**MELBOURNE METRO RAIL PROJECT ENVIRONMENT EFFECTS STATEMENT INQUIRY AND ADVISORY COMMITTEE**

**MMRA TECHNICAL NOTE**

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| **TECHNICAL NOTE NUMBER:** | 059 |
| **DATE:** | 26 September 2016 |
| **PRECINCT:** | All Precincts |
| **EES/MAP BOOK REFERENCE:** | EES Technical Appendix H (Air Quality Assessment) |
| **SUBJECT:** | Response to the 'Matters for further consideration and/or clarification' request dated 12 September 2016<br><br>(iii) Silica |

**NOTE:**

1. This Technical Note has been prepared with the assistance of AJM to respond to issues raised by the Inquiry and Advisory Committee (**"IAC"**) in the 'Matters for further consideration and/or clarification' request dated 12 September 2016.

2. For ease of reference, this Technical Note sets out each relevant request made by the IAC followed by a response from MMRA.

**Request:**

3. The IAC has requested:

   *Advice about the assessment of potential risk to human health posed by respirable crystalline silica, including:*

   *a) evidence regarding likely silica content of rocks across various weather profiles.*

**Response:**

4. Over the course of the geotechnical investigations for Melbourne Metro, petrographic studies were undertaken on samples of rock and soil recovered from boreholes. The petrographic studies seek to estimate the proportions of the various minerals forming the rock or soil. Crystalline

silica occurs in several mineral forms, the most common of which is quartz. Other forms include Cristobalite and Tridymite. Quartz was the only crystalline silica mineral encountered in the samples obtained in the geotechnical investigations for Melbourne Metro.

5. A total of 48 petrographic tests were undertaken on rocks. These tests involved studying samples under a microscope and estimating the proportion of each mineral observed within the field of view. In addition, four X-Ray diffraction tests were undertaken on soils which allowed the proportion of quartz to be measured. In total, quartz content was measured in 52 samples across various material types.

6. The table below summarises the results of the quartz content measurements. The results are grouped into geological units, and for Melbourne Formation the result are also grouped further into weathering grade and material composition.

| Geological Unit | No. Tests | Quartz Content (%) | | |
|---|---|---|---|---|
| | | Lower | Upper | Average |
| **Melbourne Formation** | | | | |
| **EW Siltstone/Sandstone** | 1 | 53 | 53 | 53 |
| **HW Siltstone/Sandstone** | 6 | 9 | 72 | 28 |
| **MW Siltstone/Sandstone** | 13 | 14 | 79 | 43 |
| **SW Siltstone/Sandstone** | 16 | 11 | 71 | 41 |
| **Dyke*** | 9 | 5 | 68 | 27 |
| **All Siltstone*** | 22 | 9 | 72 | 39 |
| **All Sandstone*** | 14 | 11 | 79 | 42 |
| **All Melbourne Formation** | 45 | 5 | 79 | 37 |
| **Older Volcanics** | 3 | 0 | 0 | 0 |
| **Newer Volcanics (Burnley Basalt and Swan St Basalt)** | 2 | 0 | 0 | 0 |
| **Brighton Group** | 1 | 85 | 85 | 85 |
| **Werribee Formation** | 1 | 82 | 82 | 82 |
| **Total** | 52 | | | |

* based on aggregate of all boreholes drilled, approximate proportions of material types in Melbourne Formation is 72% Siltstone, 26% Sandstone, 2% Dyke

7. The testing indicates that the basalts (Older and Newer Volcanics) do not contain crystalline quartz. The Brighton Group and Werribee Formations are the soils which contain sand in the form of crystalline quartz. The

Melbourne Formation contains predominantly Siltstone and Sandstone with various grades of weathering.

8. The quartz content in the Melbourne Formation is highly variable, and there are no clear correlations between quartz content, degree of weathering and material composition (siltstone, sandstone, dyke).

9. Although based on a relatively small sample, the average crystalline quartz content in the Melbourne Formation is in the order of 40%. However, it can locally be as low as 5% or as high as 80%.

10. Discussion of potential risks to human health posed by the emission of respirable crystalline silica is presented below.

**Request:**

11. The IAC has requested:

*Advice about the assessment of potential risk to human health posed by respirable crystalline silica, including:*

*b) any monitoring data from other projects on this potential risk.*

**Response:**

*Assessment Criteria for Respirable Crystalline Silica*

12. The *State Environment Protection Policy (Air Quality Management)* (**"SEPP AQM"**) provides that the design criteria in Schedule A of the SEPP AQM for respirable crystalline silica only applies to point sources.[1] For area-based sources and roads, relevant criteria must be specified in a relevant industry Protocol for Environmental Management ("**PEM"**).

13. In this case the applicable PEM is the *Protocol for Environmental Management: Mining and Extractive Industries* ("**Mining PEM"**). Whist not a mining project, the PEM is nevertheless applicable because large construction activities and mining and extractive industry both involve the excavation and movement of large volumes of excavated soil.

14. The relevant criteria for respirable crystalline silica ("**RCS"**) in the Mining PEM is set below for convenience:

**Table 2: Assessment criteria for mining and extractive industries[2]**

| Indicator | Criteria | Averaging period |
|---|---|---|
| *Respirable crystalline silica (as $PM_{2.5}$)* | *3µg/m$^3$* | *Annual average* |

[2] The assessment criteria for PM10, PM2.5, NO2, and CO are the intervention levels from the SEPP (AQM). The criteria for respirable crystalline silica and hydrogen cyanide have been adopted from the California EPA Office for Environmental Health Hazard Assessment Reference Exposure Levels. The assessment criteria for arsenic and asbestos have been derived using the Cancer Potency Factors from the California EPA Office for Environmental Health Hazard Assessment. The criteria for PAHs (as BaP) has been adopted from the National Environment Protection (Air Toxics) Measure.

[1] SEPP AQM Schedule A, footnote 1

*Monitoring data for RCS*

15. EPA Victoria does not routinely monitor for RCS. However, monitoring conducted at the Brooklyn Industrial Precinct during 2010 / 2011 did include analysis for RCS, and also included results from Footscray for comparison purposes. All samples were below the detectible limit and well below the Mining PEM criterion for RCS, as the extract below from EPA publication 1444 illustrates:

Extract from EPA Vic – 1444 (EPA Vic, 2012)

**Table 4: Results for PM10 composition analysis (July 2010 to July 2011)**

| Compound | Brooklyn (annual average in ng/m$^3$) | Footscray (annual average in ng/m$^3$) | Guideline annual average (ng/m$^3$) |
|---|---|---|---|
| Respirable[6] crystalline silica as $PM_{2.5}$ | Below detectable limit (40) | Below detectable limit (40) | 3000 |

[6] Protocol for Environmental Management: Mining and Extractive industries, State Environment Protection Policy (Air Quality Management), 2007.

16. AJM is not aware of any other background monitoring data for RCS in inner Melbourne. However, the results presented above for Brooklyn and Footscray indicate that background concentrations of RCS in metropolitan Melbourne are negligible, and that using the Mining PEM criteria for the assessment of RCS is not only appropriate, but consistent with previous EPA Victoria assessments for RCS in metropolitan Melbourne.

*Health risks during construction*

17. Air quality modelling for the higher risk construction worksites at Arden and Domain did not predict any exceedances of the annual average $PM_{2.5}$ SEPP AQM criteria of 8 µg/m$^3$, even with an assumed background $PM_{2.5}$ concentration of 5.9 µg/m$^3$. The highest annual average $PM_{2.5}$ concentrations in the vicinity of Arden and Domain are predicted to be 7 µg/m$^3$ (refer to Figures 9-3 and 13-3 of Technical Appendix H of the EES). This equates to a maximum project contribution of 1.1 µg/m$^3$ above the existing background level of 5.9 µg/m$^3$.

18. As Mr Lakmaker explained in his evidence to the IAC, even if it is assumed that 100% of the $PM_{2.5}$ emissions is RCS (an implausibly conservative assumption), a maximum RCS emission of 1.1 µg/m$^3$ would still comply with the 3 µg/m$^3$ annual criteria for RCS under the Mining PEM.

19. Since the purpose of this criteria is to protect human health, it follows that RCS emissions from constructing the Project will not lead to unacceptable human health risks.

*Health risks from point source emissions*

20. The design and location of ventilation systems will be determined during the detailed design of the Project, and were therefore not considered in detail in the EES.

21. During routine operation of Melbourne Metro, air quality impacts and associated health risks would be minimal. Electric trains operating on the network would emit few pollutants, resulting in a low probability of air quality impacts under normal operating conditions. While ventilation of the tunnel and stations would be required, the use of electric trains means that ventilation rates are expected to be low.

22. The ventilation systems would be considered to be a point source emission under the SEPP AQM. For point sources, the SEPP AQM design criteria for RCS of 0.00033 $mg/m^3$ (3-minute average) would apply and must be complied with.

23. Assessment of the detailed design and proposed ventilation systems design would be undertaken by the PPP Contractor to demonstrate compliance with EPR AQ3.

24. In addition to compliance with relevant design criteria, any emissions of RCS would need to be reduced to the maximum extent achievable to meet clause 20 of the SEPP.

**CORRESPONDENCE:**

No correspondence.

**ATTACHMENTS:**

No attachments.