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OMICS Group International is an amalgamation of Open Access publications and worldwide international science conferences and events. Established in the year 2007 with the sole aim of making the information on Sciences and technology 'Open Access', OMICS Group publishes 400 online open access scholarly journals in all aspects of Science, Engineering, Management and Technology journals. OMICS Group has been instrumental in taking the knowledge on Science & technology to the doorsteps of ordinary men and women. Research Scholars, Students, Libraries, Educational Institutions, Research centers and the industry are main stakeholders that benefitted greatly from this knowledge dissemination. OMICS Group also organizes 300 International conferences annually across the globe, where knowledge transfer takes place through debates, round table discussions, poster presentations, workshops, symposia and exhibitions.

About OMICS Group Conferences

OMICS Group International is a pioneer and leading science event organizer, which publishes around 400 open access journals and conducts over 300 Medical, Clinical, Engineering, Life Sciences, Pharma scientific conferences all over the globe annually with the support of more than 1000 scientific associations and 30,000 editorial board members and 3.5 million followers to its credit.

OMICS Group has organized 500 conferences, workshops and national symposiums across the major cities including San Francisco, Las Vegas, San Antonio, Omaha, Orlando, Raleigh, Santa Clara, Chicago, Philadelphia, Baltimore, United Kingdom, Valencia, Dubai, Beijing, Hyderabad, Bengaluru and Mumbai.

Air Quality Challenges in Wesselton Township, South Africa



5th International Conference and Exhibition
Analytical & Bioanalytical Techniques
August 18-20, 2014 Beijing, China

Shadung (SJ) Moja, University of South Africa

University of South Africa





Outline

- Define Poor Air Quality (AQ)
- Dispersion & Dilution of Air Pollutants
- Explain How Local AQ Legislation & International Best Practice Influence the Development of AQ Management Plans
- Monitoring Activities of Some Criteria Pollutants
- Results & Discussion
- Future Plans

Poor Air Quality



- Built up of biological, chemical or geological material in the lowest part of the atmosphere ≡ troposphere.
- Air pollutants – particulate matter (PM) & Gases
- PM – small particles (nm-μm) or liquid droplets
- Troposphere – very unstable & turbulent layer of air
- Composition is influenced by ground based activities

Dispersion & Dilution of Air Pollutants

- Horizontal Air Movement : wind ($F_{fric.}$, $F_{\Delta P}$, $F_{acc.rot.}$)

[irregular ground surfaces compress wind and generate mechanical turbulence; mixing and dilution are enhanced due to ↑ wind speed; but, high building & valleys reduce these effects and give rise to enhanced localized pollution]

- Vertically Air Movement : $F_{\Delta H}$, F_{gr}

[compressibility of gases, cools upon expansion and heat upon compression. During the day, differential heating of the earth's surface by the sun generate thermal turbulence. Warm air rises and is replaced by cold air, in this way vertical air currents are created and pollutants are dispersed. In winter and at night, atmospheric pressure drops, which give rise to little wind, less mixing, less dilution, enhanced localized pollution and impacts ≡ inversion effects]

AQ Legislations in S.A. & Atm. Man. Plans

- Atmospheric Pollution Prevention Act (APPA) Act 45 (RSA, 1965): controlled AP at sources, smoke free residential zones were declared, BC & SO_2 ; limitations- fragmented source control, focuses on listed point sources, could not to link sources with impacts; lacked public involvement, poor access to information, etc.
- Section 103 (Act No. 108) of the Constitution Republic of South Africa (CRSA, 1996): adopted, advocates for the environment that is not harmful to the health & wellbeing of residents; etc
- National Environmental Management Act 107 (NEMA, 1998): encouraged prevention, minimisation and remediation of environmental pollution and degradation, polluter pays principle, etc.
- Air Quality Act 39 (AQA, 2004): shift AQ Man. responsibilities from national to provincial and local government; focused on receiving environment; involves the identification of priority areas, pollutants and sources; all point sources are addressed; encourages public participation; easy access to information.
- Under AQA, South African National Standards (SANS-1929) were published by South African Bureau of Standards (SABS) Standards Division which specifies limit values for common air pollutants (SANS-1929, 2011; DEAT, 2005).

Objectives of this Pilot Study

- Access and analyse secondary data (generated from a monitoring site controlled by government, but run by a private company)
- Continuous, real time data of some criteria pollutants in a declared priority area (PM10, PM2.5, NO_2, SO_2)
- Contribute to poor health and environmental degradation
- Monitoring period (2011, 2012, 2013):

  Summer months: January, February

  Winter months : June, July

Particulate Matter Monitor



- Specified volume of air sucked into the unit
- Number of particles passing through light sensor counted & averaged
- Filter traps particles at the outlet port of air

On-line Monitoring System-Pollutant Specific

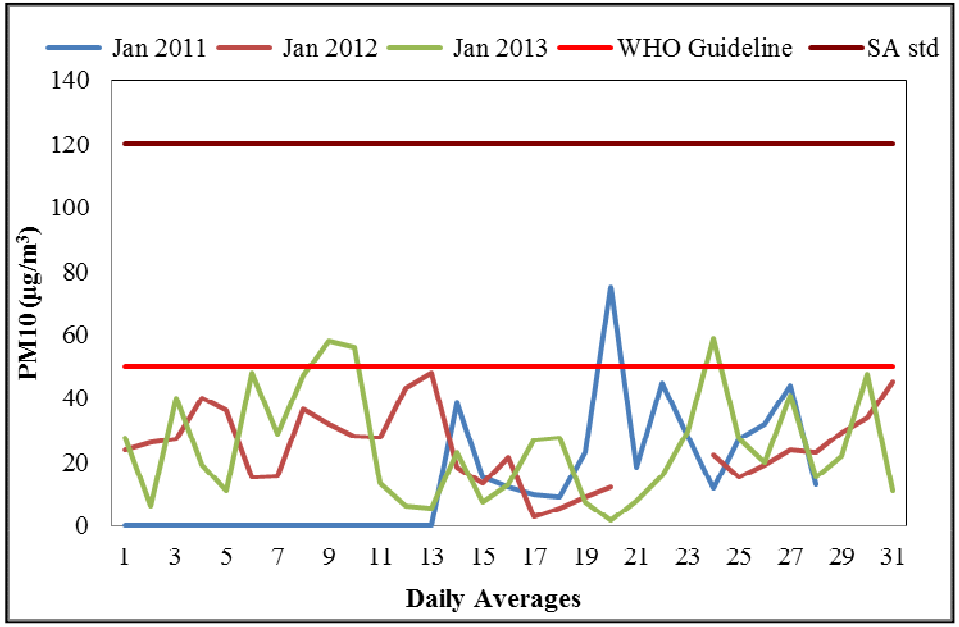


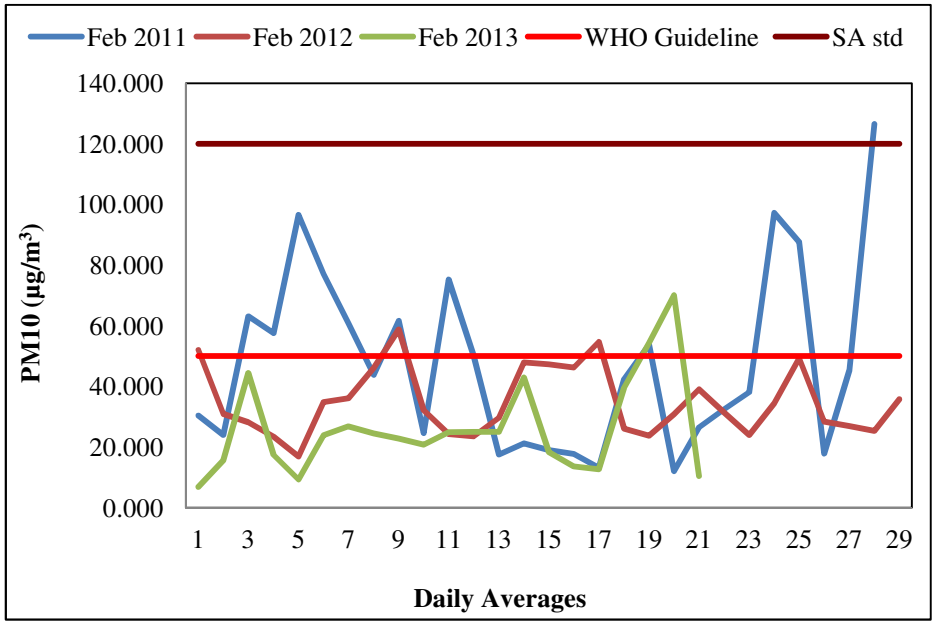
- NO_2 analyser uses chemiluminescence detection system [air sample flows thru a rxn chamber: $NO+O_3$excess$\rightarrow NO_2$ excited $\rightarrow$ decays into photons $\rightarrow$ proportional to $[NO_2]$ (Model EC9841B) - Complies with U.S. EPA Automated Reference Method (RFNA-1292-090) and the Australian standard (AS 3580.5.1-1993).

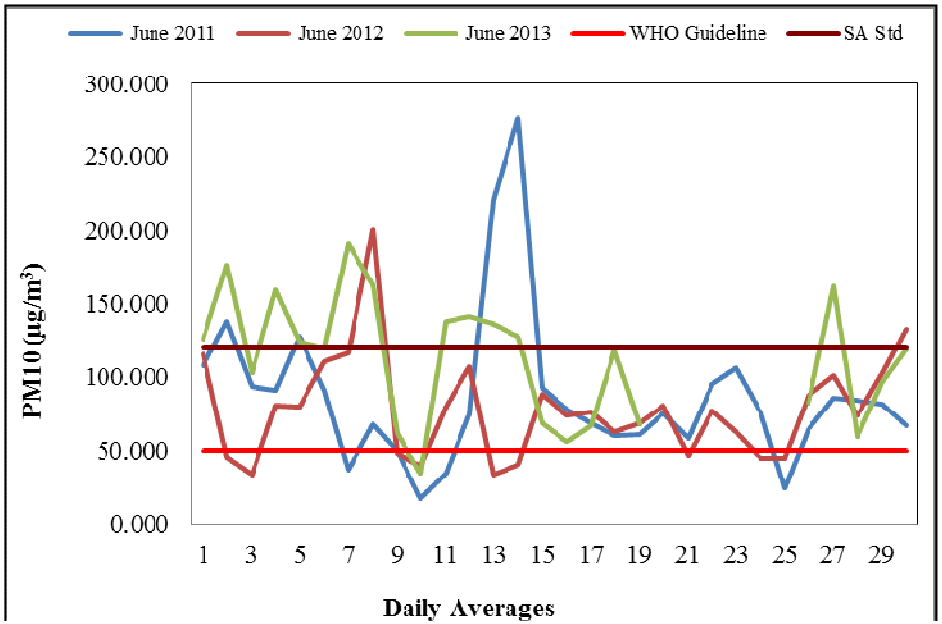
- SO_2 analyser uses a UV-fluorescence detection system [SO_2 molecule exposed UV radiation$\rightarrow$ absorbs $\rightarrow$ excited$\rightarrow$ emits radiation as it decays $\rightarrow$ measured by photomultiplier tube $\rightarrow$ whose output voltage $\rightarrow$ proposotional to $[SO_2]$

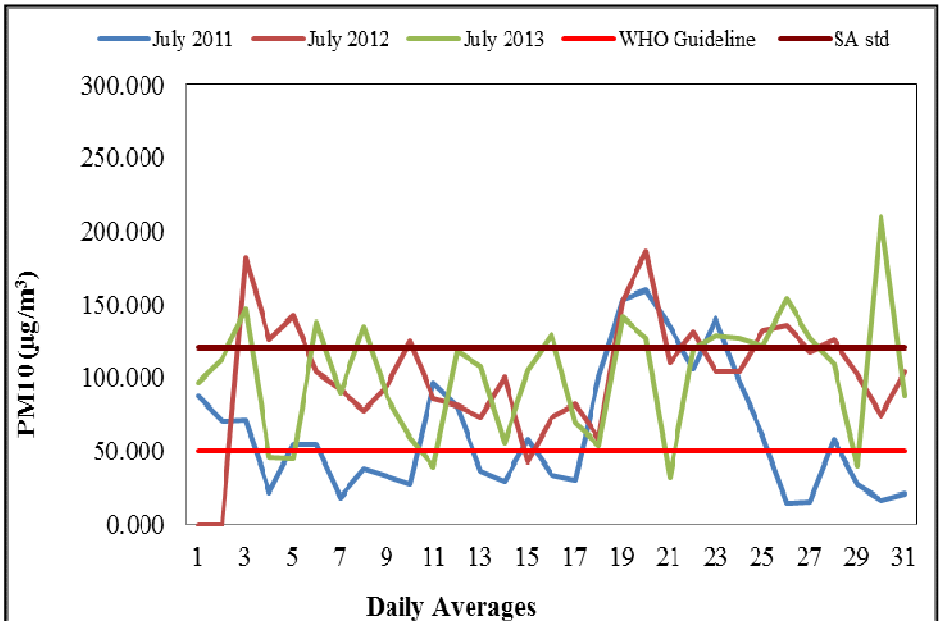
(Model EC9850B) - Complies with the U.S. EPA Automated Equivalent Method EQSA-0193-092 and with the Australian standard, AS 3580.4.1-1990.

PM10 Daily Distribution Data

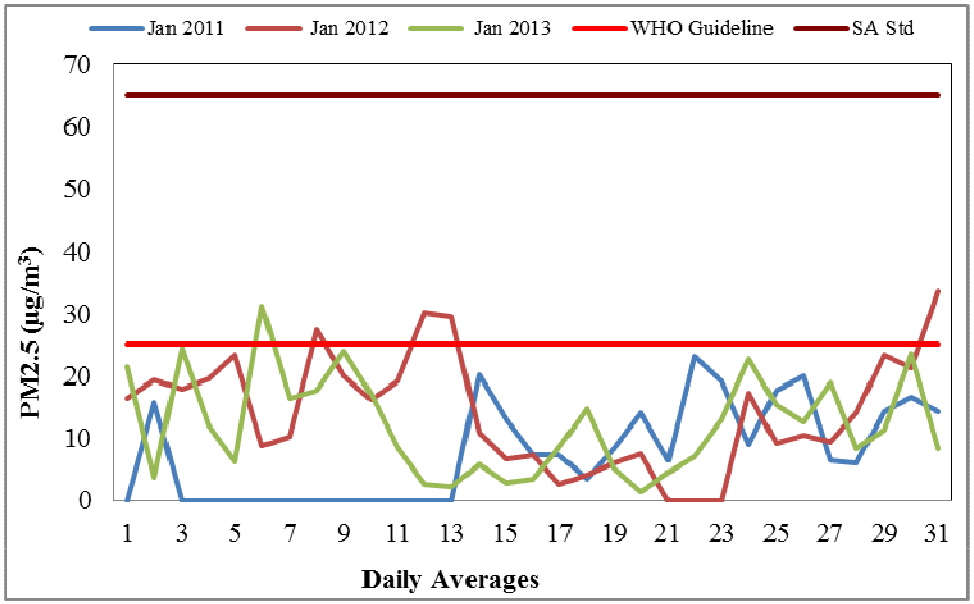


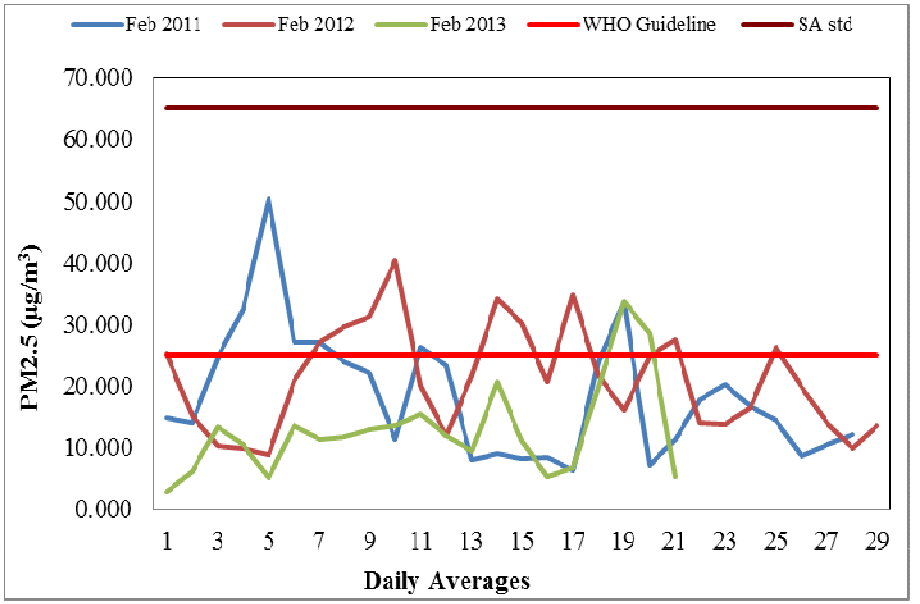


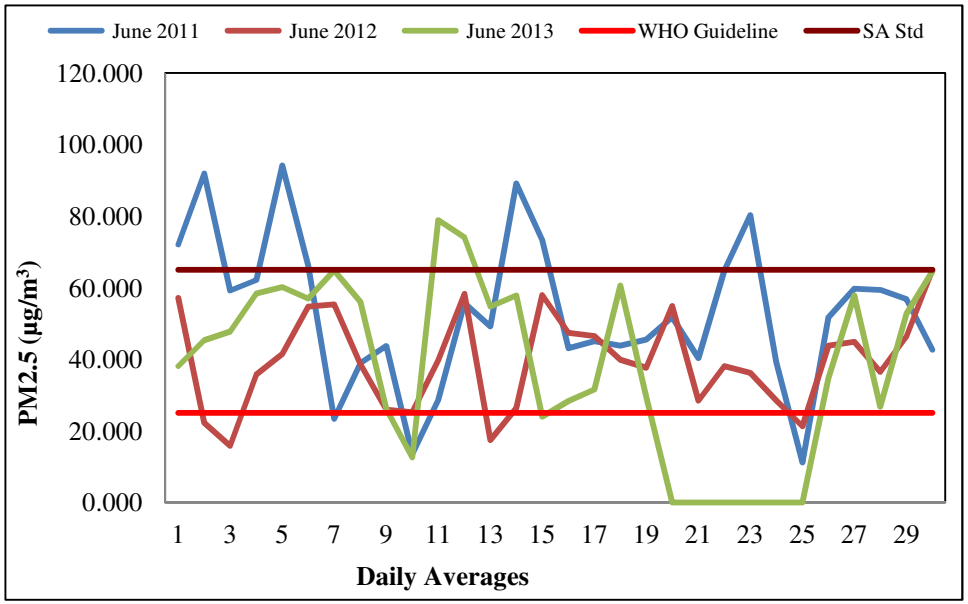


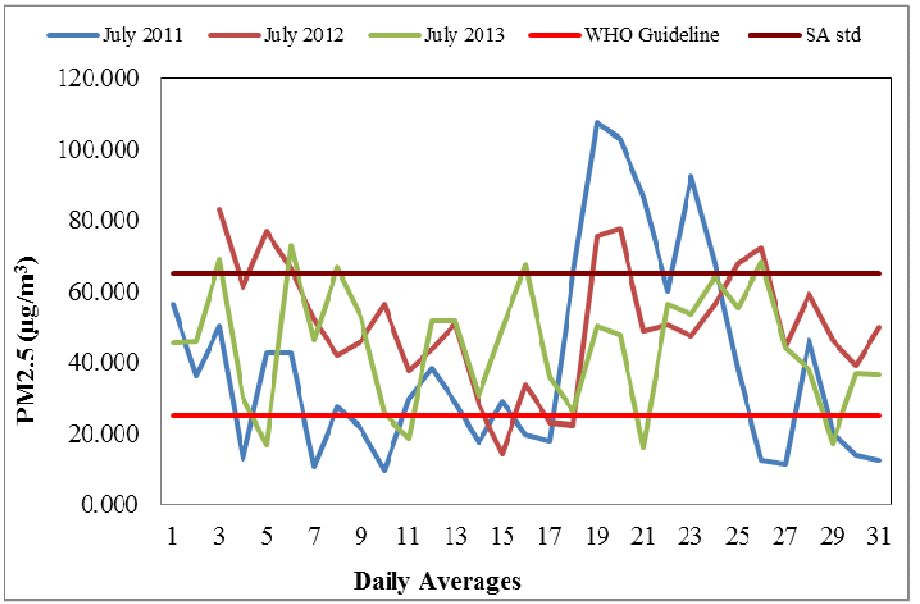


PM2.5 Daily Distribution Data

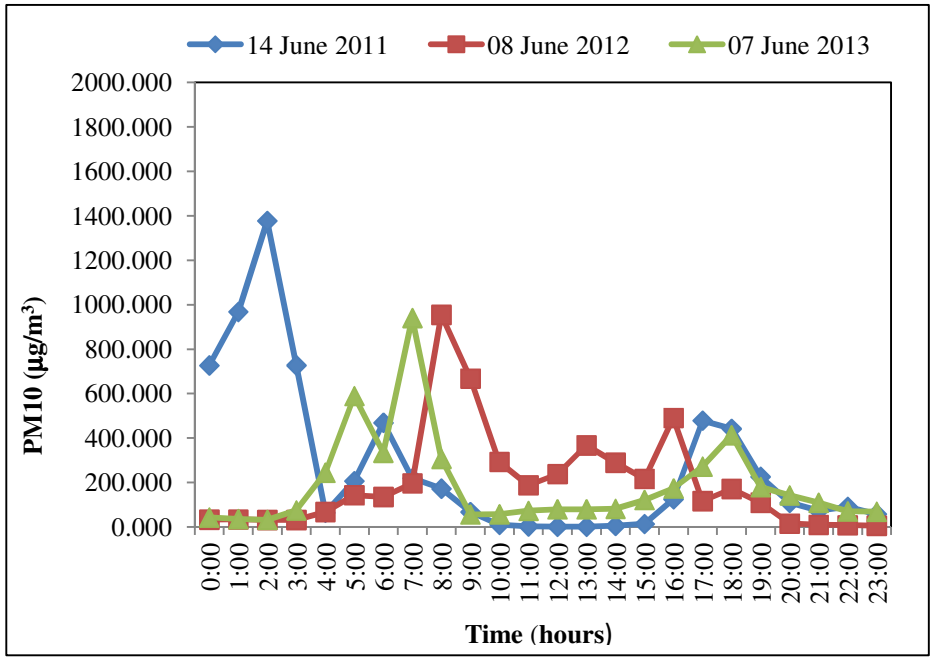


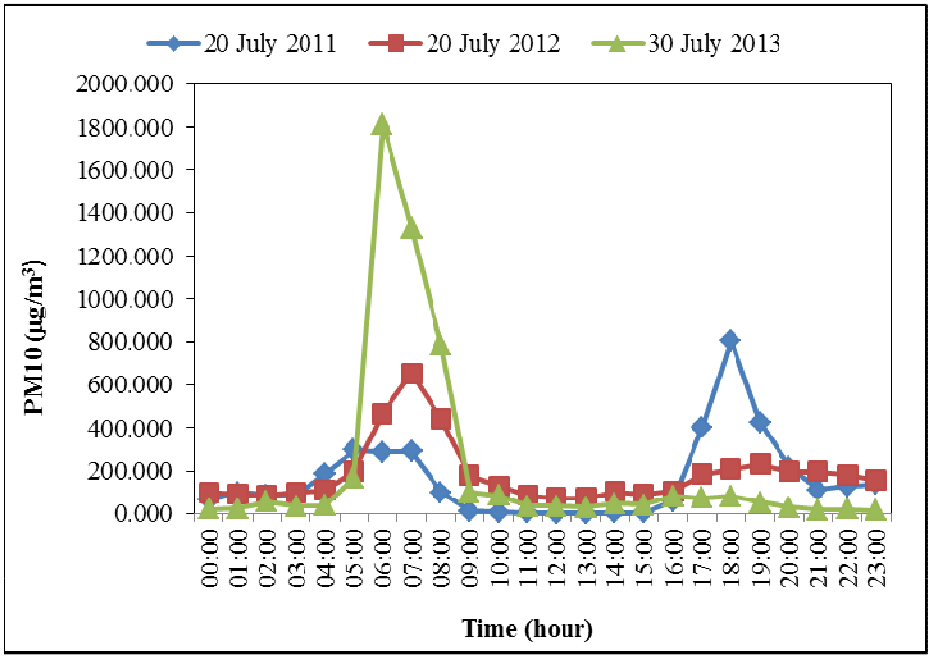


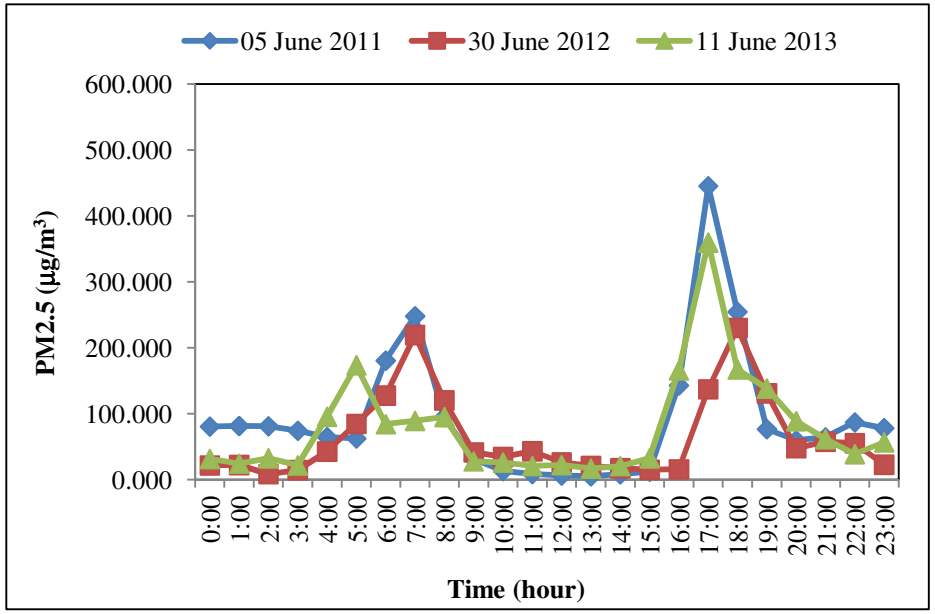


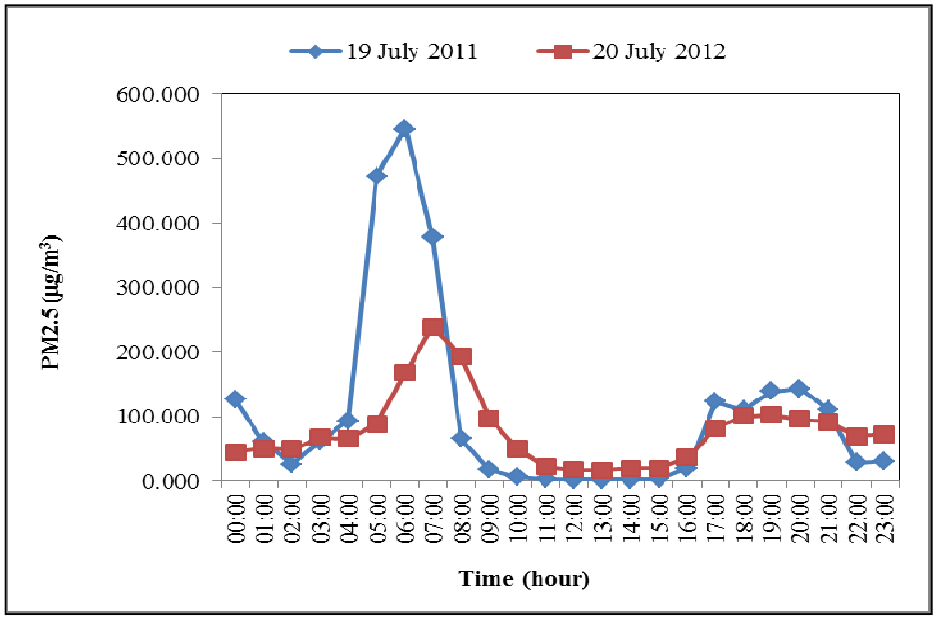


PM Hourly Data (µg/m^3) - Standard Exceeded

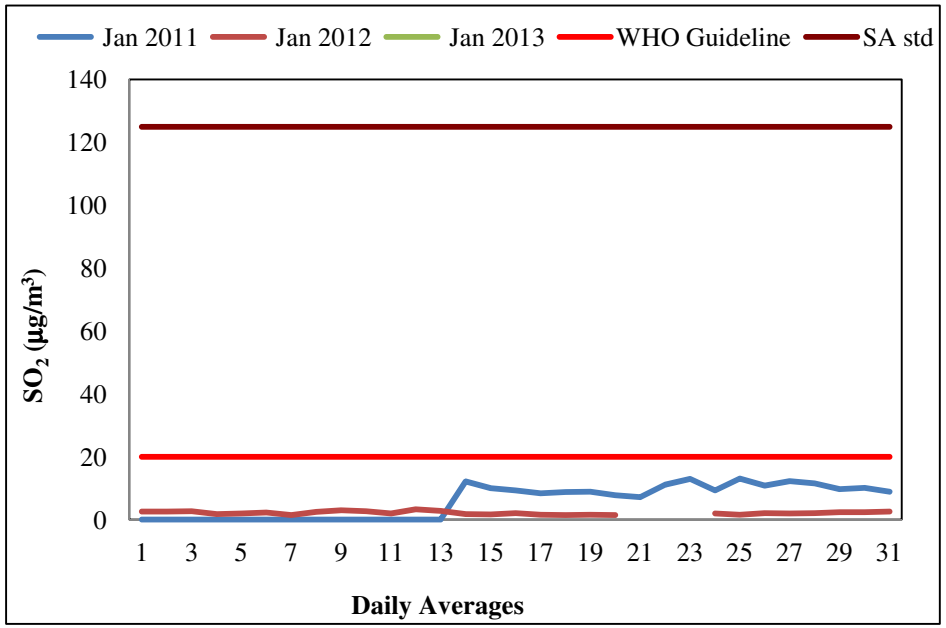


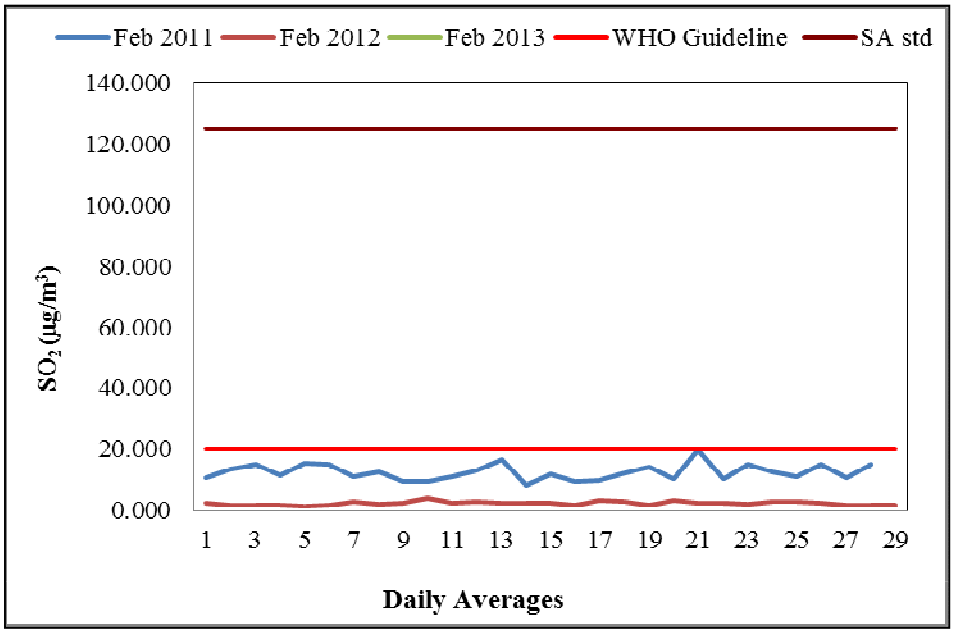


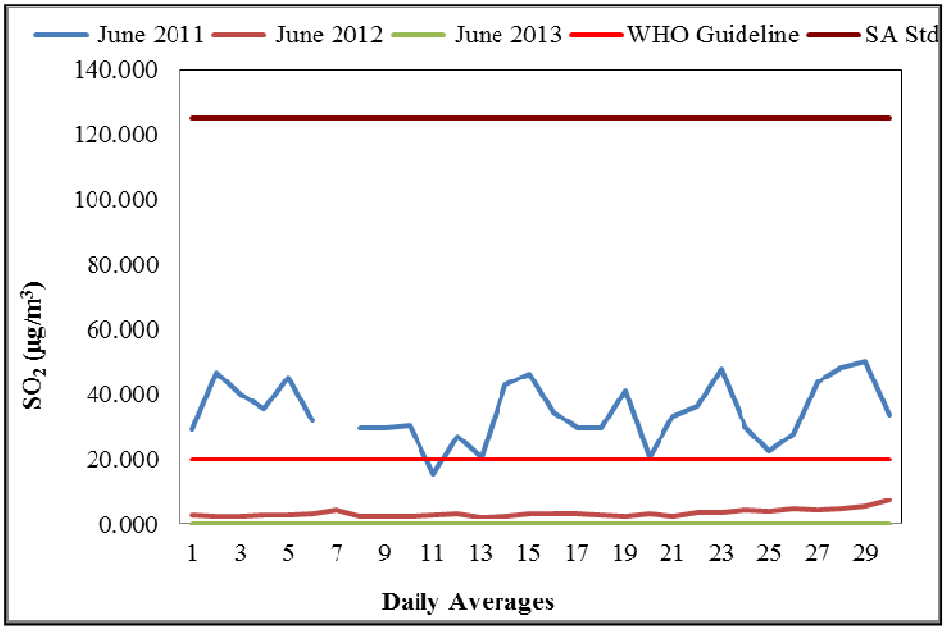


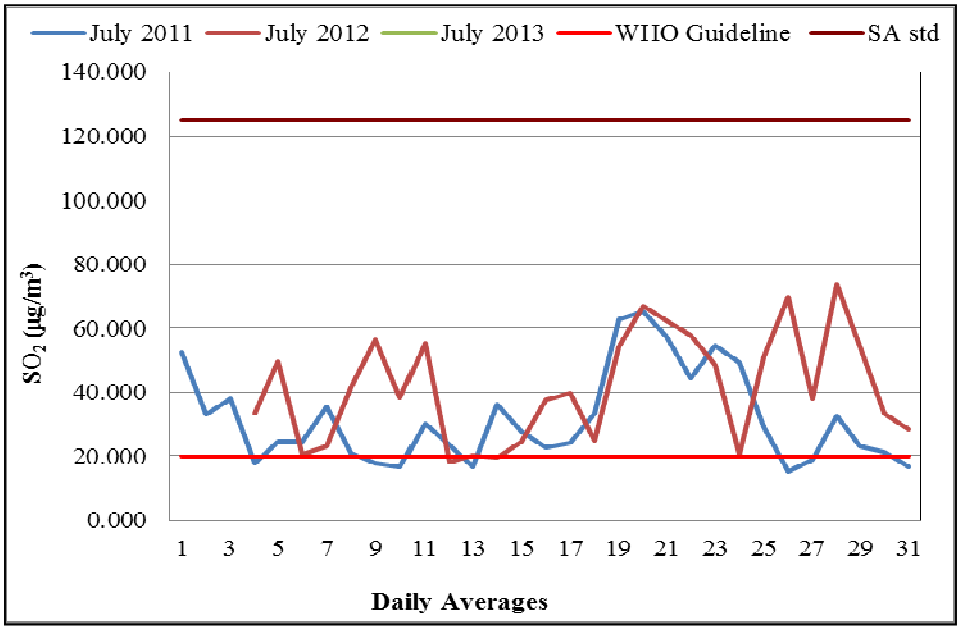


SO_2 Daily Distribution Data

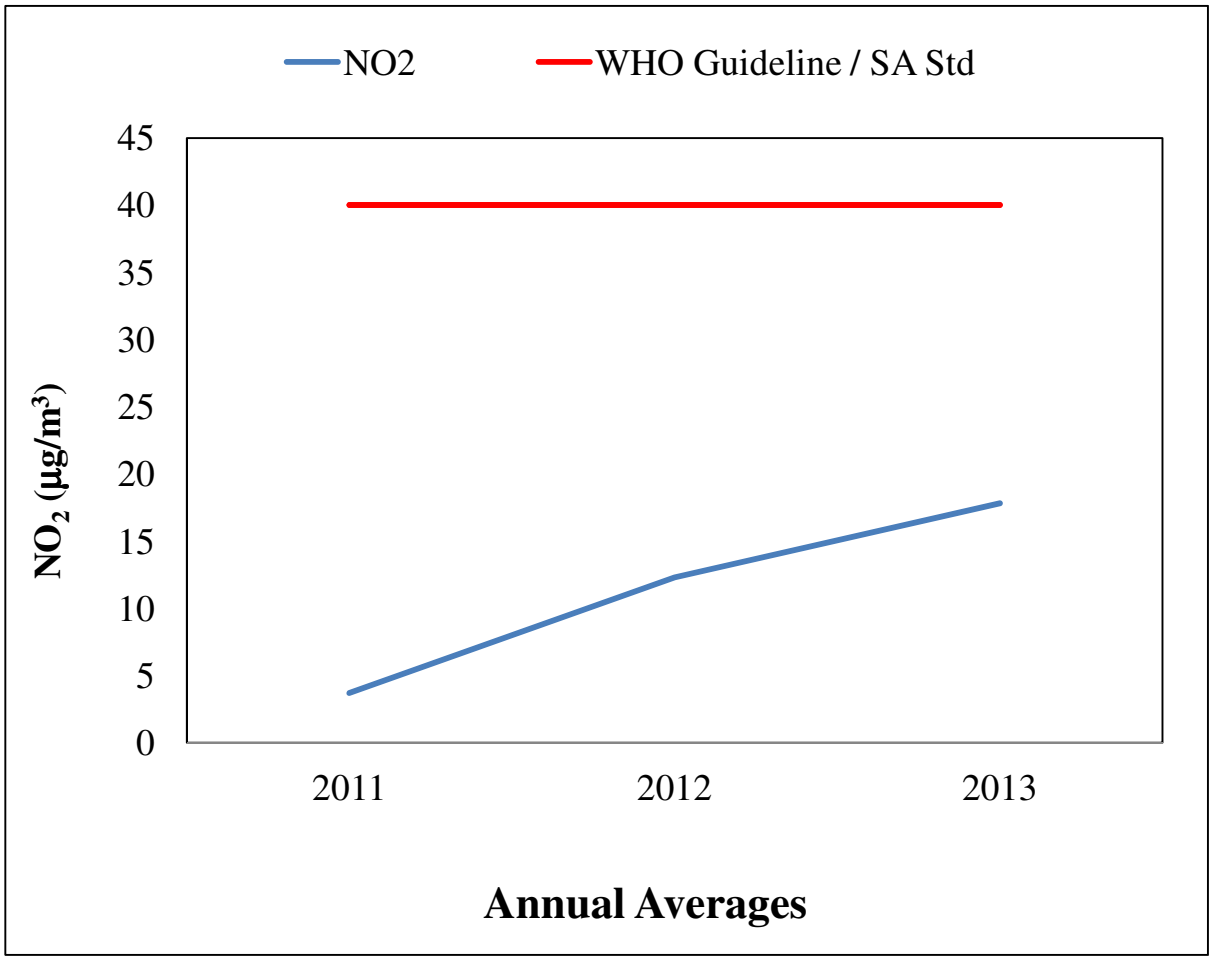








NO_2 Annual Distribution Data







Possible Sources

Need Validation











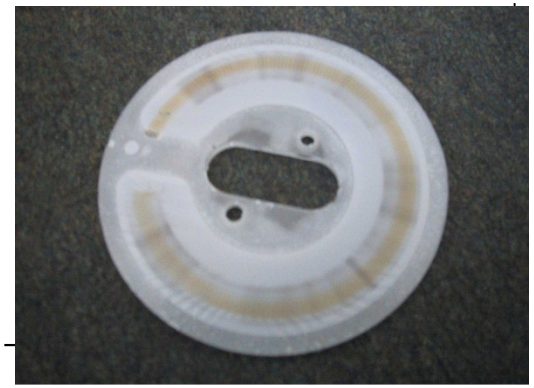
Next Phase

- Meteorological data (rainfall, wind speed & direction)

- Increase number of monitoring sites (1 to 5) – include passive gas samplers, pollutant specific – GC/MS

- O_3 precursors, CH_4, BTEX (benzene, toluene, ethylbenzene and xylene); NO_X (NO_2 + $NO\cdot$) + CO

- Characterization of particulate matter on filter paper:
  - . physical, chemical, microbiological
  - . time resolved data
  - . pinpoint activities at particular times
  - . source apportionment



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Ms Zodwa Ndhlovu – undertaking BSc(Hons) project.
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Thanks for Listening

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