BEFORE THE DECISION MAKERS APPOINTED BY THE CANTERBURY REGIONAL COUNCIL AND CHRISTCHURCH CITY COUNCIL

IN THE MATTER OF The Resource Mangement Act 1991 ("RMA")

AND

IN THE MATTER OF Resource consent applications CRC193563, CRC193564, CRC193773 and RMA 2019 373 by SOL Quarries Limited for a discharge permit to discharge contaminants to air

STATEMENT IN REPLY: JEFFREY GEORGE BLUETT ON BEHALF OF SOL QUARRIES LIMITED

AIR QUALITY

1. OBJECTIVE AND SCOPE OF CLOSING STATEMENT

1.1 The objective of my statement in reply is to highlight and address the nine key air quality issues and questions raised by the commissioners, submitters, and Canterbury Regional Council's air quality expert.

2. UPDATED ONSITE PM_{10} DATA ANALYSIS

2.1 A number of questions were raised about the relatively short on-site air quality and meteorological monitoring record. In my supplementary evidence, I included an analysis of SOL Quarry Limited's (SOL) monitoring programme data up to 5 November 2020. I have updated the results to include the period 6 November to 10 December 2020 - an additional 34 days. The data record from the site now includes a total of:

(a) 3,070 hours of data.

(b) 135 days of data (4.5 months or 37% of a year).

2.2 The updated figures from the SOL air quality and meteorological data analysis are included in Appendix A. The additional data included in the analysis has increased the strength of the results in representing the air quality conditions experienced at the SOL quarry. The additional data has not changed any of the findings or conclusions detailed in my supplementary evidence and as repeated in paragraphs 2.3 and 2.5 for completeness.

2.3 The scatter plot and wind rose show that there may be a slight increase in PM_{10} concentrations when the monitoring site is downwind of the quarry. However, in my opinion any increase observed is relatively small and concentrations are not close to trigger levels which would require work to stop work or require additional mitigation measures to be implemented.

2.4 I must highlight that there was an error in my evidence in chief (paragraph 2.15) and my supplementary evidence (Paragraph 1.5). Both these paragraphs noted that there "*may be a slight increase in TSP or PM_{10} concentrations when the quarry is downwind of the monitoring site*". This should have read "*may be a slight increase in TSP or PM_{10} concentrations when the monitoring site is downwind of the quarry".* This editorial error does not have any impact on the conclusions I drew which were based on the corrected statement.

2.5 The analysis of 24-hour average PM_{10} concentrations suggests that PM_{10} concentrations are likely to be well below the NESAQ concentration of 50 $\mu g/m^3$ and therefore unlikely to produce any significant adverse health effects. The 24-hour average concentrations of PM_{10} are all below 11 $\mu g/m^3$ with 80% of the days being below 5 $\mu g/m^3$. As classified by the Ministry for the Environment's air quality indicator programme a concentration of 10% or less of the relevant guideline value is categorised as excellent air quality. The remaining 20% of days fall into the good air quality indicator category. In my experience these concentrations are in line with those monitored at rural background sites, which do not have any significant close by sources of PM_{10}.

3. REPRESENTATIVENESS OF PM_{10} CONCENTRATIONS MEASURED BY THE SOL MONITOR

3.1 The SOL monitor draws in a sample of air, passes that sample into a chamber where light is shone through the air sample. The sample light is reflected, absorbed, or scattered depending on the amount of dust in the sample. The instrument then calculates the concentration of dust based on the amount of reflected, absorbed, or scattered light. Therefore, the instrument measures dust concentrations only at the position at which it is located.

3.2 The SOL monitor is located between the current quarry and the residential properties on Conservators Road during south-westly (195 to 255ºN) winds. Dust being transported from the SOL quarry toward the residential properties on Conservators Road will be carried in a ground level plume which must pass the monitor before reaching the residential properties on Conservators Road. In my opinion the type of technology and location of the dust monitoring equipment are suitable to capture a representative sample of any dust plume being emitted from SOL quarry during a south-west wind. There would be very little value gained from installing additional monitors.

4. RELEVANCE OF THE MOTE YALDHURST REPORT

4.1 I note the factors highlighted by Mr Paul Baynham (the author of the Mote report) in an email (Quarry Report Application question, 24 November 2020) to Mr Peter Mahoney (submitter against the SOL application) which need to be considered when using the Mote data to assess another site. I address each of these factors below.

4.2 The size of the Yaldhurst quarries is significantly larger than that proposed by SOL quarry (230 Ha compared to 9 Ha). The scale of the Yaldhurst quarries operation is significantly larger with at least 4 screening and crushing plants operating at any one time. Therefore, the concentrations of contaminants measured adjacent to the Yaldhurst quarries will be significantly higher than those experienced in close proximity to the SOL quarry.

4.3 The type of activity (extraction, screening, crushing and transport) undertaken and product produced by the Yaldhurst quarries is identical to that proposed by SOL quarry (albeit at a much smaller scale as noted in paragraph 4.2).

4.4 The aggregate (greywacke gravels) being quarried at the Yaldhurst quarries is identical to that proposed by SOL.

4.5 The dust sensitivity of the receptors (residential properties) located close to the Yaldhurst quarries is high and mirrors the sensitivity of the Conservators Road properties to the effects of dust.

4.6 The locations of the monitoring sites used for the Yaldhurst quarries project ranged between 50 m and 190 m downwind from the boundary

of the quarry area. The Conservators Road residential properties will be at least 250 m downwind from the boundary of the SOL quarry and at least 600 m from the screening and crushing plant. Therefore, the peak concentrations measured by the Mote study will be higher than those likely to be experienced at the Conservators Road residential properties.

4.7 The Yaldhurst study was undertaken over a period of four months (December 2017 to April 2018), which is not a sufficiently long enough period to accurately assess annual average concentrations. However, the monitoring programme was undertaken over the period of the year with the highest potential for dust events (dry and windy conditions). Therefore, the annual average concentration will be lower than that measured over the four-month monitoring period, which was well below the annual average guideline for PM_{10}.

4.8 In summary, I concur with Mr Chilton's conclusion that the Mote Yaldhurst report is relevant (albeit conservative) and informative for the purposes of the SOL assessments of impacts from the discharge of dust, PM_{10}, $PM_{2.5}$ and RSC.

4.9 Mr Baynham highlights that the residential properties on Conservators Road have quarries in a number of directions and are effectively "surrounded" by quarries. Mr Baynham notes that in this case the Yaldhurst study would have less value than might otherwise be. I address this issue in Section 6.

5. MR EMMERSON'S PHOTOGRAPHS AND VIDEOS

5.1 I have reviewed the photographs and videos provided by Mr Emmerson. Mr Emmerson has captured useful images showing the key sources of dust in the area, which include:

(a) Unconsolidated surfaces;
(b) Uncovered truck loads;
(c) Gravel processing equipment;
(d) Re-suspended dust from vehicles on unsealed sealed roads; and
(e) Re-suspended dust from vehicles on dusty sealed roads.

5.2 Some of these images and videos show significant plumes of dust, especially when it is very windy. From the photographs alone, it is not possible for me to identify exactly which quarry was being

photographed. However, upon a review of the surroundings included in the photographs such as bunds and walls, I conclude that many of the photographed and videoed quarry plumes were not generated by the SOL aggregate extraction and processing activities. However, there are a number of photographs that identify the SOL heavy vehicle haul road as a source of dust, especially (but not exclusively) before the road was sealed.

5.3 It is difficult to get a spatial perspective on Mr Emmerson's images and it is not possible for me to tell if the plumes of dust extend beyond the boundary of any quarry. However, I note that many of the images appear to be taken from some distance away from the source of dust and I did not see any clear evidence of dust transport over about 250 m (the minimum buffer distance between the proposed SOL quarry boundary and residential properties). I also note that the consent conditions for the proposed SOL quarry extension will require these specific potential sources of dust to be mitigated and monitored.

5.4 Mr Emmerson's photos also show the effects of dust deposited on his property including:

(a) Deposited dust on vehicles (December 2017, December 2019 and January 2020 and February 2020 – dates taken from the file name);
(b) Dirty windows (February 2018); and
(c) Brown dust on white shelves (February 2020).

5.5 The photographs clearly demonstrate that Mr Emmerson's property has been impacted by a source of dust on at least six occasions since over the last three years. From the photographs it is not possible for me to identify the type nor source of dust that has been photographed on the vehicles and shelf. However, given the apparent larger size of the dust particles (e.g. photograph file names 20171203_195858.jpg (car windscreen), 20191207_160406.jpg (car side window), 20191207_160453.jpg (car roof) and 20200201_111945.jpg (white shelf)), in my opinion the source would have been within 250 m of the property in order for this material to have landed at this property. This makes the source of dust unlikely to be a consented quarry.

5.6 Additional information about the photographs may have made them more informative. For example; Was the dust photographed a result of a single event or was it cumulative over time? Was the black car in the 2020 event the only surface affected by this event? The windows on car in the background of that photo look clean. How wide was that dust impact on the property? Did other neighbours experience similar dust deposition?

5.7 The photographs provided by Mr Emmerson show at times visible dust plumes are generated by the surrounding quarrying activities. The sources of dust photographed by Mr Emmerson have been identified, described and assessed in the dust assessment which supported the SOL consent application. Where appropriate these sources of dust have been targeted with consent conditions which will mitigate the dust risk.

5.8 In summary I consider the effects of deposited dust demonstrated by Mr Emmerson's photographs are not consistent with those quarry emissions considered in SOL's consent application, nor consistent the Regional Council's review of that application. Without further investigation it is not possible to identify the source of these deposited dust effects.

6. ASSESSMENT OF CUMULATIVE EFFECTS

6.1 Cumulative dust effects have the potential to occur at the residential properties on Conservators Road due to the combined effects of dust discharged from the current or proposed SOL quarry, other quarries in the area and background dust sources (such as wind-blown soil particles).

6.2 Some submitters pointed out that due to the number and direction of quarries that are located within 1,500 m of their properties, they found themselves downwind of a quarry at a relatively high frequency. My review of the site's wind rose shows that the properties on Conservators Road will be down wind of a quarry for a total of approximately 60 % of the time. The submitters will be downwind of the SOL quarry for approximately 25% of the time. The submitters suggested this situation provided them with no respite from quarry dust and thus created a significant adverse cumulative effect.

6.3 It is possible to use qualitative methods (such as FIDOL) to assess the cumulative impact of multiple dust sources on a specific location. However, SOL's onsite air quality monitoring data provides a robust, transparent, and quantitative method for assessing the cumulative effects of PM_{10} and dust experienced in the vicinity of the residential properties on Conservators Road under all wind directions.

6.4 Figure 5 (Appendix A) shows a pollution rose (PM_{10}) normalised by wind direction. This figure allows a comparison of the 1-hour average PM_{10} concentrations experienced at the monitoring site under different wind directions.

6.5 The wind directions for which the monitoring site is <u>not</u> downwind of a quarry are east-northeast, south and south-south-east. For the other wind directions, the monitoring site is downwind of one of the six quarries in the area. The wind rose shows that a significant majority (> 95%) of 1-hour measurements of PM_{10} for all wind directions are less than 10 $\mu g/m^3$. In my experience PM_{10} concentrations of this level are typical of those experienced in non-urban areas without any significant sources of PM_{10}. 1-hour average PM_{10} concentrations higher than 10 $\mu g/m^3$ occur most frequently (~5% of the time) with winds from the south-south-east – a direction where there is no quarry down wind.

6.6 Total suspended particulate TSP (dust) emissions from quarries will always contain a fraction of PM_{10} which is much easier to transport any significant distance. It is therefore possible to use PM_{10} measurements as a proxy or marker for the probable concentrations of larger dust size fractions.

6.7 In summary, the frequency of 1-hour average concentrations of PM_{10} greater than 10 $\mu g/m^3$ when the monitor is downwind of a quarry is no higher than for some background directions (no quarry downwind). Based on this data, I conclude that there is no significant cumulative impact of PM_{10} or dust from quarries in the vicinity of the residential properties on Conservators Road.

6.8 I was at the hearing on Monday 14 December 2020 and heard Mr Chilton present his summary of evidence. I heard and agree with Mr Chilton's answers to the Commissioner's questions on cumulative

effects and I note there is no point of difference between the two of us on this issue.

7. IMPACTS OF AND BUFFER DISTANCES FOR THE DISCHARGE OF RESPIRABLE CRYSTALLINE SILICA (RCS).

7.1 The hearing panel asked if the buffer distance of 250m was appropriate for the SOL quarry, given the Victorian dust guidelines recommend a 500 m buffer if a quarry discharges Respirable Crystalline Silica (RCS).

7.2 One of the principal minerals contained in greywacke rock is crystalline silica (SiO_2) at approximately 40% by weight. Silica is also found in large quantities in soils and clays, the most common form of silica is white sand which is almost entirely crystalline silica. Crystalline silica is inert and non-toxic, but when present in significant quantities in the form of RCS (diameter less than 4 μm) long-term exposure can cause significant health impacts including silicosis of the lung. The impacts are most frequent observed in occupational situations such as miners or pottery workers.

7.3 While the raw greywacke aggregate extracted at the SOL contains large amounts of silica, very little of it is in the form of RCS – practically all the silica is bound up in larger rocks or sand particles much larger than 4 μm. Therefore, the aggregate extraction process discharges very little RCS. During processing raw aggregate is crushed into different sized pieces to meet the specifications of particular quarry products. The crushing process is designed to produce products generally larger than 5 mm, but a small amount of RCS is generated as a by-product of the crushing process. Albeit small, the principal source of RCS on the SOL site is the screening and crushing plant.

7.4 All dust, including RCS, discharged from the screening and crushing plant is well mitigated. A large proportion of the initial discharge will be controlled by the low volume high pressure misting systems attached to the plant. The plant will be operated within the pit well below surface level and sheltered from surface winds. In addition to this, the screening and crushing plant will be located within the quarry so as to maintain a separation distance of more than 600 m to the nearest potentially sensitive receptor.

8. In summary, I conclude that any adverse effect of RCS discharged from the SOL quarry will be less than minor. This conclusion is consistent with the findings of the Yaldhurst monitoring (see section 4). The Yaldhurst monitoring which took at total of 20 RCS samples. Only two of the 20 samples had RSC above the detection limit of the analytical equipment. Both samples were taken at 50 m away from the quarry and indicated a three-month average concentration of 0.4 $\mu g/m^3$, which is 13% of the chronic exposure level for RCS (3 $\mu g/m^3$as an annual average). These results show that the health impacts of RCS discharged from a large quarry are less than minor.

8.1 While the Victorian guidelines recommend a separation distance of 500 m from a quarry that discharges RCS, it is my opinion that due to the nature of raw aggregate material involved, this separation distance is not applicable to SOL extraction activities alone. While some RCS will be discharged from the aggregate screening and crushing mitigation and monitoring demonstrate that any impact will be less than minor. In addition to that the proposed location of the SOL screening and crushing plant means that the Victorian recommended separation distance will actually be complied with.

9. LIVED EXPERIENCE OF SUBMITTERS VS MONITORED AIR QUALITY

9.1 Submissions made and presented by Mrs Janssen and Mrs Emmerson state that they suffer from significant respiratory problems which require medication. Their submissions demonstrate that their lived experience of the air quality around the Conservators Road area is poor.

9.2 The PM_{10} air quality monitoring undertaken at the SOL quarry shows that the air quality in the area as classified by the Ministry for the Environment's air quality indicator programme was excellent for 80 % of days monitored and good for the remaining 20 % of days. Given the monitored concentrations of PM_{10} it appears unlikely the symptoms experienced by Mrs Janssen and Mrs Emmerson are caused by the PM_{10} discharged from the quarries in the area.

10. Many of the submitters noted the adverse amenity affects of deposited dust on their properties. Given the separation distances between the quarries and residential locations., these observed adverse effects do

not match my understanding of the generation and transportation of dust from the quarries.

11. In summary the air lived experience of the submitters is different to that analysed from monitoring data or my understanding of the generation and transport of dust and we cannot offer a reason why that might be the case.

12. WATERING STOCKPILES

12.1 After due consideration, I understand that SOL have agreed to water stockpiles and are happy to have that requirement included in the conditions of consent.

Jeffrey George Bluett

18 December 2020

APPENDIX A: FIGURES

FIGURE 1: Air Quality monitoring equipment at SOL quarry looking nor-west.

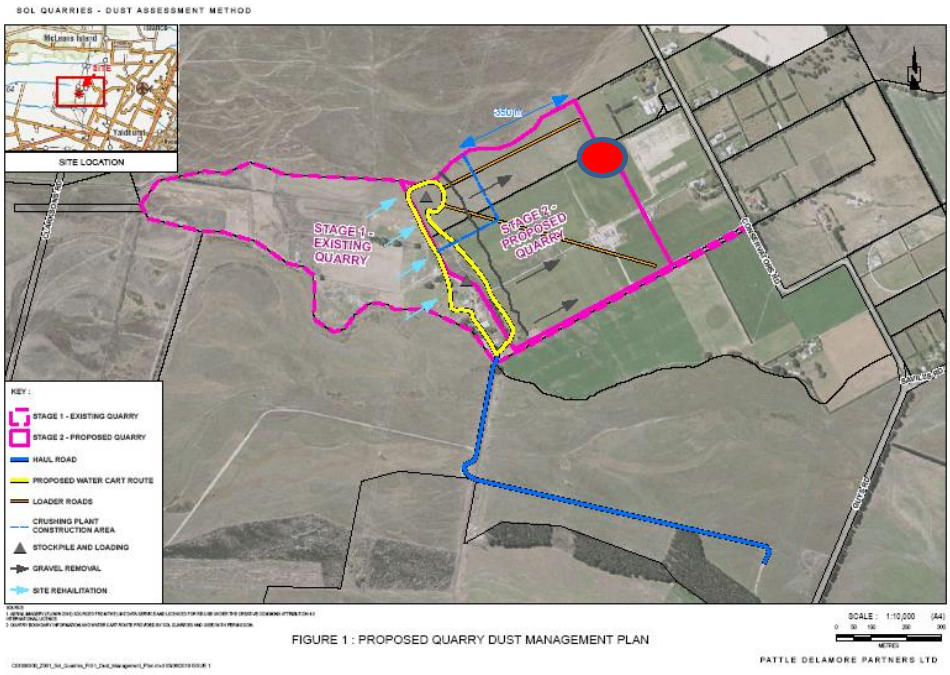

FIGURE 2: Location of Air Quality monitoring site at SOL quarry indicated by the red circle

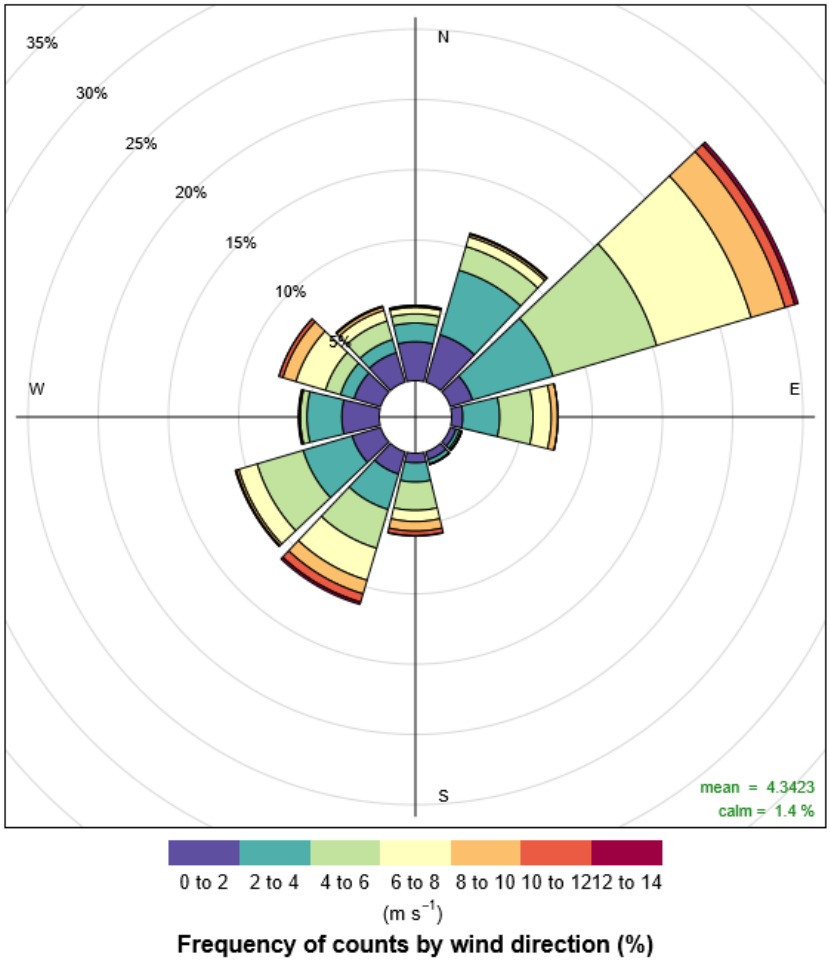

FIGURE 3: Wind rose for the hours included in the analysis (data from Christchurch airport)

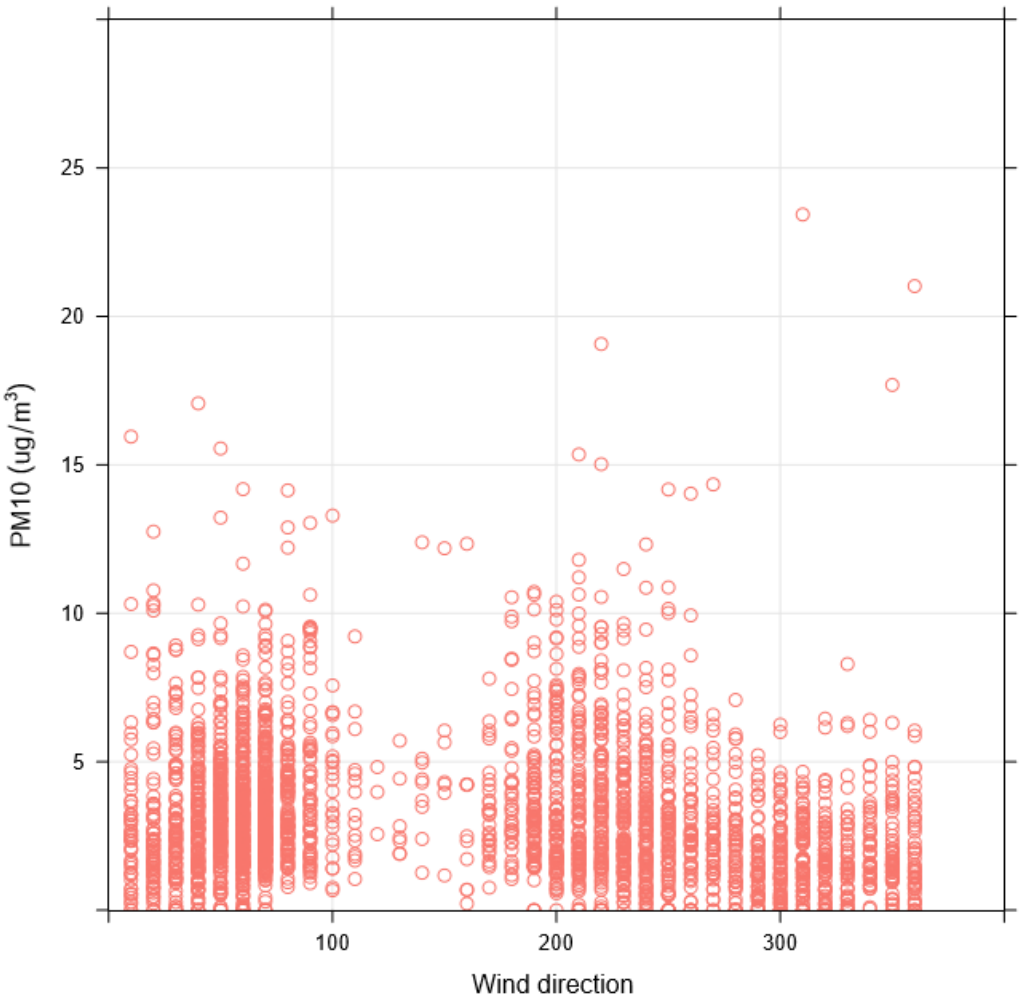

FIGURE 4: Scatter plot of 1-hour average TSP concentrations against wind direction

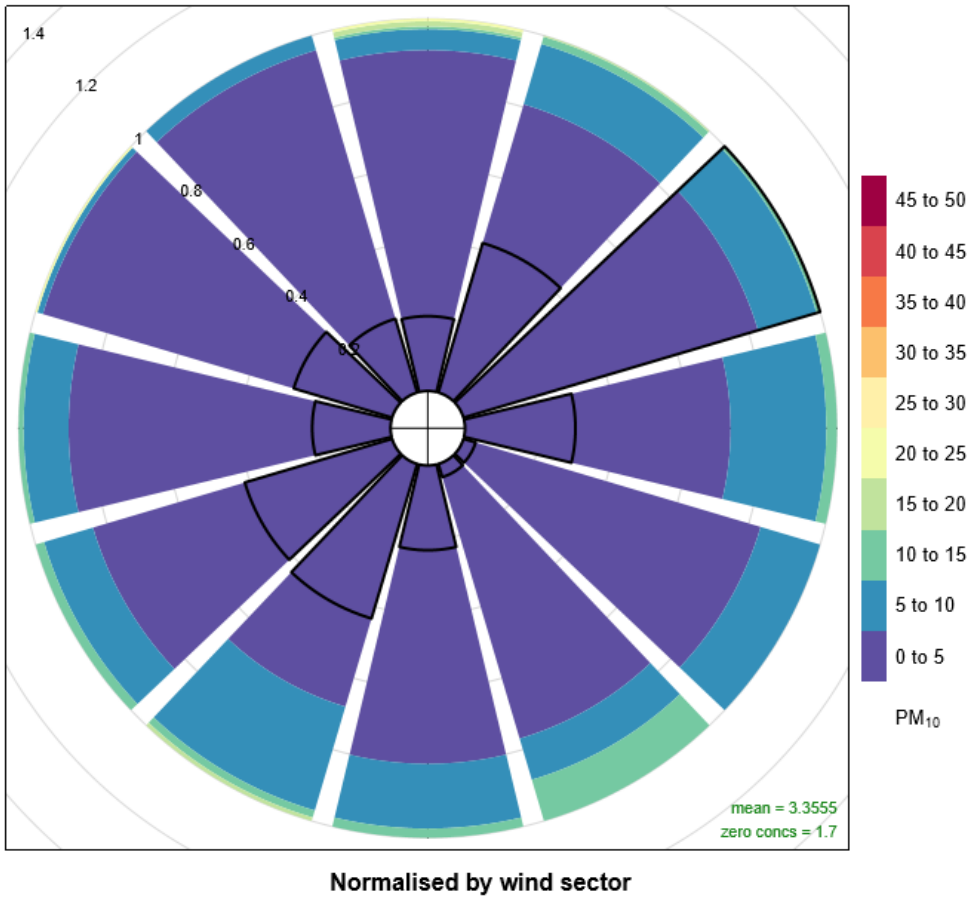

FIGURE 5: Pollution rose (1-hour average PM_{10} concentrations) normalised by wind direction.

Note the back lined inner petals indicate the relative frequency of winds from that direction.

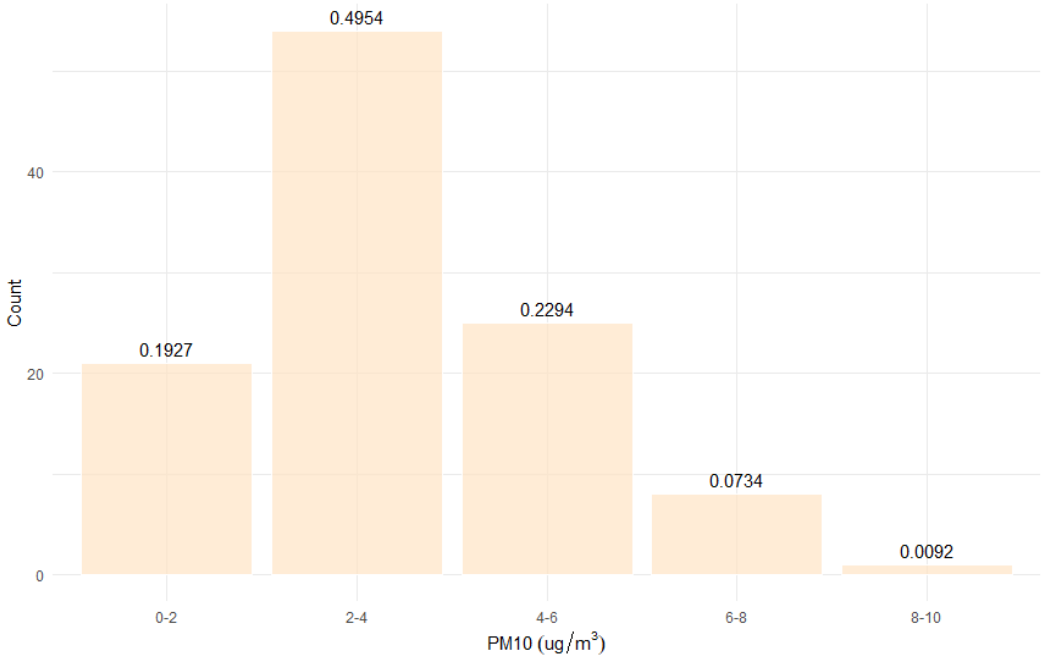

FIGURE 6. Frequency distribution of 24-hour average concentrations of PM_{10}