational population whose encounter an additional "on the road exposure" to BTEXs are in a safe environment.

Keywords: *BTEXs, health risk assessment, urban traffic policemen, Klang Valley*

Industrial Particulate Pollution and Risk of Genetic Damage among Children

Nor Ashikin Sopian^{1*} and Juliana Jalaludin¹

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ABSTRACT

Deterioration of air quality in school in proximity of industrial area had led to significant respiratory health impact especially respiratory symptoms. However, prolonged exposure to a mixture of industrial air pollutant resulted in a significant genetic damage and affects health later in life. This damage can be accessed through a validated cytogenetic testing known as micronucleus assay and comet assay. A cross-sectional comparative study was carried out in Terengganu that involved 224 children (aged 10-12 years old) who lived close to a petrochemical industrial area (exposed group) and those who live over 20 km from the industry. The 24 hours daily PM_{2.5} assessment was carried out at the selected schools by using a portable MiniVol air sampler. Besides, indoor air monitoring was also performed during school hours (8 am to 1 pm) using handheld portable equipment. Cytogenetic testings were examined on the buccal epithelial cells of the children. The indoor concentration PM_{2.5} (24hours) for the exposed and comparative schools were 30.19 and 18.43 µg/m³ respectively. This finding was still below the standard limit of the New Malaysia Ambient Air Quality Standard. Meanwhile, the values of Indoor/Outdoor (I/O) ratios of 24 hours measured PM_{2.5} ranged from 0.34 to 0.74, which suggested high penetration of outdoor particles into the indoor classrooms. The indoor air quality during the schools' hours demonstrated a significant concentration of particulate matter in the exposed classrooms. On other hand, both cytogenetic analyses demonstrated a significant higher level of chromosomal and DNA damage among children of the exposed group. The exposed group recorded an average value micronuclei frequency 4.80±3.36 per 1000 cells and 27.20±8.21 µm tail length for comet assay. Thus, it concludes the severity of genetic damage among the exposed children and requires prompt action in tackling the air quality issue in the industrial area.

Keywords: *industrial air pollutants, children, genetic damage, comet assay, micronucleus assay*

Streamlining the Process of Conducting Human Health Risk Assessments by Using a Combination of BREEZE AERMOD, Esri ArcGIS, and BREEZE Risk Analyst

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ABSTRACT

Exposure to hazardous air pollutants (HAP) can result in acute and/or chronic health effects. Humans can be exposed to toxics either directly, through inhalation, or indirectly, through ingestion or dermal contact. The magnitude of the risk varies as a function of the meteorological conditions, geographical characteristics of the surrounding area, the emission characteristics of the facility, the age of the individuals exposed, and the exposure duration and frequency. The potential health impacts from specific exposure scenarios can be quantified by performing a human health risk assessment (HHRA). Full scale HHRA analyses are useful for evaluating the potential health impacts in humans who may be exposed to specific release scenarios or actual release events. The HHRA is also important for environmental compliance and mitigation actions. The U.S. EPA Human Health Risk Assessment Protocol (HHRAP) contains the methodology guidance, fate and transport, exposure and health risk algorithms for predicting the impacts of chemicals of potential concern (COPC) released into the atmosphere from emission sources. To assist those who are conducting HHRAs, BREEZE Risk Analyst has been developed to directly integrate equations provided in the HHRAP and is well refined in its selection and use of coordinate systems, data handling, calculations, and management of georeferenced data systems. As such, combining the use of air dispersion models, such as AERMOD, with ArcGIS and the Risk Analyst tool can simplify and improve the accuracy of a risk assessment. This study provides an overview of methodology using a combination of these tools to simplify the HHRA analysis and examines a case study to demonstrate the simplicity, usefulness, and accuracy of the techniques in accordance to USEPA 2005 Final HHRAP.

Keywords: *Human Health Risk Assessment, Air Quality, Modelling Software*

Environmental Policy Database 2018: A Methodology of Health Effects Estimation from Air Pollution in Large Asian Cities-

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ABSTRACT

Environmental Policy Database (EPDB) was agreed upon at the 3rd Asia Automobile Research Institute Summit (AAIS) in Bangkok 2014, upgraded every year. EPDB 2018 focuses on health effects using simple indicators and calculations. This presentation discusses methods of estimating the health effects of air pollution in large Asian cities. Due to the absence of statistical data in Asia, this research carefully chooses methodology using data of the Japanese compensation system. A basic idea of health effects will be captured from simple indicators, such as population and air quality, in a correlation model. This correlation model enables more estimation results of respiratory mortality caused by air pollution to be yielded than by using a relative model. The correlation model may be an alternative method to estimate mortality besides the relative risk model since the results of the correlation model are comparable with those of the relative model by city and by time series. The classification of respiratory diseases is not known from the statistical yearbooks in many countries. Estimation results could support policy decision-making with respect to public health in a cost-effective way.

Keywords: *air quality, health impact, megacities*



ORAL PRESENTATIONS

**Session:
Clean Energy for Better Air Quality**

**Date & Time:
13 November 2018, 11:00-12:30**

**Chairperson:
TS Dr Shahrul Ismail,
Universiti Malaysia Terengganu
Email: shahrul.ismail@umt.edu.my**

Session	Clean Energy for Better Air Quality	
Venue	Rooms 2 & 3, BCCK	
Time	11.00 – 12.30	
Chairperson	TS Dr Shahrul Ismail, Universiti Malaysia Terengganu (Email: shahrul.ismail@umt.edu.my)	
Time Keeper	Nur Faseeha Suhaimi	
11:00	Aliashim Albani, <i>Universiti Terengganu</i> <i>Malaysia</i>	Evaluation of the Wind Shear at Three Windy Sites in Malaysia
11:15	Mohamed Shahrir Mohamed Zahari, <i>Universiti Terengganu</i> <i>Malaysia</i>	Carbon-negative biofuels (biodiesel and bioethanol) from non-food based source and waste biomass
11:30	Shahrul Ismail, <i>Universiti Terengganu</i> <i>Malaysia</i>	Pre-treatment and Biochemical Methane Potential of Cattle Manure from Feedlot: An Approach for Methane Emission Prevention
11:45	Ernesto Abaya, <i>University of the Philippines</i>	Etricycle Pilot Testing at UP Diliman
12:00	Naini Jayaseelan <i>Ex-Secretary, Government of India</i>	Clean Energy Possibilities from Sewage Treatment Plants (STPs)
12:15	Ittipol Pawarmat, <i>Pollution Control</i> <i>Department, Thailand</i>	Air Pollutant Emission Abatement Using Application of Various Ethanol-gasoline Blends in Motor Vehicles

Evaluation of the Wind Shear at Three Windiest Sites in Malaysia

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ABSTRACT

The wind data extrapolation up to the desired height is frequently made to the available data for many fields of study. The common mathematical formulation method to compute the vertical wind shear is the power law profile, due to its simplicity. This paper presents an analysis of wind speed and wind shear in terms of the directional, diurnal and seasonal patterns for a site at three windy sites in Malaysia; Kudat in Sabah, Kijal and Mersing in Peninsular Malaysia. This analysis takes a detailed look at frequency distributions to facilitate an understanding of the local climatic conditions. The wind shear is higher during the night stable condition, but it started to reduce after sunrise. Throughout the day, they were at their lowest values. However, the values begin to rise in the evening as the air above the ground started to become cool with unstable condition before slowly changing to neutral and stable. In addition, the wind shear is higher during the Northeast monsoon season (raining season), but the lowest during the Southwest monsoon season (summer season). This could be due to the summer season that projects higher air mixing above the ground; resulting in lower value than that during raining season when the ground experiences less air mixing. The averaged wind shear for three sites are 0.38 (Kudat), 0.25 (Kijal) and 0.20 (Mersing). The finding from this study could be useful for prediction of vertical wind speed at a site with similar geographical and climatic condition.

Keywords: *Wind shear, Power law, Malaysia*

Carbon-Negative Biofuels (Biodiesel and Bioethanol) from Non-Food Based Source and Waste Biomass

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ABSTRACT

Despite the concern regarding the fossil fuels depleting supplies and the well-known negative environmental consequences, there are still spiking increase in its consumption due to the need for energy sources. To be a viable alternative, biofuels should be able to reduce the greenhouse gas (GHG) emission whilst cater to the ever-increasing energy need. Despite the claim upon biomass biofuels to be carbon neutral but in actual scenario, there is the need to consider upon the carbon footprint involve in the plant cultivation, biofuels productions step and lastly on the combustion net energy. These changes in the carbon stock and foot printing can be estimated from the currently available data. Evidently, biodiesel processing steps from biomass source can yield 93% more energy in comparison to the energy invested during the production step while 25% more energy could be gained from bioethanol. Another positive outcome is upon greenhouse gas emission reduction of about 41% and 12% achievable through the combustion of biodiesel and bioethanol, respectively. The only shortfalls are on the production yields from the currently available biofuels plantation that will not be able to cope to current fuels demands and the unprofitable biofuels cost due to the high production cost. If produced from non-food based biofuels and waste biomass, then it would provide much benefit as carbon neutral source along with environmental benefits enough to merit continuous subsidy for biomass biofuels.

Keywords: *biofuel, waste biomass, greenhouse gas*

Pre-treatment and Biochemical Methane Potential of Cattle Manure from Feedlot: An Approach for Methane Emission Prevention

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ABSTRACT

Fibre composition in cow manure contains large quantities of lignocellulosic materials which is critical for producing biogas. This research is aimed to determine the pre-treatment efficiency of cow manure and potential for biogas production. Most importantly to analyse the delignification process of treated and untreated samples from reactor operations by the performing Van Soest method of Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF), and Acid Detergent Lignin (ADL). To begin with, the analysis of total solid (TS), volatile solid (VS), pH value, chemical oxygen demand (COD) and ammonia-nitrogen (NH₃-N) content for both substrate and inoculums were performed using standard method. Then, reactor operations were set up to carry out anaerobic digestion by using continuously stirred-tank. As the results, the solid analysis of substrate showed TS 11.91%, VS 10.7 %, pH 6.61, COD 79,125.0 mg/L COD and NH₃-N 2175.0 mg/L. Result showed that CM treated with *Trichoderma sp.* gave the highest methane potential with 0.023 LCH₄-STP g VS⁻¹ compared to CM treated with *A. Fumigatus SK1* (0.011 LCH₄-STP g VS⁻¹). A good correlation have been found in this study between lignin removal and reducing sugar produced where, the total lignin removal after treated with *Trichoderma sp.* was 60% followed by 43% after treated with *A.Fumigatus SK1*. While the results from inoculums are TS 38,560 mg/L, TSS 264,780 mg/L, VSS 248,680 mg/L, pH 7.27, COD 1967.mg/L COD and NH₃-N 1633.75 mg/L. The total lignocellulosic content for batch 14 days in treated reactor (61.7 g/g % dry basis) and untreated reactor (53.68 g/g % dry basis) increase about 10% than lignocellulosic content in raw cow manure (52.23 g/g % dry basis). In conclusion, the delignification process of treated and untreated samples from reactor operations succeed in degradation of cellulose, hemicelluloses, lignin than raw cow manure. These results also collectively suggested that CM treated with *Trichoderma sp.* could be a better pre-treatment method for the higher methane production in anaerobic mono-digestion process.

Keywords: *Biogas, biomass, energy recovery, GHG emission, methanogenic activity*

E-tricycle Pilot Testing at UP Diliman

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ABSTRACT

In line with the vision of the University of the Philippines (UP) to foster a green environment system in the campus, the proponents agreed to pilot-test several units of E-Tricycles (E-Trike) at the Diliman campus. The on-road test of the E-trikes was conducted over a period of 6 months. Ten units were deployed either as public transport or as service vehicle of designated offices. Each public transport E-trike was further categorized as either high or low demand depending on the route assigned. The units that were used as service vehicles of different offices in the campus carried about 25 passengers/day with total distance travelled of more than 21 kilometers/day. The computed average fuel efficiency is 9.41 km/kWh. Units used as public transport with low demand carried about 43 passengers/day. The units travelled more than 25 kilometers/day. The computed average fuel efficiency is 8.97 km/kWh. Those with high demand carried a daily average number of passengers from 114 to 191. They travelled a daily average distance of 34 to 45 kilometers, with daily average passenger-km of 60 to 112. The average kWh charged per day is 4.78 with average duration of charging of 3 hours and 40 minutes. The computed average fuel efficiency is 7.99 km/kWh with maximum 9.58 km/kWh of and minimum of 6.64 km/kWh. There were minimal cases of breakdowns reported. A perception interview survey of passengers carried out which showed favourable responses from respondents in terms of comfort, safety and travel time. Majority of the respondents were willing to pay a fare of Php 5.00 for each ride. Most of the respondents stated that they are in favour of making the E-trikes a permanent mode of transport in the campus.

Keywords: *electric tricycles, kilowatt-hour (kWh), kilometer, passenger-kilometer*

Clean Energy Possibilities from Sewage Treatment Plants (STPs)

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ABSTRACT

The link between air quality and urbanisation has been firmly established. All trends clearly exhibit the high correlation between urbanisation and emissions of both air pollutants and Greenhouse Gases (GHGs). Of the world's 31 mega cities, as many as 18 are located in Asia, out of which People's Republic of China (PRC) alone is home to six mega cities, whereas India has five. By 2030, the number of mega cities is projected to rise to 41, out of which 24 would be Asian cities. Asia is, therefore, home to not only the largest number of mega cities but also the largest number of fastest growing cities. While access, affordability and availability of sanitation services in these mega Asian cities poses huge challenges, the sanitation sector, in particular Sewage Treatment Plants (STP)'s and landfills offer enormous opportunities for mitigation of emissions of air pollutants as well as short lived climate pollutants (SLCPs). The sanitation sector is a generator of non-CO₂ GHGs emissions, as the breakdown of organic waste releases the simplest hydrocarbon, i.e., methane. If allowed to leak into the atmosphere before being used, methane effectively traps the sun's heat and contributes to global warming. The IPCC Fifth Assessment Report listed methane in the earth's atmosphere with a Global Warming Potential (GWP) of 34 compared to CO₂ over a 100 year period. In addition, to the direct influence on climate, methane has a number of indirect effects including its role as a precursor to the formation of tropospheric ozone; ozone being the main ingredient of urban smog. The paper analyses the legacy, technological and legal issues causing hurdle in capturing methane. Capturing methane can drastically reduce the dependence on fossil fuels and promote use of clean energy both for running STP's and cooking, thus offering substantial benefits in terms of improvements in air quality and public health co-benefits.

Keywords: *Asian Cities, Sanitation and STP's, Methane, Clean Energy*

Air Pollutant Emission Abatement Using Application of Various Ethanol-Gasoline Blends in Motor Vehicles

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ABSTRACT

The possibility of using ethanol-gasoline blends as fuel for vehicles as air quality management tools and oil price economic crisis has been raised worldwide. In Thailand, 10% of ethanol was first introduced to blend with gasoline fuel in 2007 following by 20% in 2009 by Department of Energy Business, Ministry of Energy. In this study, passenger cars and motorcycles were tested to investigate the ethanol-gasoline blend effect on emission abatement compared with gasoline fuel. Two ethanol gasoline blends, containing 10 and 20% ethanol by volume in gasoline fuel, and one unleaded gasoline, were used as test fuels. Criteria pollutants (CO, THC, and NO_x), volatile organic compounds, and carbonyls were evaluated on a chassis dynamometer using the ECE Regulation No.49 Test Procedure at the Automotive Emission Laboratory, Pollution Control Department (PCD), Thailand. The exhausts of these criteria pollutants and BTEX (benzene, toluene, ethylbenzene, and xylenes) were investigated and found that lower while using ethanol-gasoline blends, even in the case of the high-mileage car fuelled with an E10 blend. However, formaldehyde and acetaldehyde emissions increased as the ethanol content in the gasoline fuel was increased. The influence of ethanol blends on aldehyde emissions was more significant for the high-mileage car; there was an increase of 20–35% as compared to commercial gasoline fuel. The results also showed that using ethanol-gasoline blends may lead to low ozone-forming potential (20–45%) as compared to using commercial gasoline. In terms of toxicity-based emissions, ethanol-gasoline blends ranked higher in cancer and acute-effects, especial for the high-mileage car. In brief, this study showed that ethanol-gasoline blends could be applied in in-use passenger cars without any engine adjustment to reduce the emission of criteria pollutants and the ozone-forming potential of VOCs as compared to using unleaded gasoline, but there may be an increase in some carcinogenic toxic emissions.

Keywords: *gasoline fuel, ethanol, emission, benzene, toluene*



ORAL PRESENTATIONS

Session:

Big Data Applications and Air Pollution Modelling

Date & Time:

13 November 2018, 11:00-12:30

Chairperson:

**Prof Selahattin Incecik,
IUPPPA**

Email: inceciks@gmail.com

Session	Big Data Applications and Air Pollution Modelling	
Venue	Room 12, BCKK	
Time	11.00-12.30	
Chairperson	Prof Selahattin Incecik, IUPPPA (Email: incecik@gmail.com)	
Time Keeper	Nurfatin Izzati Ahmad Kamal	
11:00	Nathan R. Pavlovic, <i>Sonoma Technology, Inc</i>	Managing Air Quality Impacts from Agricultural Burning: Case Studies and Lessons Learned from Smoke Information Systems Developed in the United States
11:15	Dr. Sakda Tridech, <i>Pollution Control Department (PCD), Thailand Ministry of Natural Resources and Environment</i>	Application of Air Quality Model for Area-Based Management: A Case Study of Carrying Capacity for VOCs in Map Ta Phut, Thailand
11:30	Samsuri Abdullah, <i>Universiti Malaysia Terengganu</i>	An Application of Artificial Intelligence Technique for PM10 Forecasting
11:45	Ghazali, N. A., <i>Universiti Malaysia Terengganu</i>	A Feedforward Backpropagation Neural Network Model for Predicting Ground-level Ozone Concentration in Malaysia
12:00	Sompoke Kingkaew, <i>Numfon Eaktasang, Thammasat University</i>	Contribution of Transboundary Emissions of Biomass Open Burning to Haze Pollution in Bangkok Metropolitan Region, Thailand
12:15	Wilhelmina O. Lagunilla, <i>Environmental Management Bureau - Cordillera Administrative Region, DENR, Baguio City, Philippines</i>	Air Dispersion Modeling for Metro Baguio

Managing Air Quality Impacts from Agricultural Burning: Case Studies and Lessons Learned from Smoke Information Systems Developed in the United States

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ABSTRACT

Smoke from agricultural burning degrades air quality on local, regional, and international scales. Information about air quality impacts from burning can help agencies understand the causes of poor air quality and alert the public to take appropriate actions to mitigate the health consequences of smoke. Information can also support land managers in making decisions to reduce air quality impacts. Recognizing the benefits of enhanced information, agencies are developing systems to support the prediction, management, and communication of air quality impacts from agricultural burning. Development of an effective smoke information system requires consideration of its temporal, spatial, and methodological aspects. Agencies can develop tools that support historical information gathering, disseminate real-time information, or forecast air quality impacts. Smoke information systems can target smoke impacts on locations of particular concern or provide broad-scale information. Finally, methods can be used to understand the impacts of past fires or test the potential air quality impacts of hypothetical fires. A clear understanding of these aspects will help agencies allocate resources efficiently and develop appropriate systems that satisfy key needs. To illustrate successes in addressing these considerations, we will present case studies on STI's development of the Kansas Flint Hills Smoke Management and Blue Sky Gateway smoke information systems. We will also discuss key considerations for environmental agencies that are concerned about smoke from agricultural burning.

Keywords: *air quality, agricultural burning, air pollution monitoring, communication, decision support, information systems*

Application of Air Quality Model for Area-Based Management: A Case Study of Carrying Capacity for VOCs in Map Ta Phut, Thailand

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ABSTRACT

Environmental carrying capacity plays an important role in contemporary sustainable development. Maximum level of pollution release can be evaluated for optimized constraint that can secure an acceptable quality of life. However, the key success factor is how to achieve the carrying capacity. Currently, air quality models and weather forecasting models have been applied as a decision support tool for environmental assessment and development of environmental policy. Many countries have been using these kinds of simulation technique to support their national environmental regulation and specific phenomenon. In Thailand, AERMOD which is gaussian dispersion model base has been regulated as a principle tool for air pollution scenario in environmental impact assessment. However, the output from simulation might be questionable in complex situation and when considerable data are not available e.g. meteorological data. Unacceptable simulation outputs could consequently lead to inappropriate decision making. In this paper, a case study of Volatile Organic Compounds (VOCs) carrying capacity determination using a combination of numeric prediction system called weather research forecast model (WRF) and AERMOD is presented. The study area (domain) was Map Ta Phut District, Rayong Province, Thailand where numerous petrochemical industries are located in several industrial Estate. This area has been declared as a pollution control zone under national environmental regulation. The major problems occurred in this area in the last ten years are high concentrations of VOCs in ambient air e.g. benzene and 1,3-butadiene. Emission inventories of major source from environmental impact assessment report and meteorological data from WRF system were used to simulate their carrying capacities of the study domain. Carrying capacities of benzene and 1,3-butadiene obtained from the simulations for maintaining associated national ambient air quality standards are presented and discussed. The implementation of area-based limits of VOCs loading using simulation results is discussed in the final part of this paper.

Keywords: *AERMOD, Weather Research Forecast Model (WRF), Carrying Capacity, Map Ta Phut, Volatile Organic Compounds (VOCs)*

An Application of Artificial Intelligence Technique for PM₁₀ Forecasting

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ABSTRACT

Particulate Matter has shown its domination towards air pollution in Peninsular Malaysia through Air Pollutant Index (API) every year. The development of PM₁₀ forecasting model is important as the early precautionary measures can be taken by respective bodies including our community particularly during unhealthy level of air quality. This study aims at developing and evaluating two models, the traditional model of Multiple Linear Regression (MLR) and the other one is applying artificial intelligence technique of Radial Basis Function (RBF) model for forecasting daily average of PM₁₀ concentration in suburban area of Kuantan, Malaysia. Both models employed seven variables as inputs, which incorporate meteorological parameters (wind speed, ambient temperature, relative humidity) and gaseous pollutants (PM₁₀, CO, SO₂, NO₂) from 1st of January 2010 to 31st of December 2014. The development of models revealed that the RBF with spread number of 0.5 showed a better skill in forecasting PM₁₀ concentration compared to MLR with 94% and 52% of the variance of the data, respectively. In addition, two statistical indexes were calculated in order to validate the quality and reliability of the models. The error and accuracy measures for MLR and RBF were determined by RMSE (15.28 µg/m³), R² (0.63) and RMSE (8.13 µg/m³), R² (0.80), respectively. Therefore, RBF could be useful and satisfactory for use in daily forecasting of PM₁₀ concentration in this area.

Keywords: *artificial intelligence, forecasting, gaseous pollutants, meteorological, particulate matter*

A Feedforward Backpropagation Neural Network Model for Predicting Ground-level Ozone Concentration in Malaysia

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ABSTRACT

The emission of a variety of pollutant gases at ground level may present a health risk either directly, or as a result of their oxidation. This can lead to a variety of secondary photochemical pollutants such as ozone (O₃). Ground-level ozone is regarded as an important atmospheric secondary pollutant which can affect human health and ecosystem. This study examines the possibility of using Feedforward backpropagation neural network (FFBP-NN) models as a tool for prediction of O₃ concentrations in Malaysia. The development of models to predict ozone concentrations is thus very useful because it provides a basic for issuing advance warning to the public before O₃ peak are reached. Data on the concentration of environmental pollutants and meteorological variables were employed to predict the concentration of O₃ in the atmosphere. Measurement was performing continuously from 2009 to 2012 at two sampling station located in the metropolitan area of Malaysia. Five performance indicators used to evaluate the model which are root mean square error (RMSE), mean absolute error (MEA), index of agreement (IA), prediction accuracy (PA), coefficient of determination (R²). Result shows that FFBP-NN model gives good performance for prediction of O₃ for both stations with high accuracy measures (IA = 0.9503, PA = 0.8271, R² = 0.8253) and small error measures (MAE = 0.1740, RMSE = 6.8430). Results also indicated that the formation of O₃ in the study area was influenced by NO_x precursors and among the meteorological variables, temperature tended to contribute significantly to the high O₃ concentrations.

Keywords: *ground-level ozone, meteorological variables, neural network, performance indicator, prediction model.*

Contribution of Transboundary Emissions of Biomass Open Burning to Haze Pollution in Bangkok Metropolitan Region, Thailand

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ABSTRACT

Emissions of biomass open burning from Thailand's neighbours have potentially contributed to haze pollution in Bangkok Metropolitan Region (BMR) for a half decade. However, scientific evidence has not been officially reported. To investigate the contribution, this study collected two different fire satellite products of MODIS and VIIRS to estimate the emissions from Thailand's neighbours. Available activity data and emission factors were accordingly compiled to estimate the emissions of major air pollutants (PM₁₀, PM_{2.5}, CO, and ozone precursors) for January to April during the year 2015 to 2018. Ground monitored air quality data in BMR and regional meteorological condition profiles during selecting periods were analysed to find the major contributing factors by using factor analysis (FA) method. A WRF-Chem model with additional comparison of HYSPLIT model trajectory results was performed to simulate an atmospheric circulation of particulate matter for a selected haze episode. This study found that an estimated emission of biomass open burning was highly obtained from the southeast neighbours where a larger contribution to the haze episode in BMR was observed during the onset of summer when the presences of a higher emission and a weaker high-pressure system in the region were existed. FA gave that the emissions and pressure system condition were major contributing factors. Accountably, WRF-Chem and HYSPLIT modelling could depicted a possibility on a contribution of transboundary emissions from Thailand's neighbours to haze pollution in BMR, which could bring considerable scientific information to higher-level discussion on improving air quality within the region.

Keywords: *transboundary pollution, biomass open burning, haze pollution, Bangkok Metropolitan Region*

Airshed Modeling for Metro Baguio, Philippines

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ABSTRACT

An assessment of the air quality impacts from the operation of the ambient air quality monitoring within the Metro Baguio or the BLISTT Airshed was undertaken to predict ground level concentrations of criteria pollutants such as particulate matter, ozone, nitrogen oxide, sulphur dioxide and carbon monoxide. The assessment also includes identification of air sensitive receptors where the impacts are addressed and evaluated using the modelling results. The air dispersion modelling conducted was based on the modelling approach using an AERMET as a meteorological pre-processor to the air dispersion model known as AERMOD. The AERMOD model through the AERMET meteorological processor simulates complex meteorological patterns that exist in Metro Baguio. An hourly surface onsite and upper air station were used. Results assessment against the National Ambient Air Quality Guideline Value for Ambient Air Quality, showed that no exceedances were predicted at any of the air sensitive receptor. The Total Suspended Particulate exceeded the 24-hour and annual averaging period. Further modeling results revealed that the exceedance happens only once in September 03, 2018. Isopleths of the different criteria pollutants were presented showing the extent of the pollutants in a given area in Metro Baguio. Based on the model predictions and inherent conservatism, it was recommended to conduct a source emission inventory, the conduct of actual vehicle counting to account for other vehicles, counting should be done per route and per area to prevent double counting; investigation of predicted TSP concentration by conducting ambient air monitoring on September 03, 2017 and continuously conduct air dispersion modelling to include other new and potential sources of air emission within the airshed until the model estimated and observed values are consistent.

Keywords: *Air Dispersion Modeling, air pollution, impact assessment*



ORAL PRESENTATIONS

Session:

Air Pollution Control and Technologies

Date & Time:

13 November 2018, 13:30-15:00

Chairperson:

**Dr. Nor Eliani Ezani,
Universiti Putra Malaysia (UPM)
Email: elianiezani@upm.edu.my**

Session	Air Pollution Control and Technologies	
Venue	Rooms 2 & 3, BCCK	
Time	13.30-15.00	
Chairperson	Dr. Nor Eliani Ezani, Universiti Putra Malaysia (Email: elianiezani@upm.edu.my)	
Time Keeper	Noor Fatihah Mohamad Fandi	
13:30	Mohammad Fakhratul Ridwan bin Zulkifli, <i>Universiti Malaysia Terengganu</i>	A green approach using Lawsonia inermis as anti-corrosion agent in acrylic coating for marine environment application
13:45	Ahmad Jais Alimin, <i>Universiti Tun Hussein Onn Malaysia</i>	Retrofitting as an option for existing motorcycles in reducing hazardous emissions to the environment
14:00	S.M.D.J.T. Jayatilake, S.M.A Samanmali, Dr. A.G.T. Sugathapala, <i>Department of Motor Traffic</i>	Vehicle Emission Standards versus EURO technologies in Sri Lankan Context
14:15	Wan Nurdiyana Wan Mansor, <i>Universiti Malaysia Terengganu</i>	Effects of Diesel Fuel Quantity on the Performance of a Dual Fuel Engine
14:30	Georges Petelet, <i>CAPELEC</i>	REAL-e: Real emission Measurement Tailpipe & cloud based

A Green Approach Using *Lawsonia inermis* as Anti-Corrosion Agent in Acrylic Coating for Marine Environment Application

F. Zulkifli*¹, M.I.N. Isa² and W.B. Wan Nik¹

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²School of Fundamental Science, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Malaysia

ABSTRACT

Volatile organic compounds (VOCs) are compounds that easily release into the air to become vapour or gas. VOCs can cause acute symptoms such as headaches and dizziness where some VOCs are carcinogenic. A green approach towards preparing safer coating has been conducted in order to reduce VOCs and provide better air quality. *Lawsonia inermis* or also known as henna was used as an anti-corrosion additive for acrylic coating. The effect of immersion period and inhibitor concentration was characterized by optical and electrochemical techniques. Electrochemical measurements show an increasing trend of inhibition efficiency up to 1200 hours and exhibit a decrease trend afterwards. The highest inhibition efficiency was found to be at 93-95% at 1200 hours at the inhibitor concentration of 600 ppm. Optical analysis of *Lawsonia inermis* shows that it follows the Langmuir adsorption isotherm model and works by physical adsorption. Quantum chemical calculation suggests that the O₁₆, O₁₇ and O₁₉ are the potential sites for adsorption to occur due to their more negative Mülliken charge which provide a better tendency of O to be an electron donor. Further analysis was conducted in acrylic coating where the same characterizations were carried out. It was found that the incorporation of *Lawsonia inermis* in acrylic coating has caused the increment in coating resistance; R_c . Optical analysis suggests that there is a formation of hydrogen bonding between the inhibitor and the coating matrix while at the same time encourage the formation of crystalline structure. Therefore, it is inferred that *Lawsonia inermis* is a potential green additive to be used in coating industry and becomes one of the solution to reduce air pollution through the reduction of VOCs emission.

Keywords: air pollution control, additive, anti-corrosion, acrylic, *Lawsonia inermis*

Retrofitting as an Option for Existing Motorcycles in Reducing Hazardous Emissions to the Environment

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ABSTRACT

There are 150 millions motorcycles being used worldwide, with 65 millions in ASEAN region alone. With the continuous increase in fuel prices, carburetted motorcycles are becoming more popular. However, these carburetted engines are well known for its low- operating efficiency, high fuel consumption and high level of hazardous emissions, namely carbon monoxide (CO) and unburned hydrocarbons (HC). Therefore, stringent emissions regulation, such as EURO4, is in place, which requires 4-stroke engines to operate using efficient electronic fuel injection (EFI) system with an on-board diagnostic (OBD) tool, supported by appropriate exhaust after-treatment system. Nevertheless, the enforcement of this regulation is only applicable for newer motorcycles models. Normally, the lifespan of carburetted 110 – 250cc engines can go beyond seven years. Hence, retrofitting them with a newer technology will be one of the options to reduce the overall pollutants release to the environment. In this paper, the presented work was aimed to determine the feasibility of a commercially available EFI kit (branded FGK™) to reduce the CO and HC emissions coming from a carburetted 150cc, petrol-fuelled engine. The FGK kit was installed on the test engine by replacing the existing carburettor through a plug and play approach with a tuneable ECU. This ECU was tuned using dedicated tuning software (IGNITUS™) to produce combustions that would emit the lowest CO and HC emissions. Testing using a chassis dynamometer and comparing with carburetted engines, at road speeds of 70 km/hr, 80km/hr to 90 km/hr, showed significant reduction of CO (between 82% - 87%) and HC (between 36% to 48%); based on brake specific emissions values. These findings showed the potentials of retrofitting existing carburetted engines in reducing the mass of emissions released per distance travelled (gram/km). It could also benefit existing motorcycles and OEMs that are still relying on carburettor system.

Keywords: *air quality, retrofitting, motorcycles, and emissions*

Vehicle Emission Standards Versus Euro Technologies in Sri Lankan Context

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ABSTRACT

Motor vehicles are considered as largest emerging source of urban air pollution in the developing world. Thus, reduction and control of vehicular emissions involve comprehensive strategies, which requires emission standards for new vehicles, cleaner fuels, inspection & maintenance programme for in-use vehicles, vehicle importation policies, traffic and demand management measures. This also include institutional development, awareness, education and training. The Government of Sri Lanka introduced the Vehicle Emission Testing (VET) programme as mitigation option for vehicular emission in 17th November 2008. The main objective of this study is to explore the improvements of the current vehicle emission standards compared to EURO standards and identify the adaptation measures when applying in to Sri Lankan Context. Important points were gathered from the analysis of VET data and they are considered when analysing and identifying the gathered data along with the research objectives. Collected data shows the present state of the VET programme according to the current standards and to identify the factors with related to EURO technologies. Based on the petrol and diesel engine vehicle population in Sri Lanka, the adoption of the EURO technology would cause very important reductions of the total emissions of nitrogen oxides and particulate matter. With quality diesel, together with unleaded gasoline, the use of the catalyst and emission controls on motor cycles and motor tricycles would reverse the increasing trend of emission due to the significant growth of vehicle population in Sri Lanka. Therefore these findings are much helpful for policy makers to make further improvements in the advanced regulatory directives. Improving fuel quality and the possible adaptations of more advanced vehicle emission control technologies in conjunction with fuel reformulation, can give much larger emission reductions, particularly in the long run and increase the contribution to lower vehicle emissions for better air quality.

Keywords: *air quality, vehicle emissions, vehicle emission standards*

Effects of Diesel Fuel Quantity on the Performance and Emissions of a 6L Dual Fuel Engine

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ABSTRACT

In this research a John Deere 6068H compression ignition engine is converted to dual fuel operation. The engine is a Tier II, 6 cylinders, 6.8 liter, 4-stroke diesel engine with a compression ratio of 17:1 and a power rating of 168 kW at 2200 rpm. A natural gas fuel system is installed to deliver fuel upstream of the turbocharger compressor. The engine operates at 1800 rpm through five different load points in diesel and dual fuel operating modes. Through the experimental investigations, it is shown that dual fuel engines are capable of reducing nitrogen oxides (NO_x) and particulate matters (PM) emissions. However, dual fuel engines emitted excessive total hydrocarbons (HC) and carbon monoxides (CO) especially at low and intermediate loads. In order to formulate an optimized substitution scheme that would reduce these emissions in dual fuel engines at these loads, a natural gas substitution sweep as a result of diesel fuel displacement was conducted at each load. The effects of varying diesel fuel quantity on ignition delay, in-cylinder peak pressure, engine stability and emissions were investigated. Results showed longer ignition delay and reduced peak pressure when the natural gas quantity is increased beyond standard fuel tuning at low and intermediate loads. HC and CO showed a reduction trend at intermediate load but increasing at low load as compared with dual fuel baseline emission. From this findings, it is suggested that dual fuel would be turned off until intermediate loads were reached. Subsequent target diesel displacements were determined by selecting the highest diesel displacement observed during the natural gas substitution sweeps which maintained engine stability.

Keywords: *diesel emission, dual fuel, diesel natural gas engine*

REAL-e: Real emission Measurement Tailpipe & cloud based

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ABSTRACT

REAL-e is a smart kit composed of smartphone apps, cloud algorithms, EOBD dongle and embedded gas analyzer able to bridge any trip with official vehicle approval tests for a fair PASS/FAIL conclusion. Because studies failed to find alternative procedure to dyno for NOx measurement under unloaded test conditions. However, dyno investments, especially the 2 axels version, are costly and greedy for surface and time. There is a need for fair measurements from Approval, In Service conformity Test, Road Side Inspection to Periodical Technical Inspection. A new approach, nearest to real condition of use, with the same measured values comparable to the ones controlled during new approval cycles, is a must. This testing method is flexible, no need for strict test scenario, no way to skew the test results, neither from software and drivers' behaviours. This solution does not require heavy investment and is applicable anywhere. The key thing is to use any rolling/trip with a SIMPLE gas measurement to estimate NEDC, WLTC and RDE Scores to detect malfunctions or tampering. This solution is an overlap from real time data collection (EOBD values and tailpipe measurement) and cloud's algorithms. A smartphone, an EOBD dongle together with and a black box housed in the trunk with a probe plugged in the tailpipe are the only physical things allowing the cloud's algorithms to extrapolate and compare a final value of any trip against normalized emission's approval cycle. Cloud algorithms have been tested and used since 2 years by thousands of vehicles drivers. After successful test campaigns where REAL-e was compared to a PEMS from Horiba, large car-park testing campaigns are scheduled. This testing method is answering the need of fair and flexible tests all along the life of vehicle: ISCT (In Service Conformity Test), RSI (Road Side Inspection) and PTI (Periodical Technical Inspection).

Keywords: *In Service Conformity Test, RSI (Road Side Inspection) and PTI (Periodical Technical Inspection), Anti- tampering*



ORAL PRESENTATIONS

Session:
Indoor Air Pollution

Date & Time:
13 November 2018, 13:30-15:00

Chairperson:
John Mitchell,
U.S. Environmental Protection Agency
Email: mitchell.john@epa.gov

Session	Indoor Air Pollution	
Venue	Room 12, BCKK	
Time	13:30-15:00	
Chairperson	John Mitchell, U.S. Environmental Protection Agency (Email: mitchell.john@epa.gov)	
Time Keeper	Fahimah Hashim	
13:30	John Mitchell, <i>U.S. Environmental Protection Agency</i>	ISO Standards Finalized for Cookstoves and Clean Cooking Solutions
13:45	Michael Johnson, <i>Berkeley Air Monitoring Group</i>	Modeling kitchen air pollution concentrations from emissions and stove usage data in Tamil Nadu, India
14:00	Precious Benjamin, <i>Clean Air Asia</i>	The Mega Conversion Program from kerosene to LPG in Indonesia: Lessons learned and recommendations for future clean cooking energy expansion
14:15	Sumal Nandasena, <i>National Institute of Health Sciences</i>	Policy options to reduce health outcomes associated with household air pollution in Sri Lanka
14:30	Vera Phung Ling Hui, <i>Kyoto University</i>	Needs for scientific evidence on health effects of air pollution in Malaysia
14:45	Ahmad Kamruzzaman Majumder, <i>Department of Environmental Science, Stamford University Bangladesh</i>	Health Impact Assessments of Indoor Air Pollution at Dakshinkhan Area of Dhaka City, Bangladesh

ISO Standards Finalized for Cookstoves and Clean Cooking Solutions

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ABSTRACT

Household air pollution resulting from the use of polluting and inefficient energy in the home for cooking is the leading environmental risk factor for ill health globally. New WHO estimates reveal that over three billion people relied on polluting energy sources for cooking in 2016, leading to almost 4 million deaths each year, and contributing significantly to ambient air pollution. An estimated 12% of ambient air pollution is caused by household air pollution globally. Additionally, up to 25% of black carbon emissions come from residential solid fuel use (including cooking, lighting and heating), and each household can produce up to 3 tons of CO₂ equivalent greenhouse gases per year. Finally, the burden of inefficient cooking and related fuel collection falls disproportionately on women and children. To rapidly improve cookstove performance, the household energy community has been engaged in developing globally recognized standards through the International Organization for Standardization (ISO). This summer, ISO finalized laboratory testing protocols for cookstove and clean cooking technologies, which provide laboratory measurement and evaluation methods for emissions, energy efficiency, safety and durability of cookstoves. Forthcoming from ISO are a complementary set of voluntary performance targets (VPTs) that include five tiers of performance for emissions, efficiency, safety and durability, based on laboratory testing results. The VPTs can be considered as an approach to benchmarking potential performance of cookstoves and clean cooking solutions. By applying these laboratory standards and VPTs, countries can make efforts to ensure that cooking technologies are marketed as “clean” truly achieve required emission levels to protect health. These standards and benchmarks can also support countries’ climate and environmental goals, as well as provide consumer protection. In addition, standards can drive the market to higher quality products, and serve as a mechanism for manufacturers to distinguish their products from those of their competitors.

Keywords: *air quality, indoor air pollution, clean energy for better air quality, standards, testing protocols, reporting metrics*

Modelling kitchen air pollution concentrations from emissions and stove usage data in Tamil Nadu, India

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ABSTRACT

Stove usage and emissions are key predictors in kitchen-level air pollution, which can be associated with personal exposure and health effects. Measurement of usage and emissions can thus help inform potential impacts of household cooking interventions. In this work, stove usage and stove emissions data were collected from uncontrolled cooking tests in Tamil Nadu, India, in 2015. We first present the methods used to identify cooking events and durations from stove usage monitor (SUM) data streams and review the identified usage patterns. We then use these data along with the emissions results in a Monte Carlo simulation of a single zone box model to provide 24 hours estimates of kitchen-level concentrations of the pollutants. We find that full replacement of traditional stoves in households in this region, with Tier 1 through Tier 4 stoves, would be expected to result in <1%, 1%, 14%, and 88% respectively, meeting WHO PM_{2.5} daily standards. This work also provides a brief overview of a new tool, in development by the World Health Organization, that was created to allow a wide range of users to perform similar single-zone box model Monte Carlo analysis, helping provide region-specific guidance on stove and fuel interventions.

Keywords: *household cooking, traditional stoves, fuel intervention, PM_{2.5}*

The Mega Conversion Program from kerosene to LPG in Indonesia: Lessons learned and recommendations for future clean cooking energy expansion

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ABSTRACT

In 2007, the Indonesian Government instigated a national program to convert domestic kerosene users to liquefied petroleum gas (LPG) for cooking. This was primarily motivated by the rising cost of kerosene subsidies. This study intended to review the national conversion program and LPG scale up by evaluating its impacts, including assessing sustained changes in cooking behaviour and consequent reductions in exposure to household air pollution (HAP). Searches of peer-review and grey literature in both English and Bahasa Indonesian were conducted and supplemented by interviews with key informants, data from the National Statistics Agency and results from household surveys. The data were extracted and analyzed using an Implementation Science approach. The main kerosene to LPG conversion phase took place in highly populated kerosene dependent areas between 2007 and 2012 reaching over 50 million households, approximately two thirds of all households in Indonesia. Since then the drive to expand LPG use has continued at a slower pace, especially in more remote provinces where solid fuel is more widely used. Over 57 million LPG start up kits were distributed as of 2015. Beginning in 2018, the open subsidy for LPG is expected to be replaced by one targeted at lower income households. While the main conversion phase has been highlighted as an example of effective and impressively fast fuel switching at scale, the impact on domestic biomass use remains limited. Addressing HAP and the health impacts associated with kerosene and biomass use was never an objective of the program. Consequently, there is limited evidence of impact in this area, and in hindsight, missed opportunities in terms of influencing cooking behaviour change among biomass users, who are more at risk.

Keywords: *LPG, clean cooking, fuel subsidies*

Policy Options to Reduce Health Outcomes Associated with Household Air Pollution in Sri Lanka

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ABSTRACT

Cooking with solid fuel (e.g., wood, coal, etc.) is a major source of household air pollution (HAP) in many countries. In Sri Lanka, 66.0% of people use wood for cooking. The exposure to smoke from the burning of wood results adverse health outcomes. Economic and health impact analysis are important to compare the policy options. This study identified evidence-based policy options to reduce the adverse health outcomes of HAP in Sri Lanka. Based on the literature and national statistics, predictive models (i.e., decision trees) were developed to estimate health outcomes to be prevented by identified policy solutions. The adverse health outcomes considered for estimation were (1) deaths and hospital admissions of ischemic heart diseases, (2) hospital admissions of chronic and acute respiratory conditions and (3) low birth weight deliveries in government hospitals. Cost of implementation and the deaths and admission of selected diseases, and low birth weight deliveries averted for each of the policy option were estimated. Identified policy options were (1) Behaviour change campaign and training of health care staff, (2) Provision of improved wood cook stoves and (3) Provision of gas stoves with monthly supply of gas for one year. In terms of cost of intervention and health benefits, the most feasible and affordable intervention was behaviour change campaign and training of health care staff. This policy intervention is estimated to avert 4.6% of ischemic heart deaths, 6% of hospital admissions due to ischemic heart diseases, 6% of hospital admissions due to respiratory diseases and 6% of low birth weight deliveries in Sri Lanka. In terms of cost and prevention of health outcomes, the best policy option to implement for reducing HAP was identified. This methodology is recommended for other countries to reduce adverse health outcomes that use solid fuel for cooking.

Keywords: *policy options, health impact, household air pollution*

Needs for Scientific Evidence on Health Effects of Air Pollution in Malaysia

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ABSTRACT

Epidemiological studies have been suggesting the adverse health effects of air pollution. However, there are less studies in Southeast Asian (SEA) countries with tropical climate. Due to its geographical location, Malaysia faces not only local air pollutants but also transboundary haze pollutants, particularly during the dry season. The New Malaysia Ambient Air Quality Standard has been revised to improve the air quality by three phases of interim targets (IT). The country is currently on the second phase (IT-2). It is yet unclear if the adverse health effects are attributed to the local or transboundary air pollutants. We aimed to examine the current evidence on the health effects of transboundary haze in addition to the local air pollution in Malaysia. We searched for literature examining the health effects of outdoor air pollutants published in PubMed, ScienceDirect and other database using the terms (“air pollution” OR “air pollutants” OR “particulate matter” OR “air quality” AND “health” OR “mortality” AND “Malaysia”) and found 207 articles. After screening for relevance and eligible articles, we identified 3 review articles and 7 research articles which investigated the health effects of air pollution in Malaysia. Most of these studies investigated the cardiorespiratory mortality and hospital admissions due to haze but less on the local air pollution. We suggest the following directions for future studies in Malaysia. First, to investigate the adverse health effects of different sources of air pollution. Second, to investigate the adverse health effects of air pollution among susceptible groups, such as children, elderly and pregnant women. Third, to assess the association between knowledge, behaviour and attitude among the citizens regarding air pollution. These might be useful in contributing to better policy decision in improving the air quality over the SEA region.

Keywords: *air pollution, health impact, epidemiology, Malaysia*

Health Impact Assessments of Indoor Air Pollution at Dakshinkhan Area of Dhaka City, Bangladesh

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ABSTRACT

This study aims to identify the pollutant-exposure influencing parameters inside the kitchen and the effects on the persons who pass remarkable time in cooking. A questionnaire was developed based on the objectives of the study and interviews were performed with numbers of persons from different households. Total 105 male and female participated in this survey and their individual indoor environment were identified using information regarding cooking apparatus/ facilities, their daily living condition, habits, etc. The male respondents who have smoking habit scored lower (397) than the non-smoker male respondents (487) and this smoking inside houses are very common feature of the study area. Among the female respondents who have kitchen with cross ventilation scored higher (380) than the female respondents who have kitchen with inadequate ventilation (323). The female respondents who uses gas as fuel has less eye-irritation than the females who use other fuel such as kerosene, wood, leaves, etc. The female respondents who have kitchen in pucca house face more breathlessness (4 out of 25 persons) than the female respondents who have kitchen in open space (1 out of 29). It can be concluded by saying that the kitchen, which are kept inside home now-a-days for safety must be provided with proper ventilation as the air pollution inside kitchen play a big role on the cook's health. Finally, it has been suggested that, modern technologies should be adopted for cooking to reduce the smoke and standard kitchen dimensions with adequate ventilation must be provided as well as general awareness on environment pollution and their effects should be raised up by conducting campaigns and advertisements.

Keywords: *Indoor Air Pollution, exposure, smoking*



ORAL PRESENTATIONS

Session:
Sustainable Transport Solutions for Cities

Date & Time:
13 November 2018, 13:30-15:00

Chairperson:
Prof. Ir Mohamed Rehan Karim
Email: mrehan57@gmail.com

Session	Sustainable Transport Solutions for Cities	
Venue	Room 13, BCKK	
Time	13:30-15:00	
Chairperson	Prof. Ir Mohamed Rehan Karim (Email: mrehan57@gmail.com)	
Time Keeper	Nor Ashikin Mohd Sopian	
13:30	Jyoti Prajapati, <i>Institute for Advanced Sustainability Studies</i>	Air Quality and Climate Benefits of Low-Carbon Sustainable Urban Transportation in the Kathmandu Valley, Nepal
13:45	Kazutaka Oka, <i>NIES</i>	Potential Study of Diversified Transportation Energy Mix in ASEAN Countries
14:00	Yoshitaka Shibata, <i>Iwate Prefectural University</i>	Wide Area Road Surface State Crowdsensing and Communication System for Safety Driving
14:15	Ahmad Safrudin, <i>KPBB</i>	Low Carbon Emission Vehicle Roadmap in Indonesia
14:30	Kurugamage Surendra Kumar Perera, <i>CleanCo Lanka Pvt Ltd</i>	Impact of Vehicle Emission Testing Programme on Economic Benefits in Sri Lanka

Air Quality and Climate Benefits of Low-Carbon Sustainable Urban Transportation in the Kathmandu Valley, Nepal

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ABSTRACT

The transport sector, which has grown rapidly in the past decade in the Kathmandu Valley (KV), Nepal, is one of the major sectors that contribute significantly to regional poor air quality (and hence adverse health impacts) and greenhouse gas (GHG) emissions. The cumulative vehicle fleets registered in the Bagmati Zone, which includes the Kathmandu Valley, increased 30 folds from ca. 34,600 in 1990 to ca. 1,000,000 vehicles in 2016, with over 90% of them being small vehicles such as cars, taxis, minibuses and motorcycles. Since the transport sector is in the developing phase, its development towards a sustainable transport system needs science-based knowledge about current and future options, so that appropriate policies and regulations can be developed to shift swiftly from the current fossil-fuel and carbon-intensive system to a low-carbon and low-pollution transport systems for the Valley, as well as for other cities in Nepal. We analyzed various policy options under several plausible socio-economic development scenarios to identify the ones that are rooted in sound science, and carefully examined local conditions to determine the best local options to significantly reduce emissions of GHGs and air pollutants from the transport sector in the Kathmandu Valley. The associated emissions of air pollutants and GHGs with a business as usual (BAU) scenario, proposed NDC-scenario, and best low-carbon transport (BLCT) scenarios are estimated using the energy mix modeling tool Long-range Energy Alternatives Planning for a period 2010-2050 and a recently developed emission inventory for Nepal with 2011 as the base year. The study also included discussion with key experts and stakeholders. These scientific analyses of impacts of various current and future policies are essential for formulating and refining strategies, policies and action plans that will ultimately help decarbonize Nepal's economy and achieve national socio-economic development goals, including the UN Sustainable Development Goals (SDGs).

Keywords: *low carbon, sustainable transport, air quality, climate change, Kathmandu Valley*

Potential Study of Diversified Transportation Energy Mix in ASEAN Countries

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ABSTRACT

The objective of this study is to investigate potential of diversified transportation energy mix in road transportation sector and their effective use up to 2030 to realize sustainable road transportation in terms of energy. In this study existing energy policies, fuel supply and demand status related to road transportation, are considered to investigate energy mix. For this investigation an ASIF type models for each 5 countries are developed. The model estimates energy consumption via multiplications of "Activity (i.e., travel distance)", "Structure (mode structure)", "Intensity (fuel economy)", and "Fuel type". Each countries' socio-economic data such as GDP and population as well as transportation data (vehicle number, travel distance, and fuel efficiency) were collected with the support of ASEAN researchers. Firstly, Business as Usual (BAU) energy consumption from 2015 to 2030 is estimated. Here energy policies about energy conservation, alternative energy introduction are basically not considered. Then, if there are gaps between oil reduction target and BAU energy consumption or required amount of biofuels to achieve introduction target and possible supply, measures such as better FE vehicle introduction, adjustment of biofuel utilization and natural gas utilization to minimize gaps or to achieve policy target are additionally taken into account. An appropriate and cost-effective combination of measures is proposed as Alternative Case. Biofuel utilization is considered to be one of the crucial measures to meet policy target. Even in Alternative Case, however, estimated demand volume of biofuel exceeds domestic supply volume in some countries, while estimated demand volume of biofuel is less than domestic supply volume in other countries. In order to solve these gaps and construct biofuel security, a concept of multi-national cooperation of biofuel is proposed. To take policies to get rid of barriers that prevent trading of biofuels between neighbouring countries are key to success.

Keywords: *Transportation, Energy, Biofuel, Climate Change*

Wide Area Road Surface State Crowdsensing and Communication System for Safety Driving

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ABSTRACT

In this research, a new generation of wide area road surface state information platform based on crowd Sensing and V2X Technologies are introduced, to monitor the road condition and keep safe and secure driving. Various environmental sensors including accelerator, gyro sensor, infrared temperature sensor, quasi electrical static sensor, camera and GPS are integrated to precisely detect the various road surface states and determine the most dangerous locations on GIS. Those road informations are transmitted to the neighbour vehicles and road side server in realtime using V2X communication network. In V2X communication on the actual road, both the length of communication distance and the total size of data transmission must be maximized at the same time when vehicle are running on the road. The conventional single wireless communication such as Wi-Fi, IEEE802.11p, LPWA, cannot satisfy those conditions at the same time. In order to resolve such problems, N-wavelength wireless communication method is newly introduced in our research. Multiple standard wireless networks with different wavelengths are integrated to organize a cognitive wireless communication. The best link of the cognitive wireless is determined by considering their RSSI values. In order to verify the effects of our proposed method, a prototype system is constructed at the actual road and tested the performance, such as communication distance and total transmission data. Through the performance evaluation, the effects of our suggested method could be verified over the single network.

Keywords: *Crowdsensing, Road surface condition, ITS, Safety driving*

Low Carbon Emission Vehicle Roadmap in Indonesia

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ABSTRACT

The growth of motor vehicle use, even though it is needed to facilitate demand on industrial process and people's mobility, it has also brought negative effects especially on increasing of emission, and energy depletion. As an emerging market for the automotive industry, Indonesia needs to adopt lower emission vehicle to control air pollution, and greenhouse gas emissions. For the national target to lower greenhouse gas, it could be achieved by reducing energy consumption. Cost Benefit Analysis, Cost Effective Analysis, and econometric time series models could provide basic analysis to develop policy on fuel economy vehicle standard, which is the mandate of Presidential Decree No 22/2017 toward National Grand Strategy for Energy. The standard is formulated in certain period and set up with more stringent standard at the next period until 2030, a timeline of Indonesia's National Determine Contribution with roadmap as follow: 5L/100 Km by 2020. By interpolating it to growth of vehicle population along that period and using econometric time series model to forecast fuels consumption of road-transportation up to 2030; scenario has shown the possibility to reduce .28 GtonCO₂e of .47 GtonCO₂e of BAU road-transport emission in 2030 with baseline of .148 GtonCO₂e in 2015. The scenario also has shown that we could harvest economic benefit of USD 341.00 billion which covers fuel efficiency, production saving, and public health improvement. In the fuel efficiency context, it could save by up to 59.86 million KL p.a. gasoline, and 56.00 million KL p.a. diesel fuel, USD 52 billion p.a. in 2030. Meanwhile, integration of its policy to mass public transport and non-motorized mobility, and car scraping program will add another economic benefit of USD 274 billion, and USD 159 billion of each respectively in 2030. Sensitivity analysis tough that fiscal incentive/disincentive through Carbon excise will able to accelerate policy implementation.

Keywords: *fuel economy, low carbon emission vehicle, economic benefit, Carbon excise.*

Impact of Vehicle Emission Testing Programme on Economic Benefits in Sri Lanka

Kurugamage Surendra Kumar Perera
CleanCo Lanka Pvt Ltd

ABSTRACT

The vehicle emission testing industry is a fast growing an essential service industry in Sri Lanka. Approximately 25% of the vehicles are used to fail initial emission test, as a result adverse damage caused to the atmosphere and ambient air quality has been deteriorated. This ongoing vehicle emission test failures has crippled the transportation sector and brought the entire economy in to a standstill. In this regard a sample of 1500 vehicles were selected using stratified random sampling testing technique based on engine capacity to ascertain the impact of vehicle emission testing on economic benefits of the sample. Conducting a quantitative research, it was ascertained that 25% of the vehicles failed initial emission test and thereafter carrying out maintenance and fine-tuning the millage was improved to an appreciable level after the analysis of data and assessment of the results. In this research study subject to detailed analysis the research outcomes and findings indicated that fuel consumption of vehicles was reduced by 10% and fuel efficiency improved the same level. Ultimately the national crude oil importation and national fuel consumption on transportation was reduced approximately by the same level 10% from which foreign exchange savings and national expenditure was reduced to greater extent as importation was curtailed. In conclusion the Vehicle Emission Testing Programme had impacted to the benefit of the economy in Sri Lanka.



ORAL PRESENTATIONS

Session:
Air Pollution Monitoring and Process

Date & Time:
13 November 2018, 15:30-17:00

Chairperson:
Dr. Muhayatun Santoso,
Center for Applied Nuclear Science and
Technology Batan Indonesia
Email: hayat@batan.go.id

Session	Air Pollution Monitoring and Process	
Venue	Rooms 2 & 3, BCKK	
Time	15:30-17:00	
Chairperson	Dr. Muhayatun Santoso, Center for Applied Nuclear Science and Technology Batan Indonesia (Email: hayat@batan.go.id)	
Time Keeper	Nur Faseeha Suhaimi	
15:30	Marzuki Ismail, <i>Universiti Malaysia Terengganu</i>	Indoor Air Quality Assessment at Selected Primary Schools with Different Microenvironment at Kuala Nerus, Terengganu
15:45	Mohd Sabri bin Mohd Ghazali, <i>Universiti Malaysia Terengganu</i>	Corrosion inhibition of mild steel in seawater through green approach using <i>Leucaena leucocephala</i> leaves extract
16:00	Abdullah Al Nayeem, <i>Stamford University Bangladesh</i>	Investigation of Ground Level PM2.5 with Different Mode of Transports in Dhaka, Bangladesh
16:15	Begie Perdigones, <i>Institute of Environmental Science and Meteorology, University of the Philippines Diliman</i>	Temporal Variations of Particulate Matter Concentrations in Quezon City, Philippines in 2016-2017
16:30	Muhayatun Santoso, <i>Center for Applied Nuclear Science and Technology BATAN</i>	Characterization of Fine and Coarse Particulate Matter Collected in Indonesia Using Nuclear Analytical Techniques
16:45	Badar Ghauri, <i>Institute of Space Technology</i>	Air Quality in Pakistan's biggest city Karachi
17:00	Sonomdagva, <i>National University of Mongolia</i>	The Outdoor and Indoor PM2.5 in Ulaanbaatar City

Indoor Air Quality Assessment at Selected Primary Schools with Different Microenvironment at Kuala Nerus, Terengganu

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ABSTRACT

Children require good indoor environment since indoor air quality (IAQ) is very important for their growth and learning process. The failure to identify and establish IAQ status can increase the chance of long-term and short-term health problems. Two selected primary schools in Malaysia with natural ventilation in different microenvironment were chosen to determine the IAQ. The different microenvironment selected in the residential area at Sekolah Kebangsaan Tok Jembal while for industrial area, Sekolah Kebangsaan Gong Badak was chosen. In this study, the sampling was conducted for six hours to represent the actual duration during school days. The parameters that were monitored in indoor air consist of two type contaminants which are physical and chemical. Besides that, this study determined the measured concentration indoor air compliance with Industrial Code of Practice Indoor Air Quality 2010 (ICOP) as the guideline. For data analysis, Surfer 12 and Google Earth were used to represent the temporal and spatial distribution in identifying which area with high pollutants concentration. Indoor air quality in school at the industrial area is higher than at the residential area. In conclusion, there exist significantly different between school at industrial area with school at residential area due to the fact that the industrial area possesses more influence towards the pollution in indoor air quality.

Keywords: *indoor air quality, natural ventilation, school, spatial, temporal*

Corrosion Inhibition of Mild Steel in Seawater through Green Approach using *Leucaena leucocephala* Leaves Extract

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ABSTRACT

Corrosion inhibition analysis of *Leucaena leucocephala* leaves extract (LLE) on the surface of mild steel immersed in seawater has been conducted by utilizing the techniques of Fourier transform infrared spectroscopy (FT-IR), ultraviolet-visible spectroscopy (UV-Vis), electrochemical impedance spectroscopy (EIS), potentiodynamic polarization and scanning electron microscope (SEM). The result of FT-IR identified both hydroxyl (-OH) and carbonyl (C=O) groups indicating the presence of phenolic compounds in the extract whereas the analysis obtained from UV-Vis showed a peak absorption spectrum at 268 nm. The electrochemical analysis indicated an excellent inhibition efficiency of LLE up to 96.12% for the immersed mild steel at 6% of LLE coating. Furthermore, based on the study of polarization, a drastic decrease of corrosion rate at 0.2791 mm/year was observed for the same coating as compared to the uncoated substrate which was 2.3991 mm/year. The study also confirmed that LLE acts as a mixed type inhibitor as shown in the polarization curve. The morphological evaluation by SEM displayed a smooth and homogenous surface with less salt precipitation for 6% of LLE coating as compared to other types of coating affirming it to be the optimum concentration for the research.

Keywords: *Corrosion, Leucaena leucocephala, mild steel, seawater, sustainability*

Investigation of Ground Level PM_{2.5} with Different Mode of Transports in Dhaka, Bangladesh

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ABSTRACT

The study aimed to determine the correlation existed between increased concentrations of Air pollution and motorization in Dhaka. It reviewed the suspended solid particulates specifically PM_{2.5} and compared between different categories of roads which are Vehicle Free, Non-motorized, Mixed and Motorized and also with Environment Quality Standards (EQS) for Bangladesh set by the Department of Environment (DoE). Besides measuring the PM_{2.5}, a traffic volume survey also been done in 12 sites across the Dhaka city. PM_{2.5} concentration in mixed and motorized areas was on average 182% and 272% higher, respectively, than non-motorized. Surprisingly, short term measurements (~8hrs) in predominantly mixed and motorized areas already exceeded the maximum recommended limit for 24hrs (65µg/m³). This suggests a much higher pollution potential over a typical 24hrs period in motorized traffic areas. The study found a significant correlation between the concentration of the particulate matters and increasing of motorization. The study assumed that uncontrolled motorization is major cause of air pollution especially PM_{2.5} in the Dhaka city and the impact of these particulate matters on public health and environment are beyond the tolerable limits. The study has come up with some recommendations regarding improvement of air quality in respect of particulate matter and emphasized for further comprehensive study on other parameters of air pollution around Dhaka city. The study drew conclusion that the overall air quality regarding the particulate matter already exceeded highest standard limits of Bangladesh. The study recommended several measures to mitigate and prevent the harmful impacts and to improve the air quality of Dhaka city.

Keywords: *Pollutant, air pollution, motorization.*

Temporal Variations of Particulate Matter Concentrations in Quezon City, Philippines in 2016-2017

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ABSTRACT

Air particulate matter (PM), specifically PM₁₀ and PM_{2.5} has been attracting attention in recent years due to its impact on the environment and health. Analysis of its temporal variations (annual, seasonal, and diurnal) is a priori to understanding the processes affecting air quality. Thus, this research focused on investigating and analyzing one-full year temporal variations of PM in Quezon City, a highly urbanized area in the National Capital Region, Philippines. Hourly data of PM₁₀ and PM_{2.5} concentrations from October 1, 2016 to September 30, 2017 were gathered from two Air Quality Monitoring System (AQMS) stations installed strategically near roadsides (Lung Center of the Philippines (LCP) and Edsa-Muñoz (MUN)), through the AQMS platform, www.airtoday.ph. Results showed that MUN had higher annual mean concentrations of PM₁₀ and PM_{2.5}, 26.1 ± 15.6 (mean $\pm 1\sigma$) $\mu\text{g}/\text{m}^3$ and 17.3 ± 10.0 $\mu\text{g}/\text{m}^3$, respectively, while LCP had 12.1 ± 9.3 $\mu\text{g}/\text{m}^3$ and 10.9 ± 8.7 $\mu\text{g}/\text{m}^3$. Diurnal variation was observed, both PM₁₀ and PM_{2.5} mass concentrations exhibited bimodal patterns with pronounced peaks during the morning and evening rush hours (07:00 - 09:00 and 20:00 - 21:00). Day-of-the-week pattern was also evident, PM concentrations were higher during weekdays which peaked on Thursday but lower on weekends, coinciding with weekly human activity pattern. As for the seasonal variation, lower PM concentrations were recorded during wet season (May to October) indicating “monsoonal effect”. Based on the results of this study, it could be inferred that traffic emissions strongly influenced the concentrations of PM in the city though meteorological parameters such as temperature and wind speed also contributed to it. This study provides information that could be used in modeling and forecasting PM concentrations and for other air quality-related studies that would be beneficial to air quality monitoring and management.

Keywords: *PM₁₀; PM_{2.5}; diurnal variation; bimodal; meteorological parameters, airtoday.ph*

Characterization of Fine and Coarse Particulate Matter Collected in Indonesia Using Nuclear Analytical Techniques

Muhayatun Santoso*¹, Diah D. Lestiani¹, Indah Kusmartini¹, Dyah Kumalasari¹, Syukria Kurniawati¹, Endah Damastuti¹, Djoko Prakoso¹, Rita Mukhtar², Andreas Markwitz³, Janos Osan⁴

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ABSTRACT

Nuclear analytical techniques (NATs) such as Instrumental neutron activation analysis (INAA), Particle Induced X-ray Emission (PIXE), X-ray fluorescence (XRF), and X-ray absorption near-edge structure (XANES) have been used in quantification of environmental pollutants especially airborne particulate matter (APM) collected from several sites in Indonesia. The samples of fine and coarse particulates matter were analysed for their elemental concentrations using INAA facilities at Siwabessy multipurpose reactor and TRIGA 2000 reactor in Indonesia, PIXE at Institute of Geological and Nuclear Sciences New Zealand, XRF at BATAN Bandung Indonesia, and Synchrotron facilities in Elettra Italy. The techniques provide more than 20 significant elements (Na, Mg, Al, Si, S, K, Ca, Ti, Cr, Mn, Fe, Zn, Pb, As, etc.) for identification the possible sources of atmospheric aerosol. The results demonstrated that INAA, PIXE, XRF and XANES can complement significantly the elemental characterization of APM providing the concentration of several major, minor and trace elements. NATs capabilities has supported the evaluation of effectiveness national program in improving air quality improvement Indonesia through long term monitoring data of Pb concentration in APM of Bandung city. The NATs capabilities has also supported the national programs of air quality improvement through several findings such as lead pollution sources in Serpong, heavy metal pollution in east Java, forest fires event in Palangka Raya and Pekanbaru. These results can be used as an early warning, scientific based reference for government regulation and policy for proper action and strategy to improve the air quality standards in Indonesia.

Keywords: *Fine and coarse particulate, nuclear analytical techniques, Indonesia*

Air Quality in Pakistan's Biggest City Karachi

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ABSTRACT

Air quality in Pakistan's biggest city Karachi has been assessed over last six years. Pollutants concentrations monitored at the 28 intersections in 2005-2011 were compared. The net change in levels of criteria pollutants have been reported in this paper. Monitoring of criteria pollutants at main intersections when compared to those at a reference point revealed that SO₂ levels were higher by a factor of 2.5 to 3.38 over the latter whereas mean NO_x concentrations were 7.8-12.9 times higher, CO₂ at a few intersections were less by a factor of 0.78 and higher by 1.44, PM₁₀ 1.1 to 2.3 times, CO 6.67-9 times O₃ 0.87 to 1.44 times, and noise levels were 1.37 to 1.52 times higher than at the reference point. Maximum of NO_x, and particulate matter PM during the day were in exceeding the safe limits at almost all the stations. The data suggested that the impact was maximum at 50 meters from the intersections in the direction of the wind. Vehicular inspection revealed that electronic tuning was effective in achieving better fuel efficiency than non-instrumented workshops. The use of CNG as motor fuel reduced the pollution load by 380 ton/day or 138,700 tons/year. PM and diesel exhaust can have health effects. Blood tests in 134 cases out of 200 persons showed hemoglobin level of 15.1 g/dl as an average, mean corpuscular hemoglobin concentration MCHC was 28 compared to normal value of MCH: 27-33 picograms (pg)/cell in adults; while the eosinophil count representing an incidence of allergy was 3.55 % on an average. Eosinophils in blood ranges from 0.0-6.0 (%). The study was aimed at assessing the impact of vehicular emissions on physical, living and social environment of Karachi through detailed air quality surveys at designated intersections throughout the Karachi City.

Keywords: *vehicular emission, Karachi city*

The Outdoor and Indoor PM_{2.5} in Ulaanbaatar City

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ABSTRACT

More than 2 million people worldwide die every year caused by air pollution. Of all the air pollutants, fine particulate matter (PM) is one of the most hazardous pollutants leading to 9% of lung cancer deaths worldwide, 5% of cardiopulmonary deaths and 1% of respiratory infection deaths. In this study, PM_{2.5} pollution of indoor and outdoor ambience has been measured at 4 different simultaneous duration points of the capital of Ulaanbaatar, Mongolia. Data were measured at each 10 second during 24-h period. The instrument that was used to study, created by Nagoya University and Panasonic Corporation. The results of this study indicate the PM_{2.5} concentrations of air in Ulaanbaatar are higher than the air quality standard in October and peak in the December and January. Also, due to the feature of the sites being measured, pollution of indoor ambient was demonstrated strong or weak level, which is depended on outdoor ambient pollution. The measurements of the majority days were a high level of pollution from at 00:00 to 04:00 pm, however, it was decreased at 5:00 pm, but it started to increase around 07:00 to 09:00 in the morning, and it decreased from 10:00 am to low level of the pollution whole day. At 18 o'clock in the evening, the pollution was increasing and at the peak of the day, the fine particle pollution up to 02:00 on the next day. The fine particles in the air and the environment are different depending on the location of the measurement point and external and internal conditions. Indoor and outdoor PM_{2.5} has difference causing on location and activity of ambient. For instance, implement capacity exceeded with 1400 µg/m³ for some days on outdoor, near a household point while in near university point, the highest concentration of PM_{2.5} reached to 900 µg/m³.

Keywords: *air quality, outdoor and indoor, PM_{2.5}, air quality index*



ORAL PRESENTATIONS

Session:
Indoor Air Pollution

Date & Time:
13 November 2018, 15:30-17:00

Chairperson:
Assoc. Prof Datin Gs. Dr Arnis Asmat,
Universiti Teknologi MARA (UiTM)
Email: arnisasm@gmail.com

Session	Indoor Air Pollution	
Venue	Room 12, BCCK	
Time	15:30-17:00	
Chairperson	Assoc. Prof Datin Gs. Dr Arnis Asmat, Universiti Teknologi MARA (UiTM) (Email: arnisasmat@gmail.com)	
Time Keeper	Noor Haziqah Kamaludin	
15:30	Michael Johnson, <i>Berkeley Air Monitoring Group</i>	Bluetooth Beacon technology for personal exposure and behavior assessment
15:45	HD. Kumarapeli, HDS. Premasiri, <i>National Building Research Organisation</i>	Evaluating of ventilation conditions in commercial and office buildings by means of Indicating indoor air pollutant
16:00	Dustin Jefferson S. Onghanseng, <i>uHoo Air</i>	Modeling indoor air data to reduce energy consumption and carbon footprint of buildings while enhancing occupant health and well-being
16:15	Jamaiyah Yahaya <i>Universiti Kebangsaan Malaysia</i>	EQMMS: The Quarry Management System based on Integrated Digital Data Object and Modelling for Sustainable Development
16:30	Yeseul Seong, <i>Korea Environmental Technology</i>	Development of a smart indoor air quality device connected with an air ventilation system and its operation
16:45	Ajay Taneja, <i>Dr Bhimrao Ambedkar University</i>	Need for chemical characterization of ultrafine particulate in indoor environment

Bluetooth Beacon Technology for Personal Exposure and Behavior Assessment

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ABSTRACT

Measurement of personal air pollution exposure is often an expensive and logistically challenging endeavour. Advancements in Bluetooth Beacon technology have allowed the development of location tracking systems that may be used in various household energy applications including time spent in different cooking areas, exposure level in different cooking areas and away from home, and indirect modeling of personal exposure. One illustrative example comes from the Household Air Pollution Intervention Network (HAPIN) trial, which is assessing the health impacts of LPG interventions in India, Guatemala, Peru, and Rwanda. In HAPIN, a Beacon-based system for modeling personal exposure from indirect area measurements has been piloted and validated in a comparison with direct personal exposure measurements. Another completed study in Ghana focused on exposures as a function of Beacon-derived distances to various cookstove types and exposure at home vs. away from home. That work found that the Beacon data stream provided statistically significant predictive power to explain personal exposure. These studies have shown that objective location monitoring can provide a reasonable means to estimate personal exposures when combined with area pollutant measures, as well as provide insight into the impacts of exposures to different microenvironments. In addition, the sensor-based measures do not rely on participant recall which is generally an imprecise and inaccurate means of estimating location.

Keywords: *Bluetooth Beacon technology, personal exposure*

Evaluating of Ventilation Conditions in Commercial and Office Buildings by Means of Indicating Indoor Air Pollutant

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ABSTRACT

Many air pollutants build up rapidly indoors due to indoor pollution sources. These pollutants can cause various health problems such as chronic and respiratory diseases and can be fatal at high levels. Infants and elderly are spent their time in indoors even greater 90% of their time and more susceptible to indoor air pollution. This study conducted to identify pollutants that can use as indicator pollutant to represent ventilation aspect of indoor environment conditions in office and commercial buildings in Sri Lanka. In the present study, Indoor air pollutant levels measured in buildings with different environmental conditions. The buildings selected for the study includes, those with different air-conditioning systems, buildings with extensively used decorative panels, building areas having large number of electronic equipment and areas occupying large gatherings or overcrowded. The study results indicate that Formaldehyde (H₂CO) levels are relatively high compared to other pollutants in buildings with poor ventilation and most of time exceeds the relevant guideline levels. The levels can reduce to acceptable levels by increasing fresh air intake of building and/or by introducing phytoremediation depending on pollutant concentration and space. The Carbon Dioxide (CO₂) levels are relatively high in places having high gathering of people in indoor with poor ventilation, the levels could be reduced to acceptable norms by providing better ventilation conditions. The study confirms that both H₂CO and CO₂ can be used as indicative pollutants to measure indoor air quality with reference to deciding required level of ventilation condition in buildings to ensure safe indoor air quality.

Keywords: *Ventilation, Formaldehyde, Phytoremediation*

Modelling Indoor Air Data to Reduce Energy Consumption and Carbon Footprint of Buildings while Enhancing Occupant Health and Well-Being

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ABSTRACT

Inefficient heating, ventilation and air-conditioning (HVAC) systems from buildings waste US\$ 200 billion in energy annually (GE) and cause 34% of global greenhouse gas emissions. Even with green certified buildings that have energy efficient systems installed, people still get sick inside the building and energy is still continuously wasted during operations. One major challenge is providing the "right" amount of heating, cooling, ventilation and fresh air. With people constantly moving around and activities continuously changing, energy use is frequently either too much or too little. Without the proper indoor air data and feedback loop, these energy efficient systems are only as good as its installation, but not in its operation. Buildings have always been asked to choose between energy efficiency or a healthy indoor environment. Recent research has shown that continuously monitoring and modelling indoor air data can increase productivity by US\$ 6,500 per person per year, reduce illnesses, absenteeism and sick leave, and simultaneously save energy by optimizing the use of existing building systems. These building systems should no longer be designed for indoor air that is just acceptable but move towards a system where indoor air data is utilized to promote occupant health and well-being while simultaneously reducing a building's energy consumption and carbon footprint.

Keywords: *air quality, indoor air quality, green buildings, health, well-being*

EQMMS: The Quarry Management System based on Integrated Digital Data Object and Modelling for Sustainable Environment

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ABSTRACT

This research establishes how the sustainability environmental components which are particles, vibration and noise (or PVN) and their relationships can be modelled into forms of digital objects (DO). The integrated objects are then be incorporated into a repository for easy manipulation of DOs. It aims to develop an exclusive Environment Quarry Management and Monitoring System (EQMMS) that utilized an integrated digital object model (iDO). This research was conducted in four phases: 1) theoretical framework design; 2) data model design, 3) architecture and system design; 4) system development, evaluation and testing. During initial site visit at Langkawi Quarry in Malaysia, expert reviews and preliminary findings revealed that environment data is localized in their format and requirements. These three components (PVN) have great influence and impact towards the sustainability of environment particularly for quarry industry in Malaysia and requires a comprehensive system architecture, design and development. The computational and architecture for quarry environment were constructed and used as the baseline of the proposed system. The EQMMS system is useful for handling and managing issues in quarry industry particularly about complaints from surrounding communities and people. It supports the quality of life and towards healthy living and sustainable environment.

Keywords: *Quarry Management and Monitoring System, Environment Digital Object, Sustainable Environment, Environment Data Visualisation*

Development of a Smart Indoor Air Quality Device Connected with an Air Ventilation System and Its Operation

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ABSTRACT

This study developed a smart indoor air quality measuring device connected with air ventilation system to improve indoor air quality using PM₁₀, PM_{2.5}, CO₂, VOCs, temperature, and humidity sensors. The smart air quality device is controlled and commutated with the developed mobile application using long distance communication module. The mobile application basically provides air quality information (daily, monthly, yearly), air management methods, and environmental issues. According to the smart air quality device, air ventilation system is able to be operated automatically based on real time air quality and long-term air quality data can be stored in the central server to use expecting future air quality in the specific area. Therefore, this smart air quality device can help improving indoor air quality in real time and future time with great contribution to especially high populated buildings and sanitized areas.

Keywords: *smart indoor air quality device, air ventilation system, indoor air quality, mobile air quality application, air quality control management*

Need for Chemical Characterization of Ultrafine Particulate in Indoor Environment

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ABSTRACT

Assessment of potential environmental and toxicological effects of particulate matter (PM) requires a detailed characterization of physical-chemical properties of particles; in which a particular focus is placed on particles in ultrafine section. Their amplified surface/volume and increased penetration into the respiratory tract impart toxicity much higher than their counterpart. These particles are presently under study by inhalation toxicologists to determine their expectancy of threat posed to human health, yet a gap still exists regarding the chemical composition of ultrafine particles in indoor atmosphere. In the present work, mass concentration, size distribution and chemical composition of particles is determined in indoor microenvironment of domestic homes in Agra, India. Sampling was conducted using SKC cascade impactor that simultaneously collected different sized particles. Fine particles dominated (62-80%) PM₁₀ concentration in which quasi ultrafine particles (q-UFP) occupied a significant portion (24-35%) of fine PM mass. Greater correlation of UFP with accumulation mode particles (q-Acc) in fine particulate range described the inter-formation of these particles. Particle size effect on elemental bioavailability was assessed whereby metals in q-UFP and quasi accumulation (q-Acc) were more bioavailable (27.1%) than coarser range (14.53%). Bio-available concentration of toxic metals (Cu, Cr, Pb, Zn) exhibited a modal shift towards smaller particle size fraction. Indoor-outdoor regression results suggest higher infiltration capacity of q-UFP and q-Acc ranged particles elucidating their high deposition. Concerning metal characterization, heterogeneous variation of metal mass loadings with respect to particle size fraction was noted that indicates strong indoor sources with consistently varying metal concentrations. Differential PM distribution pattern indicated a uni-modality with preference to q-Acc mode (PM_{0.5-0.25}; indoor & PM_{1.0-0.5}; outdoor). Concerning the risk identification, highest value of hazard quotient is posed by metals in q-UFP that emphasize the importance of the smaller sized ultrafine particles as an utmost cause of concern in particulate characterization study.

Keywords: ultrafine particulate; indoors; risk identification; bioavailability



ORAL PRESENTATIONS

Session:
Air Pollution Monitoring and Process

Date & Time:
14 November 2018, 15:30-17:00

Chairperson:
Prof Dr Mohd Talib Latif,
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Session	Air Pollution Monitoring and Process	
Venue	Room 13, BCKK	
Time	15:30-17:00	
Chairperson	Prof. Dr. Mohd Talib Latif, Universiti Kebangsaan Malaysia (UKM) (Email: talib@ukm.edu.my)	
Time Keeper	Fahimah Hashim	
15:30	Mizuno Yusuke, Horiba, Ltd.	New solution for simultaneous quantitative measurement of Particulate Matter (PM) and qualitative element analysis using PX-375
15:45	Sumal Nandasena, National Institute of Health Sciences	Concentrations of Particulate Matter fractions and kitchen characteristics among solid fuel and LPG using households in Sri Lanka
16:00	George Nyaon, Natural Resources & Environmental Board (NREB) Sarawak	Air Quality Monitoring for Effective Enforcement
16:15	Abdul Rani Abdullah, Pakar Scieno TW	Monitoring the Nation's Air Quality: The Environmental Quality Monitoring Program (EQMP)
16:30	Yann Boquillod, IQAir	Using low-cost sensor technologies to democratize public air quality data

New Solution for Simultaneous Quantitative Measurement of Particulate Matter (PM) and Qualitative Element Analysis using PX-375

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ABSTRACT

It is important to analyze the composition of particulate matter because it will help trace the emission source. Particulate matter is one of the most important pollutants related to human health but the generating mechanism is not fully elucidated. Currently, several methods are available to monitor particulate matter and its elemental composition. However, most methods involve several instruments / steps such as using a high volume sampler to capture the particle, which is further characterized using ICP and/or X-ray instruments. Since this comprises both field sampling and laboratory monitoring technology, several issues are identified. Firstly, there is a high probability of human error especially when the user does not have well-versed techniques and knowledge for the monitoring process. Secondly, it cannot get continuous trend data in short intervals resulting in missing out important event at a particular time of the day. Lastly, it takes a lot of labor hours just to obtain and analyze a few samples. PX-375 is designed to solve all these issues. It is a continuous monitor which measures both particulate matter mass and element concentration at the field simultaneously. HORIBA succeeded in obtaining high accuracy by using Beta-ray attenuation, X-ray fluorescence and an in-house filter which has extremely low interference. Since all the processes are done in the PX-375, it will help to reduce human error with improved repeatability. The results will be obtained hourly and illustrated in a trend graph. HORIBA has carried out several experiments in the field and the finding will be shared in this BAQ 2018 conference. PX-375 will be the new solution to study and identify emission sources for particulate matter. With this, the emission process can be further optimized to reduce the generation of particulate matter.

Keywords: *Air quality, Heavy metal, Element, Mass, Particle Matter, Health impact, Emission source*

PM Concentrations and Kitchen Characteristics among Solid Fuel and LPG Users in Sri Lanka

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ABSTRACT

Use of solid fuel for cooking is a major source of household air pollution (HAP) in developing countries. Of the many pollutants emitted during solid fuel combustion, particulate matter (PM) is considered to be one of the most hazardous pollutants. The objective is to assess PM fractions emitted during solid fuel and Liquefied Petroleum Gas (LPG) combustion in kitchens of Sri Lankan households. Households of children in a longitudinal study in Ragama, Sri Lanka comprised the study population. Households of children aged 36 months were visited and different aerodynamic diameters of PM (PM₁, PM_{2.5}, respirable PM, PM₁₀, total PM) were monitored for 3 hours during the main cooking session (lunch meal) of the day. Basic characteristics of the kitchen (e.g., presence of a chimney, functionality of the chimney, dimensions of the kitchen, etc.) were assessed using a questionnaire. Cooking energy, other sources of household air pollution, size of open spaces in the kitchen (e.g., windows), etc. were assessed at the time of monitoring PM using a check list. Air quality monitoring was done in 322 households; 138(42.9%) households used a single cooking fuel to prepare the main meal during monitoring (wood - n=68 (49.3%); LPG - n=69 (50.3%) and Kerosene - n=1 (0.7%)). PM_{2.5} concentrations in the kitchen, the bedroom, the living room and in the immediate outdoors of households using only wood and cooking inside a permanent kitchen were 323 µg/m³ (Inter Quartile Range (IQR): 161 – 529 µg/m³), 76.0µg/m³ (IQR: 54.3- 129 µg/m³), 70.0 µg/m³(IQR: 54.0- 124 µg/m³) and 124µg/m³(IQR: 58.0- 210 µg/m³), respectively. PM_{2.5} concentrations in the kitchen of households using only LPG and cooking inside a permanent kitchen were 93.3 µg/m³ (IQR: 36.0 – 77.0 µg/m³). PM concentrations were higher in kitchens and other microenvironments of households using solid fuel for cooking as compared to households using LPG for cooking.

Keywords: indoor air quality, microenvironments of the households

George Nyaon

ABSTRACT

Air pollution in Sarawak, particularly during haze episode has strong relationship with existence of hotspot observed from satellite image of Borneo, especially the neighbouring countries, Kalimantan, Indonesia. Since haze occurrence traditionally occurred between Jun and September annually, the NREB (Natural Resources And Environment Board) Sarawak has making an effort for the past more than decades to monitor the air quality in the State. The CREM (Centre for Remote Environmental Monitoring) is established to closely monitor air quality in the State vis-a vis, the API, Hotspot and FWI (Fire Weather Index). The Centre is responsible to produce air quality information on daily basis and the hotspots in accordance with Section 30 (1) (a) (b) and (2) of the Natural Resources And Environmental Ordinance. This paper aims to highlight the process of issuance of Open Burning Permit and Investigation on non-compliance of burning activities as stipulated in Section 30 (1) (a) (b) and (2) the Natural Resources And Environment Ordinance. As summary, the article/presentation will deliver on the achievements by NREB in air quality monitoring activities, issues/challenges and future plan towards good air quality status in the State.

Monitoring the Nation's Air Quality: The Environmental Quality Monitoring Program (EQMP)

Abdul Rani Abdullah
Pakar Scieno TW Sdn Bhd

ABSTRACT

Environmental monitoring is an essential element in the management of the environment, allowing for sustainable planning of development projects, supporting the effectiveness of enforcement activities and enhancing the overall management of the nation's natural resources and the protection of human health. The monitoring of the nation's ambient environmental quality is generally associated with the Department of Environment (DoE). Monitoring works were carried out by the Department soon after its establishment in the 1970's. However, such works were outsourced to the private sector in 1995 until the present day. The current air quality monitoring network is part the Environmental Quality Monitoring Program (EQMP) which commenced in July 2017 that also include a nation-wide network of river and marine water quality monitoring stations. The monitoring network encompasses both the automatic mode of monitoring as well as manual sampling activities and laboratory analysis. All the data from the monitoring stations are transmitted to the Environmental Data Centre (EDC) where it is validated, analysed, displayed and stored. In addition, as part of the program, mobile monitoring facilities allow for the rapid deployment of pollution investigative capabilities. The present paper presents an overview of Malaysia's air quality monitoring network and serves to illustrate the evolution of the nation-wide environmental monitoring program towards the provision of a more comprehensive, meaningful and effective ambient data upon which management decisions can be made, either on day-to-day operation or in the context of a more long-term management strategy.



ORAL PRESENTATIONS

Session:

Urban Planning and City Solutions for Clean Air

Date & Time:

15 November 2018, 9:00-10:30

Chairperson:

**Dr. Pallavi Pant,
Health Effects Institute (HEI)
Email: ppant@healtheffects.org**

Session	Urban Planning and City Solutions for Clean Air	
Venue	Room 12, BCCK	
Time	9.00 – 10.30	
Chairperson	Dr. Pallavi Pant, Health Effects Institute (HEI) (Email: ppant@healtheffects.org)	
Time Keeper	Nur Haziqah Kamaludin	
9.00	Mark Broomfield, <i>Ricardo Energy & Environment</i>	Air quality action planning in the Greater Beijing-Tianjin-Hebei area
9.15	Attilio Poli, <i>APAQ Group</i>	Holistic Approach to Evaluate Air Quality Impact for New Building Permit in Urban Industrial Estates
9.30	Jeffery K Smith, Pawan Gupta <i>World Health Organization (Consultant), NASA-GESTAR/USRA</i>	The proliferation of environmental data and visualization sharing platforms and their impact on awareness
9.45	Dorothee Saar, <i>Deutsche Umwelthilfe DUH (Environmental Action Germany)</i>	Network on Citizens Engagement for Better Air Quality
10.00	Frederick H Young IV, <i>Alta Planning + Design</i>	Low-Cost, High-Impact Strategies for Increasing Active Mobility in ASEAN Cities
10.15	Volker Ziegler, <i>GRIMM Aerosol Technik Ainring GmbH & CO.KG</i>	Smart Air Quality Network, the measurement network for the future

Air Quality Action Planning in the Greater Beijing-Tianjin-Hebei Area

Mark Broomfield*¹, Ben Grebot,¹ Michel Vedrenne¹ and Tianlin Niu²

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ABSTRACT

Improving air quality is one of the highest priorities for authorities in the Greater BTH region. National, regional and local authorities have implemented a wide range of policies to deliver ongoing improvements in air quality. However, it is not clear that these measures will be sufficient to fully deliver the improvements in air quality that will be required, or what the most cost-effective means for delivering ongoing improvements will be, now that many of the most readily available measures have been implemented. Ricardo is now working alongside stakeholders in China to develop and implement new techniques for assessing air quality. We have used the outputs from these new systems to design and evaluate air quality action plans which go beyond the current policy landscape to test additional measures for improving air quality which will be necessary to achieve the aspirations for good air quality in China in the long term. This presentation will describe i) Meeting the data challenge: effective stakeholder engagement and data acquisition ii) Using the next generation of air quality modelling systems for flexibility, robustness and quality assurance iii) Illustrative model results: key influences on air quality in mega-cities in the Greater BTH region: Jinan, Baoding, Xingtai and Changzhi iv) Assessing the full costs and benefits of interventions to improve air quality v) Next steps.

Keywords: *air quality, traffic emissions, air quality management, action planning, megacities*

Holistic Approach to Evaluate Air Quality Impact for New Building Permit in Urban Industrial Estates

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ABSTRACT

New building projects in already densely industrial estates can significantly alter the dispersion of the airborne pollutants with potential negative impact on the air quality of the area. Given the concern of impeding and downwash of flue gas from existing chimneys, Singapore implements Building Height Constraints (BHC) limitations on new projects with very stringent criteria for its waiver. At the same time the BHC hinders the development of high-rise, multi-tenanted industrial buildings and limits the value of the land. The holistic approach based on air dispersion modelling and air quality monitoring is described through its application in a complex case study in Singapore. First, with Air Dispersion Model, theoretical risks of building downwash effects are assessed. This can advise the building developer whether or not to move on with the detailed design, or to make changes at it before applying for the in-principle approval from the regulator. Subsequently, a tailor-made air quality monitoring campaign is specified and presented to the regulator as permit conditions, and is conducted in conjunction with the construction phase. Monitoring is conducted both before and after construction, on representative locations and heights of the building, with best available instruments and techniques following USEPA standards. Data gathered from the monitoring campaign is analysed comparatively across locations, heights and meteorological and atmospheric stability conditions to verify the Air Dispersion Model findings, and to ascertain regulators that the state of localised air quality has not worsened after the new building is completed. The proposed methodology demonstrates to be successful to allow the full development and economic potential of new projects in total respect of the existing regulations, preventing any negative impact on the air quality for the stakeholders and communities involved.

Keywords: *air quality, land use, urban planning, industrial planning, Building Height Constraint, Air Dispersion Model, air quality monitoring, permit application,*

The Proliferation of Environmental Data and Visualization Sharing Platforms and Their Impact on Awareness

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ABSTRACT

Humanity's impact on the environment has created an enormous burden of disease causing 7 million deaths a year from air pollution. Solutions to air pollution provide co-benefits for the public health, climate change, and economic growth. One key challenge is the lack of overall public awareness of the health effects of acute and chronic exposure. The ubiquity of air pollution creates a sense of complacency due to familiarity, cultural and historical factors. In spite of this, the growing availability of data and platforms is increasing public awareness that reducing exposure results in significant reductions in mortality and morbidity. Technology, open data and medical studies allow us to correlate the health effects. Open data, tools, and online platforms enable real-time visualizations and data sharing and more. Open and public data from scientific-grade monitors, remote-sensing, and low-cost monitors will continue to create open datasets (OpenAQ). These datasets will enable analytical tools, visualizations, and engagement platforms (e.g., Resource Watch; Our World in Data, Clean Air Asia's Cities Clean Air Partnership; The IPE's Blue Map; The EPIC-India Start Rating Program; SEI's LEAP-IBC tool; and WHO's Urban Health Initiative tool-set) that will combine with weather, water, vehicle and marine traffic, and hospitalization data to create insights and health alerts for policymakers, motivate personal action, allow policymakers and researchers to detect pollution hotspots, allow corporations to be approached directly to reduce emissions and adopt sustainable best practices. Open data and sponsored research and technology platforms are driving awareness. Low-cost and satellite air quality monitoring together with open data platforms and tools will translate to civil society, non-profit, academia, regulatory, and policymaker collaboration and action to reduce emissions. This awareness will increase the number of participants from all sectors (governments, industry, academia, and civil society) to protect the environment and public health.

Keywords: *open data, engagement platforms, awareness*

Network on Citizens Engagement for Better Air Quality

Dorothee Saar

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ABSTRACT

Our aim is to widen our network supporting the engagement of citizens with regard to air quality. We are a German NGO working on air quality and clean transport. We collaborate with external technical and scientific experts and with NGOs from all over the world. High NO₂ concentration in ambient air occurs worldwide, corresponding with significant health risks. Major source is road transport. However, only few official monitoring stations measure NO₂ concentration in urban regions: In Germany, less than 250 stations control air quality near busy roads, for more than 90% of cities according data is not available. At the same time, citizens become more and more aware of negative impacts of air pollution and want to learn more about the concrete situation on site. Our goal is to fill those gaps with reliable data deriving from measurements by engaged citizens. Provided according code of practice diffusive sampler are a solid and proofed instrument to measure NO₂ concentration within a given timeframe. We win people to use this instrument as a reliable and low-cost option to learn more about air quality. We provide knowledge on the handling of the instruments and the data. We publish first measurements and want to share our experience (<https://www.duh.de/abgasalarm/>). We took first steps to establish a network including Eastern European NGOs. Another important pillar is the exchange of knowledge to lower air pollution from mobile and stationary sources and on the effects of harmful air pollutants on human health. This will raise awareness among citizens and stimulate the implementation of low emission transport modes.

Low-Cost, High-Impact Strategies for Increasing Active Mobility in ASEAN Cities

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ABSTRACT

For short trips, active mobility (walking and bicycling) is the most efficient way to move people in cities, no matter how you measure it (energy consumption, GHG emissions, impact on air quality, etc.) and there are significant benefits for public health. Unfortunately, the built environment in many cities throughout ASEAN countries is not suitable for safe, convenient, and low-stress active mobility options for short trips to access transit, shopping, school, or employment. These barriers include few dedicated, low-stress facilities suitable for a wide range of people, disconnected active mobility networks that result in poor access to transit and other destinations, and competing transportation services that can lead to confusion about making the smartest individual choices about transportation. All of these barriers can be overcome with low-cost, high-impact strategies. This paper will outline strategies for increasing the modal share of active mobility in ASEAN cities. The strategies will fall into several categories. Education and encouragement programs give communities the tools they need to address health equity, community-wide physical activity, and travel choices for all ages and abilities. Open streets events are free to the public and provide an opportunity for people to engage in physical activity, meet their neighbors, and discover businesses in neighborhoods throughout the City. Temporary demonstration projects help the public understand and experience a new piece of infrastructure quickly with minimal cost. Counts and benefits analyses help to build the case for investing in active mobility projects. Active mobility design guidelines that address the unique climate and cultures of ASEAN countries. Professional trainings build planning and design capacity at a local level. Real world examples will show how each of these techniques have been used successfully to shift transportation behaviours, build consensus and establish local capacity for implementing high quality active mobility infrastructure.

Keywords: *active mobility, walking, bicycling*

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ABSTRACT

Air Quality and with this, subjective and health related life quality, is one of the biggest topics of modern cities and developing countries in our time. For many regions and cities it is difficult to take action regarding air quality in mobility, residential or working areas, because there is no fine-meshed and profound database available for making right decisions in time. Although the required basic data as well as the measurement principles would be available, a proper platform for connection, combination and evaluation of measurement data to get profound decisions is still missing. SmartAirQualityNetwork is a very pragmatic and data driven attempt in which all available data will be combined to an integrated measurement strategy. Different measurement technologies and air pollution sources will be combined via a new platform and modelling concept using efficient algorithms getting valuable information to develop valuable measures against pollution levels. With the connection and combination of open data sources as meteorological data as well as research data about air pollution levels, city development plans, remote sensing data about influencing factors as mixing layer heights, comprehensive coverage with ultra-low-cost-Sensors, "scientific scouts", demand-oriented usage of UAVs together with methods of real-time-modelling and analysing, a new measurement and analysing concept will be developed. In the test region a prototype of a measurement network 2.0 will be established using IoT-Methods and analytics of big data. The main target is to give new real time information that can be used for several in-time actions and measures. Based on a central Data Cloud, important information will be available for navigation systems, traffic control systems or apps to inform the public in-time. High polluted zones and traffic control activities in order to reduce traffic and pollution levels as well as to inform people via mobile apps about pollution levels will be given.

Keywords: *Alternative Measurement Network, Instrumentation, Low Cost Sensor, Algorithm*



ORAL PRESENTATIONS

**Session:
Ozone**

**Date & Time:
15 November 2018, 9:00-10:30**

**Chairperson:
Prof. Jamal Hisham Hashim
Email: jamalhas@hotmail.com**

Session	Ozone (KOSAE)
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Venue	Rooms 10&11, BCKK	
Time	9:00-10:30	
Chairperson	Prof. Jamal Hisham Hashim (Email: jamalhas@hotmail.com)	
Time Keeper	Nurfatin Izzati Ahmad Kamal	
9.00	JiHyeon Song, <i>Sejong University</i>	Speciation of Volatile Organic Compounds and Ozone Precursors Emitted from Printing Industries
9.15	Young Min Jo, <i>Kyung Hee University</i>	Small scale VOC emission sources focusing on urban ozone precursors
9.30	Inseon Suh, <i>Korea University</i>	Characterization of OC and EC variation at peri-urban Taehwa Research Forest with implications for haze effects
9.45	Taehyoung Lee, <i>Hankuk University of Foreign Studies</i>	Observation of Secondary Aerosol Formation Potential using Oxidation Flow Reactor for the vehicles of different fuel types
10.00	Yoon-Shin Kim, <i>Global Alliance for Clean Air</i>	Why do we need The World Air Day?
10:15	Nik Rosmawati Nik Husain, <i>Universiti Sains Malaysia</i>	The sick building syndrome in hospital workers: A cross-sectional study of personal and environment-related risk indicators

**Speciation of Volatile Organic Compounds and Ozone Precursors
Emitted from Printing Industries**

Hae-Young Ahn¹, Jun Min Jeon² and JiHyeon Song*¹

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ABSTRACT

A large amount of volatile organic compounds (VOCs) is being released to the urban airshed from various emission sources such as printing industries. In Korea, based on an estimation by its government, a total amount of VOCs emitted from printing and publishing industries was 24,348 ton/year in 2014 from more than 66,000 printing shops and factories. Since VOCs play an important role in urban ozone formation, their emission quantities from individual sources and photochemical ozone creation potentials need to be carefully identified and evaluated. In this study, chemical compositions and speciations of VOCs in inks and solvents commonly used in printing processes including offset, gravure and screen were analysed. Among the three processes, the screen printing emitted the highest VOC concentrations, and methyl ethyl ketone, xylene, toluene and ethylbenzene were the most abundant compounds. Currently, their potentials for the urban ozone creation were investigated, and proper control and management options will be discussed.

Keywords: *volatile organic compounds, ozone creation potentials, printing industries*

Small Scale VOC Emission Sources Focusing on Urban Ozone Precursors

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ABSTRACT

The largest domestic emission source of VOCs in Korea is the use of organic solvents which occupy 62.1%. Amongst them, 23.8% are discharged from small shops in the residential area without systematic control devices. Thus, the chemical composition varies depending on users' recipe. Meanwhile it is known that the urban ozone appeared frequently in these days associates with this VOC emission. The present work investigated major field emission sources such as painting booths, hair shops, printing factories and laundries in terms of TVOCS and trace compounds. The VOCs found from painting shops were 15-54 species, of which TVOCs distributed from 2.76% to 99.81%. Laundry solvents contained 23-45 species, and its TVOCs were 12.66%-80.44%.

Keywords: *urban ozone, VOC emission, ozone precursor, field investigation*

Characterization of Organic and Elemental Carbon variation at peri-urban Taehwa Research Forest with implications for haze effects

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ABSTRACT

Measurements of carbonaceous aerosols were performed at Taehwa Research Forest (TRF) near the Seoul metropolitan area (SMA) during May 2013 to April 2014 to investigate the sources of organic carbon (OC) and elemental carbon (EC) and their potential roles on the primary (POC) and secondary organic carbon (SOC) formation. The annual average concentrations of OC and EC were $5.09 \pm 3.15 \mu\text{gC}/\text{m}^3$ and $1.71 \pm 0.96 \mu\text{gC}/\text{m}^3$ respectively. The high OC to EC ratio and their strong correlations in cold seasons were comparable to those in urban and suburban regions, indicating the effect of urban emissions in local and regional scale. The higher levels of OC ($6.56 \pm 3.16 \mu\text{gC}/\text{m}^3$) and EC ($2.08 \pm 0.97 \mu\text{gC}/\text{m}^3$) were observed in haze event, compared to OC ($3.45 \pm 2.19 \mu\text{gC}/\text{m}^3$) and EC ($1.30 \pm 0.75 \mu\text{gC}/\text{m}^3$) in non-event. The annual average of OC to EC ratio was higher in haze days (3.34 ± 1.29) than in non-event days (2.95 ± 1.53). In haze, the OC to EC ratio was high in the order of winter, spring and fall. In summer, the good correlations with the maximum hourly concentrations of O_3 and biogenic VOCs resulted in the highest SOC fraction of 74% against OC, suggesting that the formation of SOC was enhanced by the photochemical reactions of biogenic VOCs. The SOC against OC at TRF was 45.9% in winter under the predominant westerly wind, implying the influence of transport of anthropogenic pollutants. The concentration-weighted trajectory (CWT) analysis illustrated the potential source regions of POC, SOC and EC in haze events. High POC and EC were associated with air masses from northeast China and North Korea especially in winter haze. SOC/OC was higher in summer haze, implying the formation of SOC triggered the regional pollution in TRF.

Keywords: *Organic and elemental carbons, OC/EC ratio, haze, Forest, pollution, urban emissions*

Observation of Secondary Aerosol Formation Potential using Oxidation Flow Reactor for the vehicles of different fuel types

Taehyoung Lee^{*1}, Gyutae Park¹, Kyunghoon Kim¹, Seounghwan Lee¹, Taehyun Park¹, Seokwon Kang¹, Jihee Ban¹, Dong-gil Yoo¹, Ilgu Jang¹, Gun Guk Joe¹, Myeongbog Kim^{1,2}, Taekho Chung³, Seok-jun Seo³, Sunmoon-Kim, Sungwoon Jung³, Junghwa Kim³ and You-deog Hong³

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ABSTRACT

The formation of secondary aerosol (SA) was studied by using the Oxidation Flow Reactor (OFR) under the high photo-oxidation condition for vehicles of gasoline, diesel and liquid petroleum gasoline (LPG) fuel types. Exhaust was photo-oxidized in the continuous flow photo-oxidation cylinder. The photo-oxidized aerosol passing through OFR and the exhaust were quasi-simultaneously sampled to measure the size distribution and chemical composition of aerosol and the concentrations of precursor gaseous species alternatively by Differential Mobility Spectrometer 500 (DMS-500), High Resolution Time of Flight Aerosol Mass Spectrometer (HR-ToF-AMS), Proton Transfer Reaction Quadrupole-Mass Spectrometer (PTR-Q-MS) and several gas analyzers. The exhaust of vehicles was oxidized in the OFR using variable concentrations of either OH, ranging from hours to days of equivalent atmospheric aging. The amount SA formed in the OFR ranged 9–12 mg/km, 1–3 mg/km and 0.5–1 mg/km for gasoline, LPG and Diesel, respectively. Although diesel vehicles emitted more primary nitrogen oxides than other vehicle types, ammonia emitted from gasoline and LPG vehicles limited the secondary production of NH_4NO_3 aerosol, suggesting that gasoline and LPG vehicles with three-way catalysts could be an important source of ammonia for NH_4NO_3 aerosol formation in ammonia-limited environments such as the Seoul Metropolitan Region (SMR).

Keywords: *Secondary Aerosol, Oxidation Flow Reactor, HR-ToF-AMS, PTR-Q-MS*

Why do We Need the World Air Day? -History and Vision of Global Alliance for Clean Air (GACA)-

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ABSTRACT

Good air quality is fundamental to our survival and well-being. Most of people ignore the importance of air quality while on average while a person inhales about 14,000 litres of air every day. The presence of contaminants in this air can adversely affect people's health and poor air quality can also adversely affect the natural environment and can, in turn, have negative ecological and economic impacts. Air Day Campaign on the 22nd October has been held annually since 2010 in Korea with voluntarily cooperation of several organizations such as Korea Air Clean Association (KACA), Korea Society for Atmospheric Environment (KOSAE), Korea Society for Indoor Environment (KOSIE) , and sponsored Korea Ministry of Environment (KMOE). Air Day Campaign on the 22nd October in Korea aims to connect people with air and raise awareness on their critical importance in our lives. The theme of the 9th Air Day on the 22nd October of 2018 is "Keep Clean Air, Healthy People".World Air Day purpose an international observance and an opportunity to learn more about air related issues and advocating for the sustainable management of clean air resources. The framework of the "Global Alliance for Clean Air (GACA)" was established to make the formal process of designation of the World Air Day as a global awareness raising platform. The final goal of GACA is to get an official adoption of the World Air Day Designation by UN within a few years since World Water Day (22nd March) and World Soil Day (5th December) were already designated by UN.Many discussions are invited about how to promote the implementation of GACA activities and to make cooperation with several UN organizations such as WHO, UNEP, ESCAP, WBG, etc.. and sectors of academia, industry, government, NGOs, and other organizations.

Keywords: *World Air Day, KACA, KOSAE, KOSIE, KMOE, UN*

The Sick Building Syndrome in Hospital Workers: A Cross-Sectional Study of Personal and Environment-Related Risk Indicators

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ABSTRACT

The environment in hospital needs special attention to make sure healthful and good indoor air quality to prevent the workers against hospital-acquired infections and occupational diseases. One of the occupational related condition is a sick building syndrome (SBS) and it is a known factor that contribute to poor work productivity. This study aims to assess the influence of personal characteristics and environment factors on the symptoms of the SBS. A cross-sectional study was conducted in a teaching hospital of the northeast coast Malaysia. A total of 263 nurses from 11 wards who fulfill the study criteria were randomly enrolled for self-administered MM-40 questionnaire assessing the sociodemographic, symptoms of SBS, and work environment. Majority (54.7%) of respondents worked in intensive care wards. Most of them were female (89.0%) with the mean age of 30.4 years. More than 97% were non-tobacco smokers and the median working duration at the present area was 5 years. The prevalence of SBS symptoms was 39.9%. Personal characteristics did not significantly influence the SBS ($p>0.005$). A multivariate logistic regression modelling showed unpleasant odour and varying temperature of work environment were independent risk indicators of SBS. Nurses that exposed to unpleasant odour and varying temperature have 3.79 (95%CI: 2.08, 6.90; $p<0.001$) and 2.15 (95%CI: 1.24, 3.73; $p=0.007$) times higher risk to have SBS respectively. The study confirmed the high prevalence of SBS and the work and significant environment-related risks in hospital workers. Regular indoor air monitoring in the hospital and medical surveillance among healthcare workers is recommended.

Keywords: *Sick building syndrome, healthcare workers, nurse, indoor air quality*



ORAL PRESENTATIONS

Session:

**International Action and Cooperation on Air
Pollution Management**

Date & Time:

15 November 2018, 13:30-15:30

Chairperson:

**Dr. Ken Yamashita,
Asia Center for Air Pollution Research (ACAP)
Email: kyamashita@acap.asia**

Session	International Action and Cooperation on Air Pollution Management	
Venue	Room 12, BCKK	
Time	13:30-15:00	
Chairperson	Dr. Ken Yamashita, Asia Center for Air Pollution Research (ACAP) Email: kyamashita@acap.asia)	
Time Keeper	Noor Fatimah Mohamad Fandi	
13:30	Ken Yamashita, <i>Asia Center for Air Pollution Research</i>	Characteristics of Monitoring Data of EANET and Policy Implications for Atmospheric Environment in East Asia
13:45	Lourdes Morales, <i>U.S. Environmental Protection Agency, and Alan Chan, Sonoma Technology, Inc.</i>	U.S. EPA's AirNow International Air Sensor Applications and Initiatives in Accra, Ghana
14:00	Yiqi Zhang, <i>Hong Kong University of Science and Technology</i>	The Roles of Scientific Research and Stakeholder Engagement for Evidence-based Policy Formulation on Shipping Emissions Control in Hong Kong
14:15	Bulent O. Akkoyunlu, <i>Marmara University</i>	Study of Particulate Matter in Kizilirmak, Turkey with Meteorological Factors
14:30	Lee Kwang Chueng, <i>Camfil</i>	Air pollution and ISO 16890

Characteristics of Monitoring Data of EANET and Policy Implications for Atmospheric Environment in East Asia

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ABSTRACT

The Acid Deposition Monitoring Network in East Asia (EANET) was established as a regional cooperative initiative to promote efforts for environmental sustainability and protection of human health in the East Asian region. EANET started its regular activities in 2001 and its monitoring data has been disclosed for public to provide the scientific information. The monitoring data of EANET was analysed for checking with the ambient air quality standards of World Health Organization (WHO), United States Environmental Protection Agency (USEPA) and Japan. Concentration of ozone and PM_{2.5}/PM₁₀ are not met with the air quality standards in many monitoring sites though nitrogen dioxides and sulfur dioxides are met the standards in almost monitoring sites. The panel analysis was also implemented for checking the spatial and temporal trend in terms of the relationship of air pollutants with the other socioeconomic factors such as the economic development (Gross Domestic Products) and population growth in this area. The results from the analysis were compared with the emission inventory of air pollutants to identify the characteristics of the emission of air pollutants. Based on those analysis, the characteristics of monitoring and future direction of EANET are considered. For example, monitoring of PM_{2.5} and ozone is considered as more significant activity. In addition, the appropriate countermeasures and atmospheric environmental policies in East Asia such as the international cooperation for transboundary air pollution problems are suggested.

Keywords: EANET, air quality, ozone, PM_{2.5}

U.S. EPA's AirNow International Air Sensor Applications and Initiatives in Accra, Ghana

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ABSTRACT

Air pollution harms millions of people around the world and takes a toll on our ecosystem. Many African cities lack the capacity and cost-effective means to measure and characterize ambient air quality in support of critical air quality objectives, which includes setting ambient air quality standards and future implementation of the United Nations Environment Assembly's air quality decision. Under the Africa Megacities Partnership initiative, the Ghana Environmental Protection Agency, the United States Environmental Protection Agency (U.S. EPA), and the World Bank are working together to deploy and operate a low-cost particulate matter (PM) air sensor network in Ghana's capital city of Accra for up to a year. In addition, the project will explore the feasibility of using the U.S. EPA's AirNow International data management system for sensor data processing and management that can be applied to other cities worldwide. Two traditional, regulatory-grade air monitoring instruments will be deployed by the World Bank, which will provide an opportunity to collocate sensors for data quality assessment and sensor calibration methods development. During this presentation, we will discuss the challenges and lessons learned during the planning phase and implementation of this sensor and data management project. We will also talk about initial sensor performance metrics under Accra's unique air quality and weather conditions, spatial PM concentrations based on sensor data, and future plans.

Keywords: *air quality, monitoring, low-cost sensor, PM, Africa*

The Roles of Scientific Research and Stakeholder Engagement for Evidence-based Policy Formulation on Shipping Emissions Control in Hong Kong

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ABSTRACT

Shipping emissions control is critical to air quality management and improved public health for coastal port cities and regions with heavy marine traffic. However, Asian port cities have been slow in introducing regulations on marine fuels for two main reasons – firstly, due to a lack of information and therefore appreciation on the air quality and public health benefits that could be derived; and secondly, due to sensitivity as to whether there may be negative impacts on port competitiveness and trade opposition. Hong Kong, one of the top-ten international container ports in the world, has been proactive in reducing shipping emissions in the past decade. The Ocean Going Vessels Fuel at Berth regulation, enforced since July 2015 in Hong Kong, is the first marine fuel control regulation for ocean going vessels in Asia. This regulation has been adopted nationally by China for its coastal ports, followed by the establishment of domestic emission control areas in its coastal waters that will come into force in 2019. This paper describes the decade-long journey where scientific research led to evidence-based policy changes. New insights and understanding arising from the research enabled cross-sectoral engagement and dialogue among the key stakeholders in government, industry and civil society, which resulted in the political consensus needed for a change in policy and legislation. Similar evidence-based policy formulation, together with public-private sectors dialogue could be useful to other jurisdictions in pursuing a “win-win” path to improve environmental protection and public health through regulating shipping emissions. The same combination of science-to-engagement-to-policy approach could also become part of a knowledge-and-consensus-building process for other environmental policy areas as well.

Keywords: *shipping emissions, evidence-based policy formulation, stakeholder engagement*

Study of Particulate Matter in Kırklareli, Turkey with Meteorological Factors

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ABSTRACT

Fine particles are generally secondary pollutants that can originate from combustion in vehicles/stationary sources and then condense in the atmosphere. These fine particles have low inertia therefore can easily pass through nose and trachea reaching to lungs causing important health problems. Studies based on particulates are not at the adequate level and count in Turkey and this situation is limiting our information on the levels and composition of these pollutants. In this study, the roles of residential heating, industry and Saharan dust advection for the episodes of unexpectedly high particulate levels observed in Kırklareli is investigated. The study is based on observations, synoptic conditions and atmospheric modeling outputs including WRF meteorological model, DREAM dust transport model, HYSPLIT backtrajectory model performed for the specific episodes. PM₁₀ observations of the Kırklareli was compiled and analyzed for the period of 2007-2017. Long-term weather conditions for the same period were studied to get a comprehensive evaluation and better understanding of the dust outbreaks of Sahara. PM_{2.5} and PM₁₀ measurements have also been done in the 20.03.2018 – 21.05.2018 period by two stations in Kırklareli; one located in the city center and the other one located in a rural area to represent the background concentration. Concentrations of PM₁₀ are found to exceed the PM₁₀ daily limit of 50 µg/m³ by 51 cases out of 58 samplings in the city center and by 27 cases out of 57 samplings in the rural area of Kırklareli, that produce 87.90% and 47.36% exceedance percentages, in order. Measured PM₁₀ values ranged between 40-256 µg/m³ in the city center and 14-116 µg/m³ in the rural area. The measured values of PM_{2.5} are lower than PM₁₀ as expected, ranging from 8 µg/m³ to 87 µg/m³ in the city and 7 µg/m³ to 69 µg/m³ in the rural area. It is deduced that under specific conditions dust loaded air parcels travel towards Northeastern Mediterranean and Kırklareli. Critical conditions occur when a strong synoptic-scale low pressure system exists over middle Mediterranean Sea extending towards Africa. Convection zones created by the weather system, instability over Sahara and the pressure gradient force responsible for high wind speeds is the main reason of having high particulate matter concentrations in Kırklareli. It can be expressed that the majority of the PM_{2.5} and PM₁₀ exceedances in Kırklareli is caused by African dust outbreaks.

**Air Pollution in relation in IAQ, danger of PM₁ particles and it's health risk.
The new ISO16890 standard benefits and changes to air filter testing**

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ABSTRACT

Air pollution especially outdoor air quality has been much concern for many years, indoor air quality should be another area that should be looked into. WHO has warned that indoor air can be up to 1000 times more dangerous than outdoor air. Studies have shown that indoor air quality (IAQ) is important as we spend 90% of our time indoors, this can affect our health. Air pollution reporting are commonly reported in PM₁₀ and PM_{2.5}, however focus is shifting to PM₁ readings as more evidence is linking PM₁ particles and its risk to human health. WHO is currently consulting on new air quality guidelines to include PM₁. The new ISO16890 (Air filters for General Filtration) is a new global test standard to address filter efficiency and classification aligned with real world air pollution. ISO 16890 is a significant harmonization to bring together ASHRAE and EN779 to a common testing and eliminate confusion to everyone. An overview of how ISO16890 works, the comparison of test standards for ASHRAE, EN779 and ISO 16890. Advantages of ISO16890 and the classification of systems will be discussed.



ORAL PRESENTATIONS

Session:

**The Roles of Particulate Matter Characterization
and Source Apportionment (AWMA)**

Date & Time:

15 November 2018, 13:30-15:00

Chairperson:

**Alan Gertler,
Desert Research Institute
Email: alang@dri.edu**

Session	The Roles of Particulate Matter Characterization and Source Apportionment (AWMA)	
Venue	Rooms 10&11, BCKK	
Time	13:30-15:00	
Chairperson	Alan Gertler, Desert Research Institute (Email: alang@dri.edu)	
Time Keeper	Nur Faseeha Suhaimi	
13:30	John G. Watson, <i>Desert Research Institute</i>	Review of Successes and Failures in PM Source Apportionment for Air Quality Management
13:45	Sarath Guttikunda, <i>Urban FEmissions Info</i>	Barking up the right tree - The role of source apportionment in air quality management
14:00	N. T. Kim Oanh, <i>Asian Institute of Technology</i>	Source apportionment of fine PM in Bangkok Metropolitan Region by different approaches using continuous monitoring data
14:15	Alan W. Gertler, <i>Desert Research Institute</i>	The Application of Microscopic Chemical Imaging to Determine the Sources Contributing to PM2.5 in Shanghai
14:30	Mark Broomfield, <i>Ricardo Energy & Environment</i>	Characterizing particulate matter in industrial process emissions
14:45	Arnis Asmat, <i>Universiti Teknologi MARA</i>	Major Aerosol Types in Kuching using Threshold Classification Technique
15:00	Shun-cheng Lee, <i>The Hong Kong Polytechnic University</i>	Changes in Atmospheric PM2.5 Composition during the Implementation of Stringent Pollution Control Measures in Shanghai for the 2016 G20 Summit

Review of Successes and Failures in PM Source Apportionment for Air Quality Management

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ABSTRACT

Receptor-oriented source apportionment models intend to identify and quantify contributions from different source types to pollutant concentrations measured at receptors. While the availability of PM composition measurements from speciation networks coupled with receptor modeling software supplied by the U.S. Environmental Protection Agency (EPA) has made it ti easy to produce source apportionment outputs, these advances have not necessarily added to, and have often obscured, understanding of how PM air quality can be improved. Noted successes for air quality management are identification of uninventoried sources, such as fugitive dust, high emitting engines, cooking, solid fuel combustion, and secondary aerosols. Noted failures are mis-identification mixed source factors, lack of sensitivity testing for collinear source fingerprints, and insufficient source markers. Air quality managers should use receptor model results as part of a broader “weight of evidence” approach that challenges their accuracy in light of other information, such as that derived from applying multiple solution methods, evaluating performance measures, obtaining more source-specific PM measurements, conducting detailed case studies, and reconciling with emission inventories and source-oriented models. Modern air quality management also requires more specific source identification than “mobile sources,” “biomass burning,” “industry,” “fugitive dust,” “sea salt,” and “secondary sulfates and nitrates,” which are often the categories indicated by a receptor model study. As these well-documented sources are controlled through changes in operating conditions, fuels and feedstocks, hardware, and emission treatment devices, it becomes more important to identify less obvious sources and “high-emitters” within the broader categories. As primary emissions decrease, the importance of secondary organic aerosol (SOA) increases. Many countries have source emissions, such as those from older engines, cultural practices, and solid fuels combustion, that are not well-represented in current source profile libraries.

Keywords: *source profiles, Chemical Mass Balance, Positive Matrix Factorization, Effective Variance*

Barking Up the Right Tree - The Role of Source Apportionment in Air Quality Management

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ABSTRACT

In India, growing motorization, industrialization, construction, and energy demand in the domestic sector, accounts for the bulk of air pollution. While the scientific message is clear about the linkages between air quality and human health, the pace of the problem is overtaking the ability to mitigate pollution. For long-term gains, the city governments will have to implement vital solutions, within a short time-frame, via a pathway that is precautionary and preventive. That air pollution is a public health issue in Delhi - the capital city of India, is well known. What is less acknowledged is that smaller tier-2 cities are dealing with their own air pollution concerns. Unlike Delhi, however, these cities have not been studied and hence we have little information to assess the sources contributing to the problem, base policy on, and to measure and evaluate progress in terms health impacts. The Air Pollution knowledge Assessment (APnA) city program, launched in 2017, is an attempt to fill this lacuna of information, with an objective to create a baseline database for air pollution in 50 Indian cities, to inform policymakers as they chart out strategies to improve air quality. We use a bottom up approach to map out emissions and model source contributions via dispersion modelling. This allows us to look at the main sources (local and non-local) and communicate the same information for wider public awareness and policy making process. Apart from building baselines for 50 Indian cities, the information from the APnA city program will also feeding the All India Forecasting System, disseminating information for all 640 districts across India, for the next three days. Having a detailed emissions inventory allows us to nest these cities within the larger regional model and give us finer resolution information to support short-term pollution alert system and long-term policy making.

Keywords: *air quality, India, emissions inventory, source apportionment, dispersion modeling*

Source Apportionment of Fine PM in Bangkok Metropolitan Region by Different Approaches using Continuous Monitoring Data

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² Asia Center for Air Pollution Research, Niigata, Japan

ABSTRACT

Weekly monitoring using filter pack samplers (7-day continuous sampling per week) was done simultaneously at two sites in Bangkok Metropolitan Region (BMR): a suburb site (AIT) and Bangkok city center (PCD), from September 2015 to February 2017. The collected filters (83 weekly samples per site) were analyzed for PM_{2.5} mass and compositions (ions, elements and EC/OC). Simultaneously, the samples of gases (HNO₃, SO₂, HCl, NH₃) were also collected using impregnated filters. In the dry season, PM_{2.5} levels were well above those in wet season at both sites. The PM_{2.5} mass concentrations measured at both sites were comparable and were in the same ranges of those reported at the 4 available monitoring stations operated by PCD in BMR. The seasonal average PM_{2.5} for dry season at AIT (32 µg/m³) were even higher than PCD (28 µg/m³), while in wet season the levels at both sites were similar, 15 µg/m³. Source apportionment results by reconstructed mass, CMB and PMF models showed the major contributing source factors to PM_{2.5} at both sites being traffic, biomass open burning and secondary PM. Biomass open burning had higher contributions in dry season (35-38%) than wet season (24-26%) which can be explained by more intensive open burning in dry season, mainly rice straw field burning in BMR. In the wet season, the relative contributions from traffic were higher at both sites but their absolute contribution in terms of mass was rather stable. Back trajectory (HYSPLIT) analysis showed stagnant regional pathways of air mass in the weeks with high PM levels while the low PM weeks were associated with marine pathways of air mass. Simultaneously measured gaseous concentrations provide useful information on the aging of air pollution mixed measured at the sites. The source apportionment results can be used to propose emission reduction measures for the key sources in the study area.

Keywords: *Fine particles, composition, receptor model, source contribution, seasonality*

The Application of Microscopic Chemical Imaging to Determine the Sources Contributing to PM_{2.5} in Shanghai

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ABSTRACT

Shanghai is one of the most polluted cities in the world. In a 2016 report, the World Health Organization (WHO) ranked Shanghai as the seventh most polluted megacity, having an average PM_{2.5} level of 52 µg/m³ during the period of 2011-2015. A recent paper applied a series of economic models to estimate the costs and impacts of PM_{2.5} air pollution in Shanghai and predicted 192,400 deaths and a loss of 2.26% of GDP by 2030. To improve air quality and mitigate these negative impacts, numerous studies have been conducted to determine the major sources contributing to PM_{2.5}. While these efforts shed light on the source contributions, they all required extensive laboratory or modeling efforts that led to a significant time lag between when an event occurred and when the sources contributing to the event were determined. This limited the ability to implement effective control measures during pollution episodes. In this study we demonstrated the ability of microscopic chemical imaging (MCI) coupled with individual particle fluorescence to determine source contributions in near-real time. Monitoring was conducted at the SEMC monitoring site in Pudong during May 2017. Using this spectroscopic approach, source contributions were obtained shortly after the completion of a sampling cycle. Over the sampling period, the primary sources of PM_{2.5} were: mobile sources > industrial activity > coal-fired industrial sources > geological material > biomass burning and cooking > port activities. Based on these findings, it is recommended that: (1) additional source apportionment monitoring be implemented over an extended period and at additional locations to better assess the spatial and temporal variability in source contributions and (2) SEMC investigate control strategies for biomass burning/cooking and port activities, in addition to existing strategies for mobile sources, coal and industrial sources, and geological sources in to reduce the ambient PM_{2.5} levels.

Keywords: PM_{2.5}, source apportionment, air quality, megacities, microscopic chemical imaging

Characterizing Particulate Matter in Industrial Process Emissions

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ABSTRACT

Industrial process emissions of particulate matter pose a substantial environmental and health risk in cities and communities throughout Asia. Extensive data are available to enable emissions from industrial processes to be estimated and evaluated, often as part of air quality modelling studies to support the development of air quality action plans. The most widely used references are data compilations produced by the United States Environmental Protection Agency and the European Environment Agency. However, data on particulate matter emissions are frequently poorly characterized in these compilations. Ricardo Energy & Environment carried out an update of the EMEP-EEA air pollution emission inventory guidebook in 2016. This guidebook supports signatory states in developing emission inventories and reporting under the Gothenburg Convention on Long-Range Transboundary Air Pollution. A key component of this work was to characterize the existing emission factors provided in the EMEP-EEA Guidebook in terms of total particulate matter, filterable or condensable particulate matter, black carbon and elemental/organic carbon, and to provide guidance on interpreting and applying emission factors in relation to these components of particulate matter. Where possible, original references were consulted, and the guidance updated to reflect the status of the published emission factors. This presentation will highlight the definitions of particulate matter, and how they differ in terms of their potential environmental behaviour and risk potential. We will describe the work carried out to better characterize particulate matter emissions and summarize the key findings including: a) breakdown of emissions data between different definitions for different industrial sectors; b) areas where data remained uncertain; and c) Implications for emissions inventory compilation and air quality action planning.

Keywords: *air quality, particulate matter, filterable, condensable, black carbon, elemental carbon, organic carbon*

Major Aerosol Types in Kuching using Threshold Classification Technique

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ABSTRACT

Classification of aerosol types is essential because several aerosol types originate from different sources having different atmospheric impacts, effects on the air quality and radiation balance. This paper analyzed a seasonal characterization of aerosol types by classification threshold techniques using AERosol RObotic NETwork (AERONET) datasets for the period 2011–2015 over Kuching, Sarawak. The aerosol was classified into three major types; dust, biomass burning and urban/industrial. The characterization were carried out based on aerosol loading, aerosol sizes and the scattering direction of aerosols with the combination between Aerosol Optical Depth (AOD), Angstrom Exponent (α), Asymmetry Factor (ASY) and their interrelationship to investigate the dominant aerosol types and to examine the variation in their seasonal distribution. The results revealed that during dry and pre-monsoon, dust aerosols were dominant while during wet and post-monsoon prevailing aerosols were biomass burning and urban industrial, and the mixed type of aerosols were present in all seasons. Low concentration of AOD was recorded during wet season with (0.03 ± 0.004) in November to February. Meanwhile, high concentration of AOD (2.33 ± 1.03) was observed from June to October where the dry season is taking place. Further characterization results have shown that the urban aerosols were recorded with 34.7%, dust (35.7%), biomass burning (23.8%), and maritime (4%) based on the relationship between AOD and α . For aerosol classification algorithm using three parameters indicated that the air pollution was strongly correlated where 39% to urban/industrial, followed by dust (27%) and biomass burning (20%). These types of aerosol discriminated from AERONET were in good agreement with MODIS (Moderate Resolution Imaging Spectroradiometer) measurement.

Keywords: *Air quality, Aerosols, Aerosol Optical Depth (AOD), Sun-photometer*

Changes in Atmospheric PM_{2.5} Composition during the Implementation of Stringent Pollution Control Measures in Shanghai for the 2016 G20 Summit

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ABSTRACT

To guarantee “G20 Blue” during the 2016 G20 summit (9/4 to 9/5) in Hangzhou of Zhejiang Province, the adjacent Shanghai assigned 14 days (8/24 to 9/6) as the period of G20 Air Quality Assurance to implement a series of stringent air pollution control measures. In this paper, the concentrations and characteristics of criteria air pollutants were systematically investigated before and after the G20 summit. Two supersites in different functional areas were chosen, Pudong (urban site) and Dianshan Lake (suburban site), respectively. Daily average PM_{2.5}, carbonaceous species, water soluble inorganic ions (WSIIs), SO₂, NO₂, and O₃ concentrations were analyzed. The results show that the air quality was greatly enhanced during the 14-day G20 Assurance compared to the previous two years. Daily average PM_{2.5}, SO₂, and NO₂ concentrations decreased by 55.3%, 11.4%, and 10.7% at urban site, 49.5%, 15.8%, and 9.5% at suburban site, respectively. However, only O₃ remained an increased level during that period, which was higher than that in the same compared period of 2014 to 2015. The effective control of high altitude emissions (e.g., power plants and petrochemical industries) can reduce the emissions of PM_{2.5} and SO₂ and most of NO₂ reductions can be ascribed by traffic control. Additionally, the pollution characteristics and main influencing factors of atmospheric particulate matter were expounded by analyzing the change in trace gases by multidimensional comparisons in Shanghai. The final objective is to comprehensively evaluate the coordinated air pollution emergency control measures to ensure good air quality, to deepen the understanding of the variations of air pollution, and to summarize the effective experience and measures in practice for the scientific management of air pollution in the future.

Keywords: *G20 summit; air control measures; Shanghai; supersite; reductions*



ORAL PRESENTATIONS

Session:
Air Pollution Monitoring and Process

Date & Time:
15 November 2018, 15:30-17:00

Chairperson:
Prof Peter Brimblecombe,
City University of Hong Kong
Email: pbrimble@cityu.edu.hk

Session	Air Pollution Monitoring and Process	
Venue	Room 12, BCCK	
Time	15:30-17:00	
Chairperson	Prof Peter Brimblecombe, City University of Hong Kong (Email: pbrimble@cityu.edu.hk)	
Time Keeper	Nor Ashikin Mohd Sopian	
15:30	Ervina Ahyudanari, <i>Institut Teknologi Sepuluh Nopember</i>	Aircraft Growth Impact on Carbon Emission Load at Airport Surrounded
15:45	Dietrich Schwela, <i>Stockholm Environment Institute</i>	Low-cost Air Quality Sensors and their Use in Air Quality Management
16:00	Eliani Ezani, <i>Universiti Putra Malaysia</i>	Development of Low-Cost Effective and Novel Approaches for Personal Black Carbon (BC) Measurements
16:15	Prakash Doraiswamy, <i>RTI International</i>	Feasibility of Low Cost PM2.5 Sensors for Air Quality Monitoring by Citizen Scientists
16:30	Alan Chan, <i>Sonoma Technology, Inc.</i>	Planning Your Sensor Deployment: Practical Guidance
16:45	Margaretha Quina, <i>Indonesian Center for Environmental Law</i>	Airshed, Air Quality Implementation Plan and Local Emission Standard Reform: A Comparative Note from Asia's Biggest Cities
17:00	Arthur van der Meer, <i>AIRBUS Defence & Space Netherlands</i>	Space Solutions for Air Quality Monitoring

Aircraft Growth Impact on Carbon Emission Load at Airport Surrounded

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ABSTRACT

Flight activity produces a variety of substances that can contaminate the air around the airport and harm the environment. One of the substances contained in an aircraft emissions gas is carbon element (C) in Carbon Monoxide (CO), Carbon Dioxide (CO₂) and Hydrocarbon (HC) compounds. Contrary to Indonesian Presidential Regulation No.61 of 2011 which calls for reducing greenhouse gas emissions There has been no concrete steps taken by the government or related parties to make efforts to control gas emissions in the aviation sector. In order to obtain a solution to reduce airport carbon emissions, it is necessary to analyse the accumulation of aircrafts emission. Juanda Airport's carbon emission load due to aircraft movement is selected as the case study. Using the exponential smoothing and econometric method to predict the aircraft movements up to Year 2026. The content of CO, HC- and CO₂ compounds for each type of aircraft are reviewed. Therefore, that the aircraft emission load is obtained per unit, which is then connected with flight volume. This stages are aimed to obtain load total emission of Juanda Airport up to year 2026. Maximum emission load occurred in Year 2025 with CO concentration of 1505,611 Lbs, HC-5,867 Lbs and CO₂ 2,35 x 10⁹ Lbs. From these results it can be concluded that the largest emissions due to aircraft movement are CO₂ compounds that can trigger greenhouse gases and global warming, while CO and HC-, which can harm health and the environment, also have concentrations in aircraft emissions. In addition, the three compounds have similar distribution patterns. However, compare to the field measurement, the rate of emission for each compounds were not the same. Due to dispersion caused by wind and temperature, the predicted value of emission was different. This indicate that we may never realize that the accumulation of aircraft emission increase. This situation may occur in tropical area where the high temperature cause quick dispersion of emission compounds.

Keywords: *air quality, aircraft emission, tropical area, aircraft movement, airport area*

Low-cost Air Quality Sensors and their Use in Air Quality Management

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ABSTRACT

Within a framework of air quality management the potential uses of low-cost air quality sensors include supplementation of existing air quality monitoring networks with the objective to increase spatial representativeness and assess the compliance of air quality concentrations with air quality standards. There appears, however, to be a common misconception that measurements with low-cost air quality sensors are capable of producing results that are comparable to those of monitoring with reference devices. Laboratory and field investigations have proven that this is not necessarily the case due to the complex nature of gas and particle air quality sensor responses. Some air quality sensors show no correlation to reference instrument measurements, while others show some correlation with fair to reasonable coefficients of determination ($r^2=0.4-0.8$). In addition to poor correlations, air quality sensors often have greater data uncertainty, making them less reliable than that of measurements with reference analysers both in the USA and the European Union. Some air quality sensors have exhibited sensor sensitivity to environmental factors like temperature, humidity, and barometric pressure. The response of air sensors has been shown to change as they age while in operation. There is almost no evidence about the long-term behaviour (longer than six months) of low-cost air quality sensors. Challenges with sensor drift have necessitated frequent calibration. Sensors can be slow to respond to changes in pollutant levels, causing pollutant spikes to be underestimated. Finally, air quality sensors are often marketed for one pollutant, but exhibit cross-sensitivity to other pollutants. This paper reviews the current literature on low-cost air quality sensors and discusses the requirements to be considered before any purchase of a specific sensor. It has also the objective to pick out those low-cost air quality sensors, which eventually can be recommended for supplementing existing networks.

Keywords: *performance of low-cost air quality sensors, air quality monitoring, reference measurements, literature review*

Development of Low-cost Effective and Novel Approaches for Personal Black Carbon (BC) Measurements

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ABSTRACT

Black carbon (BC) was recently recognised as 'short lived' climate pollutant and potentially give negative implications to human health. The costs of personal real-time BC measurement system are approximately 5 times higher than the total cost of the personal sampling pump and analytical techniques. It may become necessary to apply the low cost and innovative simple system especially in the resource constrained countries that having little experience to measure personal BC exposure. This study aims to provide a straightforward and low-cost method to estimate (BC) concentrations in different environmental settings. Two novel techniques were developed using reflectance measurements and digital scanned images. AE51 Aethalometers were co-located and operated over identical time periods of monitoring. Incremental changes of filter darkness and scanned values were quantified using EEL 43D Smoke Stain Reflectometer and flat-bed office scanner respectively over different monitoring period. Measurements were made in the laboratory, indoor office, university campus walking route and a nearby outdoor urban background environment. The average percentage of darkness for all filters in this study ranged from 101.8 to 75.1%. The two reflected light techniques studied provide a good linear relationship. The variation of reflectance and scanned values (99% and 97% of the variation) were suggested to be influenced by duration of exposure, magnitude of filter sources and air monitoring approaches. The use of flexible traditional and state-of-the-art monitoring devices with appropriate validation techniques will improve the characterization of BC exposure in different microenvironments. Therefore, these approaches can be applied to approximate BC values and estimate exposures to human health.

Keywords: *black carbon (BC), measurement methods, air quality*

Feasibility of Low Cost PM_{2.5} Sensors for Air Quality Monitoring by Citizen Scientists

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ABSTRACT

Low and middle-income countries (LMICs) lack a robust air monitoring network that is necessary to track air quality, understand its impacts on human health and to inform air quality management strategies. Satellite data provide spatial coverage that cannot be achieved using ground monitors. Recently, there has also been a proliferation of low-cost sensors that are more affordable than typical regulatory-grade monitors. However, the quality of those data is uncertain. This paper will describe our findings from our NASA-funded study examining the feasibility of using low-cost sensors for monitoring of ambient fine particle (PM_{2.5}) concentrations using citizen scientists. We present the study design and findings from our evaluation of commercial low-cost sensors in the lab and in the field. We also present our experience with the sensors deployed by citizen scientists as part of a prototype field sensor network. We recruited about 45 citizen scientists in the Los Angeles area in California, USA to perform this prototype field deployment. We share experiences from the citizen recruitment and present results from the performance of the sensors in the field for nearly a 12-month period. The end goal of this project is to examine the spatial gradients in surface PM_{2.5} concentrations and compare it to satellite observations of aerosols. The data from the prototype deployment will help us explore column to surface relationships in the region and in evaluating the PM_{2.5} spatial distribution observed by satellites. Results from our feasibility study indicate that the sensors are highly correlated to the reference measurement methods and show high data completeness but show a constant positive bias. The high correlation and constant bias relative to reference instrumentation suggest potential for data post-processing. We apply the findings from this study to expand our field deployment to three regions, including India as part of our ongoing work. Our feasibility study demonstrates the utility of these sensors to be part of an ambient network. The results from this study have significant applications for air quality monitoring using sensors and satellite data, which may be particularly beneficial to LMICs.

Keywords: *air quality, PM_{2.5}, low-cost sensor, satellite, aerosol optical depth, megacities, LMIC, low and middle-income countries*

Planning Your Sensor Deployment: Practical Guidance

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ABSTRACT

Low-cost air quality sensors are being deployed in cities around the world to give people the opportunity to better understand the air they breathe. New devices are being developed and evaluated frequently, and can help air quality agencies identify pollution sources and problems more quickly and at lower cost than conventional monitoring systems. Sonoma Technology, Inc. (STI) is an independent company that has evaluated the quality of a number of low-cost sensors in the laboratory and field, and helped air quality agencies and community members worldwide to better use and understand air sensors. We will talk about practical guidance in planning measurements and deploying low-cost sensors, with a focus on sensing particulate matter (PM) concentrations. Common issues we will discuss include sensor selection, sensor network design, sensor siting, performance metrics, data validation, pre-deployment planning, deployment steps, routine maintenance needs, calibration techniques, and data reporting. We will provide some examples and lessons learned.

Keywords: *air quality, monitoring, low-cost sensor, PM*

Airshed, Air Quality Implementation Plan and Local Emission Standard Reform: A Comparative Note from Asia's Biggest Cities

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ABSTRACT

Lancet Commission Report on Pollution and Health outlines some key lessons from global experience about how to effectively use laws and policy to reduce air pollution. Among other thing, it highlights key component of successful air pollution control policy: clear target and strategy made based on data. However, since the air flows regardless administrative boundaries, in many cases the decision by one administrative unit to permit polluting sources is the main cause of pollution in neighboring cities. Telling which source to be prioritized also involves a lot of technicalities. In the developing cities of Asia, the policy tool to ensure this scientific information available and connected to decision making in controlling the air pollution is not always available. This research will look into national air quality laws and regulations governing air pollution control on Asia's biggest cities. It will look into Jakarta (Indonesia), Manila (Philippines) and New Delhi (India), given the air quality problems have driven public outcries for years. Specifically, this research will summarize and compare how the three countries regulates the use of the following policy tools: airshed, air quality implementation plan and specific emission standard for polluted localities. Given the scope and limitation of this research, the impact of air quality implementation plan to emission standard will be limited to stationary sources (e.g. industry & power plants). This research will mostly normative, based on secondary sources and literatures. At the end of the research, this paper will outline how the developing countries can take lesson learned from one another, and how other Asian cities can improve their policies and learn from their neighbor's policy tools, as well as its success or failures.

Keywords: *air quality laws, air quality implementation plan, local emission standards*

Space Solutions for Air Quality Monitoring

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ABSTRACT

AIRBUS presents a global monitoring service on atmospheric composition and emission allocation. Air composition and meteorological data from satellites and local sensors are combined into a chemical transport model to build up or validate trace gas and particulate matter emission sources and their impact on air quality. The system is using the AIRBUS' developed OMI and TROPOMI satellite sensors to be able to quickly disclose new regions around the globe at low cost, as has been done for eastern Asia and the Indian continent. This yields a database of emission sources at a spatial resolution of about 3.5 km (and in the future 1km) and provides daily observation data on regional and transboundary transport of pollutants. Target constituents are NO₂, particulate matter, CH₄, (tropospheric) ozone and SO₂. The full blown system adds data from several monitoring solutions (on ground, aircraft, HAPS and nanosatellites) and various data like land-use and traffic information to achieve street level spatial resolution while maintaining accuracy and validation status. The resulting database of emission sources has the same street level spatial resolution and is intended to serve local issues. It has presently been built for several EU cities. This advanced and cost-competitive Air Quality Monitoring solution is used for awareness building, policy development and policy evaluation and enforcement. The intent is to realize a commercial global service, based on local cooperation. The paper will describe the service and development status.

Keywords: *Air Quality Monitoring, Remote Sensing, Tropomi*



ORAL PRESENTATIONS

Session:

**The Roles of Particulate Matter Characterization and
Source Apportionment (AWMA)**

Date & Time:

15 November 2018, 15:30-17:00

Chairperson:

**Alan Gertler,
Desert Research Institute
Email: alang@dri.edu**

Session	The Roles of Particulate Matter Characterization and Source Apportionment (AWMA)	
Venue	Rooms 10&11, BCKK	
Time	15:30-17:00	
Chairperson	Alan Gertler, Desert Research Institute (Email: alang@dri.edu)	
Time Keeper	Nurfatin Izzati Ahmad Kamal	
15:30	Judith Chow, <i>Desert Research Institute</i>	Brown Carbon as a Source Marker for Biomass Burning Contributions to PM2.5
15:45	Sothea Kok, <i>Asian Institute of Technology</i>	Polycyclic Aromatic Hydrocarbons (PAHs) Levels and Contributing Source in Phnom Penh, Cambodia
16:00	Zailina Hashim, <i>Universiti Putra Malaysia</i>	Inhalation Health Risk Assessment of Atmospheric PM10 and Heavy Metals from Bauxite Mining Areas in Kuantan, Malaysia
16:15	Luke Knibbs, <i>The University of Queensland</i>	Long-term exposure to ambient air pollution and the respiratory health of Australian children
16:30	Yong Zhang, <i>Chinese Academy of Sciences</i>	Emission Characteristics of PM2.5 and trace gases from household wood burning in Guanzhong Plain, Northwest China
16:45	Dasari Prasad, <i>Telangana State Pollution Control Board</i>	Impact of urbanization on air pollution in Hyderabad-India
17:00	Mete Tayanç <i>Marmara University</i>	PM2.5 Analysis and the Determination of PAH Constituents at a Densely Populated Area of Istanbul

Brown Carbon as a Source Marker for Biomass Burning Contributions to PM_{2.5}

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ABSTRACT

Brown carbon (BrC) is being quantified along with organic and element carbon by a new multiwavelength carbon analyzer. Two years of data from U.S. speciation networks have quantified BrC, produced by the smoldering phase of biomass burning in more than 50,000 samples representing different environments. On average, non-urban samples show higher BrC fractions of short-wavelength absorption than urban samples, owing to greater influence from biomass burning from prescribed burns and wildfires. Residential wood combustion contributions are evident in urban samples during winter. Comparisons between BrC levels at nearby locations before, during, and after identified burns allow separation clear separation of biomass contributions from those from engine exhaust. Replicate analyses show agreement for the TC, OC, EC, all of the OC fractions, and EC1. High correlations of attenuation by different instruments in replicate analyses demonstrate high precision in attenuation measurement. There is evidence of filter loading effects based on the ratio of light attenuation to EC for the 25% of all samples with the highest EC concentrations, and loading corrections similar to those used for the seven-wavelength aethalometer need to be investigated and applied. These high loadings are most evident at the urban sites that normally experience higher BC concentrations. Angstrom Absorption Exponents (AAEs) are an indication of aerosol light absorption properties that affect the Earth's radiation balance. AAEs by determined by a 2-wavelength ratio (405 and 635 nm) from a least-squares exponential fit of the seven wavelengths by ~15% for flaming-dominated samples, but by as much as 50% for smoldering samples. It may be that the shape of the transmittance attenuation curve contains more information about the sources than is available from the constant AAE assumption.

Keywords: *source apportionment, carbon analysis, material balance, radiation balance, smoldering biomass burning*

Polycyclic Aromatic Hydrocarbons (PAHs) Levels and Contributing Source in Phnom Penh, Cambodia

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ABSTRACT

Polycyclic aromatic hydrocarbons (PAHs) levels in gaseous and particulate phases were collected at the urban and residential sites of Phnom Penh, Cambodia over a period of one year (February 2016 – January 2017) to investigate the seasonal variation and phase distributions. The 16 priority PAHs compounds were analyzed. The daily average of PAHs in gaseous phase was 89 ± 26 ng/m³, and 56 ± 23 ng/m³ were higher than particulate PAHs of 32 ± 8 ng/m³ and 29 ± 14 ng/m³, at the urban and residential site, respectively. The PAHs levels in dry season were higher than that in wet season at both sites, i.e., the total PAHs of 147 ng/m³ in dry months, 123 ng/m³ in wet months at the urban site. From the emission inventory analysis, mobile source contributed about 39% of total PAHs emission and followed by solid waste burning (22%), power plant (20%) and domestic cooking (15%). Diagnostic ratios of PAHs concentrations allowed to draw insight about the predominant sources and their respective importance. As results, the emission from traffic, biomass burning and diesel were the major sources of PAHs emissions in Phnom Penh. CMB receptor modeling is used to quantify the source contributions. The source apportionment results will be used to recommend measures to reduce PAH levels in the air of Phnom Penh.

Keywords: PAHs; emission inventory; source apportionment; diagnostic ratios; Phnom Penh

Inhalation Health Risk Assessment of Atmospheric PM₁₀ and Heavy Metals from Bauxite Mining Areas in Kuantan, Malaysia

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ABSTRACT

The environmental and health effect of the bauxite mining activities in Kuantan, Pahang, have been a public concern recently, hence, need to be addressed. The objectives of this study were: (1) to determine particulate matter <10 µm (PM₁₀) and heavy metal levels (Al, Cd, As, Cr, Ni and Pb) of red bauxite dust in the air within the households in the areas surrounding the mines and (2) to assess the environmental health risk of the communities nearby the bauxite mining areas. Cross-sectional study was conducted in January 2016, just after the bauxite moratorium, on 162 randomly selected households in 3 residential areas namely Felda Bukit Goh (FBG), Jalan Besar Bukit Goh (JBBG) and Kuantan Port Consortium Flat (KPCF). Respondents were interviewed for their background information and health condition. For environmental sampling, 42 households were sampled for PM₁₀ and selected heavy metals levels using Gillian air sampling pumps equipped with filter paper for 24 hours period. The results showed that the PM₁₀ levels exceeded the limit value of 150 µg/m³ for 24 hours exposure in all the 3 areas. Al, Cd, As, Cr, Ni and Pb levels in the ambient air exceeded the U.S Department of Health and Human Services (ATSDR) limit value. The health risk assessment for non-carcinogenic effects also indicated that the inhalation exposure from the hazard quotients (HQ) exceeded 1, for Cd in JBBG (HQ=4.1328), Cr in FBG (HQ=74.0560), JBBG (HQ=84.4088), KPCF (HQ=76.8655) and Ni in FBG (HQ=60.5322), JBBG (HQ=66.9509) and KPCF (HQ=58.8111). The lifetime cancer risk (LCR) also showed a lifetime excess cancer risk of more than 10⁻⁶ for Cr: KPCF (LCR=2.5234 x 10⁻²), JBBG (LCR=2.8763 x 10⁻²), and KPCF (LCR=2.6191 x 10⁻²). For Ni, the FBG (LCR=1.8401 x 10⁻⁵), JBBG (LCR=2.0352 x 10⁻⁵), and KPCF (LCR=1.7878 x 10⁻⁵). From the findings, the overall PM₁₀ levels and the heavy metals content (Al, Cd, As, Cr, Ni and Pb) exceeded the Standard Malaysian and USEPA Guidelines. Cd, Cr and Ni showed non-carcinogenic hazard in term of acute dermal problem as well as lifetime carcinogenic risks which will take time to surface. Overall, the PM₁₀ as well as the heavy metal (Cd, Ni, and Cr) content emitted in the air significantly contributed to the ill health of the respondents.

Keywords: Particulate Matter (PM₁₀), Respiratory Symptoms, Dermal Symptoms

Long-term exposure to ambient air pollution and the respiratory health of Australian children

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ABSTRACT

The majority of studies on long-term exposure to air pollution and respiratory health in children have been performed in countries with moderate concentrations of pollutants. We aimed to determine the effect of outdoor nitrogen dioxide (NO₂), as a surrogate for urban air pollution, on current asthma and lung function in Australia, a low-pollution setting. We undertook a national cross-sectional study of children aged 7–11 years during 2007–2008 in 12 Australian cities. We used a questionnaire to collect information on asthma and socio-demographic and environmental covariates. We measured lung function (forced expiratory volume in one second [FEV₁], forced vital capacity [FVC]) and fractional exhaled nitric oxide [F_eNO] using standard methods. We estimated lifetime and recent (last 12 months) exposure to NO₂ based on regulatory monitors near each child's school, and also estimated recent exposure at each child's school and home address using a satellite-based land use regression (LUR) model. Our analysis comprised 2,630 children. We observed a significant association between an IQR (4 ppb) increase in recent NO₂ exposure and current asthma using monitor and LUR-estimated exposures: odds ratios (ORs) were 1.24 (95% CI: 1.08, 1.43) and 1.54 (95% CI: 1.26, 1.87), respectively. Each IQR increase in monitored recent NO₂ exposure was associated with a significant decrease in predicted FEV₁ (-1.35 percentage points [95% CI: -2.21, -0.49]) and FVC (-1.19 percentage points [95% CI: -2.04, -0.35]). An IQR increase in NO₂ was associated with a 71% increase in F_eNO (95% CI: 38%, 112%). We found evidence of associations between exposure to outdoor NO₂ and multiple adverse respiratory effects in a population-based sample of Australian children performed in a country with low NO₂ concentrations.

Keywords: *children's health, asthma, air pollution*

Emission Characteristics of PM_{2.5} and trace gases from household wood burning in Guanzhong Plain, Northwest China

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ABSTRACT

Considering woods used as the primary fuel on countryside in Guanzhong Plain and its burning contribution for PM_{2.5}. Five kinds of common wood fuel (Persimmon-tree, Pear-tree, Apple-tree, Jujube and Peach) were collected and burned in a laboratory combustion chamber with a common stove to determine gaseous pollutants emission (i.e. CO₂, CO, NO_x, SO₂) and PM_{2.5} emission with source profiles and speciated emission factors. The average EFs were estimated to be 1401±71 g·kg⁻¹ for CO₂, 53.48±11.83 g·kg⁻¹ for CO, 1.48±0.54 g·kg⁻¹ for NO_x, 0.53±0.19 g·kg⁻¹ for SO₂ and 3.01±0.72 g·kg⁻¹ for PM_{2.5}. OC, EC and water-soluble ions (sum of Na⁺, NH₄⁺, K⁺, Mg²⁺, SO₄²⁻, NO₂⁻, NO₃⁻, Cl⁻) are major constituents for PM_{2.5} mass, accounting for average abundance of 29.86%±2.03%, 15.65%±1.07% and 17.51%±6.24%, respectively. The average EFs of OC and EC were 910±279 mg·kg⁻¹ and 465±279 mg·kg⁻¹. EC1 was the dominant carbon fraction with average abundance of 44%±3% for total carbon in PM_{2.5}. For water-soluble ions, Sodium (Na⁺), potassium (K⁺) and chloride (Cl⁻) were the dominant with average abundance of 4.69%±2.51%, 3.81%±2.13% and 3.30%±2.45% in PM_{2.5}. Average OC/EC ratio of woods burning was 1.96±0.45, lower than 11.94-20.20 for straw combustion. In addition, the average K⁺/EC ratio was 0.25±0.15, an order of magnitude lower than those from straw residues burning (0.65-3.16). Mass reconstruction of PM_{2.5} could explain average 87.35%±8.28% component. Similarity measures (i.e., Student's t-test, coefficient of divergence, correlations, and residual to uncertainty ratios) show the wood profiles were similar for the species measured. Which indicated those profiles could be resolved from one another by receptor modeling.

Keywords: *Source profiles; Emission factors; wood residues; wood burning*

Impact of Urbanization on Air Pollution in Hyderabad-India

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ABSTRACT

Hyderabad is the state capital of Telangana State and fifth largest metropolitan city of India. The city has witnessed a rapid growth rate of around 9% since the year 2000. Centralization of developmental activities around the city coupled with raise in service sector increased the economic activity resulting in large-scale migration to the city. The population of the city increased to more than 8million at present from a little over 3 million as per 2001 census leading to amalgamation of the Industrial areas as integral part of the city due to increased horizon. The result is proliferation of vehicles from 1.08 million in 2001 to a mammoth 2.8 million with no corresponding increase in the road space. The annual average concentration of Respirable Suspended Particulate Matter (PM10) and Fine particulate matter (PM2.5) for the year 2017 is 101ug/m³ and 51ug/m³ respectively and exceeding the standards by 45% on an average. An action plan for lowering the air pollution levels is under implementation involving different departments as stakeholders and can be broadly categorized into five areas. a) Infrastructure – improving roads, mass transit systems & Parking facilities b) Vehicles- Bharat stage- IV norms, Phasing out 15 years old vehicles, replacement of 2 stroke engines, etc, c) fuels - Low sulphur diesel, gaseous fuels, Low benzene petrol and Bio-diesel d) Traffic management - synchronisation of signals, removing of intercepts, providing timers, foot over bridges for pedestrians, etc. e) Industrial Pollution abatement. This paper elucidates the present air quality management in Hyderabad city and the results of source apportionment study. The gaps in the management for better air quality and suggestions for better management of air quality and the co-benefits that accrue viz reduction of green house gases, morbidity and increase in productivity are quantified.

Keywords: *Particulate matter, Action plan, Air quality management, Source apportionment*

PM_{2.5} Analysis and the Determination of PAH Constituents at a Densely Populated Area of Istanbul

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ABSTRACT

PM_{2.5} organic chemicals such as n-alkanes, PAHs, n-alkanals, n-alkanols, n-alkanoic acids, n-alkenoic acids, and dicarboxylic acids constitute 58-100% of the fine particle mass and show important diurnal and seasonal variations according to their emission sources and meteorology. An important constituent of the aerosols are polycyclic aromatic hydrocarbons (PAH) that are mainly being emitted from the incomplete combustion of organic matter. Due to their high atmospheric reactivity and potential mutagenic and carcinogenic properties, the understanding of their time variations, especially diurnal, is of great importance. This study focuses on diurnal variability of the particulate-phase PAHs for the first time in the megacity of Istanbul and the results can potentially aid in source apportionment studies for the improvement of local air quality. In this work, high-time resolved PM_{2.5} samples were collected every 2h during the day and 12h during the night at a sampling site heavily influenced by traffic and other combustion sources during 28 Jan – 04 Feb 2017. Sample processing and analysis were performed with an online thermal desorption-gas chromatography-mass spectrometry technique (TD-GC-MS). The total daily concentrations of fifteen PAHs ranged in 66-367 ng m⁻³. Significant diurnal variations were observed with lowest concentrations at night and highest concentrations at around 0900-1100h. Multiple linear regression analysis show that temperature, wind speed, wind direction, mixing height, and traffic explain 70% of the diurnal variability of the total PAH concentrations. Variability in the individual PAH values is discussed in the light of meteorology and traffic effects.

Keywords: PM_{2.5}, organic fraction, PAH, Istanbul.



ORAL PRESENTATIONS

Session:

Air Quality Management and Climate Change

Date & Time:

16 November 2018, 9:00-10:30

Chairperson:

**Assoc. Prof. Dr. Mazrura Sahani,
Universiti Kebangsaan Malaysia
Email: mazrura@ukm.edu.my**

Session	Air Quality Management and Climate Change	
Venue	Room 12, BCCK	
Time	9:00-10:30	
Chairperson	Assoc. Prof. Dr. Mazrura Sahani, Universiti Kebangsaan Malaysia (Email: mazrura@ukm.edu.my)	
Time Keeper	Fahimah Hashim	
9:00	Prof Jamal Hisham Hashim, <i>United Nations University- International Institute for Global Health</i>	How Does Climate Change Interact with Air Quality to Affect Human Health
9:30	Yang Xing, <i>City University of Hong Kong</i>	The Balance of Dispersion And Deposition In Reducing Air Pollutants In Urban Parks
9:45	HDS. Premasiri, HMPSK. Ellegala*, HU. Vindhya, <i>National Building Research Organisation</i>	Influence of Local Wind Profile on Dispersion of Air Pollutants in World Heritage City Kandy, Sri Lanka
10:00	Don S. Jayaweera, <i>Strategic Enterprises Management Agency (SEMA)</i>	Assessment of net impact by Change of Fiscal Policy on Rolling Stocks and Fossil Fuel from 2010 to date in Sri Lanka and marginal increase of Air Pollution result on those Policies – Critical Evaluation on vision less ad-hock policies

How Does Climate Change Interact with Air Quality to Affect Human Health

Jamal H. Hashim

United Nations University-International Institute for Global Health,

ABSTRACT

Climate change is probably the greatest environmental threat confronting humankind in this century. While the Paris Climate Agreement of December 2015 has agreed to hold global temperature increase to well below 2.0°C, this does not seem too promising now with the U.S. pulling out of the climate agreement and the recently erupted U.S.-China trade war. The greatest impact of climate change will be on extreme weather events which we are already witnessing in terms of increased frequency and intensity of typhoons, tropical storms, floods, droughts and erratic monsoons. What has yet to be adequately discussed are the implications of climate change on air quality and vice versa. We know that aerosol pollution leads to negative radiative forcing and global cooling, even though we know that the health threats from aerosols far outweigh any positive effect they may have on global warming. Climate-triggered droughts, sandstorms and forest fires lead to serious air pollution and health outcomes, not only locally but also across national boundaries. Air quality is also intricately associated with weather which is already affected by climate change. The recurring Southeast Asian haze as a result of the El Nino phenomenon is a case in point. On the other hand, mitigation against climate change such as promotion of mass transportation system can generate co-benefits resulting in air pollution reduction, with subsequent improvement in air quality and human health.

The Balance of Dispersion and Deposition in Reducing Air Pollutants in Urban Parks

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ABSTRACT

Air pollutant concentrations decline rapidly with distance from busy roadways into urban parks. This could potentially arise from dispersion, deposition and transformation. The balance between these factors is not always carefully considered. In particular, the role of vegetation in improving air quality may be over emphasized when considering choice of layout of vegetation and human exposure in urban green spaces. Previous work has often ignored the influence of vegetation on turbulence. Here we explore the decline in concentration of traffic derived pollutants as they disperse into urban parks and assess the balance between deposition to vegetation and advection-diffusion processes. There is a general view among those who manage urban infrastructure that the improved air quality in parks results from the uptake of pollutants by vegetation. However, measurements available from the literature and modelling studies offer only limited support to this view. In particular, VOCs, PAHs, fine particles show relatively slow rates of deposition to vegetation, with the picture for NO_x and ozone is complicated by an active chemistry. Our analysis of data from the literature, some new observations near roads and modelling suggests that in many urban parks it is dispersion that dominates the reduction in pollutant concentrations rather than deposition to vegetation. This has important policy implications given the effort expended in modern park design, the choice of trees to be planted and concern over ecosystem services.

Keywords: *decay profile, line source dispersion, pollutant transformation, near road environment, vegetation uptake*

Influence of Local Wind Profile on Dispersion of Air Pollutants in World Heritage City Kandy, Sri Lanka

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ABSTRACT

Kandy, a world heritage city in Sri Lanka is located at the middle of the island with high elevation which is surrounded by mountain ranges and the nature is similar to a bottom of a basin. Its geographical condition has made it a major transportation center which can be reached by major motor ways in several directions to the city. It has estimated that about 2,000 bus trips and more than 3,000 further through-servicers are operate daily within the Kandy urban area. Air emission from buses and other vehicles therefore deteriorate air quality in the area, and its geographical condition results worsening the condition by low dispersion. Therefore, urban air pollution is identified as a serious environmental problem in Kandy over past two decades. The study was done to investigate the influence of local and seasonal wind patterns of the city on the dispersion of air pollutant. Air quality and wind pattern was measured at different locations within Kandy Municipal Council area. Sulphur Dioxide and Nitrogen Dioxide concentrations were measured for four consecutive weeks together with observing wind direction to represent wind pattern. The results show that the air pollution concentrations are related to local wind flow path within the city. The relationship between air pollution and wind speeds was statistically analyzed and a weak inverse relationship can be observed among them ($r = -0.420$ for SO_2 and $r = -0.313$ for NO_2). Air pollution concentrations and wind measurements were mapped using inverse distance weighted (IDW) interpolation to obtain spatial variation. The long-term air quality monitoring results noted substantial correlation between seasonal wind pattern and pollution dispersion as well. The air quality management efforts in this world heritage city should specifically consider such seasonal variabilities, and should be incorporated into plans to ensure that ambient air pollution levels maintained within safe norms throughout.

Keywords: *Air Pollution, Kandy, Wind Pattern*

Assessment of net impact by change of Fiscal Policy as a demand management tool for Road Vehicle Fleet and consumption of Fossil Fuel of transport sector – Evaluation for the period from 2010 to 2018 in Sri Lanka

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ABSTRACT

Main focus of this paper is to evaluate and review the tax policies introduced by the Government of Sri Lanka (GOSL) since 2010 to 2018 with respect to the characteristics of operation road vehicle fleet and the consumption features of fossil fuel within transport sector and their impact to the air pollution which are generated from mobile sources. It has been found to be that the specifically PM_{10} and $PM_{2.5}$ reduced by 150% against “do nothing scenario”. This research has established the economic and social cost or the economic and social benefits of this fiscal policies introduced by the GOSL in 2011. This research found the 100% Petrol and Diesel motor vehicle fleet after four years period (2011 to 2014) had made 56:44 ratio Petrol and diesel fleet to Hybrid and electric motor cars. It is estimated that the US \$ 840 million saving of from the importation of petrol and diesel in 2017 against do nothing scenario. The change of fuel prices in January has costed US \$ 1.2 billion as a result deviating from the objective of fiscal policy on motor vehicle importation. This research found that the arbitrary change of the well-designed fiscal policy in 2015 and 2018 cost the economy US \$ 3 to US \$ 4 billion on importation which made very high pressure on exchange rate of Sri Lankan Rupee. This research recommended the bad policy impact experience to be overcomes with findings to reduce vehicle emission. It also came up with price, income elasticity coefficient to use on the vehicle ownership tax in order to achieve desired operational vehicle fleet. These research finding can be customized for any other country with the similar research study focusing fiscal policy.

Keywords: PM_{10} ; $PM_{2.5}$; Fiscal Policy; Hybrid and Electric, Fossil Fuel consumption, US \$, Direct and external cost and benefits;



POSTER SESSION

Comprehensive Air Quality Management in Qatar: Our Challenges and The Path Forward

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ABSTRACT

The Qatar Environment and Energy Research Institute (QEERI), in partnership with the Ministry of Municipality and Environment (MME) and the Ministry of Public Health (MoPH), are developing a comprehensive air quality management program for the State of Qatar. The six point program centers on the development of a chemistry-transport modeling Decision Support System (DSS) and national ambient monitoring program to identify the priority air quality research and management areas and introduce intervention strategies to mitigate the impacts of poor air quality. We present an assessment of the unique challenges facing air quality management in Qatar along with a summary of existing and planned ambient monitoring capabilities, assessment of PM, O₃ and NO₂ concentrations relative to national standards, development of low earth orbit satellite-based & bottom-up emission inventories, preliminary results from the triple-nested WRF-Chem DSS covering the Arabian Peninsula and future plans for an air quality sensor network. In addition, we address preliminary results of source apportionment and elemental characterization of measured particulate matter concentrations from the Doha urban area. Gas phase pollutant characterization, the dependence on local meteorology and chemical reactions driving the oxidative capacity of the local atmosphere are discussed within the context of winter and summer intensive measurement campaigns conducted in the Greater Doha Area.

A General Survey on Traffic-Induced Air pollution in Kyoto City, Japan

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ABSTRACT

The worsening of air quality induced by traffic emission in urban area have attained-growing responsiveness, resulting the global burden of diseases. Despite an increment of severe damages of air pollution, investigating traffic-induced air pollution remains a gigantic challenge. The goal of this research is to analyze the traffic characteristics in the district of Kyoto Prefecture. This research is based on the availability of real-time traffic information which gather using an intelligent transport systems. The ETC2.0 probes and high performance cameras at fixed points can estimate the travel speeds and route of vehicles and capture images of traffic flow, respectively. A data gathered from the various road classifications (national expressway, urban road, general national road and etc.), road condition (commercial and non-commercial dense populated area, flat area, mountains and other urban area) and road facilities (pavement, bicycle extension lane). The vehicle composition and volume, average daily travel, travel speed, ratio day and night and rate of congestion were estimated. The finding of this research is a beneficial platform for future research in terms of estimating the traffic emission-induced air pollution, determining the health burden or diseases and managing the traffic congestion.

Keyword: *Traffic, vehicle speed, average daily travel, rate of congestion, urban.*

Mathematic Model Prediction of Fine Particulate Matter Concentrations in Bangkok: Implications for Air Quality and Health

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ABSTRACT

Atmospheric particulate matter particles with a diameter less than 10 micron (PM_{10}) and less than 2.5 micron ($PM_{2.5}$) have been adverse human health effect. Ambient air pollution data in central area of Bangkok monitored by Pollution Control Department, Thailand were collected over ten years in Bangkok from 2008 to 2017. The daily average air pollution data were used as the input data to develop mathematic models by stepwise multiple regression technique. The equations divided for general air and roadside air were applied to forecast $PM_{2.5}$ concentration in Bangkok from 2018 to 2020. The predicted results were validated by statistical methods. The validated equations were effectively used to predict $PM_{2.5}$ concentration in Bangkok with the existing atmospheric variables. The $PM_{2.5}$ from the observed and predicted values was interpolated with GIS with Inverse Distance Weighted (IDW) technique to create PM distribution maps in Bangkok. GIS-based maps illustrated the variability and risk area of ambient $PM_{2.5}$. These outcomes could be support national policy for the awareness of human health impact from fine particulate matter.

Keywords: PM_{10} , $PM_{2.5}$, GIS, Atmospheric particulate matter, Multiple regression analysis

Cooking Fuel Used at Home during Pregnancy and Birth Outcomes among Females in Kalutara, Sri Lanka

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ABSTRACT

Household Air Pollution (HAP) is a risk factor of adverse health outcomes. The major source of HAP in developing countries is the use of unclean fuel (i.e., biomass, kerosene) for cooking. About 66% of Sri Lankan households use biomass for cooking. To compare birth outcomes among female residents in households using clean (electricity and liquid petroleum gas (LPG)) and unclean cooking fuels for cooking during pregnancy. An interviewer administered questionnaire was administered (n = 475) to women during the third trimester of pregnancy residing in selected households in the Kalutara Medical Officer of Health area to obtain information on sociodemographic characteristics, type of fuel used for cooking (primary, secondary and tertiary) and kitchen characteristics such as presence of a chimney. Birth weight, occipito-frontal circumference (OFC) and length of new born babies were ascertained from the Child Health Development Record. Out of the 469 households, a secondary cooking fuel was used by 376 (80%) and a tertiary cooking fuel was used by 160 (34.2%) households. There were 446 (95.1%) term babies and 23 (4.9%) pre-term babies. Birth weight of babies born to mothers of households using a clean primary cooking fuel (n=159) was significantly higher than the birth weight of babies born to mothers of households using an unclean primary cooking fuel (n=287) (3.05±0.43 kg vs. 2.97±0.41 kg; p=0.05). Although prematurity was less among mothers in households using a clean primary cooking fuel (3.6%) as compared to mothers of households using an unclean primary cooking fuel (4.9%), the difference in the percentages was not statistically significant. Birth weight of babies born to mothers' resident in households using an unclean primary cooking fuel was significantly less than that of babies born to mothers in households using a clean primary cooking fuel during the pregnancy.

Keywords: *air quality, health impact, megacities*

A Novel Method to Quantify the Efficacy of Surface Ozone Mitigation Policies by using Space Based Observations.

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ABSTRACT

It is crucial how surface ozone concentrations and the exposure to human or the crops respond to emission reduction of its two main precursors, NO_x and VOCs, for policymakers to explore the effective surface ozone mitigation policies. This study developed the method to estimate the efficacy of emission reduction of NO_x and VOCs to mitigate surface ozone pollutions quantitatively, using space-based observations of column FNR measured by OMI (Ozone Monitoring Instrument). Firstly, using air quality simulations for several days in summer over Japan, the quantitative relationship between column FNR and the sensitivity of ozone concentration to emission reduction of each precursor for each grid cell (about 20*20 km² square similar to that of OMI) were derived. And then, by substituting predicted column FNR values in each grid cell into the above-derived relationship curve, and also by utilising the statistical data such as population or crop yield in that grid cell, different metrics regarding the efficacy of emission reduction policies to mitigate ozone concentrations and the exposures to human and the crops were estimated. Furthermore, the estimates of these metrics obtained by the present approach were compared to those obtained directly by air quality simulations. The results show that the relationship between the sensitivity of ozone concentration to emission reduction of each precursor and column FNR could be represented by the single identical curve for each precursor, and, that the estimates of the different metrics regarding the efficacy of surface ozone pollution mitigation policies derived with the present approach were consistent with those predicted directly using air quality simulations. Therefore, it is suggested that the developed method using space-based observations can be useful when we estimate the efficacy of the surface ozone mitigation policies to be implemented now, which we can hardly estimate by using air quality simulations.

Keywords: *column FNR, efficacy of surface ozone pollution mitigation policies, spaced-based observations, OMI (Ozone Monitoring Instrument)*

Exploring the Regional Variation in the Association of Fine Particulate Matter and Emergency Ambulance Dispatches in Japan

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ABSTRACT

It has been known that there is regional heterogeneity in the health effects of particulate air pollutants on mortality. The source of heterogeneity may arise from differences in the characteristics of population at risk, the behaviour to avoid the exposure, and compositions of particles. To elucidate the regional variation in health effects of particulate air pollution, we examined the association of particulate matter with diameter of less than 2.5 μm ($\text{PM}_{2.5}$) with emergency ambulance dispatches due to acute illnesses using data from 44 cities throughout Japan during 2012-2015. Generalized linear model with Poisson distribution was applied to estimate the city-specific effects of $\text{PM}_{2.5}$ on ambulance dispatches. Ambient temperature, seasonality, long-term trend, and day of week were adjusted. Then, city-specific effect estimates were combined using meta-analysis with a random-effects model. To explore the regional heterogeneity in effect estimates, we stratified the cities based on the city characteristics, such as population and air pollution levels, and repeated the analyses. During the study period, mean $\text{PM}_{2.5}$ concentration ranged from 8.0 to 19.1 (median 14.4) $\mu\text{g}/\text{m}^3$ among the cities. Of more than 3 million emergency ambulance dispatch cases, the positive associations were observed at the same day (lag0) for most cities, followed by inverse associations at lag1, which was considered as harvesting. Per a 10 $\mu\text{g}/\text{m}^3$ increase in $\text{PM}_{2.5}$ at moving average of lag0 to lag2, the city-specific percent change in ambulance dispatches ranged from -3.0% to 3.5%. The pooled result showed that a 10 $\mu\text{g}/\text{m}^3$ increase in $\text{PM}_{2.5}$ was associated with an increase of 1.1% (95% Confidence interval: 0.8, 1.3) in ambulance dispatches. The effect estimate tended to be higher in cities with larger population. Regional heterogeneity in health effects of air pollutants may be partially attributed to city characteristics.

Keywords: *air quality, health impact, megacities*

Association between Exposure Values of Particulate Matter 10 (PM₁₀) and Lung Function Status among Workers in a Construction Site.

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ABSTRACT

Particulate Matter 10 (PM₁₀) are inhalable particles that may enter human respiratory system. Exposure towards it may result in occupational lung disease such as asthma and chronic obstructive pulmonary disease (COPD). This cross sectional study was conducted between July and September 2016. Based on purposive sampling done on 38 subjects for each exposed and non-exposed group, both groups were monitored by personal air monitoring pump for 8 hours and underwent spirometry test to measure the lung function after the monitoring has been done. Statistical analysis revealed that the exposure of PM₁₀ is significantly higher than the non-exposed group with $p=0.0001$. The lung function for exposed group is significantly lower with FEV₁ % Pred. ($p=0.005$) and FVC % Pred. ($p=0.0001$). The results of this study is consistent with the personal exposure of workers to activities such as grinding, drilling and welding process. However, correlation analysis on PM₁₀ and lung function showed no significant association ($p=0.486$, FEV₁ % Pred.) and ($p=0.608$, FVC % Pred.). This could be due to small sample size, smoking status and a not homogenous sample subjects. In conclusion, the data supports the effect of exposure to lung function, nevertheless confounding factors must be in consideration.

Keywords: *PM₁₀, Lung Function, Personal Air Monitoring, Spirometry Test, FEV₁, FVC*

Air Pollution and Effects on Cardiovascular and Respiratory System: A Time-Series Analysis.

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ABSTRACT

Air pollution is often associated with various spectrums of health problems in particular the cardiovascular and respiratory systems. This study was conducted to determine the criteria air pollutants-trends which are the PM₁₀, CO, NO₂, SO₂, O₃ in Cheras area and the meteorology factors towards the risk of admission of cardiovascular and respiratory cases in Hospital Canselor Tuanku Muhriz (HCTM) between 2010 to 2015 data. The data was obtained from the Department of Environment's (DOE), Department of Meteorology Malaysia, and Health Information Department, HCTM. Risk was estimated by using the General Adaptive Model (GAM) with the single Poisson. The combined pollutant model for cardiovascular and respiratory cases from lag 0 to 7 was analyzed using the R software. The results show that PM₁₀ had higher than the Malaysian Air Quality Standards. The trend shows that NO₂, SO₂ and CO had higher readings on weekdays while ozone had higher reading on weekends. The analysis of cardiovascular model, PM₁₀ increased the risk of admission with relative risk (RR) 1.0110 (95% CI 1.0018-1.0202) at lag 5 and risk of RR 1.0126 (95% CI 1.0036-1.0217) at lag 7. The CO increased risk of admission between RR 1.0007 and RR 1.0010 at lag 0, 1, 4, 5, 6 and 7. It was found that CO increased the risk of respiratory illness admission with RR 1.0008 (95% CI 1.0000-1.0016) at lag. 2. In the mixed pollutant model, PM₁₀ at lag 7 was noted to have a significant effect with CO at lag 0, 1, 4 and 6 for the cardiovascular model with the risk between RR 1.0098 and RR 1.0108. The results of this study support the assertion that air pollution contributes to the risk of cardiovascular and respiratory admissions. Consequently, these findings could be used as guidance for the authorities in planning better air quality management in Malaysia, and thus to reduce these burden of the disease in the future.

Keywords: *Air pollutant, meteorology factors, respiratory illness admission*

Policies on Reduction of Air Pollution in Ulaanbaatar and its Co-Benefits

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ABSTRACT

During these urbanization processes cities and townships have encountered numerous environmental problems affecting quality of air, soil and water. This paper addresses three interlinked issues that are critical to the urban air pollution management efforts of Mongolia focusing in Ulaanbaatar city. First, why air pollution in Ulaanbaatar became disastrous in winter and what are main causes and pollutant sources. Second, what legal, policy and regulatory measures were taken in the past ten years. Finally, it will present two case studies: one from energy sector and another from transport sector by examining impacts of different regulatory measures on targeted policy interventions and their co-benefits in terms of environmental and economic estimates. Specific interventions include (1) subsidized clean stove replacement program, which addressed household energy utilization practices in *ger* areas and (2) tax based incentive policy on import of electric, hybrid and LPG-fuelled vehicles - by illustrating how targeted measures led to behavioral changes and relevant co-benefits in given period. The two cases of Mongolia highlight the importance of initiating high-level dialogue and public awareness education about co-benefits approach at very early stages of any policy intervention to ensure that target beneficiaries are well informed and equipped with relevant knowledge to avoid any un-intended disruption. Based on the results and lessons learned, it concludes that on one hand, carefully designed and well-funded-policy measures could achieve long-term objectives provided that sustainable enforcement mechanisms are in continuous place. On other hand, it suggests that simple tax incentive policy measures could achieve transformative effects over short period with less efforts if target population could immediately benefit from low cost purchasing power. It is expected that co-benefits assessment results of these case studies will be relevant to other cities of Mongolia for new/similar policy intervention purposes and non-Mongolia audience in similar context.

Keywords: *Ulaanbaatar, policy, air pollution, household energy, co-benefits, hybrid vehicles, and emissions; Urban Planning and City Solutions for Clean Air.*

TVOC Measurements and GCMS Spectrums at Selected Polluted Environments in Sri Lanka

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ABSTRACT

Eleven different Total-VOC (TVOC) monitoring sites were identified for detailed measurements in Colombo. Real time TVOC measurements for 10 minutes (reporting every minuted data) from all sites were carried out using Photo Ionization Detectors (PID), EW technologies, USA. Selected sites for TVOC measurements were: wood using cook stove area; LPG using cook stove area; petroleum station; vehicle spray paint area; tobacco smoking area; incense sticks burning area; outdoor polythene/ and other garbage burning area; vehicle service area; mosquito coil burning area; kerosene using cook stove area and kerosene lamp burning area. Measurements were conducted 1ft, 5ft and 10ft. Further to understand the detailed VOC species air samples were collected using Teflon air bags for the above mentioned eleven different TVOC monitoring sites. 5 liter Screw cap valve Tedlar bags were used to collect the air samples at each location. Sample collection time was 10 minutes. Collected samples were kept in-side a black bag (to minimize the photochemical reactions). Air-conditioned vehicle was used to transport the air bag samples to the laboratory for immediate GCMS analysis to minimize further reactions. Air samples were analyzed using the GCMS available at the University of Colombo at the Department of Chemistry. USEPA Method (EPA TO-14A/TO-15 mod-Volatile Organic Compounds by GC-MS) was followed for the analysis to identify the detail VOC compounds at each location. For the quantification of the VOC species two standard VOC mixtures were used namely; USEPA Volatile Organic Compounds Mix 2 and Mix 8, 2000µg/ml in methanol. To obtain the clear spectrums, head space samples were also analyzed using GCMS. Results showed that highest TVOC was observed at petroleum station; vehicle spray paint area; kerosene using cook stove area. Further, major VOC components emitted from the sources were identified and some of them are highly carcinogenic components.

Keywords: *Volatile Organic Compounds, carcinogenic, Sri Lanka*

Air Pollution in The City of Colombo in Relation to Volatile Organic Compound Concentration

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ABSTRACT

Field measurements of predominantly transport induced Volatile Organic Compound (VOC) concentrations at seven major road traffic junctions in the city of Colombo. Vehicle counts were conducted simultaneously considering the different type of vehicles and as a total in each location. The gases produced by vehicles were collected using Teflon air bags and VOC component were analyzed using GCMS. Medium traffic flow monitoring to measure beside the road exposure were conducted using MiniRAE Lite TVOC monitor in May 2017. The Total VOC (TVOC) levels were measured by fixing TVOC monitor inside a moving vehicle keeping air flow tube outside the shatter of vehicle for on the road measurement exposure. 24-hour measurements were conducted at five locations using the mobile monitoring unit with NIST traceable. The TVOC hourly median for concentrations beside the road exposure were 226.5, 194.5, 190.0, 99.0, 91.5, 72.5 and 56.0 ppb at the sites Grandpass, Maradana, Borella, Dehiwala, Narahenpita, Kollupitiya, and Fort, respectively. TVOC concentrations for on the road exposure were 536.0, 321.5, 216.0, 195.0, 189.0 and 183.0 ppb between Narahenpita to Grandpass, Maradana to Borella, Borella to Narahenpita, Fort to Maradana, Kollupitiya to Fort and Dehiwala to Kollupitiya, respectively. TVOC levels were high on the road compare to beside the road. This could be explained by the immediate tail-pipe emissions (undiluted) from the ongoing vehicles were higher than the beside the road measurements. Further in Kollupitiya, Narahenpita and Dehiwala, highest vehicle fleet was cars and in Borella, Maradana, Grandpass and Fort, highest vehicle fleet was three wheelers. Time series data on TVOC concentrations follow the typical traffic pattern during the day at Grandpass site have hectic hours from 6.30am to 7.30am and leisurely at 5pm to 8pm. However, when the power plant was in action, TVOC concentrations were high from 3am to 5am.

Keywords: *Volatile Organic Compound (VOC), traffic exposure*

Concentration Analysis of Carbon-Free Plan in Jeju Island using WRF-SMOKE-CMAQ Simulation

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ABSTRACT

As interest and obligations regarding climate change increase in the international community, governments around the world are pursuing policies to reduce greenhouse gases. Jeju Special Self-Governing Province in the Republic of Korea is also currently working on a “Carbon Free island Jeju project” that aims to build smart grid cities, replace 100% of vehicles with electric vehicles, and completely convert to new renewable energy by 2030. According to the data announced by Jeju Special Self-Governing Province, the greenhouse gas reduction will amount to 2,812kt through the policy. However, while the data released by Jeju only show the amount of greenhouse gas reductions as expected effects due to the policy, air quality improvement caused by the reduction of air pollutants was not shown. Since ozone is a climate change gas belonging to the SLCPs category and at the same time a hazardous substance that can cause extensive damage to humans and plants, it is important to predict ozone concentration changes and its impact on air quality. Therefore, this study calculates the air quality improvement in ozone due to the “Carbon Free Island Project” using the WRF-SMOKE-CMAQ modeling framework. In the framework, WRF is the Weather Research & Forecasting model, SMOKE is the Spatial Matrix Operator Kernel Emissions model, and CMAQ is Community Multiscale Air Quality model. This study not only analyzes the air quality improvement of regional ozone, but also analyzes the air quality improvement of ozone per capita considering exposure population by using total census data.

Keywords: *Ozone, Carbon Free island Juju, CMAQ, air quality, climate change*

Contribution of Vertical Diffusion to Ozone Concentration on High Ozone Days

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ABSTRACT

Although ozone existed in substantial amounts before the Industrial Revolution, maximum concentrations are much higher today than pre-industrialization levels. Even background concentrations far away from sources of pollution are considerably higher. Ozone causes cellular damage to leaves that adversely affects and reduces photosynthetic rates, plant production, and requires increased resource allocation to repair and detoxify leaves. Ozone also acts as a greenhouse gas, absorbing part of the infrared energy emitted from the earth. Successful implementation of ozone management policies requires a detailed understanding of interactions of both ozone chemistry and related physical processes. Vertical diffusion, one of the physical processes, has a significant influence on ozone concentration. The pollutant is often accumulated through diffusion in high concentration cases, and the concentration tends to change in the vertical direction. The contribution of vertical diffusion to the ozone concentration is evaluated based on Integrated Process Rate (IPR) analysis using CMAQ in the Seoul metropolitan area in Korea on high ozone days during June, 2012. The effect of vertical diffusion illustrated a positive contribution at an altitude of around 33 m. Vertical diffusion occurs due to concentration differences caused by the dominant production of ozone by solar radiation and its precursors at ground level. The contributions of vertical diffusion at an altitude of 300m was the smallest, negative up to 1,000m, and zero above 1,000m. Understanding the contribution of vertical diffusion and other parameters as a function of altitude may provide some clues to more effective ground-ozone management.

Keywords: *ozone, vertical diffusion, CMAQ, climate change*

Effect of Mt. Baek-du Eruption on Climate Change using CMAQ

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ABSTRACT

Volcanic eruptions can release huge amounts of gases and particles in a short time, thus it can have disastrous air quality impacts on a large scale. Therefore, pre and post management of the volcanic eruption are important. Moreover, volcanic eruptions are an important natural cause of climate change since long ago. Former studies show that relatively small ash clouds can have much more impact than the same volume of sulfur-rich gases because formation of atmospheric sulfur aerosols has a more substantial effect on global temperatures than simply the volume of volcanic ash, as could be seen in the eruptions of El Chichon and Mt. St. Helens. Mt. Baek-du has the largest VEI (Volcanic Explosion Index) ever to occur in the Korean peninsula, and it has recently shown some unusual surface deformations and volcanic earthquakes. In this study, the concentrations of health and climate change related pollutants from a potential Baek-du eruption are estimated by WRF-SMOKE-CMAQ modeling system. Modeling period was from Nov 30st, 2012 to Dec 20th, 2012 for 10 days spin up period and 10 days actual simulation. The date was chosen from HYSPLIT-4 back trajectory model results as the worst-case scenario and its meteorological data were constructed by WRF-ARW. SMOKE fire algorithm was used to simulate the plinian eruption, and volcanic emissions were formulated assuming VEI-4. CMAQ was used to simulate the volcanic eruption considering atmospheric chemistry. Maximum surface concentration of PM_{2.5} simulated above the Seoul area was about 300ug/m³. This implies that an eruption of Mt. Baek-du may not only cause adverse effects in the atmosphere above the Korean peninsula, but also cause health effects due to high concentration of PM_{2.5}. There is also the possibility that impacts may reach all of East Asia, and consequently have an impact on regional climate change.

Keywords: *air quality modeling, climate change, volcanic eruption*

Ethical Considerations of Recommending or Distributing Facemasks for Community Protection from Air Pollution Events: An Organizational Perspective

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ABSTRACT

Globally, air pollution is the 9th highest cause of morbidity. Fine particulate matter is a group 1 carcinogen. Protecting populations from harmful levels of exposures is a globally-significant public health issue. One available intervention is the use of facemasks. There is very limited evidence as to the efficacy of facemask use in community settings during particulate air pollution events. This paper analyses the ethical dilemma for agencies as to whether to recommend and/or distribute facemasks. Ethical principles from public health ethics are used to conceptually analyse the issue, focusing on the principles of effectiveness, precaution, non-maleficence, autonomy, stewardship and justice/equity. There is a tension between the ethical principles of effectiveness and precaution as to whether facemasks should be provided, a tension that could be mediated by enabling the public to make an informed autonomous choice about use. A decision to recommend or provide facemasks will be contingent on a number of factors specific to the particular pollution event and the culture, economic status and expectations of the agency and society.

Keywords: *Facemasks, human ethical and behavior, air pollution*

Lessons Learn: Shortcut Policy to Adopt Soot-free Urban Bus Fleet

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ABSTRACT

Air pollution is a serious threat for people's health, especially in cities with high density traffic. The WHO released statistics on 2 May 2018 that 9 out of 10 people worldwide breathe polluted air. This leads to 7 million deaths every year. Outdoor air pollution caused 4.2 million of these in 2016 globally while each of PM and O₃ contributed to 79,700 premature deaths and more than 900 deaths in Indonesia. In Jakarta, 58.3% of illnesses were caused by air pollution, which brings the medical treatment cost to US\$ 3.9 billion in 2016. Technically, CNG helps Jakarta to adopt soot-free bus fleet from impossibility refer to its requirement especially availability fuels specifications that are comply with Euro6/VI standard. And miscalculation makes BRT Trans Jakarta (TJ) management misleading to operate bus fleet refers to its cost effectiveness, then it is bringing them set back to add their fleet with diesel buses since this year. They have perception that to operate diesel bus of Euro3/III standard would give them cost effective refer to investment cost and maintenance cost of buses and its fleet include fuel performance cost (fuel economy). Even though the power performance of fuel economy diesel fuel better 30%, with each of investment cost and maintenance cost cheaper USD .04/KM and USD .03/KM, but refer to the fuel pricing show us that CNG option gives TJ management more efficiency by USD .11/KM for the whole of cost accounting. In relation with cost effectiveness to reduce per ton emissions, CNG option also gives cheaper cost with USD 3.69, USD 5.31, USD 15.77, USD 51.31 each of them for CO, NO_x, HC, and PM; rather than to utilize Euro4/IV standard of diesel bus that needs USD 8.08, USD 11.77, USD 33.92, USD 111.46 each of them for CO, NO_x, HC, and PM.

Keywords: *soot-free bus fleet, health effect, air pollution threat, cost effective.*

Idling Emission at the Intersections and Traffic Emission Reduction Measures: A Case Study at Saladaeng Intersection in Bangkok, Thailand

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ABSTRACT

Bangkok has had a traffic congestion problem causing from high traffic volumes, complex roads route and unprofessional traffic management, etc. When vehicles stop at the signalized intersection, the drivers always keep their vehicle's engines running which also emit high level of exhaust pollutants, especially Carbon monoxide (CO). This study aimed at estimating CO concentration from traffic at the Saladeang intersection in Bangkok, Thailand, using the CAL3QHC model which has algorithm to estimate queue length for different signal timings. The required inputs were traffic volume, types of vehicles, vehicle composition, meteorological conditions and vehicle emission factors. These data were required inputs to the model to estimate pollutant concentrations at the intersection. Running and idling emission factors of different vehicle emission control technologies were estimated by using vehicle emission testing data from the Thailand Automotive Emission Laboratory and pre-developed emission factors from the Emission FACTor (EMFAC). Others data were collected from the survey and video camera at the intersections. Outputs of the model were the concentration of CO from 6am - 10pm on weekdays and weekends during December 2017 and February 2018. These output concentrations were compared with the monitoring data, and found that the predicted and monitored CO concentration showed similar pattern during different times of the day. Thus, the CAL3QHC can be used to predict traffic CO concentration at the Saladaeng intersection. The CAL3QHC model was, then, used to estimate CO concentration reduction based on three existing traffic management plans in Thailand's Transportation System Development Strategies; changing red signal timing, converting all buses to electrical buses, and allowing only eco-cars at the intersection.

Keywords: *traffic emission, idling emission, traffic management plan*

Mapping Public Discourse and Narratives for Air Quality Issues in India

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ABSTRACT

India will be facing an insurmountable crisis in the future concerning on the counts of pollution-related deaths. Data modelling for the year 2015 shows that in Asia, India has the second highest number of premature deaths attributable to air pollution and PM 2.5 concentration in the air. New Delhi, Gwalior, Varanasi and Kanpur were among the 14 Indian cities that figured in a list of 20 most polluted cities in the world, based on their toxic air quality, data released by World Health Organization. This paper will map types, attributes and characters of public discourse and narratives happening in India concerning air quality issues, post-2016. It intends to cover exhaustive investigation and high-level analysis on air quality discussions happening in public domain in national to the local context. It plans to include how diverse actors like government, academia, research institutes, TV media, print media, digital media, social media, civil societies, bi-laterals, multi-laterals, donors, scientific bodies, air quality data-based APIs, technology providers and community-based organizations or constituencies. The primary rationale behind this paper is to find on what points and traits India's public discourse on air quality is centred around and what strategic shift it needs if India wants to evolve an effective strategy to counter air pollution.

Keywords: *air quality, air pollution, PM_{2.5}, air quality monitoring, public narrative, strategic communication, public awareness, public education, government actions, public policy*

Challenges and Opportunities of Introducing Electricity as a Household Cooking Fuel Option in the HKH Region: A Case Study of Bhutan and Nepal

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ABSTRACT

The Hindu Kush Himalaya (HKH) mountains serve as the water towers of Asia providing water to over 1.3 billion people, and a number of other services, including food, biodiversity, and energy. These HKH mountain system have an estimated hydropower potential exceeding 500 GW that should be able to meet the growing energy need of the region. Access to electricity in the HKH countries is increasing, but access to clean cooking facility have remained low, as over 80% of the population still rely on solid fuel to meet their cooking needs. This has implications in the air quality which effects human health negatively. According to Global Burden of Disease data for 2016, premature deaths attributed to illness as a result of household air pollution from the use of solid fuels for cooking and heating in HKH countries was 1.68 million. Thus, it is imperative that steps are taken to utilize the hydropower resources and replace solid fuel based cooking to electricity cooking. Our paper discusses the challenges and opportunities of introducing electricity in the cooking fuel mix in the HKH region. We draw upon lessons learned from other countries including Bhutan, Ecuador, South Africa that have introduced electricity in the cooking fuel mix to illustrate the potential pathways for the transition of solid fuel based products to electricity cooking. These countries have used a basket of approaches in including electricity in their cooking fuel mix such as favorable electricity pricing, cost reduction in cooking appliances, developing national policy, and programs to facilitate the integration of electricity in cooking fuel. We present a case study of Bhutan and Nepal, two countries with similar geographical areas in the HKH region yet significant differences in household cooking energy sources, for cross learnings and to recommend pathways for moving from fossil fuel-based products to electricity.

Keywords: *air quality, electricity based cooking, Hindu Kush Himalayas*

The Estimation of Economic Losses from Air Pollution using Satellite Imageries

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ABSTRACT

Air pollution in Thailand causes economic losses from the mortality and morbidity more than 51,000 million US dollar in year 2017. The main pollutant is from a particulate matter especially Particulate Matter less than 2.5 microns in diameter ($PM_{2.5}$). Thailand has 77 provinces while air monitoring stations are installed only in 33 provinces. However, the use of satellite imageries can be applied for estimating $PM_{2.5}$ cover all provinces in Thailand. The imageries of Aerosol Optical Depth (AOD) from Himawari were used for estimating $PM_{2.5}$ concentrations. The regression analysis between the reflectivity values and $PM_{2.5}$ concentrations from monitoring stations was generated for $PM_{2.5}$ evaluation across Thailand. We found that the annual mean of $PM_{2.5}$ were ranging from $7 \mu\text{g}/\text{m}^3$ (at Krabi) to $50 \mu\text{g}/\text{m}^3$ (at Bangkok). The number of premature deaths in Thailand year 2017 caused by $PM_{2.5}$ were around 23,000 persons. The highest number was found in Bangkok at around 4,300 persons while the lowest number of about 25 persons was Ranong. This study may be an example of using remote sensing to access air pollution problems in the area where has no the air monitoring station. This also can be used for estimating the economic losses of all countries in Asia.

Keywords: *$PM_{2.5}$, Aerosol Optical Depth, Economic losses, Mortality, Morbidity*

Determining The Best Probability Distribution Model for Predicting Ozone (O₃) Exceedances at Several Air Quality Monitoring Sites in Malaysia

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ABSTRACT

Tropospheric Ozone (O₃) is one of the strongest atmospheric oxidants and has become an important criteria pollutant in the earth atmospheric surface layer in Malaysia environment. High concentration O₃ has been found negatively contributes to many environmental problems including health problem, vegetation, building materials, as well as climate changing. Thus due to the facts, it is necessary to gain a good understanding on the characteristics and behaviour of O₃ pollution as well as predicting the exceedances for the purpose of managing and mitigating O₃ pollution. In this study, several probability distributions including Gamma, Lognormal, Normal and Weibull were investigated with the aim to find the best model to predict O₃ exceedances at three air quality monitoring sites; Petaling Jaya, Shah Alam and Putrajaya. The study analysis was conducted using two years' period (i.e., 2013 and 2014) of hourly O₃ maximum data with Maximum Likelihood (MLE) parameter estimation method. The models performance was assessed using Kolmogorov-Smirnov, Cramer-von Mises and Anderson-Darling test and visualized using Cumulative Distribution Function (CDF) curve. The study has found that in general, hourly maximum O₃ can be represented by Gamma model at all sites. However, during the Southwest Monsoon season, Weibull distribution was found to be the best distribution for Petaling Jaya and Shah Alam. The return period of O₃ exceedance was estimated to be in the range of 3 to 8 days and became shorter during the Southwest Monsoon season at all sites. Thus, this result indicates that the frequency of exceedances per month is between 4 to 10 times. The result also has shown that O₃ in Petaling Jaya, Shah Alam and Putrajaya has exceeded the Malaysia Ambient Air Quality Guideline of 0.1 parts per million (ppm).

Keywords: *air quality, probability distribution, Ozone, return period, exceedances*

Effects of Land Use Types on PM₁₀ Concentration Distribution In Central and Northern Regions of Peninsular Malaysia

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ABSTRACT

This study presents the distribution of PM₁₀ variations during the normal period (without haze, monsoon wind influence and biomass burning) at selected region in the central and northern regions in Peninsular Malaysia for year 2014. The variations of PM₁₀ between the regions were analysed to see how it can be associated with varies land use types. Spatial interpolation of Kriging and Inverse Distance Weighting (IDW) methods were employed for interpolating PM₁₀ concentration over limited dataset from eight monitoring stations for both regions. As for land use types, satellite image Landsat was classified into five major classes; forest, agriculture, clear land, mix-development (industrial, residential and commercial). From the classification map, land use type of mix development occupied most of the central region. Meanwhile, different landscape of land use in northern region was revealed, where the forest and clear land that related to agriculture activities is more obvious. Overall results show that the central region has exhibited high concentration of PM₁₀ (55.523 µg/m⁻³) as compared to the northern region where the highest concentration only recorded at the 31.804 µg/m⁻³. This has indicated that the PM₁₀ concentration can be associated with the land use type which reflects the activities at particular areas.

Keywords: *Air quality, PM₁₀, Land use type, Spatial interpolation, GIS*

Temporal Assessment of Near-Road Traffic-Related Emission Pollutants in Petaling Jaya, Selangor, Malaysia

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ABSTRACT

The aim of this study is to assess the temporal analysis of near-road pollutant concentration of vehicular emission in an urban area. The final results revealed that most of the concentration of the traffic-related pollutants measured are significantly higher at highways than the urban and local streets due to its high traffic volumes. Results showed that traffic emission on Petaling Jaya streets significantly contributes to poor near-road air quality, except for carbon monoxide concentration. Most of the pollutants show almost the same daily trends of 12-hour period of time at all type of streets. It is assumed that the concentration of pollutants occurred twice a day which spike during the period of rush-hour time; morning rush hour and evening rush hour. The pollutants concentration such as nitrogen dioxide (NO₂), carbon monoxide (CO), particulate matter with an aerodynamic diameter of equal to or less than 2.5 microns (PM_{2.5}), and particulate matter with an aerodynamic diameter of equal to or less than 10 microns (PM₁₀) started to peak at 7:00 to 10:00 am and eventually, it decreased slowly during non-rush hour period (10:00 am–4:00 pm) and a rising level of pollutants was experienced in the evening rush hour (4:00 pm–7:00 pm). The study also displayed that most of the Petaling Jaya streets including highways suffer from very high concentrations of gaseous pollutants, primarily caused by the traffic-related pollutants which surpassed a number of standards and guideline maximum limits, except for CO.

Keywords: *temporal, near-road, emission, air quality*

Association of Traffic-Related Air Pollution (TRAP) with DNA Damage and Respiratory Symptoms among Primary School Children in Selangor

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ABSTRACT

The study aimed to determine the association between TRAP exposure with DNA damage in buccal mucosa cells and respiratory symptoms among school children in Selangor state. PM_{2.5}, PM₁₀, UFP, CO, CO₂, NO₂ and SO₂ were measured as TRAP. A cross-sectional comparative study was carried out among respondents in Kajang as exposed group (n=52) and Hulu Langat as comparative group (n=52). Exposed group comprised of children who attended schools near heavy traffic roads, whereas comparative group was those children who attended schools near the less traffic roads. A set of standardised and validated questionnaires were used to determine respiratory symptoms and history of exposure. Measurements of indoor and outdoor air pollutants were conducted in classrooms. Buccal mucosa cells were collected, which then followed by investigation of DNA damage using a comet assay. Statistical analyses show that there were significant differences in indoor and outdoor PM_{2.5}, PM₁₀, UFP, CO₂, NO₂ and SO₂. All pollutants were significantly associated with reported respiratory symptoms, which were cough and wheezing at p<0.05. Meanwhile, PM_{2.5} (PR=2.63, 95% CI=1.21-5.70), PM₁₀ (PR=2.52, 95% CI=1.11-5.74) and UFP (PR=8.45, 95% CI=3.31-21.64) were significantly associated with comet tail length at p<0.05. Additionally, comet tail length in the exposed group was significantly higher (35.95 ± 7.93 µm) than those in the comparative group (30.32 ± 8.358 µm), and the difference was significantly different (t=3.450, p=0.001). Children were six times more likely to have genotoxicity of buccal mucosa if they were exposed to higher levels of UFP. This study demonstrated that children in schools near heavy traffic roads have an increased risk for respiratory symptoms and DNA damage due to higher exposure to TRAP. Therefore, this study supports its importance as a risk factor in associations documented between TRAP and respiratory health among children.

Keywords: *traffic-related air pollution, DNA damage, respiratory symptoms, school children, comet assay*

Heavy Metal Concentrations in Respirable Particles (PM₁₀): Relationship with Neurotoxicity of Secondary School Students in Kuantan, Malaysia

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ABSTRACT

The objectives of the study were: to determine the heavy metal levels (Al, Cd, As, Cr, Ni and Pb) in respirable particulate (PM₁₀) and the relationship with neurotoxicity among school children located close to the mines. This is a cross sectional study that conducted at SMK Bukit Goh, located 600 metres from the bauxite mines. The questionnaires were used to obtain personal background information and education, reported health symptoms within the last 12 months. The PM₁₀ were collected on the mixed cellulose ester filter paper using Gillian Personal Air Sampler Pump in the classrooms for 5 hours. The heavy metal were extracted and analyzed using ICP-MS. Total particulates matter, PM₁₀ were collected in each of the Form 1 and Form 2 classes. There were 10 points locations for 3 days consecutively. The PM₁₀ levels at the Form 1 classes, was only 5.08 µg/m³ while for Form 2 classes the level was 4.84 µg/m³, which did not exceed the MAAQ Guideline for 24-hour. Chromium showed highest level and next is nickel. The NCTB test comprised the Santa Ana Manual Dexterity, Simple Reaction Time, Benton Visual Retention, Pursuit Aiming, Digit Symbol, Digit Span and Trail-Making Tests were conducted to monitor the neurotoxicity heavy metals exposure. Half of the children scored high while another half scored low for almost all the tests. Age influenced the Digit Symbol and Trail-Making Tests. Since chromium was found at high levels, it showed significant relationship with almost all of the NCTB test items except for Benton Visual Retention and Pursuit Aiming Tests. Majority of the children reported headache experienced rashes on their bodies. The PM₁₀ level did not exceed the standard, however, the high content of particulate chromium and nickel resulted in reduction neurobehavioral scores and reported skin rashes.

Keywords: *bauxite, neurobehavioral test core, PM₁₀ and heavy metals.*

Association between Traffic-Related Air Pollutants (TRAP) with Lung Function and Respiratory Symptoms among Primary School Children in Kajang, Selangor Malaysia

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ABSTRACT

The high loading of particulate matter in heavy traffic area has urged researcher to pay greater attention as it frequently associated with significant health impact particularly among children. This study aims to determine the association between TRAP with lung function and respiratory symptoms among primary school children in heavy and low traffic area. A cross-sectional comparative study was carried out among primary school children in heavy traffic area (N= 69, Kajang) and low traffic area (N=69, Hulu Langat). An air quality assessment was conducted which included parameters of PM₁₀, PM_{2.5}, UFP, NO₂, SO₂ and CO. A standardised questionnaire was distributed to respondents' parents. Spirometry test was carried out and traffic count survey was conducted at two time intervals per day (7.00-7.30 am and 1.00-1.30 pm). Lung function abnormalities found in children at heavy traffic area was 3 times higher than low traffic area. Children in heavy traffic area were 6 times more likely to experience runny nose and blocked nose, 7 times more likely to experience dry and sore throat, 10 times more likely to experience cough and 8 times more likely to experience breathing difficulties than children in low traffic area. The higher PM₁₀ and PM_{2.5} will increase the FVC abnormality by 4 and 6 times of getting FVC abnormality by exposing PM₁₀ and PM_{2.5} and increase the FVC abnormality by 2 and 3 times of getting FEV₁ abnormality. The higher PM₁₀ and PM_{2.5} will increase the runny nose and blocked nose by 2 and 3 times of getting runny nose and blocked nose, increase the cough by 4 and 6 times of getting cough by exposing PM₁₀ and PM_{2.5}. The finding concluded that exposure to PM₁₀ and PM_{2.5} increases the risk of getting lung function abnormality and respiratory health symptoms among children.

Keywords: TRAP, lung function, school children

Simulation of High Ozone Episodes in Islamabad, Pakistan using WRF Model

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ABSTRACT

Elevated ozone levels in ambient air of Islamabad have been observed frequently over a period of five years. High ozone episodes were identified by analysis of hourly ozone concentrations and exceedances than the standard limit of 66 ppbv. These episodes have been observed to be lasting for many days which is quite alarming. Two high ozone episodes were selected for thorough analysis; the first episode occurred during June 09-15, 2009 and the second high ozone event was observed during August 15-19, 2011. Observations of ozone precursors, meteorological parameters, back trajectories computed with HYSPLIT model and WRF model simulations have been incorporated in order to understand the origin and contributing sources of these events. The synoptic analysis has been conducted in order to appropriately assess the role of meteorology to high level of ozone during selected durations for Islamabad city. The regional background O₃ concentration for Islamabad has been estimated to be ~31ppbv which shows the contribution of air advection into Islamabad that is not influenced by direct emissions in the city. Contribution of emissions from the road transport to ozone formation seems significant as the atmospheric concentration of nitric oxide (~41 to ~120 µgm⁻³) have been observed to exceed National Environmental Quality Standards. Along with the availability of precursor gases, high ozone levels also depend on the photochemical processes depending on meteorology. Transport of pollutants from the adjacent city of Rawalpindi adds to the degree of ozone formation in Islamabad. It is revealed that the stagnant meteorological conditions led to accumulation of ozone in the area causing high pollution episodes.

Keywords: *air quality, ozone episode, WRF model*

Analysis of Dust Mite Allergen Exposure in School Environment in Relation to Allergic Sensitization in Secondary School in Depok Year 2018

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ABSTRACT

Although dust mite is one of the most common aeroallergen that has strong relation with allergy manifestation and sensitization, there is little study to assess its exposure in school environment. Further study is needed to analyze school indoor air quality related to dust mite and its effect on allergy sensitization in students. This study aims to know the relation between dust mite exposure in school and allergy sensitization and to identify risk factors related to allergy sensitization. Cross-sectional study is conducted in 3 randomized junior high schools in Depok. 142 students are randomized to be the respondent in this study. Dust mite exposure is assessed by vacuuming settled dust in classrooms and then analyzes it using flotation method. Student's sensitization is assessed using skin prick test while risk factors are identified by filling ISAAC questionnaire. 31 students are sensitized to *D.pteronyssinus* and 37 students are sensitized to *D.farinae*. Classrooms have good humidity rate (<70%), temperature (30°C), adequate ventilation, and low level of particulate matter. 1.7 grams of settled dust are retrieved from 8 samples. The dust mite density in school is 0.58 mite/gram dust. There is no significant relation between dust mite exposure and allergy sensitization towards *D.pteronyssinus* and *D.farinae* (*D.pteronyssinus* $p>0.05$ and *D.farinae* $p>0.05$). There is significant relation between pet (cat or dog) ownership and *D.farinae* sensitization ($p<0.05$), and a significant relation between gender and *D.pteronyssinus* sensitization ($p<0.05$). Low amount of dust mite exposure in school environment has no significant relation with children's sensitization.

Keywords: Allergy, Dust Mite, School, Sensitization

The Exposure and Health Risk of Indoor Particulate Matters (PM_{2.5} and PM₁₀) to Public Junior High School Students in Depok City

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ABSTRACT

Nowadays, humans spend most of their time indoors and exposed to indoor air pollution. Children particularly spend 6-8 hours in school and are susceptible to air pollution due to higher respiratory frequency, higher physical activity and the development of the respiratory system. Particulate matters were common indoor air pollutant and associated with the prevalence of respiratory diseases. Therefore, indoor particulate matters and its health risk at the school environment need to be considered. This research was aimed to represent indoor particulate matters in the school environment and assess its health risk to students. The measured parameter in this study was PM_{2.5} and PM₁₀ of two public junior high schools located in different environmental setting then followed by health risk assessment to a total of 305 students consisted of 139 males (45.6 %) and 166 females (54.4 %). The mean concentration of indoor PM_{2.5} and PM₁₀ in school A, adjacent to traffic was 0.113 mg/m³ and 0.215 mg/m³, meanwhile school B in residential area showed 0.164 mg/m³ and 0.075 mg/m³. The particulate matters concentration in classrooms of school A was found to be higher than outdoor. The exposure of PM_{2.5} in both schools was estimated to inflict health risk (HQ > 1). Meanwhile, the health risk of PM₁₀ was perceivable only in school A. Therefore, the level of particulate matters had to be maintained below the safe thresholds which are 0.034 mg/m³ (for PM_{2.5}) and 0.141 mg/m³ (for PM₁₀) to protect 90% of the student population. This research concluded that indoor air in both schools was polluted with particulate matters and school adjacent to traffic had higher health risk to students.

Keywords: PM_{2.5}, PM₁₀, indoor air, school, health risk

Implementation of National Policy for Elimination of Kerosene use for Cooking in Indonesia: Co-Benefits Analysis

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ABSTRACT

Indonesian government has been implementing a National Program of conversion from kerosene to liquefied petroleum gas (LPG) which is considered as one of the world's largest efforts to promote cleaner cooking fuels. This study analyzed the impacts of the policy on the potential emission reductions of toxic air pollutants and climate forcers to quantify co-benefits on air quality and climate forcing mitigation. National emission inventory for residential sector and other sectors was conducted for base year of 2007 and 2010 using the Atmospheric Brown Cloud Emission Inventory framework. This government fuel switching program for residential cooking has achieved 72% of completion and converted 4.9 Tg kerosene to 2.6 Tg LPG in 30 designated provinces of the country during the first 3 years implementation (2007-2010). The net emission reductions of different species varied from 48 tonnes (SO₂) to 7.6 Tg for CO₂. The global warming potential (GWP, 20-year and 100-year) of the emission from residential cooking would be reduced by 2-4% while for the national total emission would be 1-2%. Even though the co-benefits were achieved, more significant reductions in the residential sector emission are expected if the solid cooking fuel could be targeted in future fuel conversion programs.

Keywords: *kerosene, LPG, co-benefits, emission, GWP*

Daily Risk Safe Communication of Benzene Exposure to Workers in Informal Shoe Industry

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ABSTRACT

The aim of this study was to determine the daily risk safe communication of benzene exposure to workers in the informal shoe industry. This research is analytic and observational, research was carried out by cross-sectional study method. The population and sample of the study were all informal shoe industry workers in Tambak Osowilangun, Surabaya, amounting to 25 people. The variables in this study were the existence or absence of benzene hazard risk communication, benzene Risk Quotient (RQ) risk communication, benzene control risk communication, and safe daily exposure time. The risk level analysis of existence or absence risk communication to daily exposure time is carried out by Odds Ratio (OR). The result of the research showed that the daily exposure time of respondents who classified as safe is 2 persons (8%) and all respondents never carried out benzene hazard, RQ, and control risk communication. The conclusion is no risk communication in the form of information exchange about the danger of benzene and the time of daily safe exposure between manajamen company and the worker. The minimum daily exposure time of informal shoe maker in Surabaya is 0.38 hours/day.

Keywords: *Safe Communication, Benzene Exposure, Workers, Shoe Industry, Informal Industry*

Air Pollution Indoor of Particulate Matter 2.5 (PM_{2.5}) with Pulmonary Function Disorders in First Middle School Students in Depok City in 2018

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ABSTRACT

Air pollution is associated with millions of premature deaths worldwide and 20% of them are respiratory origin from outdoor and indoor air pollution in the form of particles. Particulate Matter 2.5 (PM_{2.5}) exposure that comes from inside the room has an early health effect on children, because children are vulnerable groups and as long as the child is in the process of developing the lungs can cause long-term effects on lung function. This study aims to identify the relationship between Particulate Matter 2.5 (PM_{2.5}) exposures to pulmonary function impairment in Depok City First High School students. This study uses a cross-sectional study conducted in March-May 2018. The number of samples is 160 students aged 13-15 years with a simple random sampling method. The results showed exposure to PM_{2.5} > NAB 35µg / m³ at risk of 11 times experiencing impaired lung function in students in schools near the highway compared to students in schools that are far from the highway with ventilation conditions that do not meet the requirements, temperature and humidity abnormal. It is necessary to control the risk of air pollution in the school environment by avoiding or limiting themselves from air pollution sources.

Keywords: *Particulate Matter 2.5, pulmonary function disorders, children*

Effects of Diurnal Wind Reversal on the Air Quality of the National Capital Region (NCR), Philippines

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ABSTRACT

An overlooked, negative impact of a coastline is the thermally generated winds due to the difference in heat capacities of land and water, which could transport and entrap pollutants. The highly urbanized and densely populous region of NCR makes it a hotspot for vehicular and industrial activities, consequently emitting high levels of air pollutants. It is strategically located by the coastline of Manila Bay. We aim to characterize the diurnal reversing winds brought by Manila Bay, the non-reversing winds due to large-scale weather conditions, and stagnation conditions identified by weak winds. Their effects on particulate matter (PM) concentration levels, as indicator of air quality, are discussed. Hourly meteorological data and particulate matter levels were taken from stations around NCR. Surface wind behavior covering December 2016 to November 2017 were illustrated. Seasonal, monthly, and diurnal behavior of diurnal wind reversal, non-reversal, and stagnation days were characterized. Surface winds of NCR are more influenced by the large scale monsoon winds and winds due to the Pacific Ocean rather than smaller scale winds due to Earth surface thermal contrast. Frequency of surface wind reversals observed in each station are not dependent on the season but differ per station itself. Stations closer to the coast record more non-reversing and diurnal reversing winds within the period. PM levels of stagnation days show no relationship to PM₁₀ and PM_{2.5} levels of reversal and non-reversal days but diurnal plots show the accumulation of pollutants throughout the day. While there is generally a significant difference in PM levels during a diurnal wind reversal and a non-reversal day, the correlation of surface wind with PM levels is generally weak. PM_{2.5}/PM₁₀ ratio was not observed to be dependent on surface wind speed, direction, and reversal/non-reversal frequency. This deviation from expectation is hypothesized to be due to NCR's unique coastal geometry.

Keywords: *air pollution, diurnal wind reversal, non-reversing winds, stagnation, surface winds*

Levels of PM_{2.5} and its Adsorption in Green Spaces in Marikina City, Philippines

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ABSTRACT

Air pollution is one of the biggest environmental risks today, as exposure to atmospheric fine particulate matter (PM_{2.5}) alone causes premature deaths worldwide. In urban areas, the main sources of PM_{2.5} are various anthropogenic emissions, and actions must be done in order to reduce the concentration of this pollutant and thus minimize exposure risks of the public. Given the adsorption capacity of vegetation to remove air pollutants in the atmosphere, the presence of green spaces is an additional approach to improve air quality in cities. This study focuses on the measurement of PM_{2.5} concentrations and its adsorption in the green spaces in the Freedom Park, Harding Bayan and Industrial Valley Park in Marikina City, Philippines. The city is known for its efforts in environmental management and is currently in the process of developing their Clean Air Action Plan. In this study, levels of PM_{2.5} are measured within and outside the green spaces through the use of hand-held optical sensors. Corresponding traffic volume and tree characteristics in the area were also collected to show how air quality differs due to the presence of the green space. The PM_{2.5} pollutant removal by the green spaces is quantified using the I-Tree Eco model, through the input of tree characteristics in the study sites. Approximations of air pollution reduction as based on hypothetical green space areas to be added in the city will be done by combining the results of the air quality monitoring and pollutant removal modeling. Communication to the public of the data from this study can increase knowledge on the city's air quality and incite appreciation for green spaces. More importantly, the results from this research can provide scientific basis for policies which can promote the maintenance and provision for more green spaces in the city to improve air quality.

Keywords: *green spaces, urban air pollution, PM_{2.5}, I-Tree Eco*

The Everydayness of Monitoring Air Pollution in India

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ABSTRACT

The Air Act, 1981 was formulated for the prevention, control and abatement of air pollution. Following this, the Central Pollution Control Board (CPCB) and through the model of decentralization, State Pollution Control Boards (SPCB) were conferred the powers to implement the provisions of the Act and entrusted with the task of regulating pollution levels. One of the primary responsibilities of the SPCBs is to continuously monitor air pollution levels and to disseminate this information to other government departments and the public at large. Under the Act, they can, by order, give directions considered necessary to control air pollution to persons/bodies not adhering. Drawing extensively on fieldwork conducted with various SPCBs, this paper asks and addresses the question *what does monitoring air pollution mean to the officials of Pollution Control Board?* It elaborates on individual officers' perceptions around air pollution and monitoring, bureaucratic challenges of monitoring air pollution and systemic issues, ownership of responsibilities, authority to penalize defaulters, knowledge and awareness about the significance attached to their work and its larger impact on the society, among others. The paper then analyzes how all these local micro factors cumulatively impact the macro goal of maintaining better air quality. This paper situates the officials of the pollution control board as central figures and not machines in the discussions on monitoring processes of air pollution. By doing this, it argues that national policies and frameworks on environment are repeatedly interpreted at local and individual levels and in order to understand the success or failure of a policy, it is imperative to understand how those policies are interpreted at local levels. In the context where the authority and existence of smaller bodies such as PCBs are repeatedly questioned, we contend that such bottom-up understanding of government departments will aid better formulation and implementation of policies.

Keywords: *Air pollution monitoring, air quality, policy, challenges, awareness*

Evaluation of Performance of Low-Cost Aerosol Monitors in LMIC Settings

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ABSTRACT

Low-cost aerosol sensors are promising tools for supplementing existing air quality monitoring networks globally. However, the evidence for their performance primarily stems from typical outdoor levels in urban areas of high income countries, and there always remains a debate on their performance in rural and urban low-and-middle income country (LMIC) settings which generally feature tropical climatic conditions and high air pollution levels. In the present study, we aim to quantify the agreement between low cost and reference grade aerosol monitors in Delhi which is one of the highly polluted LMIC cities across the world with PM_{2.5} levels ~5-10 times higher than the WHO prescribed annual standards. We monitored PM_{2.5} levels in Hauz khas area (N 28.5530178, E 77.2015695) of Delhi during winter and summer seasons of 2018. We used Atmos PM_{2.5} monitor, an assembly consisting of Plantower particulate matter sensors, Spark fun SHT15 RH and temperature sensor for PM_{2.5} measurements. We considered a nearby (~1km aerially) central pollution control board monitoring station which uses beta attenuation monitor-federal equivalent reference technique for PM_{2.5} measurements data for comparison. Our results indicate that the 24 hr average PM_{2.5} levels in Delhi to be 147.47 ± 46.80 , with winter time levels (150.46 ± 45.77) three times higher than summer levels (57.64 ± 31.18). We find PM_{2.5} trends exhibiting bimodal distribution with peaks during morning and evening peak hours. We observe that the data from our low-cost monitors were moderately fair in comparison with the reference grade monitors (absolute bias=0.5076 and R²= 0.5921). We find a stronger agreement between both the instruments in winter (absolute bias= 0.2033 and R²=0.6388) than in Summer (absolute bias=0.8483 and R²=0.0647). Our study emphasizes the requirement of research to comprehensively understand the response of low cost monitors under different meteorological and environmental conditions.

Keywords: *air pollution, low-cost sensors, air quality monitoring*

Assessment of Crowdedness in Public Transportation in Colombo City, Sri Lanka

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ABSTRACT

Assessment of crowdedness in public transportation was carried out to evaluate and compare the crowding in various public transport modes in Colombo city. The buses and trains are the principal modes of public transport in Sri Lanka and more than 45% of Sri Lankans use public transport for their daily travel purposes. Public transportation lost their modal share up to 45% and private modes are significantly increased up to 55%. The public transport modal share was 67% in 2009 has been reduced to this level. The private modes within Colombo city has increased with the increase of travel demand as many people avoid using public transportation mainly due to overcrowding, its inefficiency and poor quality. Public buses running on the busiest urban roads and the main railway line were selected for the survey. Proximal Density is calculated using Number of standing passenger and number of seats in a survey area. For each mode least 10 proximal density classes were observed. Respondent were asked to rate the perception of crowdedness in the scale ranging from -4 to +4 and hypothetical social norm curve is obtained by plotting average acceptability rating versus proximal density. Temperature, Noise level, Availability of Air conditioning inside the compartment were measured. Proximal density of the bus changed from 0 to 2.5 and the proximal density of train changed from 0 to 4 while crowd rating given by the passengers ranged from +4 to -4. The maximum acceptable density for public bus was found to be 1.6 and the maximum acceptable density for train was found to be 2.2. It is concluded that increasing of private transportation lead to many negative implications such as congestion, air pollution, road accidents, etc. Introduction of efficient, quality & interlinking railway system can attract people towards the public transportation. This research is providing basis to identify the public transport system to capture the passengers who used private motorization for their travel through observing different behaviors of passengers to avoid crowdedness situation.

Keywords: *Crowding in public transportation, Proximal Density, Maximum acceptable density, social norm curve*

The Impact of Ambient Temperature on Mortality In Klang Valley, Malaysia

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ABSTRACT

Associations between ambient temperature (AT) and mortality have been consistently observed in temperate countries. However, there is a lack of studies from Asian countries. Our study investigated the association between AT and mortality due to natural, respiratory and cardiovascular diseases in the urban area of Klang Valley, Malaysia. The study utilized time series study design that used seven-year daily data from 2000 to 2006. The mortality data were provided by the Department of Statistics and the meteorological data were obtained from the Meteorological Services Department. The relationship between daily mortality counts and AT were estimated using Poisson Regression in Generalized Additive Model, controlling for time trend, relative humidity, rainfall, day of the week and the two main pollutants which were O₃ and PM₁₀. Poisson regression with cubic spline smoothers for time and weather variables were applied at different time lags. The effects of the AT on the current day (lag 0) to previous five days (lag 5) were observed. There were 48580 natural mortalities which included 14385 cardiovascular mortalities and 6036 respiratory mortalities. AT ranged from 23.2 °C-30.8°C with the daily average was 27.8°C. Natural mortality of all ages showed acute and delayed effects of AT at various time lags with the highest risk (RR=1.140, CI= 1.008-1.288) at AT threshold of 29.8°C at lag 2. This was further analysed by age stratified and was found that residents below 65 years old showed delayed effects (lag1) with highest risk (RR=1.341, CI=1.007-1.788) at AT threshold of 30.1°C. Older residents above 65 years old also showed delayed effects at lag2 but with lower threshold of 28.0°C (RR=1.030, CI=1.001-1.059). Respiratory mortality showed acute effects at lag0 (RR=1.058, CI=1.001-1.119) with AT threshold of 27.4°C. No association was found with cardiovascular mortality. AT are associated with natural and respiratory mortality. Both older and younger mortality showed delayed effects to AT. Older residents had lower AT threshold to mortality compared to younger residents.

Keywords: *Ambient temperature (AT), Relative risk, Poisson regression; Mortality, Klang Valley*

Study on Determining Discharge Permit Capacity Based on Environmental Quality

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ABSTRACT

Discharge permit capacity refers to the “concentration and quantity of pollutants allowed to be discharged by a pollutant discharge unit within a certain period of time”, which is the most important indicator of corporate emission behavior. It is an important control factor in the environmental management system in China around the fixed pollution sources in the last thirty years. At present, the approved technical standards for discharge permit capacity that have been studied or released at the national level are mainly based on generation performance standard, and there is a lack of systematic research on the approved method for the discharge permit capacity based on environmental quality. This study proposes a technical method system based on the response relationship between air quality and pollutant emissions, fully considering various factors such as social-economic development, economic and technical feasibility, scientifically selecting indicator factors and decomposing performance control objectives to provide a technical basis for determining the permitted discharge limits in order to improve the quality of the environment.

Keywords: *permitted discharge limits; generation performance standard; environmental quality*

Sulphur Recovery and Tail Gas Treatment Unit for Better Air Quality in Oil and Gas plant

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ABSTRACT

Energy demand in the entire world have more than doubled during the past 40 years, is estimated to reach 17,000 million tons of oil equivalent in 2030. Banyu Urip oil field First oil production from the Banyu Urip field commenced in December 2008 through the Early Production Facility (EPF) which began the production of 20,000 barrels of oil per day in August 2009 and has successfully ramping up the oil production to 200,000 barrels per day until now. Gas Treating & Sulphur Recovery Facilities are one of the supporting process system to support oil production, the objective of the Banyu Urip Gas Treating & Sulphur Recovery Facilities is to meet environmental regulations, since it is important to control the industrial emissions to avoid any adverse effects. The acid gas treatment unit was built to generate fuel gas for electric power generator and the residual gas will be processed on Sulphur Recovery Unit (SRU). Associated gas containing 1.6% H₂S and 45% CO₂ from Primary Separation is sweetened in The Acid Gas Recovery Unit (AGRU) using generic MDEA to selectively remove H₂S and CO₂. An Acid Gas Enrichment Unit (AGE) is used to increase H₂S concentration from 9% to 30-35%. Sulphur purity of >99.5% is achieved through Two-bed reactor in Sulphur Recovery Unit (SRU) and Tail Gas Treatment Unit (TGTU). In this study, the methods of H₂S measurements in air carried out using (a) passive/diffusive samplers and (b) a high-frequency or real-time analyser can be compared to evaluate advantages and limitations of the two techniques. The SULFUR RECOVERY UNIT (SRU) is the best choice to safely rid and reduce the H₂S emissions, and to give 99% sulphur recovery and continue with tail gas treatment unit to improve sulphur recovery to 99,8%.

Keywords: *Sulphur Recovery Unit, Acid Gas Treatment, passive samplers, diffusive samplers, Gas Treating, Acid Gas Enrichment, Two-bed Reactor.*

The Analysis of Physical Environments and Pollutants (PM₁₀ and PM_{2.5}) In a Long Distance Coach by Using Boosted Regression Trees Technique

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ABSTRACT

There are still not many study focus on the in-vehicle long distance coach study in Malaysian although the exposure to indoor air pollutant is more dangerous than outdoor air pollution. The exposure of air pollutants inside a moving vehicle could be potential health risk to the driver and passenger. The aim of this study is to analyze the exposure of air pollutants to the bus driver and passengers between Kuala Terengganu, Terengganu (TGG) to IPOH, Perak (3 return trips) which travelled hour between 7 to 8 hour journey mostly used motorways route that lift passengers. The concentrations of particulate matter (PM₁₀ and PM_{2.5}) and physical parameters (air flow, speed, relative humidity, temperature and number of passengers) were measured. Data were captured and gathered in one-minute by using TSI Dustrak 8530, Q-Trak TSI model 7565, IAQ Monitor and Kanomax Climomaster and were analysed by using a comprehensive software an open-air R-Software and its packages for the variability and statistical analysis. The Boosted Regression Tree (BRT) algorithm model for PM₁₀ and PM_{2.5} with learning rate 0.01 and 0.05, tree complexity 5, and number of tree 1184 and 700. Based on PM₁₀ and PM_{2.5} pollutants model established, it was found that the most important variable for trip 1 (TGG – IPOH), trip 2 (TGG – IPOH) and trip 3 (TGG – IPOH) are temperature (26.24%), speed of bus (30.24%) and temperature (32.40% respectively. Meanwhile for return trip from IPOH to TGG which is trip 1, trip 2 and trip 3, the major important variable was speed of bus (30.87%) and (46.57%) followed by temperature (38.57%) respectively. Temperature, bus speed, relative humidity and air flow are partially responsible for the different levels of each in-vehicle pollutants.

Keywords: *long distance travelled, in-vehicle pollutants, Boosted Regression Trees, R-software*

Monitoring of Airborne Particulate Matter in Denpasar, Bali

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ABSTRACT

Bali is the most popular island in Indonesia. Many tourists from all around the world are coming to Bali, due to its natural beauty as well as the culture and its highly developed arts. Economic activity in Bali mostly comes from tourism. These activities in Bali will impact its air quality. This study presents Airborne Particulate Matter (APM) datasets consist of fine and coarse particles ($PM_{2.5}$ and PM_{10}) obtained from monitoring in Denpasar as the capital city of Bali during 2012-2015. APM samples were collected once a week using a Gent stacked filter unit sampler capable for collecting particulate matter in the $PM_{2.5-10}$ and $PM_{2.5}$ size fractions. The annual average mass concentration of $PM_{2.5}$ and PM_{10} ranged from 11.0 – 15.3 and 23.5 – 43.7 $\mu\text{g}/\text{m}^3$, respectively. The annual average of $PM_{2.5}$ and PM_{10} in Bali were still below the Indonesian national ambient air quality standard (15 and 50 $\mu\text{g}/\text{m}^3$, respectively). Monitoring in Bali showed that there are no significant change in air quality during that period of time. Therefore, Bali is still comfortable for tourism destination. However, these data were investigated as a pre-study in step to the evaluation of air quality in this area and still needs further study to assess the possible sources of particulate air pollution.

Keywords: *Monitoring, APM, Bali, air pollution*

Towards Better Air Quality Management: Strategies and Implementation in Delhi India

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ABSTRACT

Maintaining a better air quality in the era of rapid industrialization and ever increasing vehicular transport in the wake of swiftly changing lifestyle of the masses, has imposed a serious challenge before the administrators of the cities especially in the developing countries. Air quality has been reduced due to diffusion of Respirable Suspended Particulate Matter and various other gasses like; CO, SO₂ and NO₂. It is believed that vehicular transport contributes 70% to environmental pollution. Low quality of air is a main worry throughout the world, with fine particulate matter (PM_{2.5}) especially related with the consequences of serious health problems in human beings. According to World Health Organization, India experiences significantly air contamination having four of the top ten cities with the highest concentrations of particulate matter (PM_{2.5}) throughout the world. And despite, the authorities of India are implementing ambitious measures of pollution control; the anticipated financial development in India may additionally decline Delhi's air quality. This paper consolidates the various strategies followed by Delhi government to improve the quality of air in the city. The government of Delhi recently suggested a new rule to run the private vehicles with odd and even numbers on substitute/alternate days, as a measure to bring down and control pollution in Delhi and also all vehicles will have to follow the standards of Euro IV 2017. This rule was implemented in Delhi, India from 1 January 2016. The main open worry in the city of Delhi is transport system. Population increase and high engine vehicle rates should be upgraded so as to make better-quality of air. Transport approaches should comprise of different systems especially in developing nations. The point of this paper is to improve our comprehension of the polluted atmosphere in major cities against the emission of toxic gases, climatic conditions, population conditions that are leading causes to air pollution. This paper will deliver state-of-the-art for the sources of contamination of air and the quality of air in the city of Delhi, India.

Keywords: *industrialization, suspended particulate matter, contamination, pollution, transportation.*

Artificial Neural Networks Modeling And Optimization Based Methodology For Cold Air VAV Systems

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ABSTRACT

The advancement of building energy savings techniques and models results in being apparently more essential for a sustainable future. The cooling coil is a vital component of HVAC systems. The accurate prediction of a cooling coil performance is significant in many energy solution applications. This paper examines the modeling methods of a chilled water cooling system using artificial neural networks. The goal of this research paper is to effectively build the model to predict the cooling coil performance accurately. This study utilized data from an existing building located in Sarawak, Malaysia. Data such as chilled water supply temperature, airflow rate, mixture and supply air temperatures and humidity ratios, etc., are obtained over the course of 90 days for developing and testing the model. Numerous neural network structures are tested along with multiple input and output delays to identify the one yielding the optimal results. Furthermore, an optimization approach is formulated to opt for most recognized model that can predict results accurately, validated by the actual data. The observations from this research validates the use of artificial neural network model as an accurate tool for predicting the performance of a chilled water air handling unit.

Monitoring of Carbon, Water and Heat Fluxes from Natural and Managed Peat Ecosystems in Sarawak, Malaysia

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ABSTRACT

Over recent decades, tropical peatlands in Southeast Asia has become a major climate change concern because of the vast amounts of carbon accumulated in peat deposits over centuries to millennia, and the consequences of land cover change for the greenhouse gas release into the atmosphere. However, the current status of tropical peatlands and the impacts on conversion to agro-ecosystem from natural ecosystem which include carbon pools and fluxes are lesser known. Direct measurements of land-atmosphere exchanges of trace gases and particles allow us to observe the ecosystem metabolism as well as the role of ecosystems in regulating climate, soil, water and air quality. Ecosystems, both natural and managed, alter the physical and chemical properties of the atmosphere as sources and sinks of greenhouse gases and other atmospheric constituents that affect air quality and climate on temperature, precipitation, evapotranspiration and albedo – and vice versa. In order to improve the current state of knowledge of tropical peat forests with respect to the seasonal and interannual variability in carbon and energy fluxes, the eddy covariance flux towers installed at three different peat ecosystems in Sarawak, namely oil palm plantation, primary forest and secondary forest in late 2010 provide one of the longest continuous record of net ecosystem carbon exchange, energy and water flux between the atmosphere and the ecosystems at 10Hz time resolution. The eddy covariance technique provides a top-down view for measuring how ecosystems breathe and is complemented by meteorological and ground measurements where we can identify the biophysics of the surface and its interaction with the atmosphere. These towers represent novel flux studies as ecosystem-scale carbon dioxide (CO₂) and methane (CH₄) exchange of oil palm plantation as well as undisturbed primary tropical peat forest have not been measured to date. The secondary forest, on the other hand, is now converted into oil palm plantation allows for a unique opportunity to measure the carbon fluxes with respect to land use change. During the course of the measurements, we found that CO₂ fluxes are highly variable over time and ecosystems, indicating tropical peat ecosystems are sensitive to changes in the soil-vegetation-atmosphere continuum. Results also suggest that tropical peat swamp forests can be the natural major source of CH₄ in the tropics although the annual emissions are relatively small in comparison to mid- and high latitude peatlands. Ongoing research is exploring the sensitivity of fluxes to variability in micrometeorological and hydrological conditions.

Keywords: *tropical peatland, eddy covariance, carbon fluxes, climate change*

Methane Gas Production from Oil Palm Empty Fruit Bunch (OPEFB) via *Volvariella volvacea* Enzymatic Hydrolysis and Cultivation

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ABSTRACT

This study highlighted on *Volvariella volvacea* as pre-treatment technology to support the Anaerobic Digestion facilities with aim to maximize the biogas production. In the same time this mushroom cultivation can also be improved in terms of quality and quantity especially in reducing growing time. The cultivation part will be one of the main works in the research and continued with the anaerobic digestion using the spent waste from them. Suitable inoculum used in the Biomethane Potential Test (BMP) from local anaerobic digester with specific methanogenic activity between 0.05 – 0.20 gCOD/gVSS.d. The most suitable method for pre-treatment of OPEFB before cultivating of VV with aim to reduce the composting time. The best method applied for cultivation of VV that is easy and low foot print. The knowledge can be commercially applicable for oil palm industries and resolving the solid waste management issues while increasing revenue through new product development. By the way these findings can also benefitted to other industries as well.