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This is the author's version of a work that was submitted/accepted for publication in the following source:

Jayaratne, Rohan, Pushpawela, Buddhi, He, Congrong, Morawska, Lidia, & Gao, Jian
(2016)

First observations of new particle formation in Beijing using a neutral cluster and air ion spectrometer (NAIS). In
12th Annual Workshop of the Australia New Zealand Aerosol Assembly,
4-5 August 2016, Queensland University of Technology, Brisbane, Qld.

This file was downloaded from: <https://eprints.qut.edu.au/108834/>

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First Observations of New Particle Formation in Beijing using a Neutral Cluster and Air Ion Spectrometer (NAIS)

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The ILAQH neutral cluster and air ion spectrometer (NAIS) was operated for a continuous period of three months from November 2015 to January 2016 as part of a major air quality monitoring campaign coordinated by the Chinese Research Academy of Environmental Sciences in Beijing. The NAIS provides neutral and charged particle and cluster concentrations in real time in the size range 0.5 to 42 nm. Molecular clusters of precursor gases transform into particles at a size of about 1.6 nm - a phenomenon that is known as nucleation or new particle formation (NPF). NPF requires a sufficiently high level of gaseous supersaturation in the air – a condition that is mitigated by the presence of high concentration of particles in the atmosphere. November and December 2015 was characterised by several severe pollution episodes in Beijing, yielding mean daily PM_{2.5} levels of 120 and 154 $\mu\text{g m}^{-3}$, respectively. The average daily PM_{2.5} level exceeded 100 $\mu\text{g m}^{-3}$ on most days. However, the pollution level eased during January 2016 giving a mean daily PM_{2.5} level of 67 $\mu\text{g m}^{-3}$. The mean number of NPF events observed per month in November and December was just over 4, and in January it increased to 16. In this paper, we will show that severe pollution events in Beijing occur in a cycle of 5-8 days and generally coincide with winds that bring industrial pollution from the south. Successive severe pollution episodes are separated by 2-5 days of relatively clean air periods coinciding with winds from the less-industrialized north. NPF events almost always occurred during these clean air periods.

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Abstracts due: 31 May, 2016

Prof Lidia Morawska
ANZAA Chair