Submission

New Zealand's Potential Accession to MARPOL Annex VI:

Discussion Document

February 2019

Mihi

Ka mihi ake ai ki ngā maunga here kōrero,
ki ngā pari whakarongo tai,
ki ngā awa tuku kiri o ōna manawhenua,
ōna mana ā-iwi taketake mai, tauiwi atu.
Tāmaki – makau a te rau, murau a te tini,
wenerau a te mano.
Kāhore tō rite i te ao.

I greet the mountains, repository of all that has been said of this place,
there I greet the cliffs that have heard the ebb and flow of the tides of time,
and the rivers that cleansed the forebears of all who came those born of this land and the newcomers among us all.
Auckland – beloved of hundreds, famed among the multitude, envy of thousands.
You are unique in the world.

Overview

1. Thank you for the opportunity to provide feedback on New Zealand's possible accession to MARPOL Annex VI. This joint Auckland Council and CCO submission is structured by responses to questions posed in the discussion document. Only questions relevant to Auckland Council's interests and expertise have been addressed.

2. Shipping is a significant contributor to Auckland's economy bringing over 170,000 guests to our shores and moving almost 1 million twenty-foot container equivalent units each year[1].

3. Auckland's port is located on the shores of the city centre in close proximity to where large numbers of people live, work and play. This prime location affords cruise passengers an increasingly rare opportunity to arrive directly into the city centre, but also exposes large numbers of residents, workers and visitors to elevated levels of air pollution generated by ships entering and leaving the harbour and berthed at the port.

4. Shipping emissions are a key contributor to air pollution near the waterfront and have been responsible for exceedances of the National Environmental Standards for Air Quality (NESAQ). They are also responsible for 2.2% of GHG emissions globally[2].

5. Anticipated growth in freight (200% by 2040) and passenger (40% by 2030) ship visits, increasing size of ships, and the growing number of international events hosted by Auckland[3], are likely to result in a corresponding increase in air pollutant and GHG emissions.

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[1] Port Future Study 2016 http://www.portfuturestudy.co.nz/docs/pdfsconsensusworkinggrouprecommendations072016.pdf

[2] UNEP DTU CO_2 emissions from international maritime shipping - file:///C:/Users/Jonesl3/Downloads/Working-Paper-4_Emissions-from-Shipping.pdf

[3] Port Future Study 2016 http://www.portfuturestudy.co.nz/docs/pdfsconsensusworkinggrouprecommendations072016.pdf

6. Auckland Council has a regulatory responsibility under the RMA 1991 to manage air quality for the protection of human health and is also committed to achieve carbon neutrality (Resolution ENV/2018/149), in line with national aspirations.

7. While local solutions are being investigated to reduce shipping emissions in Auckland, these are limited to technology solutions and voluntary participation of ship operators based on national regulations that prevent local government control of emissions from ship engines. Local action may further be limited due to concerns associated with impacts on Auckland ports competitiveness.

8. Action at a national policy level to reduce emissions from ships will help affect the scale of impact needed to meet our health and climate commitments and ensure an even playing field for New Zealand ports.

Improving New Zealand's influence and credibility on climate policy

Q1. ***New Zealand's stated ambition is to be a global leader on climate change and strengthen our credibility and influence in international climate negotiations. To enable New Zealand to influence climate change policy at the IMO we need to accede to Annex VI and be at the table to influence decisions. Do you agree? Please provide a detailed response. If you don't agree please provide reasons why.***

9. Auckland Council considers accession to Annex VI is essential to be in a position to work with international partners and influence decisions that will impact our climate goals, trade and reputation.

10. Auckland is committed to taking bold action on climate change. In February 2018, the Environment and Community Committee provided the mandate for Auckland Council to facilitate the development of Auckland's Climate Action Plan (ACAP) and in November 2018 unanimously endorsed the associated regional target of limiting temperature increase to 1.5^{o}C.

11. Delivering on our ambitious national and local climate commitments will require NZ to tackle emissions from global transport networks such as shipping where we have limited influence and control.

12. While local emissions reduction solutions are being investigated[4], such as shore power installation at Ports of Auckland Limited (POAL), such initiatives are limited in their impact on climate emissions as they only tackle emissions from ships while berthed. Global regulation is required to effect significant reductions in shipping emissions.

13. New Zealand's reputation and ability to influence decisions therefore directly affects Auckland's ability to deliver on its climate commitments. Being one of only a few OECD nations that have

[4] Ports of Auckland Limited, Cruise Vessel Emission Reduction Technologies - http://www.poal.co.nz/sustain/Documents/Cruise%20Vessel%20Emission%20Reduction%20Technologies.pdf

not acceded to Annex VI poses a potential reputational risk that could compromise our credibility in global GHG negotiations.

Protecting New Zealand's trade interests and advancing effective mitigation measures

Q3. What are the benefits associated with the Energy Efficiency Design Index (EEDI) and Ship Energy Efficiency Management Plan (SEEMP) requirements?

14. A study commissioned by IMO to assess the climate emissions reduction potential of mandated fuel efficiency measures estimated reductions in annual CO_2 emissions of 151 million tonnes by 2020, increasing to 330 million tonnes by 2030[5]. Emissions of air quality pollutants should also reduce proportionally in response to these measures.

15. The above reductions are due to an expected reduction in fuel consumption, resulting in significant cost savings for the shipping industry, even when taking into consideration the increased cost of low sulphur fuel. The study acknowledges that investment in new technology and practices will be required.

Improving public health

Q5. What are the public health benefits of acceding to Annex VI?

Summary of benefits

16. If ships comply with MARPOL Annex VI regulations that require the use of low sulphur fuel from 2020, SO_2 emissions from ships could be reduced by 75%[6]. Sulphate particulate emissions will also decrease.

17. Likewise, fuel efficiency measures resulting in lower fuel consumption will reduce emissions of all pollutants.

18. These reductions would likely improve health outcomes for thousands of Aucklanders living, working and visiting in the city centre.

19. Accession would also compliment and build on Auckland's commitment to the C40 Cities Fossil Fuel Free Streets declaration[7] and the significant emissions reductions already made over several decades due to improvements in land transport fuel quality and engine technology.

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[5] International Maritime Organisation - http://www.imo.org/en/MediaCentre/PressBriefings/Pages/57-EEDIstudy.aspx#.XEYSelUzaUk

[6] Auckland air emissions inventory 2016 – sea transport http://www.knowledgeauckland.org.nz/assets/publications/TR2018-017-Auckland-air-emissions-inventory-2016-sea-transport.pdf

[7] C40 Cities - https://www.c40.org/other/fossil-fuel-free-streets-declaration

Health and exposure

20. An important factor to consider when assessing impacts of emissions is exposure: the number of people exposed to the emissions and their proximity to the emission source or peak concentrations.

21. Auckland's city centre is the most densely populated location in New Zealand, housing 57,000 residents, providing a workplace for over 100,000 employees, and hosting over 200,000 visitors each year. It is also home to Auckland's main port which receives over 1500 ship visits per year. While a convenient location for the workforce and tourism, it places a large population in close proximity to a significant localised emission source.

22. Emissions from ships include sulphur dioxide (SO_2), oxides of nitrogen (NOx), particulate matter (PM), volatile organic compounds (VOCs) and other toxics including heavy metals. These pollutants contribute to poor health outcomes for Aucklanders including respiratory illnesses, heart disease, stroke, and cancer.

23. The Health and Air Pollution in New Zealand 2012 update estimated annual social costs of $2.3 million and over 300 premature deaths from PM_{10} emissions in Auckland alone. Continued population and tourism growth will exacerbate exposure to hazardous air pollutants and associated poor health outcomes.

Shipping emissions impacts in Auckland

24. While air quality across Auckland is generally considered good, elevated pollutant concentrations and exceedance of standards and guidelines still occur, particularly in the city centre where transport emissions are the predominant source.

25. For example, measurements taken at Auckland Council's permanent peak roadside monitoring site on Queen Street shows that nitrogen dioxide (NO_2) concentrations exceed the World Health Organisations (WHO) annual guideline most years. Short-term monitoring studies using low cost passive sampling techniques indicate that exceedances are likely in a number of other city centre roadside locations.

26. While motor vehicles are the predominant source, shipping emissions also make a notable contribution to elevated levels of air pollution across the city centre with the scale of impact determined by wind direction and distance from the source.

27. For some pollutants it is not possible to ascertain the contribution of shipping emissions to measured concentrations, however, comparison of estimated source emissions provided in the 2016 Transport[8] and Sea Transport[9] emissions inventories (Table 1) provides an indication of their relative influence on air quality near the waterfront.

[8] Auckland air emissions inventory 2016 – transport http://www.knowledgeauckland.org.nz/assets/publications/TR2018-016-Auckland-air-emissions-inventory-2016-transport.pdf

Table 1: Proportion of air pollutant emissions from ships at-berth compared with Auckland's regional motor vehicle fleet.

Pollutant	Regional motor vehicle emissions[10]	Ship emissions at-berth on Auckland waterfront[11]*	Shipping emissions as proportion of motor vehicle emissions (%)
SO_2	73	472	647
NOx	10,250	488	4.7
PM_{10}	647	53	8.2
$PM_{2.5}$	314	48	15.3
VOC	3238	15	0.5

* While these data include emissions from ships using the Manukau Harbour, their contribution is minor.

28. Table 1 shows that SO_2 emissions are 6.5 times higher than total regional motor vehicle emissions, making shipping the largest source of SO_2 emissions in Auckland. This is not surprising considering the heavy fuel oil contains on average 2,700[12] times more sulphur than automotive diesel.

29. The dominance of shipping among SO_2 sources near the waterfront, in conjunction with wind direction data, means measured ambient SO_2 concentrations can feasibly be used to indicate likely impacts of shipping emissions on air quality. A number of such monitoring studies have been summarised in the Auckland Council report 'A review of research into the effects of shipping on air quality in Auckland'[13].

30. The review found that SO_2 concentrations measured using low cost passive sampling techniques were highest near the waterfront, particularly when the wind direction was from the port, and that long-term average concentrations at these sites were up to four times higher than elsewhere in Auckland. These findings were corroborated by a recent campaign conducted by NIWA and Drexel University in 2018[14].

31. Further, a short-term monitoring campaign at the ports using NESAQ compliant methods measured exceedances of the NESAQ 1-hour standard for SO_2. The exceedances occurred while several cruise ships were hoteling in port during the Rugby World Cup.

32. Table 1 also shows a significant contribution of NOx (includes NO_2) from ships on Auckland's waterfront, equivalent to almost 5% of regional motor vehicle emissions.

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[9] Auckland air emissions inventory 2016 – sea transport http://www.knowledgeauckland.org.nz/assets/publications/TR2018-017-Auckland-air-emissions-inventory-2016-sea-transport.pdf
[10] Auckland air emissions inventory 2016 – transport
[11] Auckland air emissions inventory 2016 – sea transport
[12] Auckland air emissions inventory 2016 – sea transport
[13] A review of research into the effects of shipping on air quality in Auckland: 2006-2016 http://knowledgeauckland.org.nz/assets/publications/TR2017-005-Review-of-research-effects-of-shipping-on-air-quality-in-Auckland-2006-2016.pdf
[14] An interim summary of results is appended to this submission. Full results are due for publication this year.

33. Analysis of particulate from samples collected at the Queen Street monitoring site found that shipping emissions influenced particulate (PM) concentrations some distance away from the waterfront. They are estimated to contribute 5% to overall $PM_{2.5}$ concentrations. Elevated concentrations measured coincide with wind direction from the ports, and the presence of trace metals, vanadium and nickel, which are markers of combustion of heavy fuel oil only used by ships.

34. These findings are supported by the emissions inventory that shows significant emissions of $PM_{2.5}$ from ships equivalent to 15.3% of regional motor vehicle emissions.

35. Black carbon is an important sub-micron (<PM_1) particle associated with significant negative health impacts and is a climate forcing agent. Auckland Council's review found that 10% of annual black carbon measured from $PM_{2.5}$ samples at Queen Street can be attributed to shipping emissions[15].

36. Auckland Council will be installing a new permanent monitoring site within the shipping emissions impact area near the waterfront during 2019. SO_2 and black carbon will be monitored at this location.

Low sulphur fuel

Q13. What are the benefits of moving to fuel with a sulphur limit of 0.5 percent?

37. As stated under Q5., SO_2 emissions from ships berthed at the waterfront could be reduced by 75%, with a corresponding reduction in sulphate particulate.

38. If in the future the NESAQ adopts a lower SO_2 standard (currently 120ug/m^3 24-hr mean) in line with the WHO guideline (20ug/m^3 24-hr mean), the risk of non-compliance will be significantly reduced.

Q21. What are the benefits of switching to diesel?

39. Diesel is a much cleaner fuel, containing only 0.001% sulphur and free of a multitude of heavy metals and other toxics, including vanadium and nickel (known neurotoxins) present in heavy fuel oil.

Q24. What are the costs associated with using abatement technology?

40. The increased use of open-loop water scrubbers may increase risk of environmental impacts in the marine environment. Open-loop water scrubbers, produce wastewater that is discharged in the ocean[16]. More research is required to better understand the impacts of these discharges[17].

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[15] The impacts of transport emissions on air quality in Auckland's city centre http://knowledgeauckland.org.nz/assets/publications/TR2018-028-Impacts-of-transport-emissions-Auckland-city-centre.pdf

[16] American Bureau of Shipping - Exhaust Gas Scrubber Systems Status and Guidance https://www.eagle.org/eagleExternalPortalWEB/ShowProperty/BEA%20Repository/References/Capability%20Brochures/ExhaustScrubbers

Q27. Are there any other considerations apart from price that is likely to be taken into account when deciding to switch fuels or use abatement technology?

41. Fuel availability and the impact on fuel prices at the pump should be considered. Increased demand for diesel, for example, could result in the need to import more fuel and potentially increase fuel prices for motorists.

Other issues

Q36. Are there any other issues not considered above, but which you deem important and need to be factored in when considering the costs and benefits of accession to MARPOL Annex VI?

42. Additional issues to be considered:

    a. A timely decision to accede, provision of clear timeframes for implementation and a plan for low sulphur fuel security would provide industry with certainty and adequate time to transition. The pace of implementation should not impact ship owner's decision to come to New Zealand.

    b. While almost all ships involved in New Zealand's international trade are registered to states that have acceded to Annex VI and are therefore required to comply regardless of the status of the port state they visit, without New Zealand's accession there will be no mandate to monitor their compliance when visiting our shores.

    c. Failure to reduce emissions from shipping could reduce Auckland's ability to comply with potentially more stringent air quality standards in the future. The NESAQ for particulate is currently under review and the anticipated outcome is that there will be a new standard for fine particulate ($PM_{2.5}$). There is also a growing body of evidence globally concerning black carbon and its health and climate impacts that could support development of guidelines and standards in the future.

    d. New Zealand's clean green image is a key driver for our tourism industry. Visual impacts of ship plumes may pose a risk to our reputation as Auckland's waterfront is often a first destination and therefore first impression of New Zealand. Accession to Annex VI will demonstrate our values and passion for the environment and our people.

Q37. Having taken all of the above into consideration, should New Zealand accede to Annex VI?

43. Auckland Council strongly supports New Zealand's accession to MARPOL Annex VI.

[17] A New Perspective at the Ship-Air-Sea-Interface: The Environmental Impacts of Exhaust Gas Scrubber Discharge
https://biblio.ugent.be/publication/8559894/file/8559895.pdf

Appendix 1:

Update for Auckland Council on the SO_2 results for the 2018 NIWA-Drexel city centre measurement study

Taihoro Nukurangi

Update for Auckland Council on the SO_2 results of the 2018 NIWA-Drexel city centre measurement study.

Purpose of the study

This international collaboration has previously measured particles in the Auckland city centre, with an aim to capture the spatial variation in pollutants commonly associated with traffic, shipping and domestic heating activities. This second campaign was focused on emissions from shipping and so included sulphur dioxide (SO_2) which had not been included in the initial study.

With a view to determining the best method for measuring the impact of shipping emissions in the city centre, NIWA and Drexel deployed the two most common types of passive SO_2 monitors (namely, Gradko Palmes tubes and Ogawa samplers) over various durations (four, six and eight weeks). For the final month, low cost particle counters called ODINS (Outdoor Dust Information Nodes) and portable Harvard Impactor filter samplers were deployed for four week-long periods.

Currently the Gradko tubes have been analysed and the data from this method are summarised here.

Gradko SO_2 method

SO_2 was measured using Palmes-type diffusion tubes (Palmes, 1981). These consist of a small plastic tube, approximately 7 cm long with an absorbent for SO_2 inside the top end. During sampling, the bottom end is capped with a porous filter so that ambient air can enter the tube and reach the absorbent but particles which might interfere with the absorption of SO_2 are excluded. After the sampling period exposed tubes are analysed using a colorimetric or spectrophotometric technique, or alternatively ion chromatography.

Palmes tubes are widely used in air quality monitoring around the world as a cheap and reasonably reliable alternative for expensive reference monitors.

Tubes were purchased pre-prepared with the standard absorbent mixture of 50% triethanolamine (TEA) and 50% acetone (C3H6O). When not exposed in the field, tubes were kept refrigerated. The analysis of the tubes was conducted by the suppliers of the Palmes tubes, Gradko Laboratories, in the UK. Tubes were attached to traffic signposts or lamp posts at a 'tamper-proof' height of approximately 2.5 metres.

Quality control measures of the sampling and analysis included deploying the tubes in triplicates and the mean of the three tubes is reported here. Where tubes were missing, the remainder are reported. If the duplicate tube concentrations differed by more than 30%, the results would have been removed. (No duplicate measurements reached this threshold).

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Locations of measurements

Measurement sites were chosen in transects radiating out from the waterfront. There were initially 30 sites where Gradko SO_2 tubes were deployed, however site 24 was not used after the first tubes were set out, as they were immediately taken. (Other losses occurred throughout the deployment, particularly in the first fortnight.) Figure 1 shows the approximate locations of the monitoring sites.

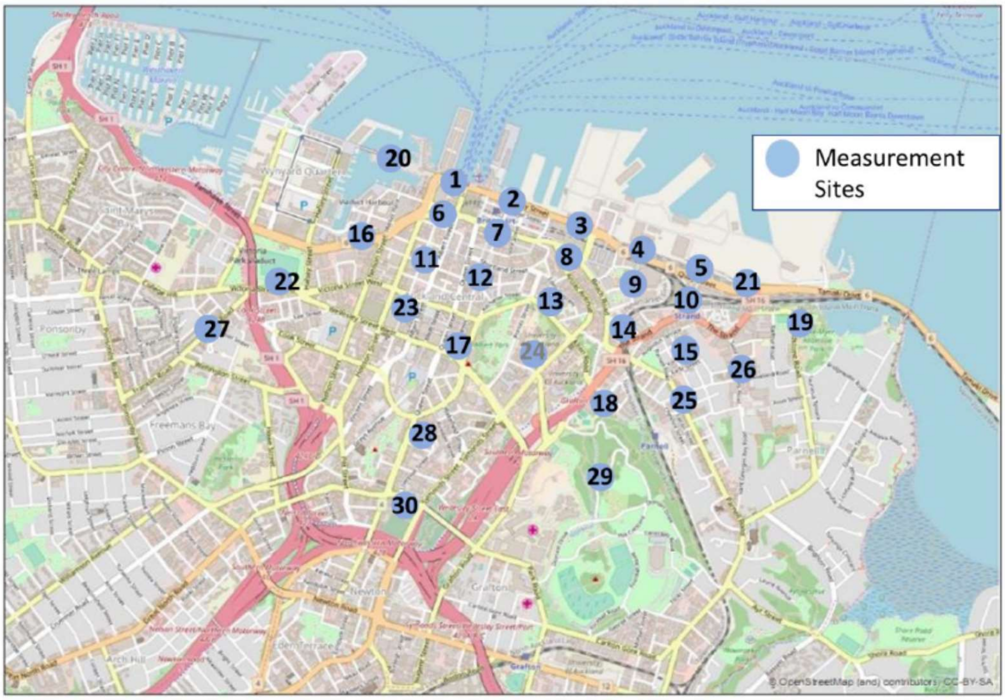

Figure 1: Sites in central Auckland where Gradko SO_2 tubes were deployed

Time of Deployments

Deployment of the tubes was staggered into three durations, so that the maximum number were in the field during the final month when the Harvard samplers were in place. Table 1 below shows how the deployments were arranged.

Table 1 Deployments of Gradko (and Ogawa) SO_2 samplers

Session number	Session 1	Session 2	Session 3	Session 4
Start and end dates	21st Feb – 6th March	6th – 21st March	21st March – 6th April	6th – 22nd April
1-month deployments				
6-week deployment				
2-month deployment				

Results

The results presented here are for the overall two-month period and the individual month results.

The general pattern is as expected with higher concentrations seen along the waterfront and a falling away with distance from Quay Street. Overall the predominant wind direction was from the north-east, meaning emissions from the port and harbourside were dispersing over the city centre.

Overall Period

Figure 2 shows the concentrations measured by Palmes tubes exposed for eight weeks. The wind-rose insert shows that for the two-month period winds were variable in direction with a general south-westerly flow and a secondary countering north-easterly flow.

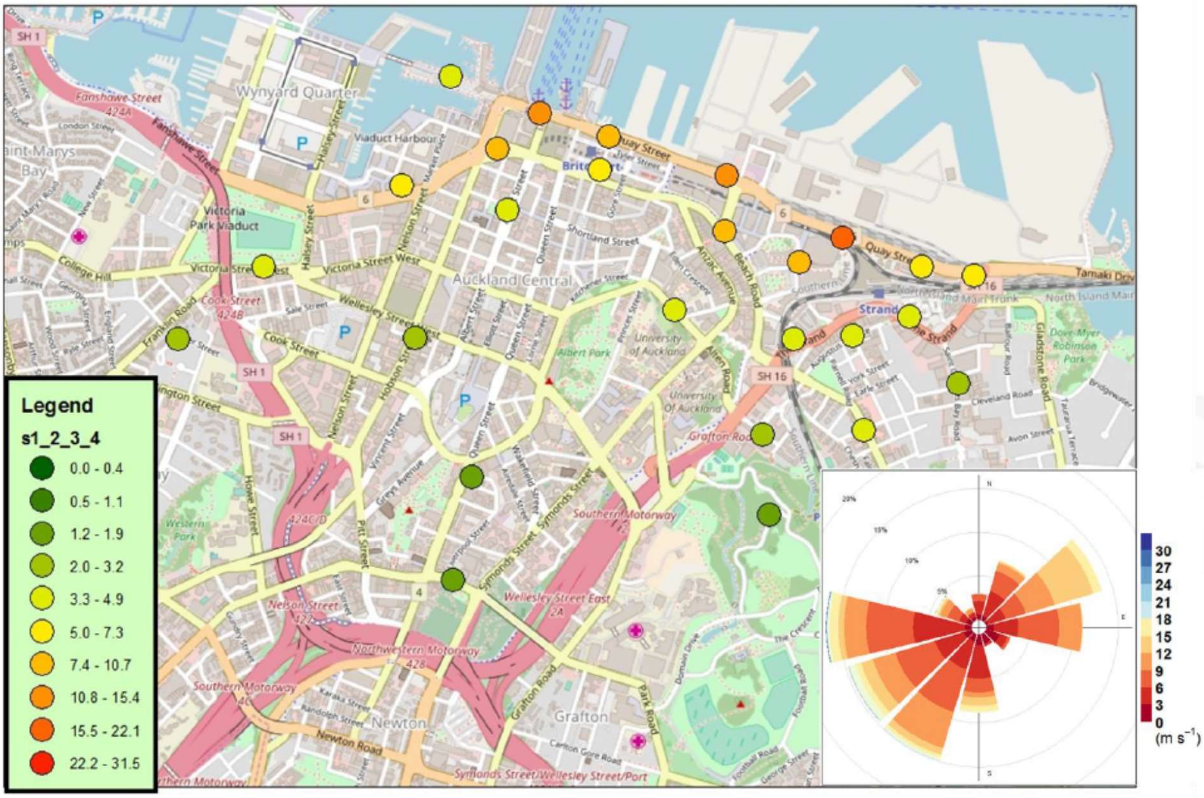

Figure 2: SO_2 concentrations over the two-month period

Sessions 1-2 (the first month)

Figure 3 shows the concentrations measured by Palmes tubes over the first month (21st Feb – 21st Mar 2018). Along with the actual measurements represented by points, an interpolation is included to indicate possible concentrations over the city centre during this time. During the first half of this month there were extended periods of easterly winds, while south-westerly winds dominated in the second half. As well as the regular ongoing emissions from the port and harbour, nine cruise ships docked and departed during this month.

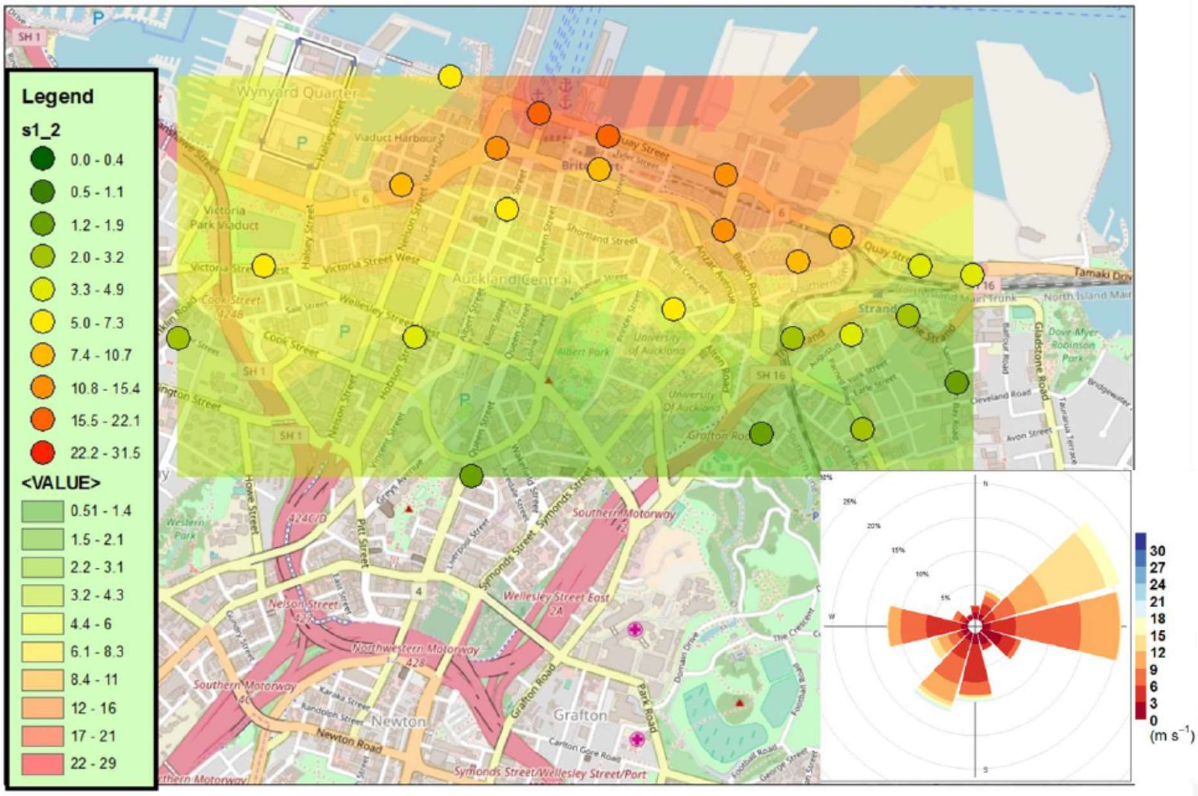

Figure 3: SO_2 concentrations over the first month

Sessions 3-4 (the second month)

Figure 4 shows the concentrations measured by Palmes tubes over the second month (21st Mar – 22nd Apr 2018) and concentrations interpolated from those measurements. Overall the concentrations were much lower than in the first month as south-westerly winds continued to dominate, effectively dispersing shipping emissions away from the city centre. Eleven cruise ships departed during this month.

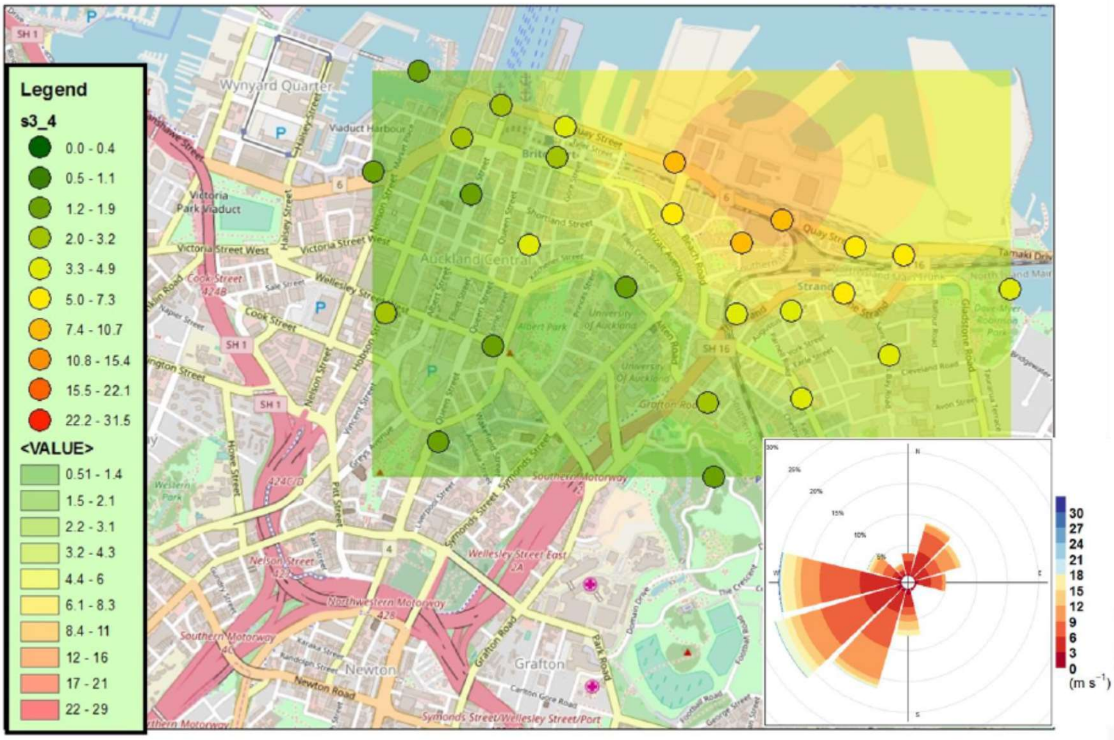

Figure 4: SO_2 concentrations over the second month

Conclusion

The SO_2 concentrations reported here are not comparable to National Environment Standards (NES) air quality standards or the World Health Organisation's guideline concentrations, as these are both based on short term exposures of at most, a day in length. (In the NES, the concentration limits are based on an hourly measurement.) However, these measured concentrations give an indication of the extent of the impact of shipping activity over central Auckland and could be used to calculate population exposure to SO_2. Further supporting data from this study will become available in due course.

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