



11 April 2024

Reference: BB-53-04

Joel Chance
Senior Environmental Advisor, Environmental Services
Renewal SA
Level 16, 11 Waymouth Street
Adelaide South Australia 5001

RE: Greater Seaton Project Area, Air Quality Monitoring

Dear Joel,

Land & Water Consulting (LWC) was engaged by Renewal SA to undertake air quality monitoring for the Greater Seaton Project Area to determine if the potential Greater Seaton Project Area (and future sensitive receptors) may be exposed to emissions produced by the service stations located on the eastern and western boundaries of the project area, with reference to the air quality guidelines under the *Environmental Protection (Air Quality) Policy 2016*.

Please find attached the outcomes of the investigation (Attachment A) and LWC's statement of limitations associated with this report provided in Attachment B.

If you have any questions regarding the above information, please don't hesitate to call the undersigned.

Yours sincerely,

A handwritten signature in black ink, appearing to be 'EP' followed by a long horizontal stroke.

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ATTACHMENTS

Attachment A Air Quality Assessment – Seaton ULP Emissions, Report 24-0404
Attachment B Statement of Limitations

ATTACHMENT A

Air Quality Assessment – Seaton ULP Emissions, Report 24-0404



ENVIROSCAN

INDUSTRIAL & MARINE SURVEYS

Air Quality Assessment -Seaton
ULP emissions

Report 24- 0404



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AIR

SOIL

WATER

**Air Quality Assessment - Seaton
ULP emissions
Report 24- 0404**

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1. Background

Enviroscan was commissioned by Land & Water Consulting to assess air quality impacts on a Residential Zone at Seaton from two service stations (Figure 1). The primary area of interest is within the 50 -100 meters separation buffer distance around the United Petroleum Seaton and the AM/PM West Lakes petrol stations.

This air quality assessment is specifically focussed on significant pollutants in Unleaded Petrol (ULP) including benzene, toluene and xylenes to determine whether they are compliant with SA EPA Environment Protection (Air Quality) Policy (EPAQP) 2016 criteria.

The assessment will also evaluate whether vehicle ULP refuelling at either petrol station poses a risk to current or future receptors.

EPA has published guidelines on the 'recommended evaluation distances' for retail petrol stations operating with Stage 1 vapour recovery during refilling of underground storage tank (UST) by petrol tankers. This buffer distance is currently 50 meters or 100m reflecting 24hr operation or late-night closure.

The Environment Protection (Air Quality) Policy 2016 Schedule 2 lists maximum ground level concentration (GLC) for significant pollutants in unleaded petrol (ULP), including benzene 0.058 mg/m³, toluene 13.4 mg/m³ and xylenes 12.4 mg/m³.

Typically, ULP petrol makes up the bulk of retail sales at 60%, with 35% diesel and 5% LPG.

The retail petrol station industry has attracted much study in recent years reflecting their recognition as a significant source of benzene exposure.

Unleaded petrol in Australia is specified with a maximum content of 1% benzene and Stage 1 ULP vapour recovery during fuel tanker delivery to underground storage tanks (UST) is now standard practise.

Stage 2 ULP vapour recovery at each vehicle refuelling hose is gradually being implemented in new petrol stations, with the benefit of much reduced benzene emissions. The petrol vapours are drawn into the coaxial fuel hose and returned to the UST.

Toluene and xylenes are present in ULP at higher levels, typically 8 and 5% respectively. However, they are much less volatile than benzene and laboratory studies indicate that neither have a synergistic effect on benzene toxicity (Mahendra et al 2011).

Petrol station emissions were studied in Brazil (Correa et al, 2012), where dispersion modelling of benzene, toluene, xylenes and ethylbenzene indicated elevated levels extending 150 meters from the refuelling pumps. Samples of ambient air at the petrol station sites averaged 0.0297 mg/m³ which is about half the Schedule 2 GLC of 0.058 mg/m³ (3-minute averaging time) in South Australia.

Terrés et al. 2010 reported a similar result to Correa et al. using the n-hexane /benzene ratio to show the aromatic hydrocarbon zone extended up to 75 metres beyond the petrol station site.

The required separation distance to ensure compliance with EPAQP 2016 Schedules 2 and 3 was assessed for the Seaton project by considering the maximum vehicle ULP refuelling rate at both service stations. The AM/PM servo on West Lakes Boulevard has 16 ULP pumps under the driveway canopy, plus diesel and LPG pumps (Fig. 2).

The United Petroleum service station (Fig. 3) on Tapleys Hill road has 10 ULP pumps each with a maximum fuel delivery rate of 40 litres per minute, plus diesel and LPG refuelling points.

Refuelling emissions were modelled to assess GLC levels of benzene, toluene and xylenes within the 50–100 m buffer which extend into the Residential Zone (Fig. 1). Both petrol stations have Stage 1 vapour recovery for tanker UST delivery. Conservative modelling parameters were adopted to provide allowance for any upset in normal refuelling operations.

Odour from ULP vehicle refuelling activity was measured around the perimeter of both petrol stations by field olfactometer to assess compliance with Schedule 3 of the EPAQP.



Figure 1 Seaton Residential Zone (orange) and petrol station 50/100m buffers.



Figure 2 AM/PM West Lakes service station layout and 50-meter buffer

The ULP refuelling points are indicated under the drive-way canopy, with the UST vent near the western boundary and parking bays at the convenience store entry.

Vehicle entry is via Frederick Road and West Lakes Boulevard.

The nearest dwelling in the Residential zone (1) is beyond the 50-meter buffer distance.



Figure 3 United Petroleum Seaton service station layout, with 50-meter buffer

The United Petroleum Seaton petrol station on Tapleys Hill Road is shown with a 50-meter buffer extending westwards and up to 20 meters inside the Residential Zone. The nearest dwelling (2) in the Residential Zone is highlighted (yellow). Refuelling pumps are indicated (red) under the drive-way canopy. The UST vent is on the canopy.

2. Assessment Criteria

The South Australia Environment Protection (Air Quality) Policy 2016 (EPAQP) Schedule 2 specifies ground level concentration (GLC) criteria for pollutants with averaging periods of 3-minute to 1-year.

Table 1 lists significant pollutants in ULP emissions.

Pollutant	Air Quality Criteria(mg/m ³)	Averaging Period	Classification
Benzene	0.058	3 minute	Group 1 carcinogen (IARC)
	0.01	12 month	
Toluene	0.71	3 minute	Odour
	13.4	3 minute	Toxicity
	4.11	24 hour	
	0.41	12 month	
Xylenes	0.38	3 minute	Odour
	12.4	3 minute	Toxicity
	1.18	24 hour	
	0.95	12 month	

Table 1 South Australia Air Quality Policy Criteria for ULP emissions

Compliance with EPAQP GLC criteria can be determined by dispersion modelling with conservative parameters to ensure that exposure risks are not under-estimated.

3. CALPUFF dispersion modelling

Dispersion modelling for benzene, toluene and xylenes was performed with CALPUFF 7.3 (Scire et al 2000) in accord with EPA “Ambient air quality assessment” 2016.

CALPUFF was selected for this Air Quality Impact Assessment as it is a multi-layer non-steady-state puff dispersion model able to simulate effects of time and space variable meteorology on pollutant transport.

The model can also accommodate low wind-speed dispersion, coastal fumigation and photochemistry.

Meteorology

TAPM ver. 4 was used to generate a meteorological data file for CALMET from CSIRO Y2009 synoptic data. Y2009 is specified by SA EPA and considered to reflect current weather patterns in South Australia.

A nest of four TAPM grids (41x41 horizontal x 30 vertical heights) was set up with outer grid resolution of 30km and innermost grid at 1km. CALMET calculated micrometeorology at 300m resolution on a 101 x 101 horizontal grid with 10 vertical levels. The CALMET meteorology file is input for the CALPUFF dispersion model, and the model configuration is summarised in Table 2 below.

Meteorology Grid centre	Seaton 34°53' S, 138°30.5' E
Year modelled	2009, 1 January to 31 December
TAPM grid domains (1200x1200 nest to 40x40 km)	Four nested grids with 41 x 41 horizontal grid points with spacing of 30, 10, 3 and 1 km. 30 vertical levels up to 8 km above sea level
CALMET grid domain (30x30 km)	101 x 101 horizontal grid points, 300 m spacing 10 vertical levels up to 4 km above sea level.
Radius of terrain influence	10 km
Terrain	Shuttle Radar Topography Mission 30m resolution horizontal
CALPUFF grid domain	43 x 43 horizontal grid points, 50m spacing

Table 2 CALPUFF model configuration

A Y2009 windrose was generated for Seaton (Fig. 4) to show light winds (<1-2 m/s), associated with poor dispersion, are predominantly from the eastern quadrants.

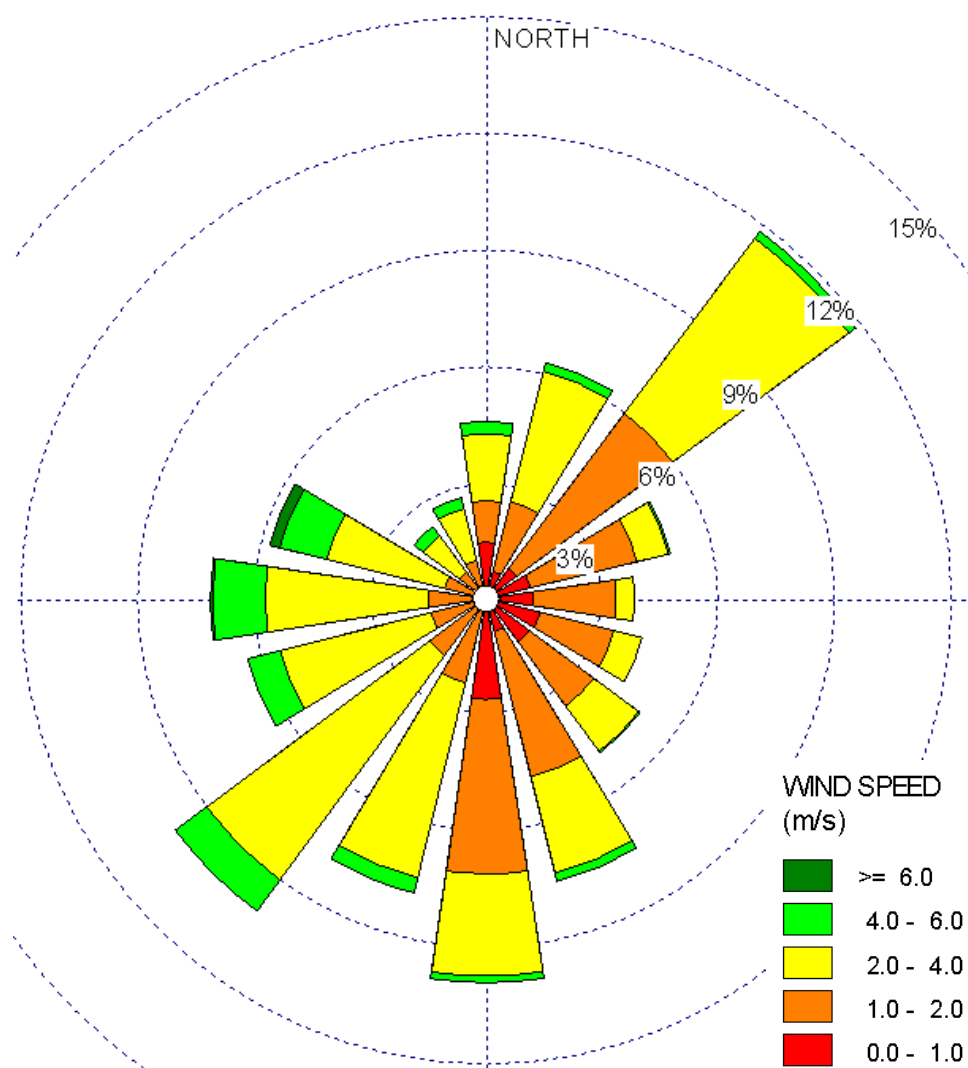


Figure 4 Seaton windrose, Y2009.

ULP VOC emissions

ULP emissions occur when the vehicle is being refuelled, with displacement of tank vapours and evaporation of the dispensed fuel to atmosphere.

The VOC emission rate from the vehicle fuel tank vent and spillage during refuelling in average conditions is 1.4 g VOCs per litre of ULP fuel (USEPA AP-42, 5.2) of which benzene is 0.3 weight % (NPI)

VOC emission factors and composition are summarised in Tables 3 and 4, below.

Emission Source	VOCs (g) per L throughput	Reference
Vehicle Refuelling	1.32	USEPA AP-42, 5.2
Spillage	0.080	USEPA AP-42, 5.2
Delivery to UST	0.040	NPI 1999, US EPA AP-42

Table 3 ULP VOC Emission Rates

Compound	Vapour % v/v	Reference
Benzene	0.3	NPI EETH Emissions from Service Stations 1999, amended for Benzene Fuel Standard (petrol) Determination 2001 (Office of Legislative Drafting and Publishing 2008).
Toluene	1.2	
Xylenes	0.48	

Table 4 ULP VOC emissions composition

Sulphur levels in Australian fuels are low; diesel <10ppm, PULP <50 ppm and ULP <150ppm with further reductions proposed.

Worst-case scenario

EPA have recommended modelling for a worst-case scenario and the underlying assumptions are detailed here.

- Assume all ULP refuelling pumps are in use at the same time, each with a maximum delivery rate of 40 litres per minute. Service station fuel sales are typically 60% ULP, 35% Diesel and 5% LPG. In peak hours, diesel and LPG refuelling can delay vehicle access to ULP pumps which increases the conservative margin built into the modelling inputs.
- Assume average ULP refuelling volume per vehicle is 40 litres.
- Assume total time for a vehicle to refuel is 5 minutes, from drive-in to drive-out.
- Assume tanker delivery volume is 42,000 L / hour. Modelled continuously during expected delivery hours, 8am to 4pm / 365.

Total ULP refuelling volume per pump is 40 Lpm x 12 vehicles x 0.6 (288 L/hr). This provides a worst-case emission rate for benzene of 1.2 g/hour or 0.00034 g/s per ULP pump.

The AP-42 emission factors likewise provide worst-case emission rates for xylenes and toluene of 1.9 and 4.8 g/hr respectively.

The AM/PM West Lakes site with 16 ULP pumps has maximum emission of 0.0054 g/s benzene, 0.0086 g/s xylene and 0.022 g/s toluene, from a 4,608 LPH refuelling worst-case limit

The United Petroleum Seaton servo with 10 pumps has a maximum emission of 0.0034 g/s benzene, 0.0054 g/s xylene and 0.013 g/s toluene, from a 2,880 LPH ULP refuelling worst-case limit.

These ULP refuelling rates adopted for a worst-case scenario are very conservative compared to actual sales history for an entire year from several petrol stations around Adelaide, with a maximum of 1,479 LPH

The fugitive ULP refuelling emissions were modelled as volume sources and the UST vent as a point source (Table 5) at locations shown in Figure 2 and 3.

Building profiles (BPIPS) were included (outlined yellow on the site maps) with wake effects calculated by the Plume Rise Model Enhancement (PRIME) algorithm.

	Height above ground	Base Elevation	Initial horizontal spread	Initial vertical spread	Diameter	Velocity
	metres					m/s
ULP pumps	1	4	10	1	-	-
UST Vent	4	4	-	-	0.05	0.1

Table 5 Emission source parameters.

Background VOCs

Estimates of background levels for benzene, toluene and xylenes were adopted for the dispersion modelling as shown in Table 6.

Short term background concentrations were estimated from published averages using peak to mean ratios of about 3.4 and 11 to calculate 3-minute averages from 24 hour and 12-month periods.

Pollutant	Background concentration($\mu\text{g}/\text{m}^3$)	Reference	Averaging Period
Benzene	11	Peak to mean factor	3 minute
	1	DPTI SA Gov 2007	12 month
Toluene	28	Peak to mean factor	3 minute
	8	DPTI SA Gov 2007	24 hour
	3	DPTI SA Gov 2007	12 month
Xylenes	38	Peak to mean factor	3 minute
	11	DPTI SA Gov 2007	24 hour
	2	DPTI SA Gov 2007	12 month

Table 6 Adopted Background concentrations.

4. Ground level concentrations

The worst-case scenario with continuous ULP refuelling is shown for AM/PM West Lakes (Fig. 5) and United Petroleum Seaton (Fig. 6).

The 50-meter buffer (white circle) for the AM/PM West Lakes servo extends across Frederick Road, and the benzene 0.029 mg/m³ GLC (contoured at half the Schedule 2 0.058 mg/m³ limit), extends towards the residential boundary and the nearest residence (Discrete Receptor 1, highlighted yellow) (Fig. 5).

Ambient odour sampling positions (blue) are shown around the site boundary (red) and clear of drive-through traffic.



Figure 5 AM/PM West Lakes, 50-meter buffer and benzene GLC.

The United Petroleum Seaton site (Fig. 6) shows benzene 0.029 mg/m³ (contoured at half the Schedule 2 0.058 mg/m³ limit), extending across Tapleys Hill Road to encroach on the Residential Zone by some 10 meters, and specifically Discrete Receptor 2. Several residences are within the 50 m buffer zone from the ULP refuelling pumps.

The maximum benzene GLC extending to the Residential Zone is indicated by the 0.036 mg/m³ contour, which is 38% below the Schedule 2 GLC of 0.058 mg/m³.

Ambient odour sampling positions (blue) are shown around the site boundary and clear of drive-through traffic.



Figure 6 United Petroleum Seaton, with benzene GLC contours (mg/m³)

ULP pollutant GLCs at the two Discrete Receptors are listed in Table 7 below. All pollutants remain compliant with EPA EPAQP guidelines. Benzene is 39% of the Schedule 2 GLC criterion, while toluene and xylenes are more than ten times below their respective Schedule 2 criteria.

VOC		Schedule 2 GLC	Discrete Receptor 1	Discrete Receptor 2
		mg/m ³	mg/m ³	mg/m ³
Benzene	3-min	0.058	0.023	0.023
	12 month	0.01	0.0014	0.0019
Toluene	3-min	13.4	0.075	0.076
	24 hour	4.11	0.026	0.030
	12 month	0.41	0.0048	0.0066
Xylenes	3-min	12.4	0.057	0.057
	24 hour	1.18	0.018	0.020
	12 month	0.95	0.0027	0.0034

Table 7 Maximum GLCs at Discrete Receptors

Table 8 shows benzene exposure decreases with height above ground, at Discrete Receptors 1 and 2.

A fifth-storey apartment at either Discrete Receptor 1 or 2 is indicated to have about half the benzene exposure (0.013 mg/m³) compared to a ground-level apartment (0.023 mg/m³).

These benzene concentrations remain well below the EPA GLC limit of 0.058 mg/m³.

Receptor Height above ground level	1	2
metres	mg/m ³	mg/m ³
Ground Level	0.023	0.023
3m (1 storey)	0.021	0.020
6m (2 storey)	0.017	0.016
9m (3 storey)	0.014	0.014
12m (4 storey)	0.014	0.014
15m (5 storey)	0.013	0.013

Table 8 Benzene concentration trend for a 5-storey residential tower

Odour was measured around both service stations during ULP vehicle refuelling, by experienced operators using a Nasal Ranger field olfactometer (s/n 90200651). The Nasal Ranger is used to measure ambient odour from a detection threshold (<2 OU_{EQ}) reliably up to 60 OU_{EQ}, as equivalent AS 4323.3 odour units, and is often used to ground-truth odour dispersion modelling. Wind direction (bearing compass $\pm 5^\circ$ M) and speed (vane anemometer ≥ 0.2 m/s) were recorded as ambient odour is measured downwind of the ULP refuelling vehicle.

Measurements were made during vehicles ULP refuelling in dry weather conditions and light winds (<2 m/s) from 25th March to 3rd April 2024 (Table 9). Sampling positions at AM/PM West Lakes are located clear of driveway traffic, and all six are within 30m of refuelling pumps; two positions are within 20 meters. (Fig 5).

At the United Petroleum Seaton petrol station, sampling positions are within 30m of the pumps, and along Tapleys Hill Road they are within 20 meters.

Date	Time hrs	Petrol Station	Wind Direction °Magnetic	Wind Speed m/s	Max OU _{EQ}
25/3/24	0718-0743	AM/PM	160-190	0.3-1.5	<2
	0750-0826	UP Seaton	140-180	0.3-1.4	<2
26/3/24	0710-0742	AM/PM	110-120	0.3-0.8	<2
	0755-0832	UP Seaton	115-120	<0.3 calm	<2
27/3/24	0712-0740	AM/PM	110-130	<0.3 calm	<2
	0752-0827	UP Seaton	120-140	<0.3 calm	<2
02/4/24	1032-10-47	AM/PM	135-150	1.1-2.8	<2
	1055-1108	UP Seaton	200-210	1.3-3.0	<2
03/4/24	0720-0752	AM/PM	020-005	<0.3 wet road	<2
	0757-0835	UP Seaton	065-090	<0.3-0.5 wet	<2
03/4/24	1118-1149	AM/PM	320-350	<0.3 dry road	<2
	1202-1237	UP Seaton	330-350	<0.3 dry road	<2

Table 9 Ambient Odour survey - wind conditions

Odour from ULP vehicle refuelling activity was not detected (< 2 OU_{EQ}) at either petrol station (Table 9), even when only 20 meters down-wind from multiple pumps refuelling.

5. Discussion of Results

Dispersion modelling of a worst-case maximum ULP vehicle refuelling scenario at both the AM/PM West Lakes and United Petroleum Seaton petrol stations indicates that benzene refuelling fugitive emissions will remain well below the Schedule 2 GLC criterion of 0.058 mg/m^3 across the entire Residential Zone (Fig.1).

Benzene concentrations were also shown to decrease with height for 5-storey apartment towers.

The modelling parameters are conservative with a constant 24/7 ULP refuelling rate and no reduction for off-peak periods.

Toluene and xylenes were also shown to be present at levels well below their Schedule 2 toxicity GLC.

Ambient odour measured downwind and within 30m of vehicles refuelling remained undetected ($<2 \text{ OU}_{\text{EQ}}$) despite poor dispersion conditions viz. calm weather and light winds ($< 1 \text{ m/s}$).

This result is consistent with previous odour surveys at other petrol stations around Adelaide, where ambient odour is less than 2 OU_{EQ} at distances of 30 meters or more downwind from multiple ULP pumps in operation.

The default 50-meter buffer distance from the refuelling pumps (United Petroleum Seaton) extends across Tapleys Hill Road and 20 meters into the Residential Zone (Fig. 6). However, the benzene GLC at the nearest residence (2) is indicated to remain less than half the 0.058 mg/m^3 EPA Schedule 2 criterion.

The AM/PM West Lakes (Fig. 5) benzene 0.029 mg/m^3 GLC (contoured at half the Schedule 2 0.058 mg/m^3 limit), extends across Frederick Road but does not reach the Residential Zone. The benzene GLC at the nearest residence (1) is less than half the EPA Schedule 2 0.058 mg/m^3 .

A 50-meter buffer distance around both petrol stations is adequate to ensure that ULP refuelling emissions and odour will not adversely impact on the adjacent Residential Zone, including both current and future receptors.

Technology advances including Stage 2 vapour recovery and uptake of electric vehicles are anticipated to lead further reductions in ULP refuelling emissions.

6. References

- AQMD CARB, 2007. Emission Inventory and Risk Assessment Guidelines for Gasoline Dispensing Stations. 1-8.
- Correa, S.M., Arbilla, G., Marques, M.R.C., Oliveira, K. M. P. G., 2012. The impact of BTEX emissions from gas stations into the atmosphere. *Atmospheric Pollution Research* 3, 163-169.
- EPA: 2016. Environment Protection (Air Quality) Policy 2016.
- EPA: 2019. Evaluation distances for effective air quality and noise management
- Lonneman, W. and Kleindienst, T, 2010. Hydrocarbon Concentration of Gasoline Vapor Emissions from Enclosed Fuel Tanks. US EPA-420-D-10-001.
- Singh, M. P., Ram, K. R., Mishra, M., Shrivastava, M., Saxena, D. K., 2011. Effects of co-exposure of benzene, toluene and xylene to *Drosophila melanogaster*. *Chemosphere* 79, 575-587.
- Terrés, I.M.M., Miñarro, M.D., Ferradas, E.G., Caracena, A.B., 2010. Assessing the impact of petrol stations on their immediate surroundings. *Journal of Environmental Management* 91, 2754-2762.
- Ugochukwu, O., Ijioma, O, Ikechukwu, O., 2014. Environmental Impact Assessment of Petrol and gas filling Stations on Air Quality in Umuahia, Nigeria. *Global Journal of Engineering Research* 13, 11-20.

ATTACHMENT B

Statement of Limitations

STATEMENT OF LIMITATIONS

This report has been prepared by Land & Water Consulting for Renewal SA (the Client), the Crown in rights of the state of SA and any site contamination auditor appointed to undertake a site contamination audit in accordance with the agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice.

None of LWC Management Pty Ltd or any of its related entities, employees or directors (each a Land & Water Consulting Person) owes a duty of care (whether in contract, tort, statute or otherwise) to any third party with respect to or in connection with this report and no Land & Water Consulting Person accepts any liability for any loss or damage suffered or costs incurred arising out of or in connection with the use this report by any third party.

The report has been prepared with the objectives and scope of work outlined in the proposal dated 1 June 2023. The work was carried out in accordance with the existing contract between Land & Water Consulting and Renewal SA.

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Land & Water Consulting may have also relied on data and other information provided by the Client and other qualified individuals in preparing this report. Land & Water Consulting has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. These opinions, conclusions and recommendations are subject to uncertainty given the potentially complex nature of any subsurface environment. Variation in soil and groundwater conditions may vary significantly between the specific sampling and testing locations and other locations at the site. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

No warranty or guarantee of the site conditions is intended.

This report may be relied upon by Renewal SA (the Client), the Crown in the right of South Australia and any site contamination auditor appointed to undertake a site contamination audit. Any reliance on this report by third parties shall be at such parties' sole risk. This report shall only be presented in full and may not be used to support any other objectives than those set out in the report, except where written approval with comments is provided by Land & Water Consulting and/ or Renewal SA.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the Site.