



**International Laboratory  
for Air Quality  
and Health**



**WHO Collaborating Centre**

**2011 ANNUAL REPORT**

**INTERNATIONAL LABORATORY FOR AIR QUALITY  
and HEALTH**

**(ILAQH)**

## 1. Introduction

The International Laboratory for Air Quality and Health (ILAQH) is part of the Institute for Health and Biomedical Innovation (IHBI) at the Queensland University of Technology (QUT). ILAQH undertakes research, postgraduate training and consultancy in the complex, interdisciplinary field of air quality and its impact on human health, with a specific focus on ultrafine and nanoparticles. The three main aspects of ILAQH research activities are:

- Comprehensive characterisation of indoor and outdoor air, including emission sources;
- Integrated health and environmental risk assessments; and
- Strategies for controlling and managing air pollutants.

To address the challenge related to the interdisciplinary nature of air pollution and its impact on human health, academics from a number of Faculties within QUT are involved with the programs undertaken by the ILAQH, including discipline areas such as: physics, chemistry, microbiology, mathematics, public health and engineering. The expertise of the ILAQH personnel is strengthened by close collaboration with a number of government and non-government organizations. Through joint research, lecturing and postgraduate student supervision, the ILAQH collaborates closely with a number of North American, European and Asian research and tertiary organizations.

The facility is equipped with state of the art instrumentation for aerosol generation, mass and number size classification; monitoring of atmospheric gases; real time biological studies; radioactivity studies, vehicle emission testing, filter testing, lung deposition studies, and computer modelling. Access to electron microscopy and analytical chemistry facilities is available through the links existing within the Faculty of Science.

ILAQH has built up a scientific program, which is recognised internationally through a high publication rate in reputable international journals, visits by scholars from around the world to the facility, and invitations to the ILAQH key researchers to address international conferences and participate in international initiatives. In Australia both the Queensland State and the Federal government and non-government organizations regularly seek the expertise of this facility.

ILAQH is a Collaborating Centre of the World Health Organization on Research and Training in the field of Global Burden of Disease due to Air Pollution, since 2004.

## 2. ILAQH Researchers in 2009

### **Director**

Professor Lidia Morawska, PhD (School of Physical and Chemical Sciences)

### **Academic Staff**

A/Professor Godwin Ayoko (School of Physical and Chemical Sciences)

A/Professor Megan Hargreaves (School of Life Science)

A/Professor Zoran Ristovski (School of Physical and Chemical Sciences)

### **Research Associates**

Dr Congrong He

Dr Rohan Jayaratne

Dr Graham Johnson

Dr Luke Knibbs

Dr Mandana Mazaheri

Dr Branka Miljevic

### **Associated QUT Academic Staff**

Ms Rosemary Kennedy (School of Design)

Dr Thor Bostrom (Electron Microscopy Facility)

Dr Samantha Low Choy (School of Mathematical Sciences)

Adjunct A/Professor Riaz Akber (School of Physical and Chemical Sciences)

A/Professor Richard Brown (School of Mechanical Engineering)

Professor Shilu Tong (School of Public Health)

Professor Kerrie Mengersen (School of Mathematical Sciences)

Professor Steve Bottle (Chemistry)

Professor Graham Miller (Chemistry)

Professor Ross Crawford (Engineering)

Dr Colin Solomon (Cell & Molecular Biosciences)

Dr Flavia Huygens (Cell & Molecular Biosciences)

Dr Jim Smith (Cell & Molecular Biosciences)

### **Associated Academic Staff Other Universities**

Dr Giorgio Buonanno (University of Cassino, Italy)

Dr Marcelo Pereira (University of São Paulo, Brazil)

Dr David Katoshevski (Ben Gurion University, Israel)

Dr Hai Guo (Hong Kong Polytechnic University, Hong Kong)

Dr Erik Uhde (Fraunhofer WKI, Germany)

Adjunct Professor Tunga Salthammer (Fraunhofer WKI, Germany)

Adjunct Professor Werner Hoffman (University of Salzburg, Austria)

A/Professor Richard De Dear (University of Sydney, Australia)

Professor Markku Kulmala (University of Helsinki Finland)

Professor Urs Baltensperger (Paul Scherer Institute, Switzerland)

### **Postgraduate & Research Co-ordinator**

Mrs Rachael Appleby

### **Doctoral Students (enrolled in Discipline of Physics)**

Neale Hudson (Supervisor: Godwin Ayoko)  
Ross Kleinschmidt (Supervisor: Riaz Akber)  
Hing Cho Cheung (Supervisor: Lidia Morawska)  
Alamsyah Juwono (Supervisor: Lidia Morawska)  
Peter McGarry (Supervisor: Lidia Morawska)  
Nicholas Surawski (Supervisor: Zoran Ristovski)  
Adrian Friend (Supervisor: Godwin Ayoko)  
Tran Ngoc Quang (Supervisor: Lidia Morawska)  
Sam Clifford (Supervisor: Lidia Morawska)  
Megat Mokhtar (Supervisor: Lidia Morawska)  
Rusdin Laiman (Supervisor: Lidia Morawska)  
Lingli Guo (Supervisor: Lidia Morawska)  
Farhad Salimi (Supervisor: Lidia Morawska)  
Ali Pourkhesalian (Supervisor: Zoran Ristovski)  
Ehsan Faghihi (Supervisor: Lidia Morawska)  
Jayan Karunasinghe (Supervisor: Lidia Morawska)  
Mostafizur Rahman (Supervisor: Zoran Ristovski)  
Natasa Butalovic (Supervisor: Zoran Ristovski)  
Svetlana Stevanovic (Supervisor: Zoran Ristovski)  
Sarah Lawson (Supervisor: Zoran Ristovski)  
Tenzin Wang (Supervisor: Lidia Morawska)

### **Doctoral Students (enrolled in other QUT Schools and other Universities)**

Madhumita Iyengar (Urban Development, Supervisor: Luis Ferreira)  
Tom Cole-Hunter (Life Science, Supervisor: Lidia Morawska)  
S. Mahbub (Urban Development, Co-Supervisor: Godwin Ayoko)  
J. Gunawardena (Urban Development, Co-Supervisor: Godwin Ayoko)  
Timothy Bodisco (Engineering Systems, Co-Supervisor: Zoran Ristovski)  
Praveen Vijaysegaran (Engineering Systems, Co-Supervisor: Lidia Morawska)  
Meisam Babaie (Engineering, Co-Supervisor: Zoran Ristovski)  
Md Animul Islam (Engineering, Co-Supervisor: Zoran Ristovski)  
Md Jahirul Islam (Engineering, Co-Supervisor: Zoran Ristovski)

### **Honours Students**

#### **Masters Students**

Ms Soon-Che Chan (Supervisor: Godwin Ayoko)  
Ms Sohair El-tahir (Supervisor: Godwin Ayoko)  
Mr Luke Cravigan (Physics, Supervisor: Zoran Ristovski)

#### **Post Graduate Completions**

Mr Hao Wang (Supervisor: Lidia Morawska)  
Ms Philipa Perrott (School of Life Science, Supervisor: Megan Hargreaves)  
Mr Fraser McGregor (School of Urban Development, Supervisor: Luis Ferreira)  
Ms Rachel Thomson (Cell & Molecular Biosciences, Supervisor: Megan Hargreaves)  
Ms Colette King (Cell & Molecular Biosciences, Supervisor: Megan Hargreaves)

### 3. Awards and Achievements

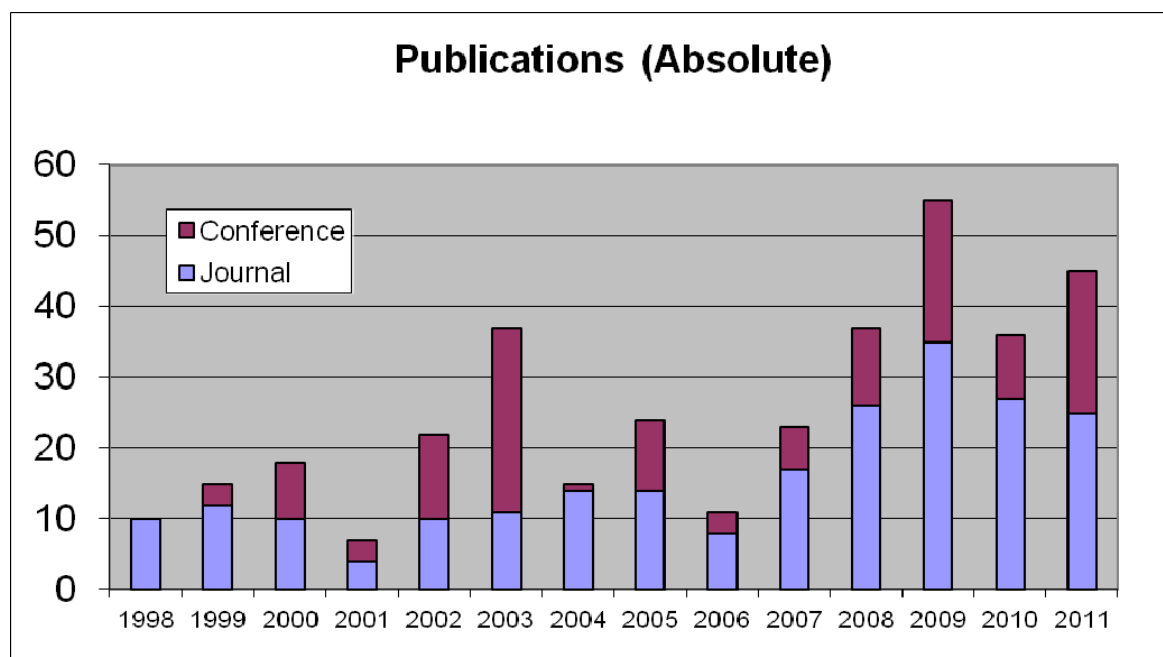
The following article was one of the "**Top 50 Most Cited Articles**" published in Atmospheric Environment (an A\* journal) from January 2006 - February 2011: L. Morawska. A review of dispersion modelling and its application to the dispersion of particles: An overview of different dispersion models available. *Atmospheric Environment*, 40(30): 5902-5928, 2006.

Professor Lidia Morawska was selected as a **key female researcher at QUT**, for inclusion in the "Women in Science, Technology and Innovation" section of the book "*Australia's Nobel Laureates, Adventures in Innovation*".

Dr Branka Miljevic won the "**2010 Physics Higher Degree Research Student Publication Prize**" and Dr Rob Modini was the runner-up.

The following article was one of the "**Top 5 Most Downloaded Articles**" published in Atmospheric Environment (an A\* journal) from April-June 2011: Knibbs, L., Morawska, L. et al. A review of commuter exposure to ultrafine particles and its health effects. *Atmospheric Environment*, 45: 2611-2622, 2011.

## 4. Peer Reviewed Publications

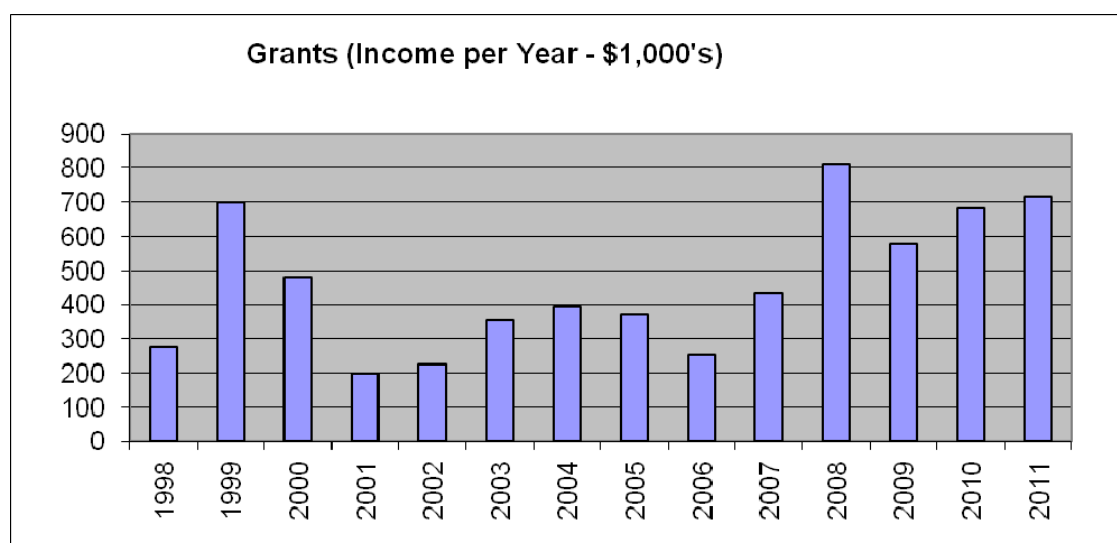


**Figure 1.** ILAQH Refereed Publications from 1998 – 2011.

- Mejía, J., Low Choy, S., Mengersen, K. and Morawska, L. Methodology for assessing exposure and impacts of air pollutants in school children: data collection, analysis and health effects - a literature review. *Atmospheric Environment*, 45: 813-823, 2011.
- Wang, L., Morawska, L., Jayaratne, R., Mengersen, K. and Heuff, D. Characteristics of Airborne Particles and the Factors Affecting Them at Bus Stations. *Atmospheric Environment*, 45: 611-620, 2011.
- Morawska L., Mengersen K., Holmes N.S., Tayphasavanh F. Darasavong K. and Wang H. Impact of housing characteristics and occupants' activities on pollutant concentrations within households in Lao PDR. *Environmental Science and Technology*, 45: 882-889, 2011.
- Mengersen K., Morawska L., Wang H., Murphy, N., Tayphasavanh F. Darasavong K. and Holmes N.S. Association between indoor air pollution measurements and respiratory health in women and children in Lao PDR. *Indoor Air*, 21: 25-35, 2011.
- Parianta, D., Morawska, L., Johnson, G., Ristovski, Z., Hargreaves, M., Mengersen, K., Corbett, S., Chao, C., Li, Y. and Katoshevski, D. Theoretical analysis of the motion and evaporation of exhaled respiratory droplets of mixed composition. *Journal of Aerosol Science*, 42: 1-10, 2011.
- Mengersen K., Morawska L., Wang H., Murphy, N., Tayphasavanh F. Darasavong K. and Holmes N.S. The effect of housing characteristics and occupant activities on the respiratory health of women and children in Lao PDR. *Science of the total Environment*, 409: 1378-1384, 2011.
- He, C., Morawska, L. and Mengersen, K. The Effect of Indoor and Outdoor Sources and House Characteristics on Indoor Airborne Particles and NO<sub>2</sub>. *Air Quality & Climate Change*, 45: 36-41, 2011.
- Knibbs, L., Cole-Hunter, T., Morawska, L. and Solomon, C. A review of commuter exposure to ultrafine particles and its health effects. *Atmospheric Environment*, 45: 2611-2622, 2011.

- Cheung, H.C., Morawska, L. and Ristovski, Z. Observation of new particle formation in subtropical urban environment. *Atmospheric Chemistry & Physics*, 11: 3823-3833, 2011.
- Mazaheri, M., Johnson, G. and Morawska, L. An Inventory of Particle and Gaseous Emissions from Large Aircraft Thrust Engine Operations at an Airport. *Atmospheric Environment*, 45: 3500-3507, 2011.
- Jayarathne, R., Ling, X. and Morawska, L. Corona Ions from High-Voltage Power Lines: Nature of Emission and Dispersion. *Journal of Electrostatics*, 69: 228-235, 2011.
- McGarry, P., Morawska, L., He, C., Jayaratne, R., Falk, M., Tran, Q. And Wang, H. Exposure to ultrafine particles from laser printers operating within office workplaces. *Environmental Science and Technology*, 45: 6444-6452, 2011.
- Buonanno, G., Johnson, G., Morawska, L. and Stabile, L. Volatility characterisation of cooking-generated aerosol particles. *Aerosol Science and Technology*, 45: 1069-1077, 2011
- Clifford, S., Low Choy, S., Hussein, T., Mengersen, K. and Morawska, L. Using the Generalised Additive Model to Model the Particle Number Count of Ultrafine Particles. *Atmospheric Environment*, 45: 5934-5945, 2011.
- Johnson, G., Morawska, L., Ristovski, Z., Hargreaves, M., Mengersen, K., Chao, C., Wan, M.P., Li, Y., Xie, X., Katoshevski, D. and Corbett, S. Modality of human expired aerosol size distributions. *Journal of Aerosol Science*, 42: 839-851, 2011.
- Jayarathne, R., Johnson, G., McGarry, P., Cheung, H.-C. and Morawska, L. Characteristics of Airborne Ultrafine and Coarse Particles during the Australian Dust Storm of 23 September 2009. *Atmospheric Environment*, 45: 3996-4001, 2011.
- Friend, A., Ayoko, G. and Guo, H. Multi-criteria ranking and receptor modelling of airborne fine particles at three sites in the Pearl River Delta region of China. *Science of the Total Environment*, 409: 719-737, 2011.
- Friend, A., Ayoko, G. And Elgabir, S. Source apportionment of fine particles at a suburban site in Queensland, Australia. *Environmental Chemistry*, 8(2): 163-173, 2011.
- Buonanno, G., Morawska, L. and Stabile, L. Exposure to welding particles in automotive plants. *Environmental Science and Technology*, 42: 295-304, 2011.
- Knibbs, L. and Morawska, L. An investigation of commuter exposure to ultrafine particles in Sydney. *Air Quality and Climate Change*, 45(2): 15-20, 2011
- Jayarathne, R., Ling, X. and Morawska, L. The Role of Vegetation in Enhancing Radon Concentration and Ion Production in the Atmosphere. *Environmental Science and Technology*, 45: 6350-6355, 2011.
- Buonanno, G., Giovinco, G., Morawska, L. and Stabile, L. Tracheobronchial and alveolar dose of submicrometer particles for different population age groups in Italy. *Atmospheric Environment*, 45: 6216-6224, 2011.
- Knibbs, L., Morawska, L., Bell, S. and Grzybowski, P. Room ventilation and the risk of airborne infection transmission in three health care settings within a large teaching hospital. *American Journal of Infection Control*, 39: 866-872, 2011.
- Knibbs, L., Morawska, L. and Bell, S. The risk of airborne influenza transmission in passenger cars. *Epidemiology and Infection*, 9: 1-5, 2011
- Surawski, N., Miljevic, B., Ayoko, G., Eltahir, S., Stevanovic, S., Fairfull-Smith, K., Bottle, S. and Ristovski, Z. A physico-chemical characterisation of particulate emissions from a compression ignition engine: the influence of biodiesel feedstock. *Environmental Science and Technology*, 45: 10337-10343, 2011
- Ristovski, Z., Miljevic, B., Surawski, N., Morawska, L., Fong, K., Goh, F. and Yang, I. Respiratory health effects of diesel particulate matter. *Respirology*, **Accepted 15 November 2011.**
- Wang, H., He, C., Morawska, L., McGarry, P. and Johnson, G. Ozone-initiated particle formation, particle ageing and precursors in a laser printer. *Environmental Science and Technology*, **In Press, Accepted 12 December 2011.**

## 5. Competitive Grants (Granted and Applied)



**Figure 2.** ILAQH Grant Income Distribution per Year (1998-2011)

### **Granted**

Grant Title: HHWB Collaborative Grant

Project Title: Sources of potentially infectious bioaerosol during orthopaedic surgery

Chief Investigators: Lidia Morawska, Luke Knibbs, Graham Johnson

Awarded: \$29,604

Grant Title: NHMRC Early Career Fellowship

Project Title: Understanding and preventing airborne infections

Chief Investigators: Luke Knibbs

Awarded: \$294,894

Grant Title: NHMRC Centres for Research Excellence

Project Title: Understanding and ameliorating the human health effects of exposure to air pollution from knowledge to policy and public health practice

Chief Investigators: Guy Marks, Bin Jalaludin, Michael Abramson, Gail Williams, Stephen Leeder, Lidia Morawska, Alison Jones, Geoff Morgan, Shyamali Dharmage

Awarded: \$2,411,828

Grant Title: ARC Discovery

Project Title: Fundamental study into the role of the organic fraction on the toxicity of combustion generated airborne particles

Chief Investigators: Zoran Ristovski, Steve Bottle, Branka Miljevic et al.

Awarded: \$390,000

Grant Title: 2011 Faculty of Science Capacity Building Research Equipment Bid

Project Title: Simulation Chamber for Atmospheric Transformation of Biofuel Emissions

Chief Investigators: Zoran Ristovski

Awarded: \$107,811

### **Applied (Outcome Still Pending)**

Grant Title: ARC LIEF

Project Title: Alternative Fuels Engine Emission Research Facility

Chief Investigators: Zoran Ristovski, Lidia Morawska, Rohan Jayaratne et al

Requested: \$523,745

Grant Title: ARC Super Science Fellowship

Project Title: Exploiting New Tools for Monitoring the Oxidative Capacity of Atmospheric Pollutants in Assessing the Impact of Land Use and Climate Change

Chief Investigators: Steve Bottle, Zoran Ristovski, Lidia Morawska et al

Requested: \$556,800

### **Applied (Not Successful)**

Grant Title: NHMRC Project Grant

Project Title: Characterisation of airborne infection spread in hospital environments

Chief Investigators: Lidia Morawska, Megan Hargreaves, Graham Johnson, Luke Knibbs et al

Requested: \$559,938

Grant Title: ARC Linkage

Project Title: Developing new technologies for reducing the toxicity of diesel engine particle emissions into confined environments

Chief Investigators: Zoran Ristovski, Richard Brown, Graeme Millar, Steve Bottle, Branka Miljevic

Requested: \$407,625

## **6. Collaboration with WHO**

- Professor Morawska attended the WHO Working Group meeting on “Guidelines for Indoor Air Quality” in Geneva, Switzerland from 24-25 January 2011
- ILAQH was re-designated as a WHO Collaborating Centre for Air Quality and Health from 2011-2015

## 7. Conference Presentations

### **12th International Conference on Indoor Air Quality and Climate, Austin, Texas, 5-10 June 2011.**

- The Effects of Ultrafine Particles from Traffic Emissions on Children's Health.  
*Morawska, L.*
- Nature of printer-generated ultrafine particles and their formation processes.  
*Morawska, L.*
- How to identify optimal printer location in offices: By CFD modelling or visual assessment and professional judgement?  
*Morawska, L.*
- Particle emissions from vacuum cleaners.  
*Knibbs, L.*
- Comprehensive particle characterization during four nanotechnology processes.  
*Knibbs, L.*
- Viable bioaerosol measurements in large teaching hospital using a UVAPS.  
*Knibbs, L.*
- The Effect of Indoor and Outdoor Particle Sources on Indoor Air Quality of a New Multilevel Office Building In The Vicinity of a Busway.  
*He, C.*
- Characteristics of Indoor and Outdoor Particles in a Children's Hospital.  
*He, C.*
- Vertical and horizontal profiles of ultrafine particles around urban office buildings.  
*He, C.*

### **20th International Clean Air and Environment Conference, Christchurch, New Zealand, 5-8 July 2011.**

- The Relationship between Ultrafine Particles from Traffic Emissions and Children's Health.  
*Morawska, L.*
- Workplace exposure to nanoparticles produced by nanotechnology processes.  
*Morawska, L.*
- Road tunnels and in-vehicle ultrafine particle exposure.  
*Morawska, L.*
- Are volatile organic components responsible for driving the oxidative capacity of combustion generated particles.  
*Morawska, L. (presented on behalf of Ristovski, Z.)*
- A comparative investigation of C6-C15 hydrocarbons emitted from a passenger car powered by unleaded petrol and 10% ethanol fuel.  
*Morawska, L. (presented on behalf of Ayoko, G.)*

### **European Aerosol Conference, Manchester UK, 4-9 September 2011.**

- Personal Exposure Assessment of School Children to Airborne Nanoparticles.  
*Jayaratne, R.*

- Effect of vehicle emissions on the chemical composition of airborne particulates in urban schools.  
*Jayaratne, R.*
- On the Influence of Biodiesel Feedstock on Diesel Particulate Emissions.  
*Miljevic, B.*
- Reactive oxygen species (ROS) emissions from diesel engines running on various biofuel percentages.  
*Miljevic, B.*
- Sea spray aerosol production via bubble bursting during the Surface Ocean Aerosol Production (SOAP) study.  
*Ristovski, Z.*
- Secondary organic aerosol on southern Pacific Ocean.  
*Ristovski, Z.*

## 8. Presentations - Other

### **Lidia Morawska**

- “Transport Outcomes: Air Quality & Health” - Measuring Transport Outcomes Short Course, Brisbane, 30 March 2011
- “Indoor Air Pollution and Health” & “Road Transport – Impact on Urban Air and Human Health”, Guangzhou Institute of Chemistry, Chinese Academy of Science, 21 July 2011
- “Indoor Air Pollution and Health”, Huazhong Normal University, 23 July 2011
- “Indoor Air Pollution and Health”, Wuhan Centres for Disease Prevention & Control, 23 July 2011
- “Indoor Air Pollution and Health”, Shanghai University, 27 July 2011
- “Road Transport – Impact on Urban Air and Human Health”, Shanghai Environmental Monitoring Centre, 28 July 2011

## 9. Activities – Other

### **Lidia Morawska**

- Member, Standards Australia Technical Committee NT001 (Nanotechnology), Working Group 2 (Measurement and Characterisation).

### **Zoran Ristovski**

- Member, Standards Australia, TC 24/ SC 4
- Member, Committee on Nucleation and Atmospheric Aerosols
- Australian Representative in the ISO Technical Committee 24, Single Particle Light Interaction Methods
- Member, European Supersites for Atmospheric Aerosol Research (EUSAAR) “Building a new generation of humidity-controlled aerosol monitors”

### **Godwin Ayoko**

- Chair, Analytical and Environmental Chemistry Group, Royal Australian Chemical Institute QLD Branch
- Member, National Analytical Chemistry Division Committee, Royal Australian Chemical Institute, Australia.
- Member, Chemical Education Committee, Royal Australian Chemical Institute QLD Branch

## 10. Media Appearances

### **Lidia Morawska**

- ABC News – Post-Flood Air Quality Study in Brisbane

### **Zoran Ristovski**

- Diesel emissions work was highlighted in the 2010 Annual Report of the Australian Coal Association Research Program (ACARP).
- Biofuels work was highlighted in the 2010 Annual Report of the ARC Centre for Excellence for Free Radical Chemistry and Biotechnology.

## 11. Visitors

- Dr Petri Vaattovaara, Physics and Mathematics, University of Eastern Finland, December 2010 – August 2011  
*Visiting Academic – The Great Barrier Reef as a Significant Source of Chemically Relevant Aerosol Particles*
- Professor Morteza Abdolzadeh, Mechanical Engineering, University of Kerman, December 2010 – June 2011  
*Visiting Academic – The Effect of Particle Deposition in Turbulent Flows on the Performance of Photovoltaic Cells*
- Dr Heidi Salonen, Finnish Institute of Occupational Health, Helsinki, January – December 2011  
*Visiting Academic – Quantification of Bioaerosol Transport in Indoor Environment*
- A/Professor James McGlothlin, Purdue University, USA, 17 June 2011  
*Visiting Academic – Exposure Assessment: Real-time occupational & environment sensors.*
- Dr Alex Huffman, Max Planck Institute of Chemistry, Germany, 1 July 2011  
*Visiting Academic – Ambient bioaerosol measurements using the UV-APS and complementary off-line analysis techniques at Cape Grim*
- Ms Sarah Styler, University of Toronto, Canada, 8 July 2011  
*Visiting PhD Student - Characterisation, chemistry, and health impacts of urban particulates and gas-phase urban pollutants.*
- Ms Fernanda Fuoco, University of Cassino, Italy, September 2011 – August 2012  
*Visiting Student – The Effect of Ultrafine Particles from Traffic Emissions on Children's Health*
- Mr Nick Talbot, National Institute for Water and Atmospheric Research, New Zealand, 10-20 October 2011  
*Visiting Student – The Effect of Ultrafine Particles from Traffic Emissions on Children's Health*
- A/Professor Giorgio Buonanno, University of Cassino, Italy, 17-18 October 2011  
*Visiting Academic – The Effect of Ultrafine Particles from Traffic Emissions on Children's Health*
- Dr Erik Uhde Fraunhofer WKI, November 2011  
*Visiting Academics - Laser Printer Generated Nano and Ultrafine Particle*
- Professor Werner Hofmann, University of Salzburg, Austria, November 2011  
*Visiting Academic - Regional Deposition of Combustion Nanoparticles in Human Lung*
- A/Professor Tunga Salthammer, Fraunhofer WKI, December 2011  
*Visiting Academics - Laser Printer Generated Nano and Ultrafine Particle*