Atmospheric Pollution at Southampton: Synthesis Report

Edited by Chenxuan Li

UNIVERSITY OF Southampton
Institute of Maritime Law

FOREWARD

This report provides a synthesis of the main findings from the *Atmospheric Pollution at Southampton Workshop*, held on 13th July 2016 at the National Oceanography Center (Southampton), in order to assess the impact of atmospheric pollution on the city of Southampton and provide recommendations, policy measures as well as innovative engineering solutions to mitigate the negative impacts of atmospheric pollution on the city. The workshop was organized by Professor Michael Tsimplis, Dr. Emily Reid and Dr. Johanna Hjalmarsson from the Institute of Maritime Law within the Law School, at the University of Southampton.

This synthesis report was written by Chenxuan Li and it draws on the work of a number of other contributors: Professor Ian Williams, Dr. Ben Waterson, Dr. Matthew Loxham, Dr. Emily Reid, Professor Michael Tsimplis, Dr. John Boswell, Kim Tanneberger, Motonobu Tsuchiya, Colin MacQueen, Liz Batten, Steve Guppy and Dr. Patrick Osborne.

Contributions and inputs into the *Atmospheric Pollution at Southampton Workshop* were provided by all participants: Professor Damon Teagle, Professor Gavin Foster, Dr. Robin Wilson, Professor Martin Palmer, Annie Sheehan, Professor Bob Whitmarsh, Rod Figg, Aart Lambers, Steve Yendall, Esmé Adam, Zak McElvenny, Dr. Viktor Webber, Dr. Meixian Song, Clare Brady, Mandi Bissett, Debbie Chase, Thomas Webber, Adam Goulden and Hannah Stones.

The workshop was funded by the Law School, University of Southampton.

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1. INTRODUCTION

1.1 Background

The City of Southampton is the largest city in Hampshire and a major coastal port located on the South Coast of England, which has a population of 249,500.[1] Southampton is the UK's number one vehicle handling port, Europe's leading turnaround cruise port and the UK's most productive container port, because of its excellent strategic position and channel characteristics.[2] The Port of Southampton is run by Associated British Ports (ABP), and is operated by DP World Southampton, creating hundreds of jobs. The city has very good transport infrastructure links, served by a regional airport just outside the city's northern boundary, the M3 and M27 Motorways and a main line railway to London and along the south coast.

The major source of atmospheric pollution in Southampton is road transport emissions. In addition, domestic gas boilers, industrial emissions, shipping emissions as well as aviation emissions also significantly contribute towards the total.

Atmospheric pollution is an important global problem affecting human health. Port cities face additional challenges due to atmospheric pollutants introduced by port activities including land and sea transport emissions. Southampton, which also has an airport in addition to its port facilities, has been identified as one of the few UK cities that will not meet the requirements of EU atmospheric pollution standards by 2020.

1.2 Objectives

The workshop has four objectives:

a. Review the health related, environmental, social and legal considerations of atmospheric pollution;

b. Establish a dialogue between local stakeholders and researchers in order to optimise interaction and consensus building;

c. Develop an inclusive prototype for dealing with atmospheric pollution in port cities;

d. Initiate a discussion on the long-term future of Southampton in the context of sustainable development.

1 Based on the Mid Year Estimate (MYE) 2015 <https://www.southampton.gov.uk/council-democracy/council-data/statistics/mye-southampton.aspx> accessed 19 July 2016.

2 <http://www.abports.co.uk/Our_Locations/Southampton/> accessed 19 July 2016.

2. ATMOSPHERIC POLLUTION MAPPING- HOW DOES SOUTHAMPTON FARE?

2.1 Global and regional trends in atmospheric pollution & atmospheric pollution at Southampton, Professor Ian Williams, University of Southampton

Air pollution can be distinguished in indoors and outdoors. Both pose serious health risks. Various sources contribute to the outdoor pollutant emissions: natural, area, stationary, power plant and mobile. Air pollutants can transport and have serious effects on human health. With a focus on Southampton, the City Council has noticed the air pollution problem and taken action. In Southampton, motor vehicles are believed to be the main contributors to pollution while about a quarter of pollution comes from the background and is not attributed to local sources. The contribution of the port (not only emissions from ships but also emissions from port-linked road traffic) is estimated to be around 7%, however, this is considered as an underestimate. There are several issues to be resolved at different spatial and time scales: a) policy and strategy for the city and region; b) impacts of port, airport and development; c) use of air alert systems; d) spatial and temporal variation in air quality in cities; e) variations in inhaled dosage from physiological and environmental factors; f) co-exposure to other pollutants and allergens; and g) role of urban morphology, technology, behavior change & modeling, regulation and financial incentives. When dealing with the air pollution problem, we have to be realistic and give a clear signal of the seriousness of the problem despite the uncertainties concerning the attribution of pollutants to various sources.

2.2 Air pollution-what is it doing to our health?, Dr. Matthew Loxham, University of Southampton

Recent studies have suggested that 7 million people worldwide die each year as a result of exposure to air pollution, around 40,000 of these in the UK. Air pollution is a mixture of gases and microscopic airborne dust, known as particulate matter (PM); it is this PM which is the component of pollution most strongly linked to adverse health effects. The health effects of PM are thought to be linked to their chemical and physical properties, which in turn relate to their source and mechanism of generation. It is therefore crucial enhance our understanding of the links between PM source, PM properties, and health effects, so that emissions can be more effectively targeted in order to reduce the burden on health. In the context of shipping, ocean-going ships emit about 1.5 million tonnes of respirable PM, 3-8% of total fine PM-related deaths worldwide are attributable to shipping-related fine PM. Southampton is facing several problems which require resolution of the following questions a) What is personal exposure to air pollution in Southampton? b) Where are the key emission sources? c) What are the pollution sources with greatest toxic potential? d) How do these sources of PM damage health? and e) How can we mitigate these issues?

2.3 Clean air for Southampton, Steve Guppy, Southampton City Council

For the cleaner air in Southampton, the city council established Local Air Quality Management Regime, which includes: a) the review and assessment of air quality within the local authority area; and b) the development and implementation of action plans to tackle local air pollution if levels exceed thresholds. To achieve the new target set by EU law, the City Council is working on a Clean Air Zones (CAZs) strategy, including two steps: a) defining clean air zones, an action which has already started; b) introducing clean air zones penalty charging. Beyond the CAZs, other supporting measures could be: a) planning policies and advice to promote lower emissions vehicles; b) clear signage of extent of CAZs, and introduction of ANPR cameras to monitor fleet make-up; c) media campaign to raise awareness on vehicle emissions and suggest behavioural changes that everyone can consider or d) introduce a Clean Air Partnership. In addition, the emissions from port and airport of Southampton should not be underestimated.

2.4 Balancing public health and economic interests: key principles and approaches to regulatory decision making, Dr. Emily Reid, University of Southampton

Southampton's poor air quality has significant adverse impacts upon public health, which is a very real problem facing the city and those who live and work in it. What are the regulatory responses to this problem? What kind of regulation might be effective in responding to this challenge? With respect to air pollution, we should be realistic and balance competing interests. We need an environmentally, socially and economically, sustainable solution. Overly prescriptive regulation, or regulation which seeks to achieve more than is 'possible' is little better than useless. The challenge is to develop regulation that achieves a compromise. Regulation which leaves some flexibility to stakeholders is likely to be more widely supported than that which is simply imposed top down. Proportionality, accountability, transparency and predictability are four key regulatory principles. To conclude, Southampton is facing the challenge of how to apply these principles locally; how to involve key stakeholders; recognition of validity of competing interests and the need for deliberation regarding the outcome to be pursued.

3. THE MARITIME SECTOR AND ATMOSPHERIC POLLUTION

3.1 MARPOL Annex VI-air pollution, Motonobu Tsuchiya, Lloyd's Register

MARPOL Annex VI, first adopted in 1997, limits the main air pollutants from ships. It also sets out requirements for shipboard incineration and for the control of emissions of volatile organic compounds from tankers. Following entry into force of MARPOL Annex VI on 19 May 2005, the MARPOL Annex VI was revised with the aim of significantly strengthening the emission limits in light of technological improvements and implementation experience. The main changes to MARPOL Annex VI are a progressive reduction globally in emissions of SOx, NOx and particulate matter and the introduction of new emission control areas (ECAs) to reduce emissions of those air pollutants further in designated sea areas. The revised measures are expected to have a significant beneficial impact on the atmospheric environment and on human health, particularly for those people living in port cities and coastal communities. With regard to SOx and particulate matter control, MARPOL does not prescribe emission rules but contents of SOx in bunker oil. The NOx emitted is based on tests run on ship engines and may not correspond to actual emissions. MARPOL Annex VI also addresses CO2 emission by requiring minimum energy (fuel) efficiency design for ships constructed on or after 1 January 2013. The future challenges that MARPOL Annex VI facing are: mandatory data collection; reception facilities; technical co-operation; conflict/duplication with EU initiatives; continuous monitoring; modification of various tables when other fuel is in practical use. Training of seafarers may also be addressed under other IMO Instruments (e.g., the STCW Convention).

3.2 The maritime regulatory framework and atmospheric pollution, Professor Michael Tsimplis, University of Southampton

In UK, atmospheric pollution from ships is regulated at three levels: UK law, EU law and International law. EU is usually a step ahead of International law with its gold-plating principle. This means that IMO environmental regulations are made stricter during EU implementation, if this is what the EU member states consider appropriate. Business lobbyists generally argue against it because additional regulation tends to raise costs for businesses. In fact, the UK lobbied hard both within the IMO to keep the atmospheric pollution measures from ships such that business is not disadvantaged and also within the EU to minimize any divergence of the proposed directive from the revised MARPOL Annex VI. Can the UK take more responsibility especially for Southampton? The answer is "yes", the UK can regulate ships flying its own flag, can implement its own rules for ships coming to their ports[3], and can impose increased limits to ships not trading in other jurisdictions as well as ships smaller than 400 gross tonnes which are excluded by the MARPOL Convention. The UK can set stricter regulations on shipping emissions but should consider: a) competition between ports and states; b) cost of shipping; c) the effects of IMO "Grandfathering Clauses"; and d) the effects of Brexit. Looking beyond law, other technological measures e.g. slow steaming and use of onshore power supply could also be behavioural and market options which can help in reducing atmospheric pollution.

[3] If ECJ's decision (Judgment of the Court of 23 January 2014. *Mattia Manzi and Compagnia Naviera Orchestra v Capitaneria di Porto di Genova*) is the correct interpretation of MARPOL.

3.3 The changing scene of marine fuel oils, Kim Tanneberger, Lloyd's Register

Air pollution from ships mainly comes from the engine. Changing fuels is therefore a way to reduce emissions. The Port of Southampton is located within a Sulphur Emissions Control Area (SECA). From 1 January 2015 fuel oil burnt within the SECA cannot contain more than 0.1% m/m sulphur. When shipowners consider use of another energy source, environmental compliance, economics (investment costs and operational costs), technical considerations and social & reputational considerations are all in the pack. Although many alternative energy sources are available, e.g. LNG, Bio-diesel and natural energy sources, it ought to be borne in mind that using the alternative energy sources may have the unintended consequences.

3.4 An AIS-based approach to calculate atmospheric emissions from the UK fishing fleet, Professor Ian Williams, University of Southampton

Ian Williams and Simon Kemp established a Carbon Management Group in 2009, aiming at cost-effective, practical, repeatable outcomes to assist in making informed emissions reduction policy decisions. Traditional emissions estimation methods do not easily allow temporal and geographical allocation of emissions; results from 2 methods show relatively good agreement. The fishing industry is heavily reliant on the use of fossil fuel and emits large quantities of greenhouse gases and other atmospheric pollutants. Methods used to calculate fishing vessel emissions inventories have traditionally utilised estimates of fuel efficiency per unit of catch. A large proportion of fishing and other small commercial vessels are also omitted from global shipping emissions inventories such as the IMO's Greenhouse Gas Studies. In conclusion, IMO methods significantly under-estimate carbon emissions from shipping. Evaluating the contribution of small vessels and the fishing fleet should be included in the estimated emission and should be regulated and reduced, accordingly.

4. ATMOSPHERIC POLLUTION AND THE BROADER TRANSPORTATION SECTOR

4.1 Perceptions of personal impact: why air quality concerns often do not lead to behavioural change, Dr. Ben Waterson, University of Southampton

There is a planned behavior theory which includes three aspects: knowledge, attitudes and social norms. The air quality concerns often do not lead to behavioural change and individuals need to see the personal benefit of behavioural change in order to take action. Therefore, in an air pollution context, you have to factor everyone's effort to reduce the emissions and in doing so there must be evidence of the benefits conferred. The challenges include social and scientific understanding of the causes of poor air quality; achieving recognition of individual contribution; overcoming the sense of helplessness; enabling suitable alternatives; and rewarding good behaviour.

4.2 Clean Air Southampton – why bother? Colin MacQueen and Liz Batten, Clean Air Southampton

Clean Air Southampton was launched in April 2016 for the purpose of raising public awareness. Their programme for 2016/17 includes working with schools and health professionals, and organising citizen science projects. They have identified several obstacles to achieving cleaner air in Southampton, e.g. lack of political will, insufficient resources and a lack of vision for the whole City, including a failure to assess the cumulative impact of development on air quality. Clean Air Southampton made several suggestions for the city: a) take advantage of new infrastructure money (if the Solent area devolves) to create low emission public transport b) create a Solent Air Quality (monitoring) Network with a membership of academics, commercial interests, local authorities and representatives of community groups to consider and help develop sensible, scientifically tested methods to assist in progressing towards cleaner air in Southampton.

4.3 Neither nannying nor nudging: towards the democratic governance of public health, Dr. John Boswell, University of Southampton

Atmospheric pollution is a "wicked" politics problem. It is highly complex and therefore difficult to blame specific parties. There are three traditions in policy making: a) nannying – telling people what is happening; b) regulation; and c) nudging – changing default behaviour e.g. through financial disincentives. There is evidence that this threefold approach can work, albeit not in an atmospheric pollution context. There is a need to get a cross-section of the public to get together and have a chat about the issue, for the purpose of softening the public up to regulation. If ordinary Southampton citizens could get together and agree the ideas, this might serve to build momentum and win the hearts and minds of the people. Another way to address the issue is to deal with user groups instead of the ordinary cross section of the public, but it is potentially difficult to organize the groups in Southampton on the subject of the atmospheric pollution. The above approaches can be used in tandem but there is no precedent for this happening.

5. THE WAY FORWARD

The workshop finished by having two working groups gathering proposals on the approaches that may be included in a holistic approach by the citizens, the City Council, scientists and engineers to improve the present situation and develop plans for a long term evolution of Southampton in a financially, environmentally and socially sustainable way.

5.1 Technological Innovations

The following key points were expressed by the group:

a. There is a need to think in terms of both short-term and long-term innovations. The former might include monitoring whereas the latter should consider major infrastructural developments as well.

b. An immediate need is to improve the spatial resolution of monitoring and live feedback of advice to citizens. Companies such as Fitbit and Apple who make fitness watches have an interest in launching devices for the public and the data will easily be misunderstood. We should act now both to improve monitoring and to avoid misunderstandings by the public in the future.

c. Advances need to be made in the attribution of poor air quality to sources. This is hampered by a poor understanding of what really matters. E.g. for particulate matter, is it volume of particulates, their number, size, shape, material or all of these that affect toxicity?

d. Neither the EU nor the WHO levels themselves are good indicators of potential harm since long term exposure to lower doses (e.g. just below the legal thresholds) may also be harmful. Better understanding on the specific mechanisms that cause harm is needed.

e. A start can be made on attributing poor air quality to sources by using high resolution data, e.g. derived from satellites. Consistency of hot-spots is likely to suggest key sources. Extending the monitoring network to the port and airport areas would be a significant improvement.

f. The group noted that resistance to monitoring air quality needs to be overcome e.g. by local schools (fearing parents' reactions) and in industry (concerned about competitive disadvantage). There is a fear of being the first to innovate. Is there an appropriate legal framework for supporting monitoring programmes without the fear of litigation if ill-effects are found?

g. Careful consideration needs to be given to avoid displacing the problem from one source to another, and to unintended consequences in supporting vested interests. E.g. if shipping were found to be exceeding safe levels, would the transport load be taken up by increased road traffic?

h. There is a clear need for better use of the planning system to control developments and incremental deterioration of air quality. Assessments of risk and harm are largely inadequate since they fail to take in account costs to the health system.

Looking towards longer-term solutions for the city, the group identified the need for:

a. A far better, integrated transport system that moves people out of private cars, together with better facilities for pedestrians and cyclists.

b. More joined-up thinking in local government. For instance, why are trains to the docks permitted during peak traffic hours, causing long tail-backs and emission of pollutants from standing vehicles?

c. Radical thinking in solving the road transport issue to the docks. If Southampton wants to keep the port and the economic benefits it delivers, it will need a bold solution such as a tunnel from the M27.

5.2 Behavioural Changes

The following key points were expressed by the group:

a. There is a need for a joined up approach, to bring together the whole city.

b. There is a need for consideration of unintended consequences, e.g. the knock on effect of policies or displacement of pollution.

c. There is a need to raise public awareness by sharing information, but how much information to be shared and how the problem be presented is another issue.

d. A recognition that small changes in behaviour can add up to make a big difference.

e. Awareness that when talking about behavioural changes – it is about all parts of society and stakeholders playing their part.

f. It is essential to involve the port of Southampton as well as the airport of Southampton into the discussion when addressing the atmospheric pollution issues.

g. Information and education is essential and there is a need to emphasise the practical benefit of this exercise of reducing pollution.

h. The group identified several data gaps in terms of levels and causes of pollution. There is a need for a joined up stakeholder analysis, bringing in schools, business groups and individuals.

5.3 Further Cooperation

Several proposals for further cooperation have been put forward, these include collaborative work on awareness at school with participation from all stakeholders and the University, the development of common research proposals to attract money for further research into the atmospheric solution sources and the way to combat it. Research to better understand the

port's influence on the city and formulating a city port strategy would be beneficial in this context.

Within the University of Southampton a number of proposed actions have been put forward:

a. Establish a University Strategic Research Group on air pollution, or establish a Special Interest Group within the Southampton Marine and Maritime Institute as the first step.

b. Develop a methodological approach and a team that will participate in "The Port of the Future"[4] bid presently coordinated through the SMMI.

c. To take measures to better our understanding of the air quality subject (e.g. measurements).

d. Evaluate alternative fuels infrastructure and other technologies to reduce maritime impact and decision making processes.

[4] The Port of the future <http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/topics/2105-mg-7.3-2017.html>

ANNEX 1: WORKSHOP PROGRAMME

Venue: Seminar Room, National Oceanography Centre, Southampton SO14 3ZH

Time: 08:15-17:00, 13th July 2016

08:15 – REGISTRATION AND COFFEE

08:45 – WELCOME – ORGANISING COMMITTEE

Theme 1: Atmosphere Pollution Mapping – How does Southampton Fare?

09:00 – 09:20 – Professor Ian Williams (University of Southampton)

'Global and regional trends in atmospheric pollution & atmospheric pollution at Southampton'

09:20 – 09:40 – Dr Matthew Loxham (University of Southampton)

'Air pollution – what is it doing to our health?'
09:40 – 10:00 – Mr Steve Guppy (Southampton City Council)

'Clean air zone'

10:00 – 10:20 – Dr Emily Reid (University of Southampton)

'Balancing public health and economic interests: key principles and approaches to regulatory decision making'

10:20 – 10:50 – Questions to the speakers and discussion

10:50 – 11:20 – COFFEE BREAK

Theme 2: The Maritime Sector and Atmospheric Pollution

11:20 – 11:40 – Mr Motonobu Tsuchiya (Lloyd's Register)

'MARPOL Annex VI – how it works?'

11:40 – 12:00 – Professor Michael Tsimplis (University of Southampton)

'The maritime regulatory framework and atmospheric pollution'

12:00 – 13:00 – LUNCH

13:00 – 13:20 – Ms Kim Tanneberger (Lloyd's Register)

'The different alternative fuels and emissions abatement technologies'

13:20 – 13:40 – Professor Ian Williams (University of Southampton)

'An AIS-based approach to calculate atmospheric emissions from the UK fishing fleet'

13:40 – 14:10 – Questions to the speakers and discussion

14:10 – 14:30 – COFFEE BREAK

Theme 3: Atmospheric Pollution and the Broader Transportation Sector

14:30 – 14:50 – Dr Ben Waterson (University of Southampton)

'*Perceptions of personal impact: why air quality concerns often do not lead to behavioural change'*

14:50 – 15:10 – Mr Colin MacQueen & Ms Liz Batten (Clean Air Southampton)

'Clean Air Southampton - why bother?'

15:10 – 15:30 – Dr John Boswell (University of Southampton)

'Neither Nannying Nor Nudging: towards the democratic governance of public health'

15:30 – 16:00 – Questions to the speakers and discussion

Synthesis: The way forward

16:00 – 17:00 – All Participants in two working groups: Technological Innovations Group and Behavioural Changes Group

'A discussion on how things can improve and with what actions'

ANNEX 2: WORKSHOP DELEGATE LIST

Professor Damon Teagle	National Oceanography Centre
Professor Gavin Foster	University of Southampton
Ms Debbie Chase	Southampton City Council
Dr Robin Wilson	University of Southampton
Professor Martin Palmer	University of Southampton
Annie Sheehan	University of Southampton
Dr Patrick E. Osborne	University of Southampton
Professor Bob Whitmarsh	University of Southampton
Rod Figg	DP World Southampton
Aart Hille Ris Lambers	DP World Southampton
Steven Yendall	DP World Southampton
Esmé Adam	University of Southampton
Zak McElvenny	Solent Stevedores Ltd
Dr Viktor Webber	University of Southampton
Dr Meixian Song	University of Southampton
Ms Clare Brady	University of Southampton
Ms Chenxuan Li	University of Southampton
Mandi Bissett	Southampton Climate Conversations
Thomas Webber	University of Southampton
Adam Goulden	The Environment Centre