Meeting Report

Air Quality in the 21st Century

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Building on the success of last year's conference, this event presented an update on a range of relevant topics providing a broad survey of the measurement, regulatory and scientific issues affecting air quality. The conference was held in collaboration with DEFRA's Air Quality Expert Group (AQEG), with a number of presentations focused on the group's recently published reports, and in conjunction with the UK Clean Air Programme..

Laura Alcock, Secretary of the ECG opened the conference, introducing the ECG, the primary goals of the event and the sponsors who contributed to its success before handing over to **Ally Lewis** of UK Clean Air Programme to chair session one. He raised awareness of the AQEG group of DEFRA and their current drive to recruit new members before a brief overview of the session format.

Eiko Nemitz (UK Centre for Ecology and Hydrology) presented *UK atmospheric ammonia sources, trends and impact*, which included a deposition profile of ammonia particulate matter and the emissions that contribute most significantly to reducing levels. The talk concluded with a summary statement that current aims to reduce emissions are not sufficient to protect biodiversity as intended and vigilance is needed for emerging sources of ammonia emissions.

Dr Sarah Moller (University of York, NCAS) took up this point with her talk *Exploring the future: the role of ammonia in UK industry, energy and transport systems.* This summarised an AQEG workshop with representatives from multiple sectors to discuss potential issues and forecasts for the future. The lack of ammonia production and infrastructure in the UK was identified as a potential future security risk and potential applications were identified with risks and issues associated. Headline conclusions were presented with future use dependent on decarbonisation strategies being implemented.

Will the air pollution health and economic co-benefits of UK Net Zero policy help justify future action? was delivered by **Sean Beevers** (Imperial College London). This presented the method, basis data and result forecasts of a model for prediction of air quality for the UK with and without implementation of Net Zero policy. Health impact and cost-saving analyses (by most significant sectors) analyses were summarised with long-term benefits for all but some lacking in short-term cost benefits. A profile of indoor air pollution with gas and electricity cooking was compared before a summary of the forecast policy implications.

The final talk of the first session was **Chris Dore's** (Aether Ltd, AQEG) *Uncertainties and Emerging Sources of Air Pollution.* This talk discussed the complexity of activities and emissions sources as contributing to uncertainty of data for suitability and accuracy of conclusions and calculations. Assessment of data uncertainty and methods for improving this were discussed with introductions to some methods in use or development. Emerging sources of pollution were also mentioned, as the low understanding of their contributions result in high uncertainty, and many of these are being driven by changes in policy. Conclusions recapped the metric requirements for different users and development of new methodologies and concepts, as well as the implications of emerging challenges.

After an open discussion between the presenters and delegates, the event sponsors were invited

to present flash talks on their work and activities in line with their exhibitions. The event then moved to lunch for networking and review and discussion of posters. 19 posters were displayed with the following themes observed:

- $PM_{2.5}$ sources and levels, as well as significant contributors and impacts.
- Measurement and monitoring of air quality including methods, modelling and development and maintenance of measurement tools and equipment.
- Measurement of other pollutant and reactions, as well as adjustments required to achieve this monitoring and potential consequences of pollution levels.

The second session of talks was opened and chaired by **Gary Fuller** of Imperial College London.

Roy Harrison (University of Birmingham) was introduced to present *Ultrafine particles: the new frontier in air pollution*. After clarifying the definitions of "ultrafine particles" (UFPs), the health risks associated with them was discussed, highlighting that their influence is independent of $PM_{2.5}$ exposure. The primary and secondary sources of UFPs were discussed, as well as the diseases linked to UFP exposure (cardiovascular and dementia diseases). Mechanisms of UFP control were discussed as well as concerns that these are linked to the presence of other pollutants whose concentrations are being reduced.

Chemical composition and toxicology of ultrafine shipping PM was the subject discussed by **Nat Easton** (University of Southampton), highlighting that shipping emissions are among the least regulated sources of pollution, globally. Coarse, fine and ultrafine particle emissions were simultaneously sampled at various sites of Southampton port, measured by ICP-MS and compared with a non-port urban background site. The study found that Cruise shipping contributed much more significantly to emissions than cargo shipping. Primary health impacts were investigated based on the emission composition which indicated that a pro-inflammation response was noticeable and antiviral gene responses were supressed, resulting in a virally-susceptible state.

The first keynote talk of the day was delivered by **Rosie McEachan** (Bradford Institute for Health Research) – *Pollution, place, people and…politics: Lessons learnt from 15 years of evidence and action reduce pollution in Bradford.* Implications of health challenges and life expectancy related to local pollution was highlighted at the beginning of the talk, including the statement that children living just 10 miles apart had a 10-year gap in life expectancy, poorer families experiencing the lower expectancy. Distribution of pollution factors across geographic, ethnic and wealth backgrounds showed that primary sources overlapped noticeably with each other and those of poorer backgrounds and ethnic minorities. Difficulties around influencing policies caused by political appearance were highlighted, as well as angles applied to communication of scientific information statements by public media and the need to drive for positive measures and persist in order to actually see the desired benefits.

At this point, the conference took a second break for networking and poster review before returning for the final session which was chaired by **Valerio Ferracci**, Environmental Chemistry Group.

Ruth Doherty (University of Edinburgh) spoke on *Implications of Climate Change for achieving WHO Air Quality guidelines across Europe: Key processes and uncertainties* which discussed street-scale temperature change project modelling based on existing continental models, as well as potential impacts on air pollution at a level that affects individuals. An overview of the forecast emissions and the chemistry driving the changes in pollutant concentrations in the atmosphere. Summer and winter profiles were modelled, demonstrating the consideration of the

different air quality profiles related to seasonal conditions. The modelling and differential charts were based on 2090's compared with 2000's data. Current guidelines were shown alongside future guidelines with ozone increasing – this related to its control by other pollutants which show reduced concentration limits in the guidelines.

Assessing the Air Quality impact of the London-wide Ultra Low Emission Zone (ULEZ) was presented by **Yvonne Brown** (Transport for London). The history of London emissions charges and zones, as well as the current rules was introduced before reviewing the level of compliant vehicles (those not subject to charges) and the emissions trends with clear reductions attributable to Covid-19 and the implementation of ULEZ, as well as a noticeable rebound of emissions following movement restriction easing at the end of the global pandemic. An estimation of potential emissions without ULEZ implementation was shared, as well as the method used to calculate it. The team took care to consider nationwide and global action for reducing emissions when modelling this, rather than assuming no change. The challenges of working on this were shared, including a statement of the threats and abuse that the team faced as a result of the analysis and conclusions shared. However, the work proved that the implementation had had a significant impact on emissions and air quality in London.

Maria Val Martin (University of Sheffield) discussed *Air quality impacts of wildfires and prescribed burns in the UK uplands.* The similarities and differences between the two types of burns was highlighted. The UK's largest wildfire and its impacts was summarised, as well as the impact of controlled burns for moor management resulting in increased levels of $PM_{2.5}$ in the atmosphere in surrounding cities to above WHO limits. The study presented focused on the Peak District due to occurrence of both wildfires and controlled burns within its boundaries. Efforts to deploy air quality sensors in the affected areas were discussed and projects behind the efforts.

Finally, **Eloise Marais** remotely delivered the second keynote talk of the event on *Inequitable exposures and health burdens of air pollution from the major oil and gas lifecycle stages in the United States.* This talk started with an overview

of the key contributors to natural gas contribution, the major stages of the oil and gas lifecycle and the pollution from each of these stages. The reasons for this study were presented, including the gaps present in the information from historic studies. Data selected was from 2017 as it was the most recent significantly comprehensive global dataset. The contribution of oil and gas to specific pollutant emissions were determined and shared. A model of pollutant concentrations was created for each stage of the lifecycle, including a baseline. From this model, an estimate of the geographic health burden was formed – the input information for this was also summarised. Among the key points discussed were the facts that some of the poorest areas of the US were subject to the majority of downstream stage pollution and

ethnic minorities, including Native Americans experienced higher rates of health burdens. Concluding remarks shared the limitations of the data and the conclusions of the study.

Gary Fuller addressed the delegates with concluding remarks, summarising the passionate presentation and also participation of the delegates. The sponsors were thanked and the highly successful event was closed with sentiments of intention to repeat next year.

Figure 1. Photograph of all event speakers, delegates and organisers at RSC Library.