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Consulting Acoustical & Vibration Engineers

**ORICA AUSTRALIA PTY LTD.
KOORAGANG ISLAND
ENVIRONMENTAL NOISE AUDIT
JUNE 2023**

53.6719.R13:GA/DT/2023

Rev 00

Prepared for: Orica Australia Pty Ltd
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1.0 INTRODUCTION

Atkins Acoustics was retained by Orica Australia Pty Ltd (*Orica*) to conduct an environmental noise audit for their Kooragang Island plant. The report presents results and findings of the audit, an assessment of operational noise from the site including plant associated with the expansion of the ammonium nitrate plant (*the Project*) and the implementation of noise mitigation to existing plant. Works undertaken as part of the first phase of the *Orica* expansion are described in Environmental Noise Audit Report dated November 2012, include;

- a new Ammonia Plant Process air compressor;
- cooling tower cells and pumps to service the Ammonia Plant;
- steam power generator 183L; and
- de-commissioning two (2) process air compressors (102J and 122J).

In addition to the above uprate works, *Orica* implemented a site noise reduction program (*SNRP*). Details of those works are summarised in the *Atkins Acoustics* Environmental Noise Audit report dated March 2013. Site improvement works implemented during 2020 included the decommissioning of the off-site boiler, commissioning of a new site boiler and relocation of the CO₂ vent with an inline discharge attenuator.

2.0 OVERVIEW

To control industrial noise exposure for the Stockton residential area, the NSW Department of Planning (*Department*) concluded that any additional noise emitted from *the Project* must achieve a noise contribution at least 10dBA below the agreed existing levels determined prior to the proposed uprate works.

Initially noise audit monitoring locations were selected to provide for reliable site access to install instrumentation and security. The locations identified as R4 and R6 due to access arrangements and instrumentation security were relocated from the riverside to roadside positions. Similarly, due to access restrictions monitoring location R1 (294 Fullerton Street) was changed to 284 Fullerton Street, R2 (218 Fullerton Street) changed to 220 Fullerton Street and R3 186 (Fullerton Street) changed to 184 Fullerton Street.

2.1 Compliance Noise Monitoring

For the assessment of noise emitted from *Orica*, six (6) reference assessment locations (*Figure 1*) were selected. The locations are referenced in the *Orica* Noise Management Plan (*NMP*), three (3) located at Stockton and three (3) on Kooragang Island.

- R1 - 284 Fullerton Street, Stockton.
- R2 - 220 Fullerton Street, Stockton.
- R3 - 184 Fullerton Street, Stockton.
- R4 - Roadside (south) opposite Ammonium Nitrate Area
- R5 - Riverside (central) opposite Administration Building.
- R6 - Roadside (north) north of Ammonia Plant.

Figure 1. Compliance Noise Monitoring Locations



2.2. Competence Statement

Atkins Acoustics is a member firm of the Association of Australasian Acoustical Consultants (AAAC). The site attended audits and analysis were conducted by a staff member of Atkins Acoustics with tertiary qualifications and experience in the discipline of acoustics and a 'Member' of the Australian Acoustical Society (AAS)

3.0 STATUTORY REQUIREMENTS

The following *Project* noise assessment requirements are referenced in Schedule 3 'Specific Environmental Conditions' of the *Department* Project Approval (as modified) dated 1 December 2009.

Noise Limits

30. The Proponent shall ensure that noise levels from the operation of the Project are at least 10dB(A) below noise levels from the Initial Operations as specified by conditions 31 and 32.

Note: Ammonia flaring events are excluded from the noise limits and levels referred to in conditions 30 and 31.

Initial Operations - Noise Verification Program

31. Prior to the commencement of construction, the Proponent shall prepare and implement an Initial Operations Noise Verification Program to the satisfaction of the Secretary. The Program shall:
- a) be undertaken by a suitably qualified and experienced person;
 - b) identify future reference points that will be used to demonstrate compliance;
 - c) collect new or review existing data, and report on the seasonal background levels for the noise catchment; and
 - d) confirm the noise levels from the Initial Operations.

Note: Some construction activities may occur under the Project Approval provided that such activity are not undertaken during the monitoring period or that the Proponent can demonstrate that the activity would not contribute to the background noise level, to the satisfaction of the Secretary.

Noise and Vibration Management Plan

32. The Proponent shall prepare and implement a Noise and Vibration Management Plan for the Project to the satisfaction of the Secretary. The Plan shall:
- a) be prepared by a suitably qualified and experienced expert whose appointment has been agreed to in writing by the Secretary;
 - b) be approved by the Secretary (see Conditions 49A and 49B for scope and timing and Condition 49C for management plan requirements);
 - c) demonstrate how noise levels from the Project would be managed to ensure noise levels would be 10dB(A) below noise levels from the Proponent's Initial Operations (see Conditions 30 and 31);
 - d) include a detailed monitoring program for reporting on ongoing compliance. The monitoring program shall:
 - outline the proposed receiver sites at Stockton and sites on Kooragang Island that would be monitored;
 - include both attended and unattended noise monitoring;
 - verify that actual noise levels from the Project are consistent with the predictions made in the EA;
 - verify that noise levels from the Project are 10dB(A) below the noise levels identified in Condition 31 for the Proponent's Initial Operations;
 - e) provide details of any complaints received in the preceding year relating to noise generated by the Project, and action taken to respond to those complaints;
 - f) detail procedures for implementing additional reasonable and feasible noise mitigation measures for the Project in response to exceedance of limits and/or noise complaints;
 - g) be updated annually, unless otherwise agreed to by the Secretary; and
 - h) describe the measures that will be implemented to prevent and minimise potential adverse noise and vibration impacts from the Project, including:

- reasonable and feasible measures being employed on the Project site;
- plant and equipment being maintained to ensure that it is in good order;
- how potential noise and vibration impacts will be minimised and managed; and
- identification of the likely nature and timing of Project-related activities and works that could generate potential elevated noise emissions and a description of the mitigation measures that will be implemented to ensure compliance with the relevant conditions of this approval and the EPL,

4.0 PROJECT SPECIFIC NOISE CRITERIA

Night-time attended audits reported for the monitoring locations on Kooragang Island (2011) confirmed that noise from *Orica* was steady state with minimal influence from other industrial sources. At the reference monitoring locations it was reported there was minimal variation between the measured L_{A90} and L_{Aeq} levels.

Referring to the *Departments* Conditions for assessing noise trends and compliance status, operational noise resulting from *the Project* should be at least 10dBA below levels from *Orica's* existing plant. *Table 1* presents a summary of the baseline background levels and the Project noise criteria.

Table 1: Project Noise Criteria

dBA re: 20×10^{-6} Pa

Reference Assessment Location	Baseline Background Sound Pressure Levels	Project Noise Criteria
		dBA
Assessment Location R4	62	52
Assessment Location R5	57	47
Assessment Location R6	56	46

4.1 Stockton Noise Criteria

Modelling reported for *the Project* (Atkins Acoustics Feb '09) predicted noise levels would satisfy *the Project* criteria. *Table 2* presents a summary of noise levels predicted for the Stockton reference residential assessment locations from the existing plant and *the Project* for calm weather conditions.

Table 2. Predicted Pre Uprate and Project Noise Contributions

dBA re: 20×10^{-6} Pa

Reference Assessment Location	Predicted Sound Pressure Levels	
	dBA	
	Pre-Uprate Noise Levels	Uprated Plant Contributions
Assessment Location R1	50	37
Assessment Location R2	53	41
Assessment Location R3	51	39

5.0 RESULTS AND ASSESSMENT

For the assessment of noise from *the Project* and compliance status, it was recognised that demonstration of compliance would be difficult to confirm by direct measurement alone due to the variability of ambient background levels and contributions being greater than 10dB below the pre-uprate level. Therefore, to assess compliance with *the Project* noise criteria in accordance with the *NMP*, it was proposed to:

- Update the site noise model following the commencement of operation of *the Project* to determine contributions from *the Project*; and
- undertake attended and unattended monitoring at the reference locations to assess changes in ambient background levels and noise trends.

5.1 Noise Model Updating

Modelling reported in the *Kooragang Island Noise Assessment (Report Number 39.6357.R1:GACD03 Rev 3, Atkins Acoustics, 2009)* was updated to determine predicted noise contributions from *the Project*.

Table 3 presents a summary of the predicted pre-uprate noise contributions and levels from *the Project* (phase one). Compliance with *the Project* Approval Conditions was to be assessed against the pre-uprate noise levels.

Table 3. Predicted Baseline and Project Noise Contributions

L_{Aeq} re: 20 x 10⁻⁶ Pa

Operating Plant Conditions	Predicted Sound Pressure Level dBA					
	R1	R2	R3	R4	R5	R6
Pre Uprate	50.4	52.1	49.9	66.3	62.6	59.1
Uprate Plant (Phase one) Ammonia Plant Compressor and 183L Generator	19.7	22.3	21.1	23.5	32.9	41.7

5.2 Site Attended Noise Measurement Results (May 2022)

For noise compliance purposes attended audit measurements were undertaken on Tuesday night 13 June 2023. The noise measurements were conducted in accordance with procedures referenced in Australian Standard AS1055-1997 '*Acoustics - Description and Measurement of Environmental Noise*' and the *Noise Policy for Industry* (EPA 2017).

5.2.1 Measurement Instrumentation

Instrumentation comprised Class 1 Svantek 949 and Svantek 957 Sound Level Meters. The instruments manufactured prior 2019 meet AS/NZS IEC 61672.1:2013 *Electroacoustics: sound level meter specifications* standards.

Instrumentation reference calibration levels were checked with a portable Bruel & Kjaer calibrator before and after the audit measurements to verify that the variation remained within $\pm 0.5\text{dB}$. The calibrator manufactured prior before 2017 meets AS/NZS IEC 60942:2017 *Electroacoustics: sound calibrators* standards.

Copies of the meter calibration certificates are available on request.

5.2.2 Noise Descriptors

Instrumentation was set for measurement time interval of 15 minutes and 'fast' (F) time weighting.

The noise descriptors for the purpose of the measurements included the following:

- equivalent A-weighted continuous sound level ($L_{Aeq,T}$)
- maximum A-weighted sound pressure level ($L_{AFmax,T}$)
- A-weighted sound pressure level exceeded for 90% of the measurement time ($L_{AF90,T}$)
- A-weighted sound pressure level exceeded for 10% of the measurement time ($L_{AF10,T}$).

5.2.3 Meteorological Conditions

Prevailing weather conditions during noise monitoring were extracted from the onsite meteorological station. During the attended audit, meteorological conditions were clear sky, wind $< 4\text{m/sec}$ from the north-west, air temperature 12°C and relative humidity 80%.

5.2.4 Measurement Locations

Resulting from access arrangements at 218 Fullerton Street (Reference Location R2), instrumentation for noise monitoring was installed at 220 Fullerton Street.

5.2.5 Site Operating Conditions

During the attended night audit *Orica's* processing plants other than NAP 1, were reported as normal operations.

5.2.6 Review of Incident Reports

As part of reporting procedures the *Senior Specialist-Environment* confirmed seven (7) noise incidents were reported during the twelve (12) months from June 22 and 23 and investigated by Orica staff. The incidents related to steam venting (13 October 2022) and the Ammonia Plant (24 March 2023).

5.2.7 Site Attended Noise Measurement Results

Table 4 presents a summary of attended noise measurements and noted observations. During the Tuesday night audit the ambient background L_{A90} levels at Stockton were influenced by Orica, unloading (bulk) ship, coal transfer conveyors and localised intermittent road traffic.

Attended audits on Kooragang Island confirmed noise from *Orica* was steady state. The measurements confirmed that Orica related maximum (L_{Amax}) levels were not observed to cause exceedances greater than 5dBA above the L_{Aeq} levels.

Orica noise sources identified at the Stockton/Kooragang Island monitoring locations during attended audit included:

- Ammonia Plant - low frequency noise, quench valves and steam venting;
- General operational noise NAP and AN Plants;
- NAP 1 steam venting;
- Steam pipe hammer AN 2;
- NAP cooling towers, and
- intermittent steam pipe hammer

Table 4. Attended Noise Measurement Results/Observations

Location	Sound Pressure Level dBA						Comment
	L _{Amax}	L _{A1}	L _{A10}	L _{A50}	L _{A90}	L _{Aeq}	
R1-284 Fullerton Street	58.6	56.5	55.2	53.8	52.6	54.0	Ammonia plant steam; Steam pipe hammer, NAP 1 steam vent; General Orica plant; Bulk ship unloading; Coal conveyors; Intermittent passing road traffic.
R2-220 Fullerton Street	59.5	57.2	55.5	54.1	53.0	54.3	Ammonia plant steam; Orica plant general; NAP 1 steam vent; NA 2 steam pipe hammer L _{Amax} 55/6dBA; Steam pipe hammer L _{Amax} 54/6dBA; Bulk ship unloading; Intermittent road traffic.
R3-184 Fullerton Street	58.1	57.1	55.5	54.9	52.8	54.2	General Orica plant; Steam pipe hammer, NAP 1 steam vent; Bulk ship unloading; Intermittent passing road traffic.
R4-Roadside (South)	67.6	65.3	63.4	61.8	60.8	62.1	Orica plant general; NA 2 steam pipe hammer L _{Amax} 64/5dBA; Steam pipe hammer L _{Amax} 65/6dBA; NAP 1 steam vent.
R5-Riverside (Central)	64.9	62.9	61.3	59.9	58.9	60.1	NAP 1 steam vent L _{Amax} 60/4dBA; Steam pipe hammer L _{Amax} 62/3dBA; Ammonia plant; Converter valves (4KHz- 10KHz); NAP cooling towers.
R6-Roadside (North)	66.9	65.9	64.7	63.3	62.2	63.5	Ammonia Plant; Converter valves (4KHz- 10KHz); High pressure steam venting; Orica plant general; Coal loader conveyors.

5.2.8 Unattended Noise Measurement Results

Table 5 presents a summary of the L_{A90} and L_{Aeq} sound pressure levels measured from Tuesday 13 June to Tuesday 20 June 2023. Attachment 1 presents a summary of the measurement results in graphical form. Prevailing meteorological conditions reported for the audit period show that the prevailing winds during nighttime hours (10.00pm to 7.00am) were generally less than 5m/sec.

Table 5. Summary of Rating Background (RBL) and Ambient Levels

(Tuesday 4 June - Thursday 23 June 2022)

dBA re: 20×10^{-6} Pa

Measurement Location	Ambient Sound Pressure Levels					
	dBA					
	RBL			Ambient Levels		
				L_{Aeq} , period		
	Day	Evening	Night	Day	Evening	Night
R1. 284 Fullerton Road (Residential)						
RBL	49.9	50.1	50.9			
Logarithmic Average L_{Aeq}				62.5	60.5	56.8
R2. 220 Fullerton Road (Residential) ⁽ⁱ⁾						
RBL	49.5	49.0	49.2			
Logarithmic Average L_{Aeq}				60.5	57.1	55.0
R3. 184 Fullerton Road (Residential)						
RBL	48.9	48.3	48.4			
Logarithmic Average L_{Aeq}				61.4	58.5	55.1
R4. Greenleaf Road Roadside (South)						
RBL	59.0	60.1	60.0			
Logarithmic Average L_{Aeq}				61.8	61.4	62.4
R5. Greenleaf Road Riverside (Centre)						
RBL	55.1	55.7	56.1			
Logarithmic Average L_{Aeq}				58.2	58.6	59.2
R6. Greenleaf Road Roadside (North)						
RBL	61.8	63.5	63.3			
Logarithmic Average L_{Aeq}				65.8	65.9	66.5

(i) due to access and instrumentation security no measurement were conducted for this period

Notes: Daytime: 7.00am to 6.00pm Monday to Saturday, 8.00am to 6.00pm Sunday and Public Holidays.

Evening: 6.00pm to 10.00pm.

Night: 10.00pm to 7.00am Monday to Saturday, 10.00pm to 8.00am Sunday and Public Holidays.

5.2.9 Assessment of Noise Trends

For assessing noise trends associated with *Orica*, the *NMP* recommends that future noise monitoring on Kooragang Island (R4, R5 and R6) be considered. Baseline RBL's established for the Kooragang Island monitoring locations are referenced in *Atkins Acoustic (September 2012)*.

The measurement results summarised in Table 6 demonstrate the night-time RBL at R4 (60.1) is marginally (0.6dB) higher than the long-term median level of 59.4; for R5 (56.1dB) the level is 0.3dB higher than the long-term medium of 55.8dB, and for R6 (63.3) the level 0.3dB higher than the long-term medium of 63.0dB

Table 6. Baseline RBL Noise Trends

Reference Measurement Location	Ambient Background RBL's dBA		
	Range	Median	June 2023
R4 - Roadside (South)	54.2 to 63.0	59.4	60.0
R5 - Riverside (Central)	49.3 to 60.7	55.8	56.1
R6 - Roadside (North)	60.1 to 65.4	63.0	63.3

6.0 SUMMARY

Atkins Acoustics was retained by *Orica* to conduct an environmental noise audit for the Kooragang Island plant. The audit included attended and unattended measurements at Stockton and on Kooragang Island during June 2023.

Resulting from access arrangements at 218 Fullerton Street (Reference Location R2), instrumentation for noise monitoring was installed at 220 Fullerton Street.

As part of reporting procedures the *Senior Specialist-Environment* confirmed seven (7) noise incidents were reported during the twelve (12) months from June 22 and 23 and investigated by Orica staff. The incidents related to steam venting (13 October 2022) and the Ammonia Plant (24 March 2023).

Prevailing weather conditions during noise monitoring were extracted from the onsite meteorological station. During the attended audit, meteorological conditions were clear sky, wind <4m/sec from the north-west, air temperature 12°C and relative humidity 80%.

During the attended night audit Orica's processing plants other than NAP 1 were reported as normal operations. *Orica* noise sources identified at the Stockton/Kooragang Island monitoring locations during attended audit included:

- Ammonia Plant - low frequency noise, quench valves and steam venting;
- General operational noise NAP and AN Plants;
- NAP 1 steam venting;
- Steam pipe hammer AN 2;
- NAP cooling towers, and
- intermittent steam pipe hammer

The measurement results summarised in *Table 6* demonstrate the night time RBL at R4 (60.1) is marginally (0.6dB) higher than the long-term median level of 59.4; for R5 (56.1dB) the level is 0.3dB higher than the long-term medium of 55.8dB, and for R6 (63.3) the level 0.3dB higher than the long-term medium of 63.0dB

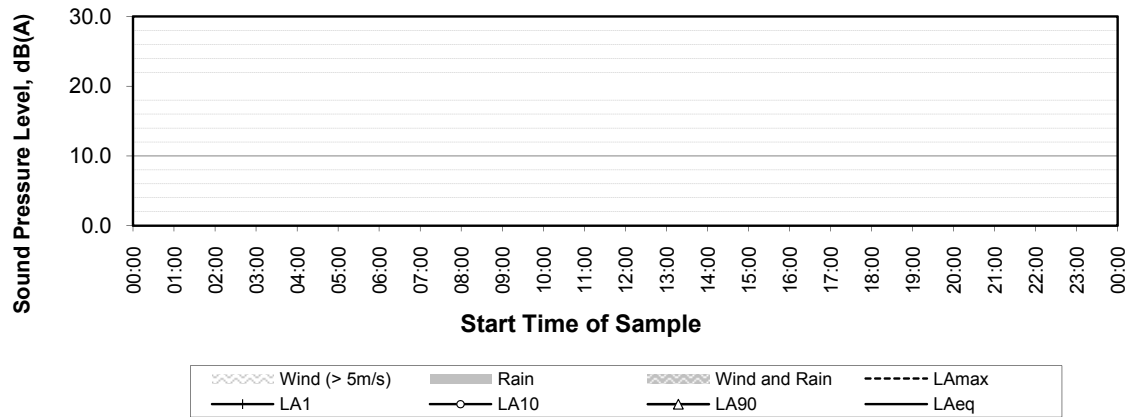
The findings from the June 2023 audit demonstrate that noise contributions from *the Project* satisfied the project noise criteria (*Table 3*).

Attended night audits confirmed that *Orica* related maximum (L_{Amax}) levels were not observed to cause exceedances greater than 5dBA above the measured L_{Aeq} levels at the referenced residential monitoring locations.

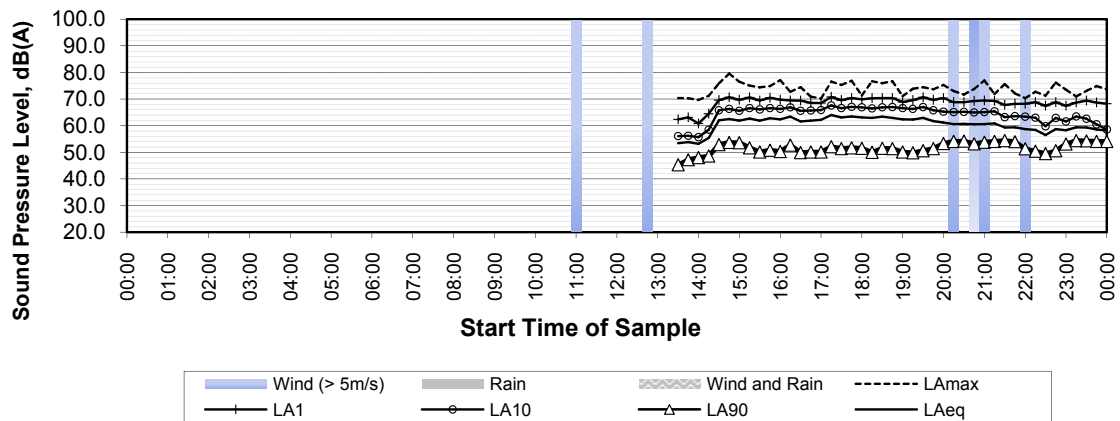
ATTACHMENT 1. AMBIENT SOUND PRESSURE LEVEL MEASUREMENT RESULTS

Ambient Sound Pressure Levels

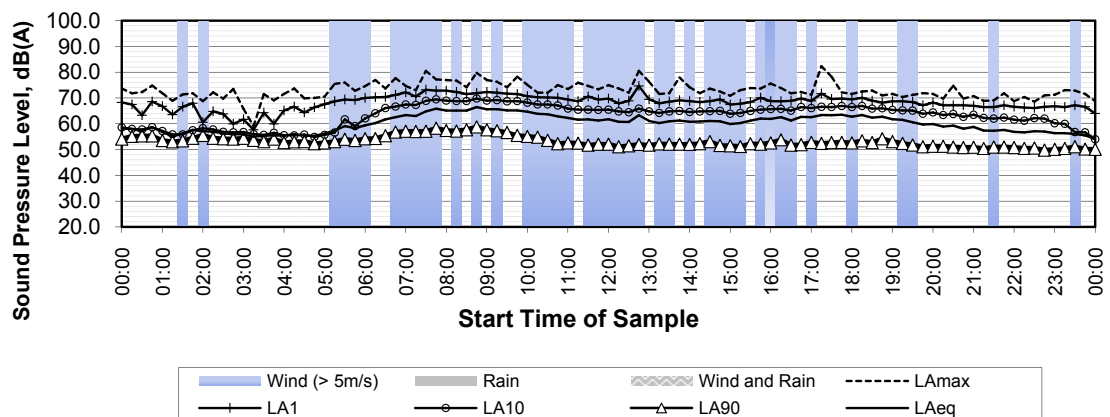
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Tuesday, 13 June 2023



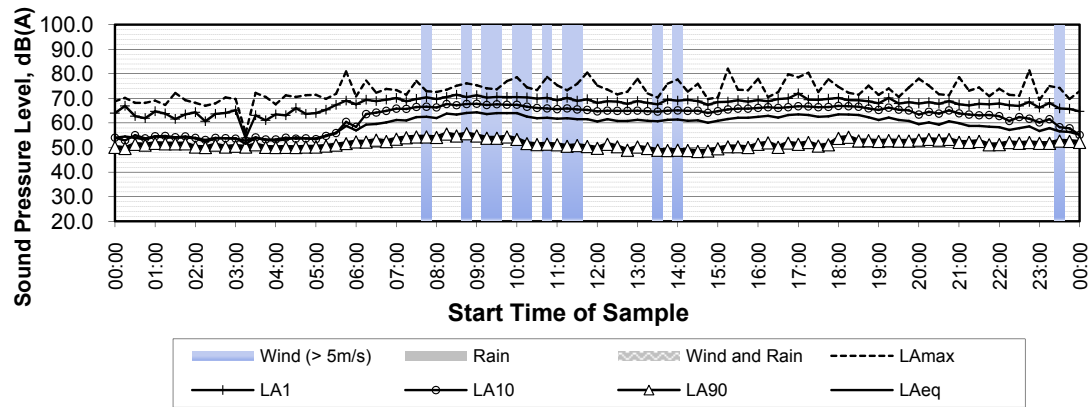
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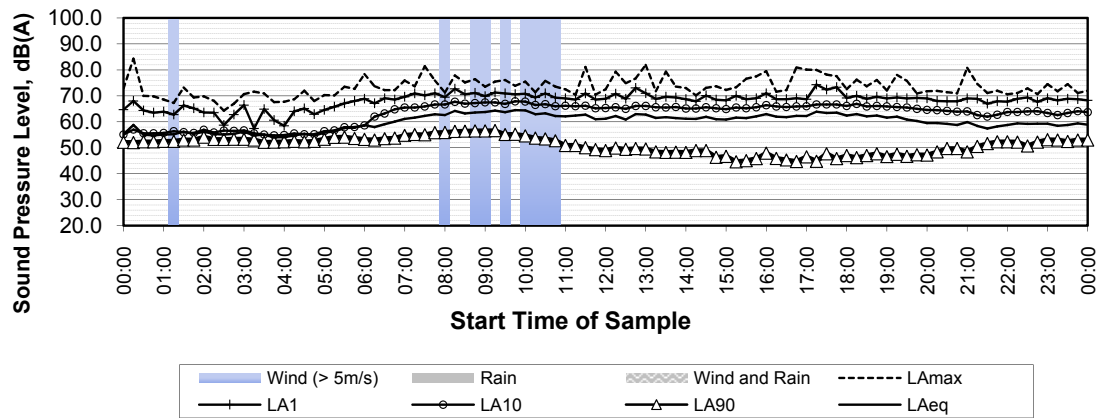
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284 Fullerton Road

Ambient Sound Pressure Levels

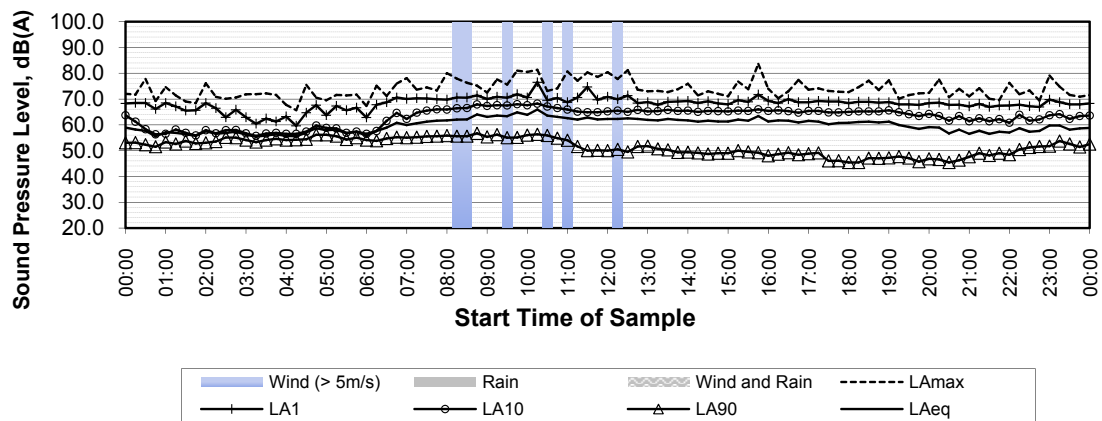
Thursday, 15 June 2023



Friday, 16 June 2023



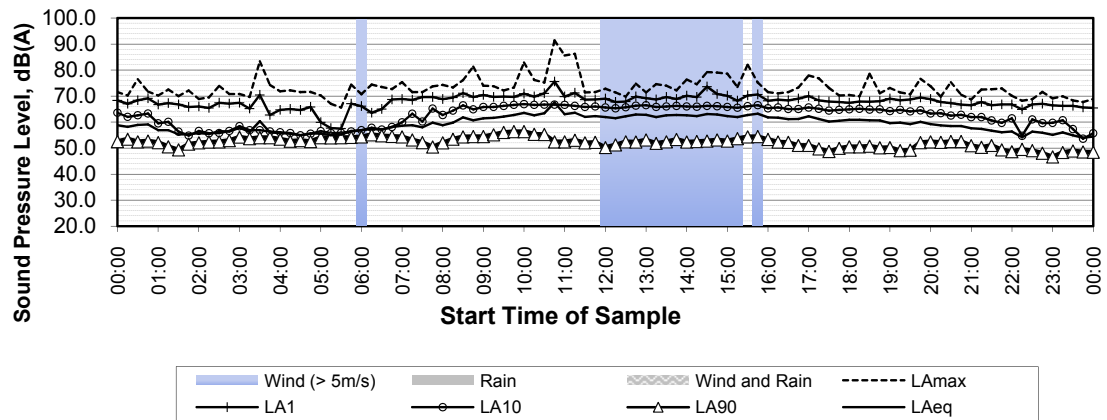
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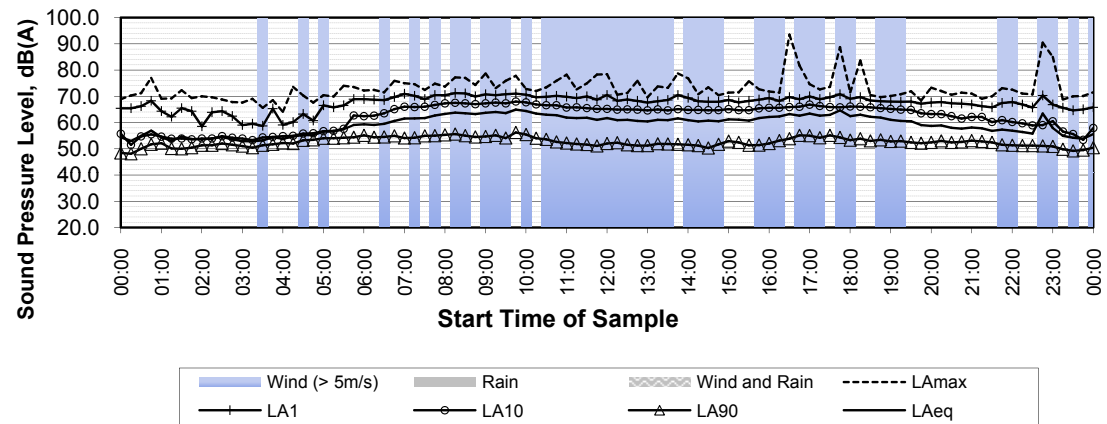
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284 Fullerton Road

Ambient Sound Pressure Levels

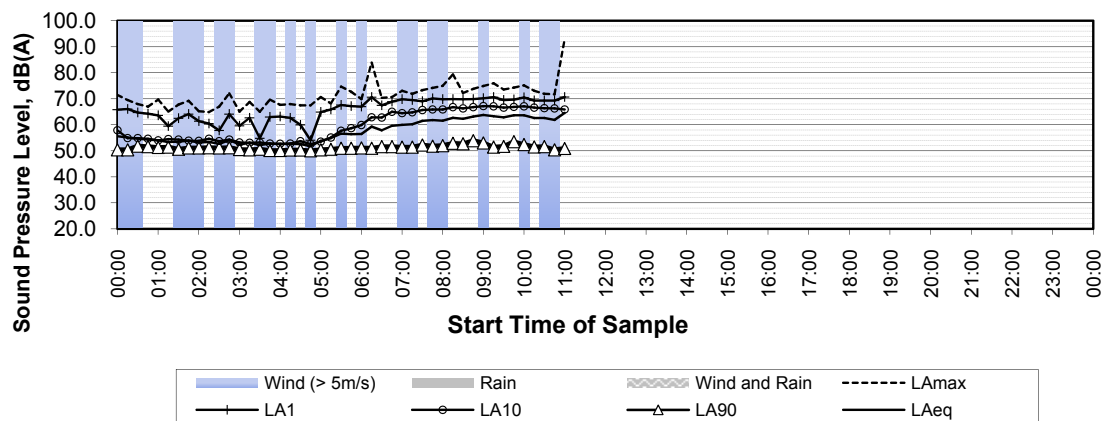
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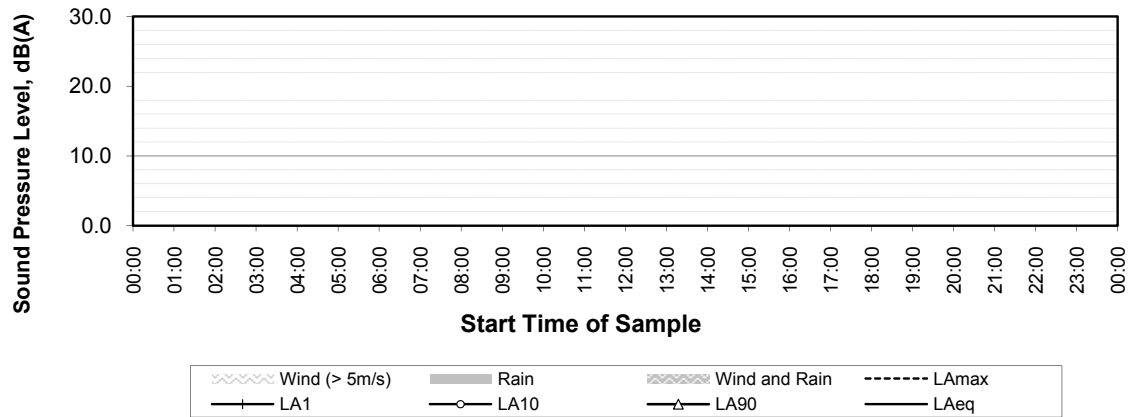
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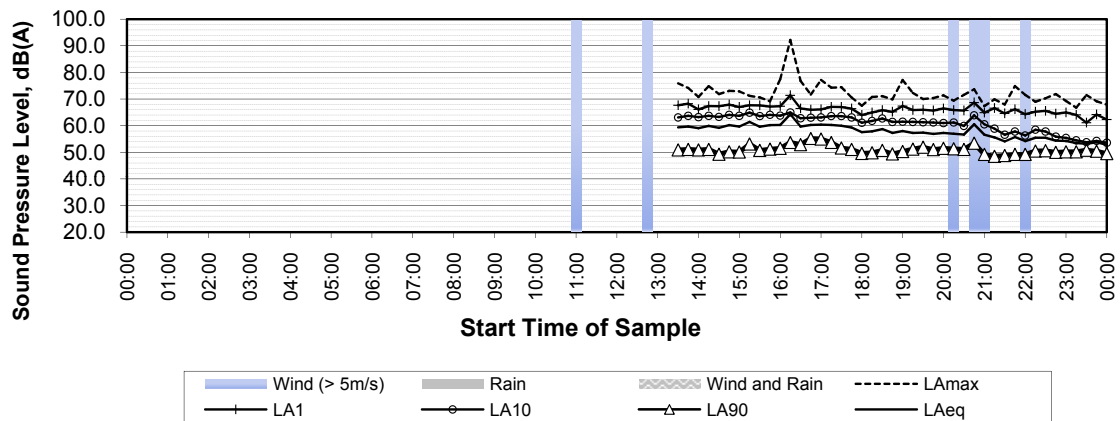
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Ambient Sound Pressure Levels

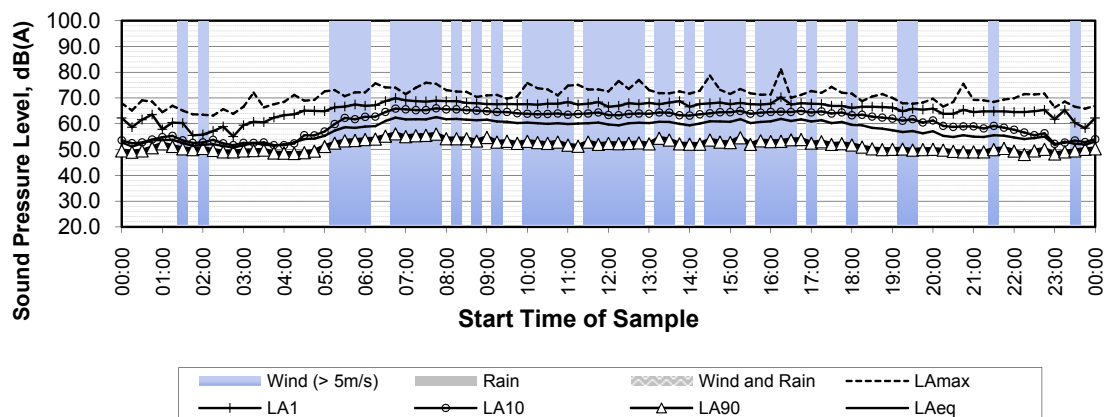
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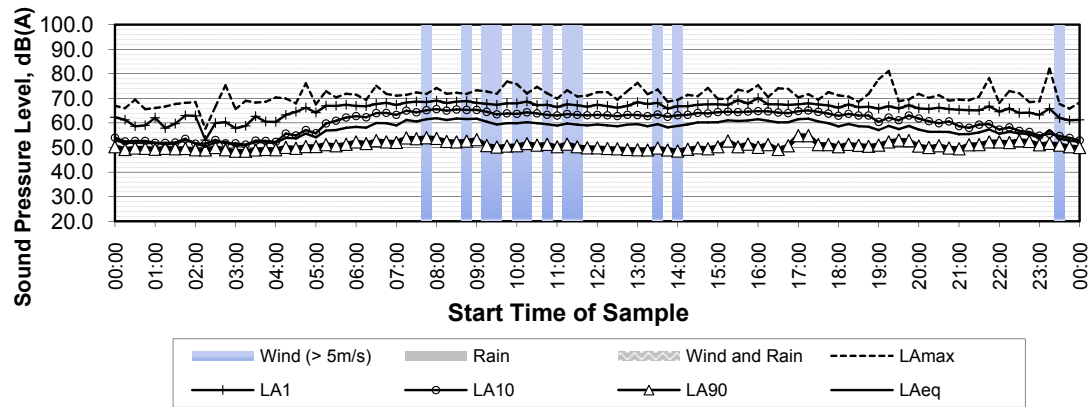
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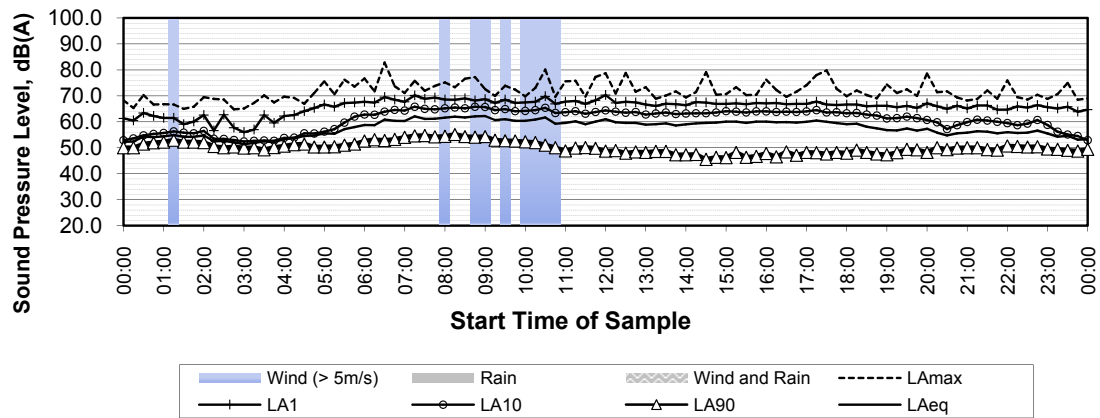
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220 Fullerton Road

Ambient Sound Pressure Levels

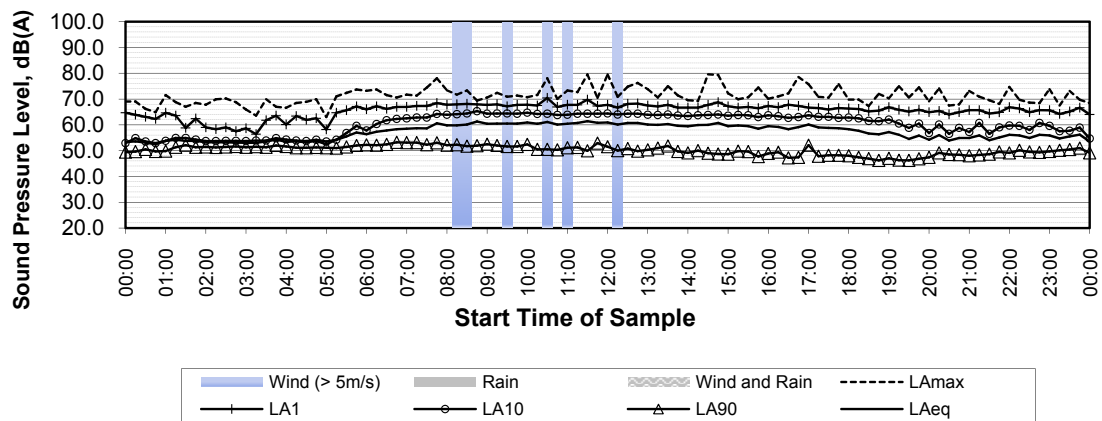
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Friday, 16 June 2023



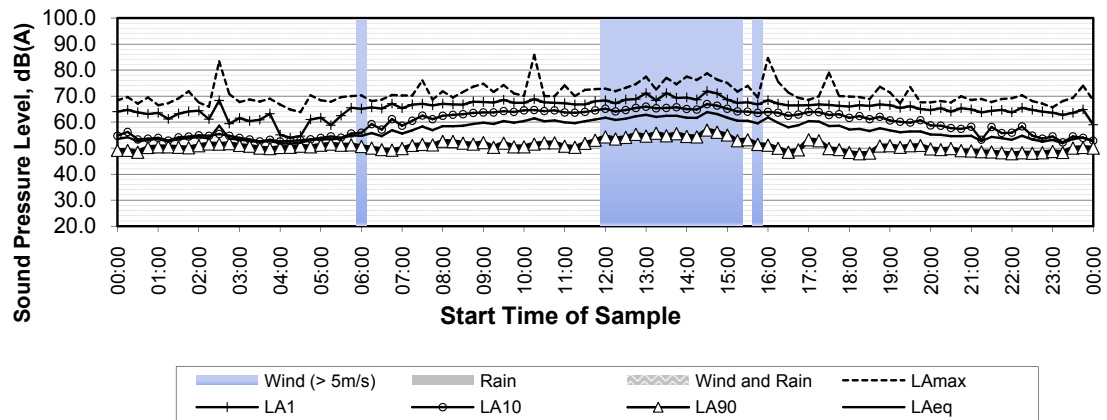
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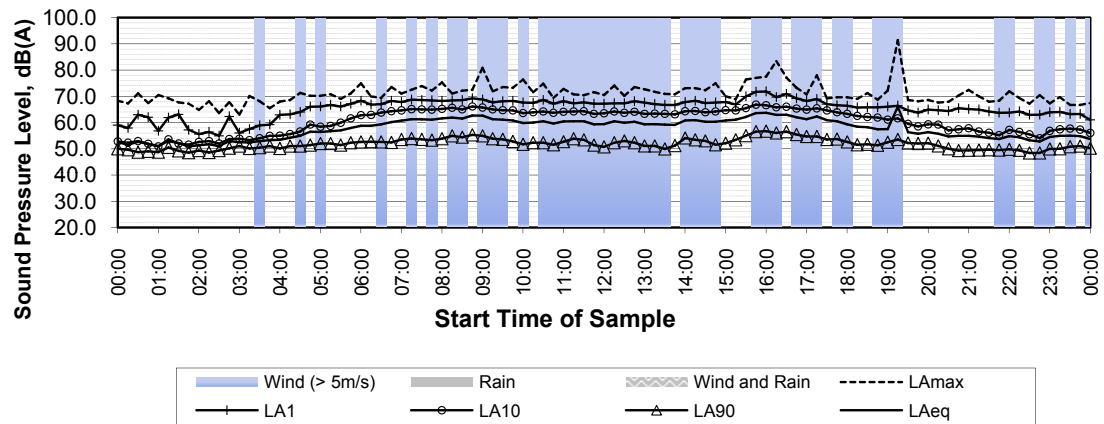
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220 Fullerton Road

Ambient Sound Pressure Levels

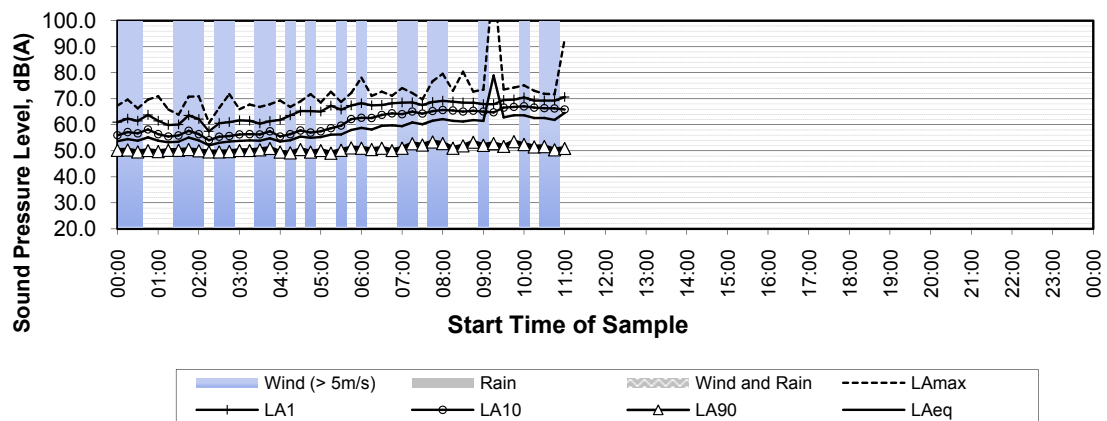
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Monday, 19 June 2023



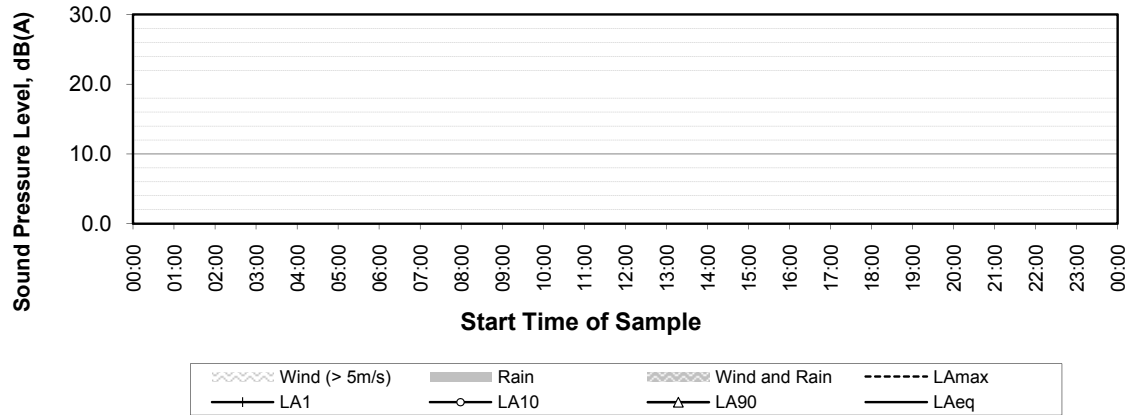
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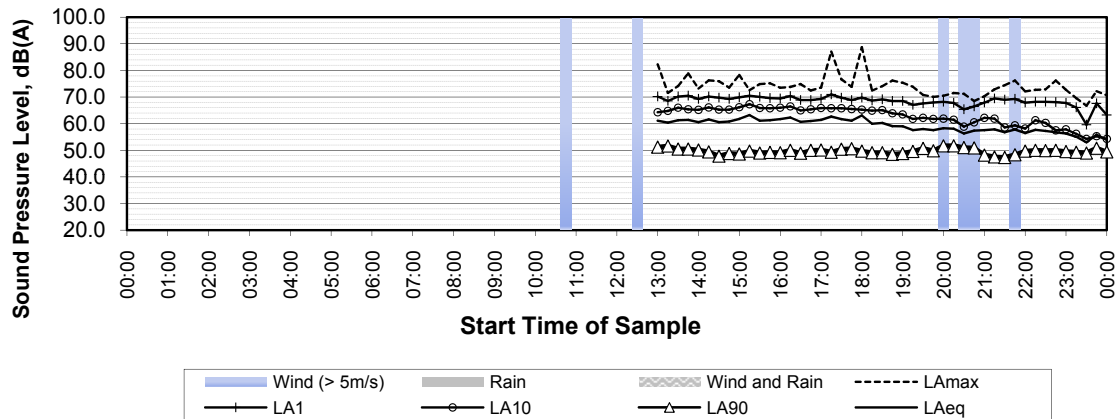
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Ambient Sound Pressure Levels

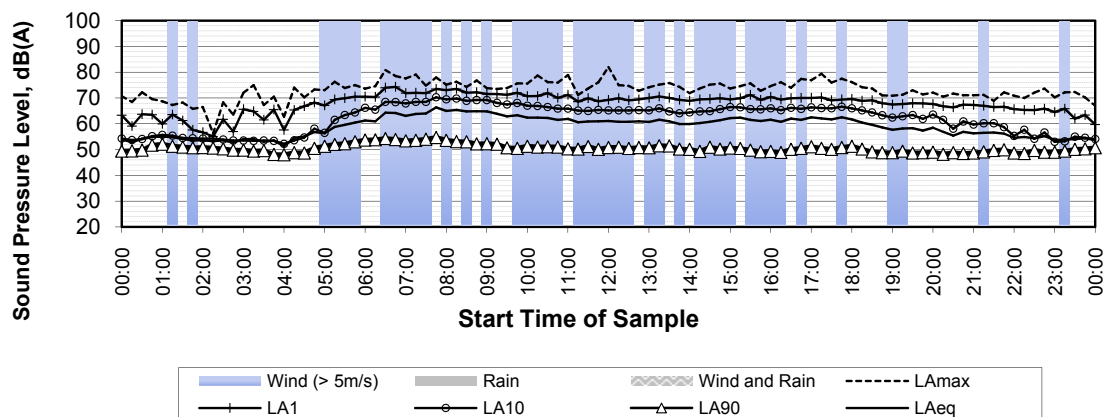
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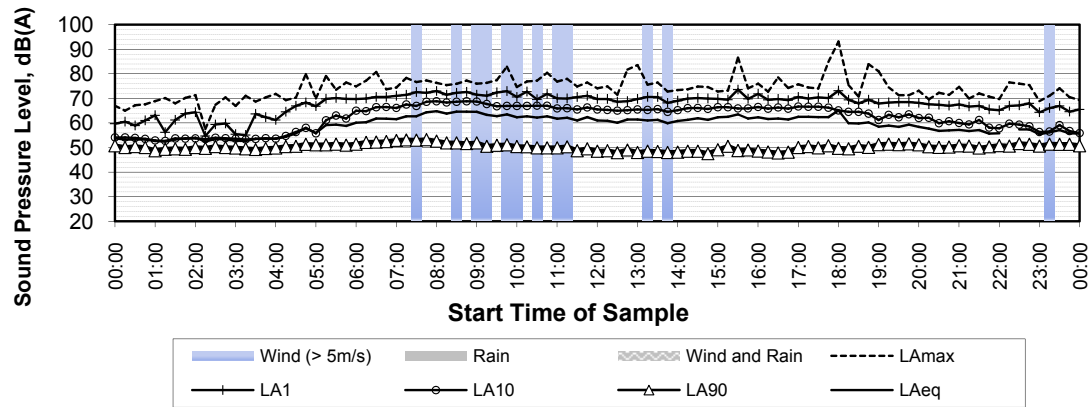
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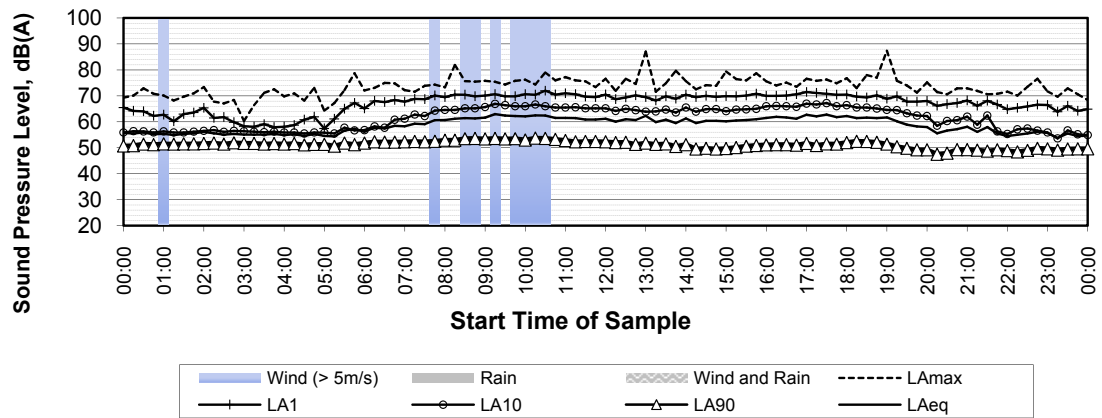
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184 Fullerton Road

Ambient Sound Pressure Levels

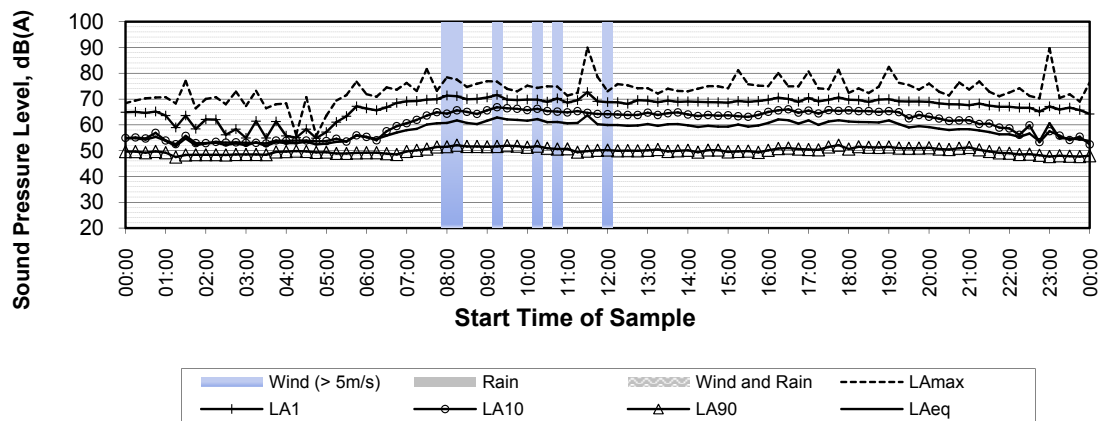
Thursday, 15 June 2023



Friday, 16 June 2023



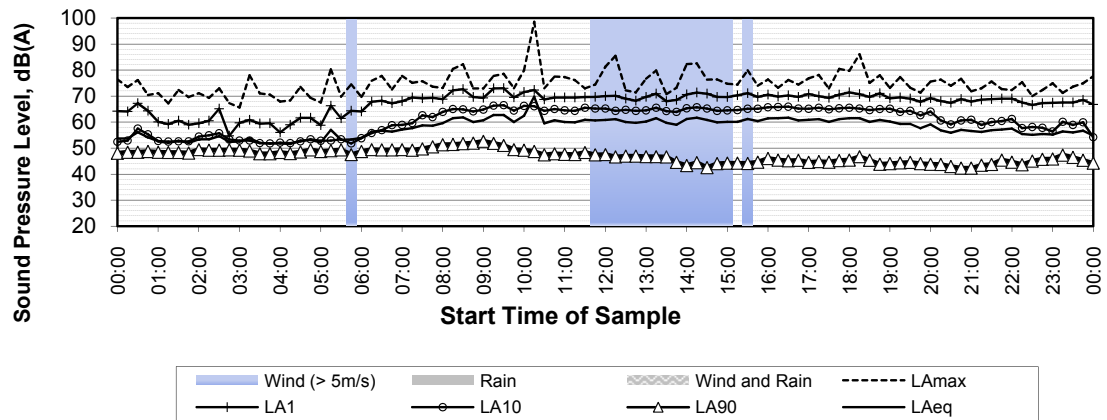
Saturday, 17 June 2023



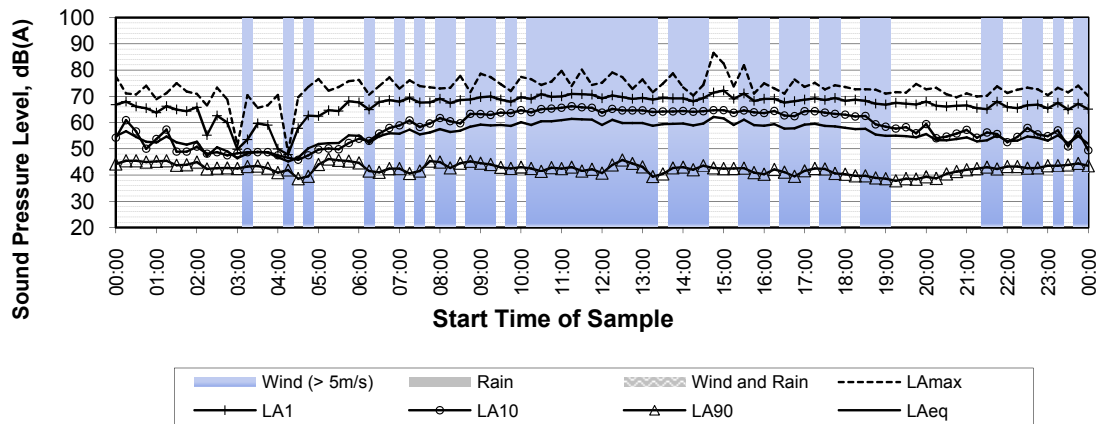
Reference Measurement R3
184 Fullerton Road

Ambient Sound Pressure Levels

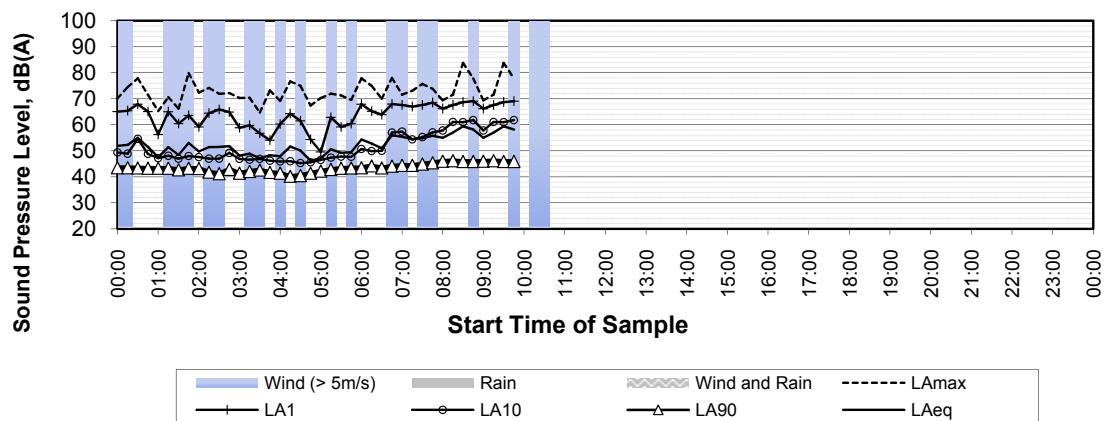
Sunday, 18 June 2023



Monday, 19 June 2023



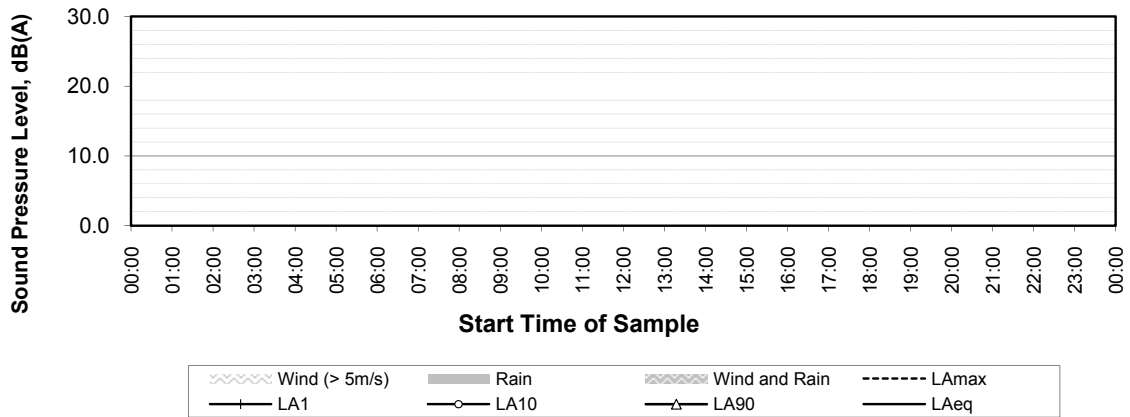
Tuesday, 20 June 2023



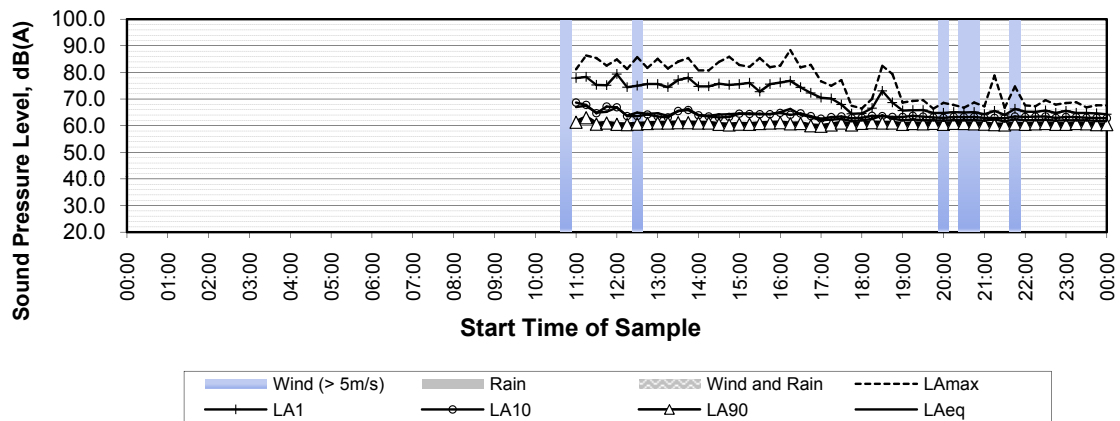
Reference Measurement R3
184 Fullerton Road

Ambient Sound Pressure Levels

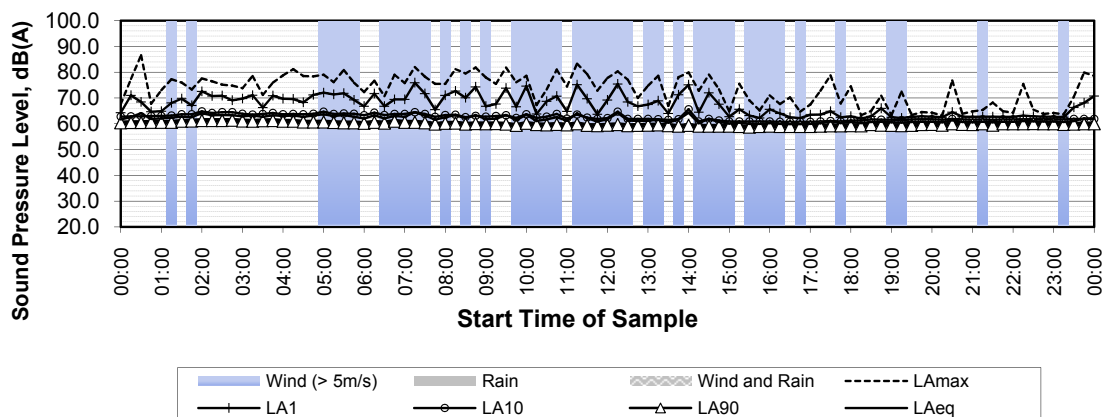
Monday, 12 June 2023



Tuesday, 13 June 2023



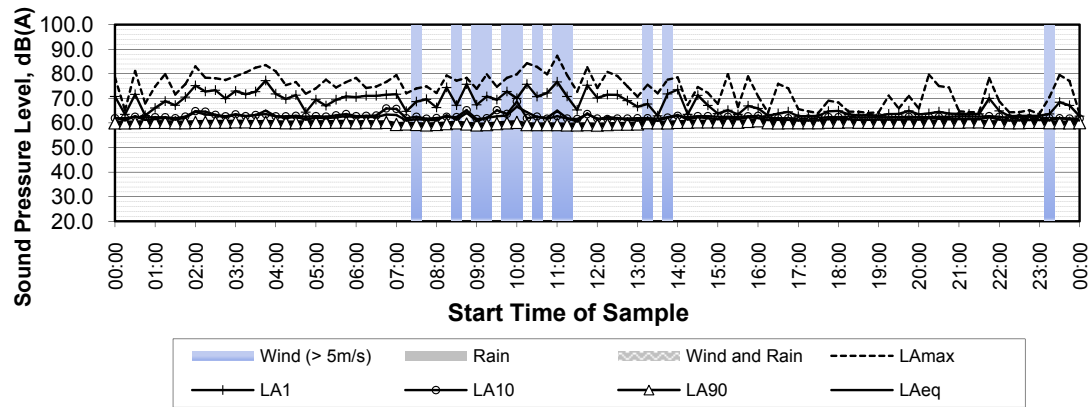
Wednesday, 14 June 2023



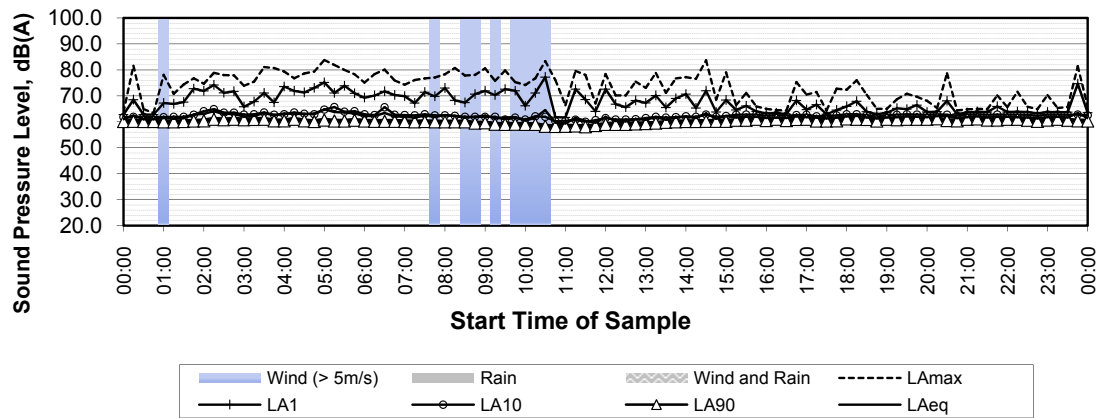
Reference Measurement R4
Greenleaf Road Roadside (South)

Ambient Sound Pressure Levels

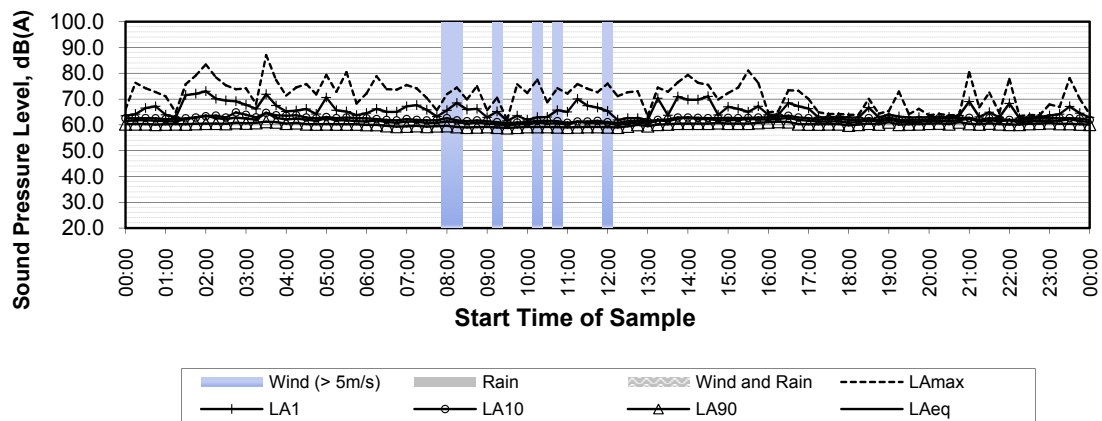
Thursday, 15 June 2023



Friday, 16 June 2023



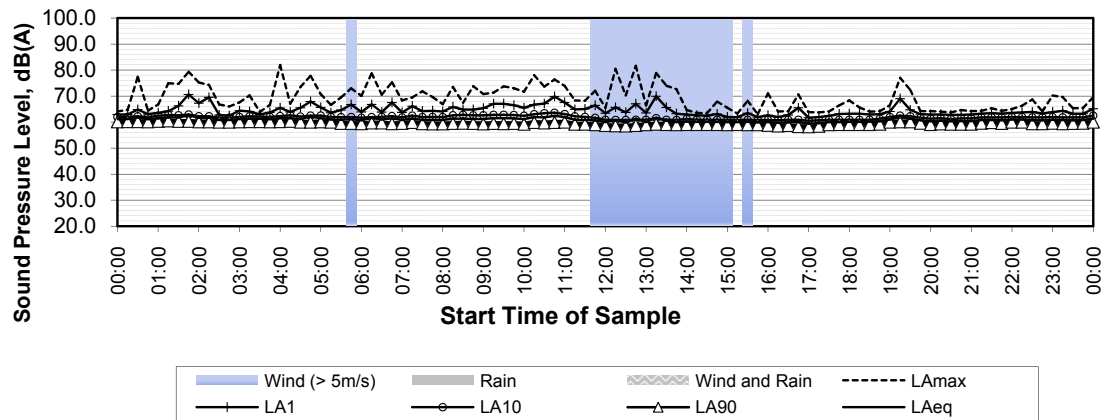
Saturday, 17 June 2023



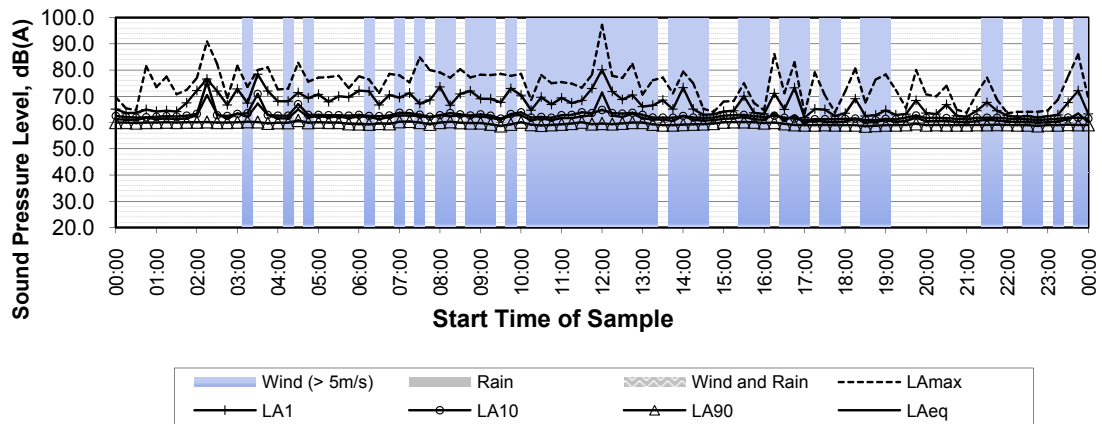
Reference Measurement R4
Greenleaf Road Roadside (South)

Ambient Sound Pressure Levels

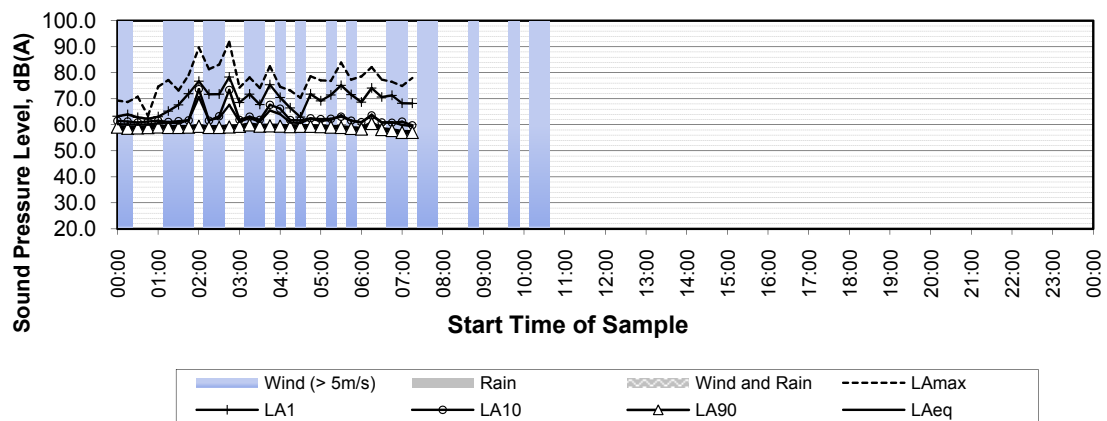
Sunday, 18 June 2023



Monday, 19 June 2023



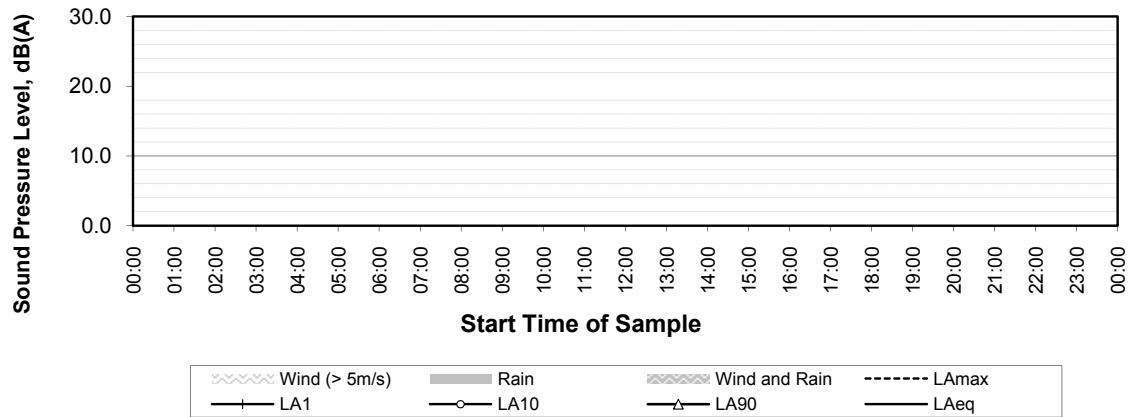
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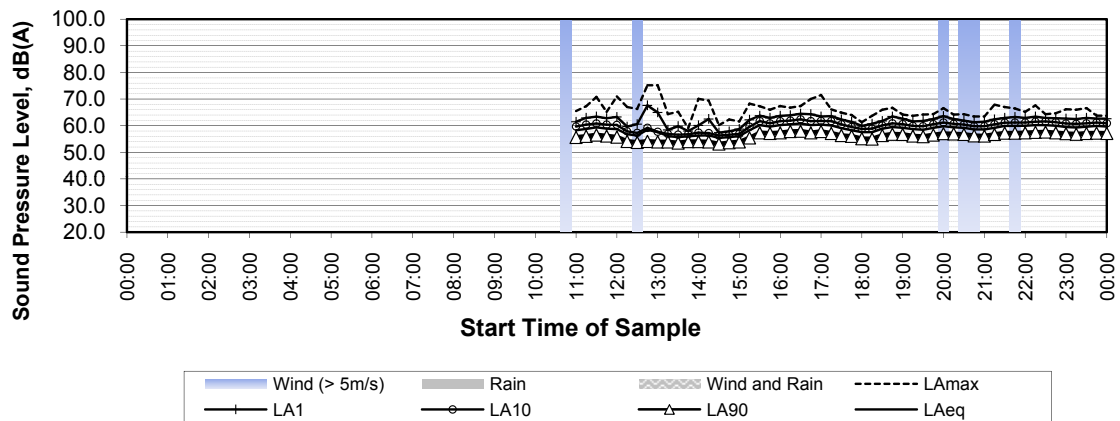
Reference Measurement R4
Greenleaf Road Roadside (South)

Ambient Sound Pressure Levels

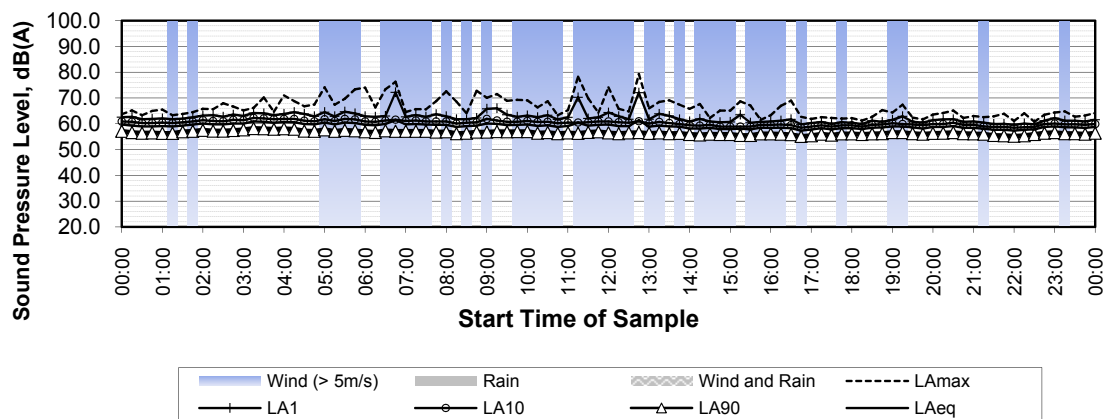
Monday, 12 June 2023



Tuesday, 13 June 2023



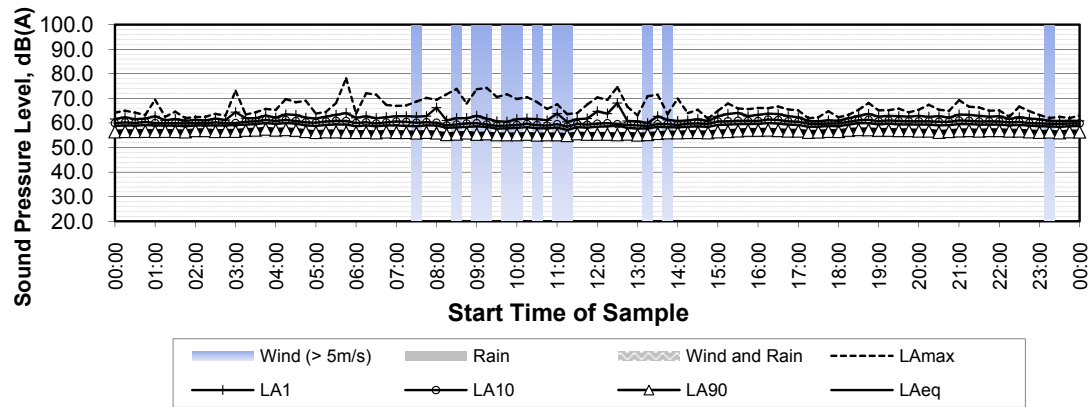
Wednesday, 14 June 2023



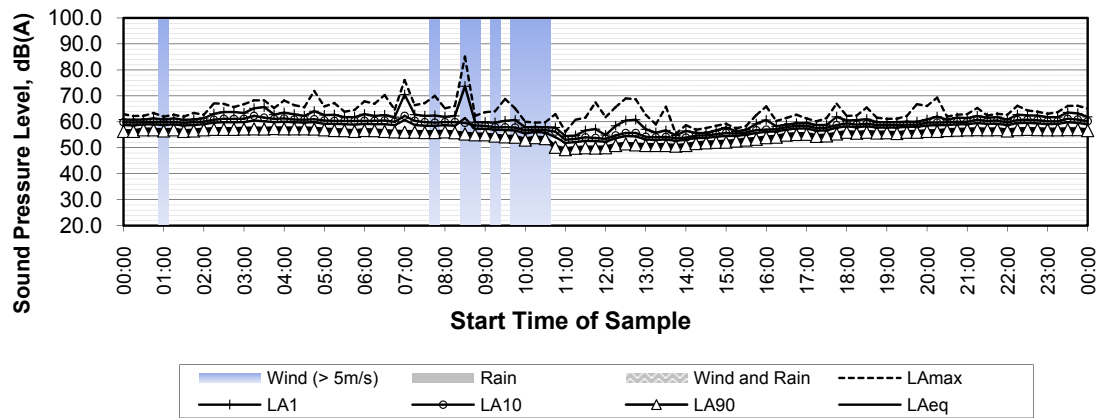
Reference Measurement R5
Greenleaf Road Riverside (Centre)

Ambient Sound Pressure Levels

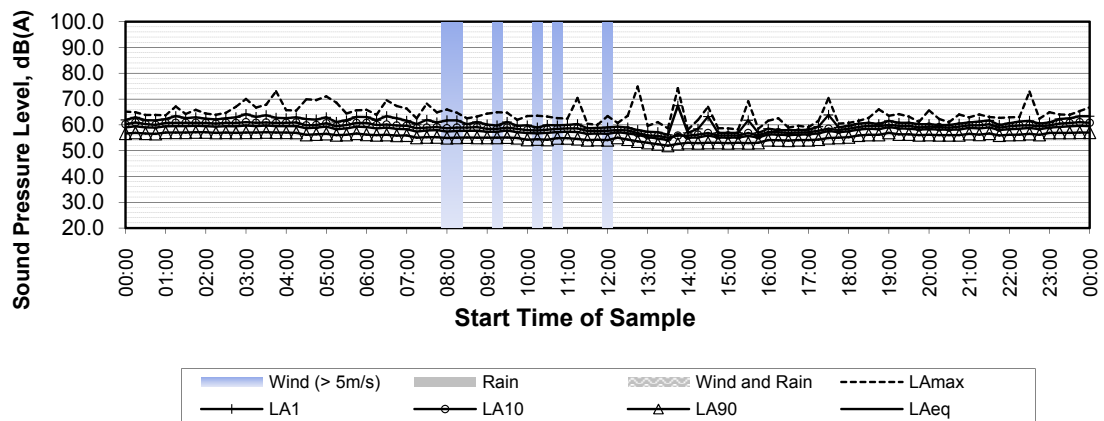
Thursday, 15 June 2023



Friday, 16 June 2023



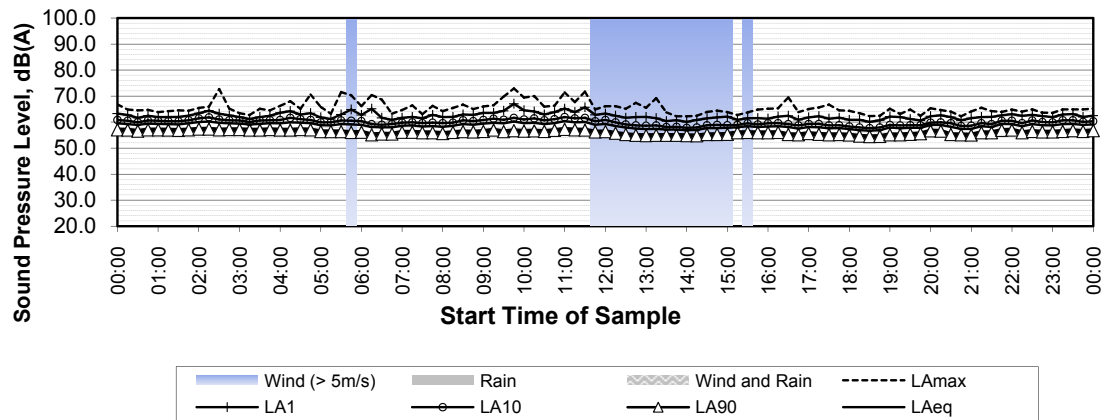
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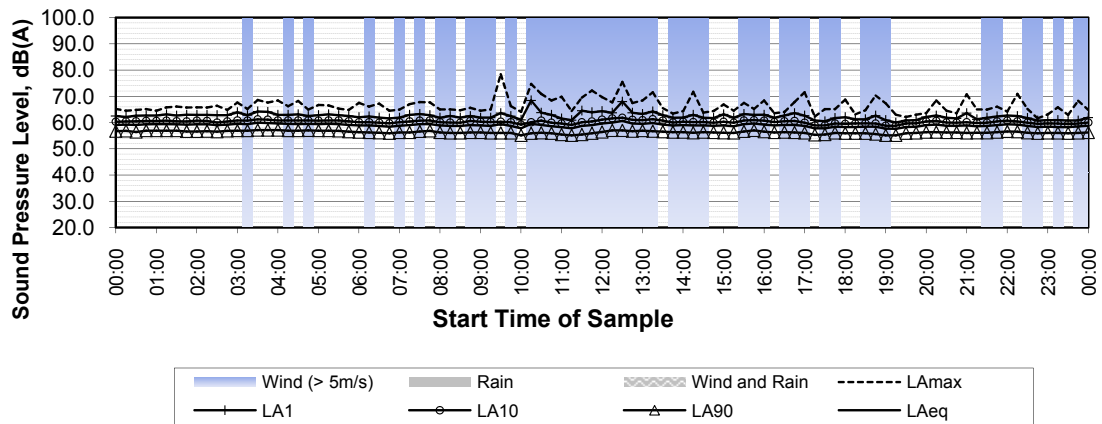
Reference Measurement R5
Greenleaf Road Riverside (Centre)

Ambient Sound Pressure Levels

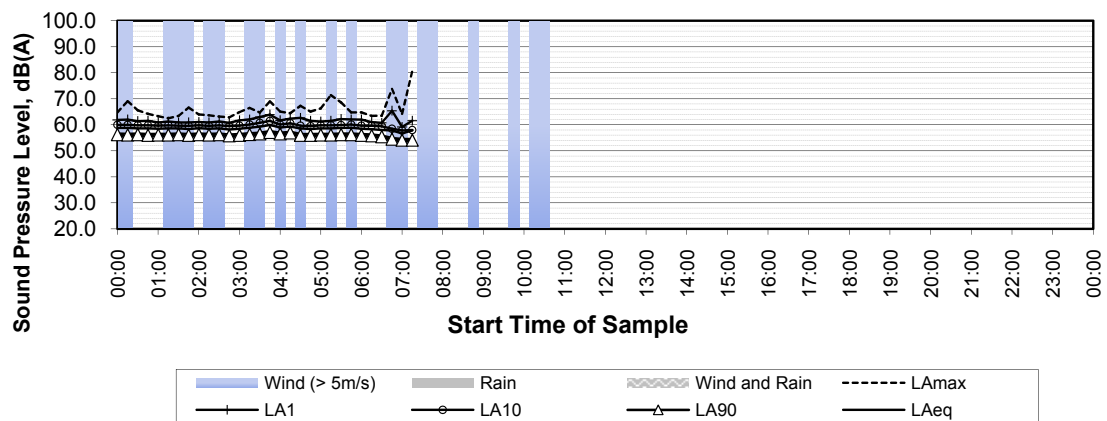
Sunday, 18 June 2023



Monday, 19 June 2023



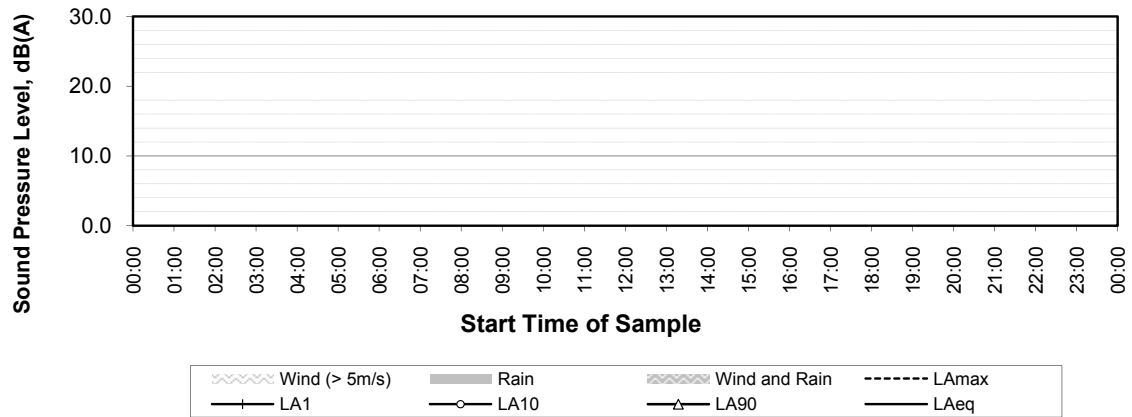
Tuesday, 20 June 2023



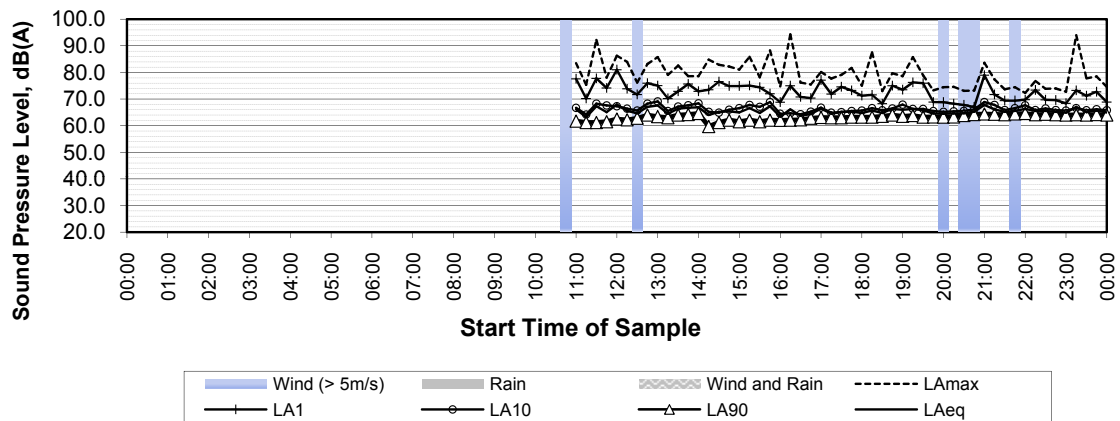
Reference Measurement R5
Greenleaf Road Riverside (Centre)

Ambient Sound Pressure Levels

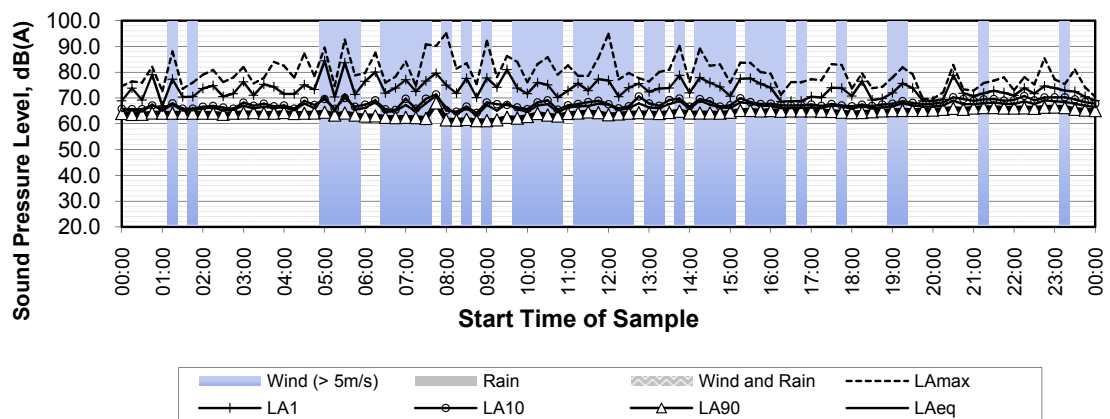
Monday, 12 June 2023



Tuesday, 13 June 2023



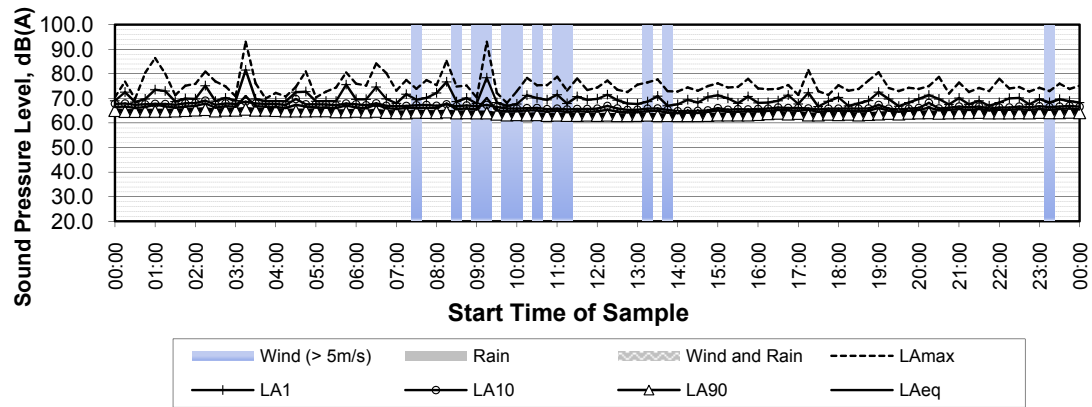
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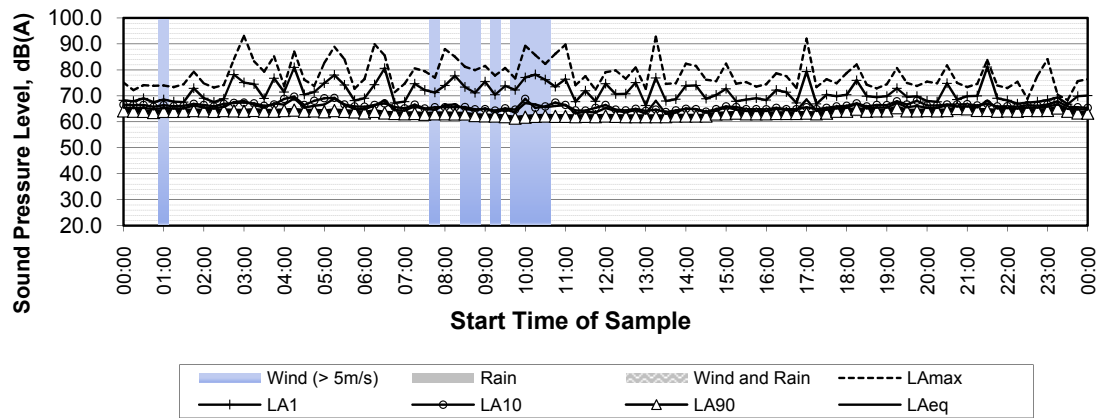
Reference Measurement R6
Greenleaf Road Roadside (North)

Ambient Sound Pressure Levels

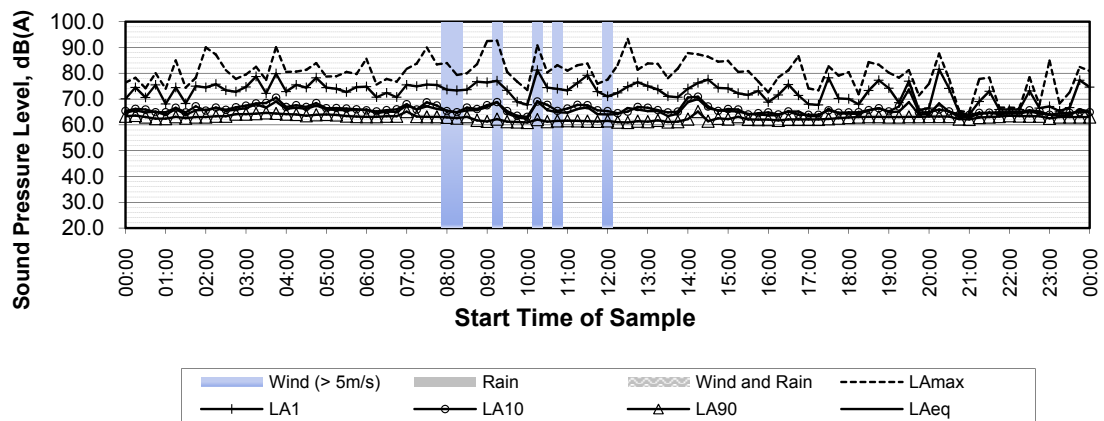
Thursday, 15 June 2023



Friday, 16 June 2023



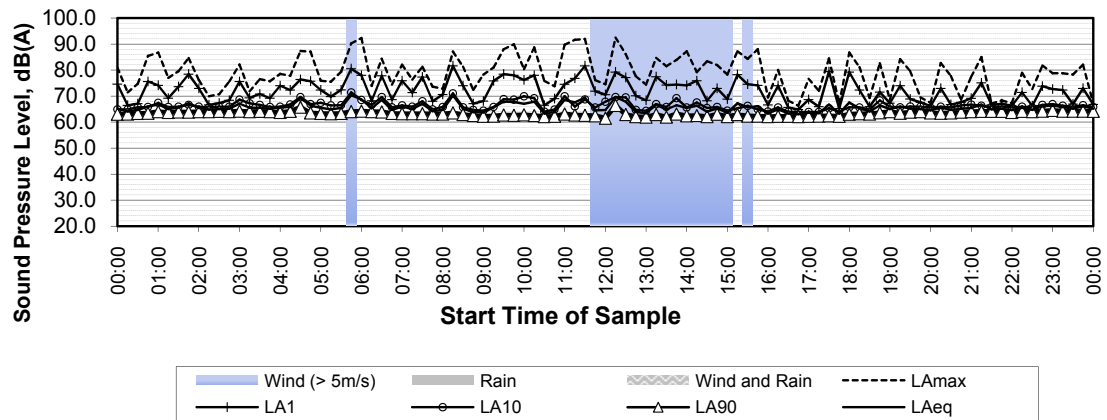
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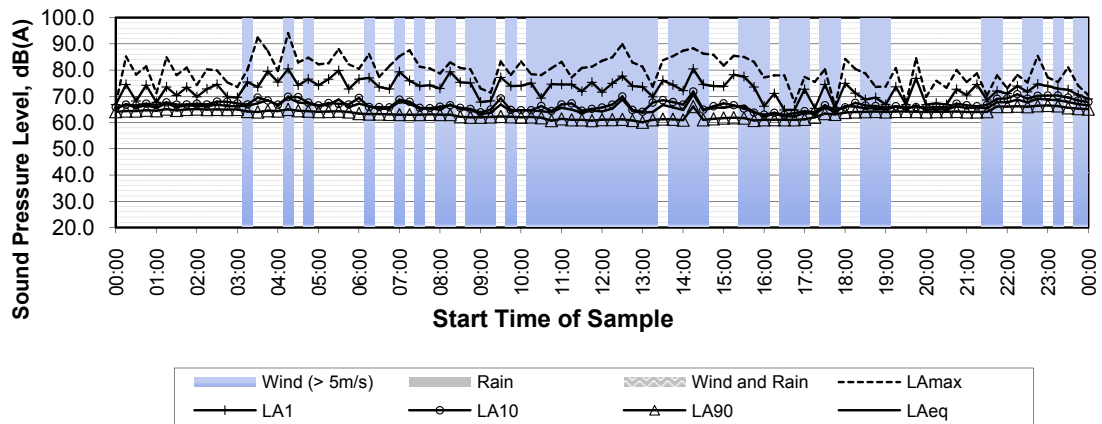
Reference Measurement R6
Greenleaf Road Roadside (North)

Ambient Sound Pressure Levels

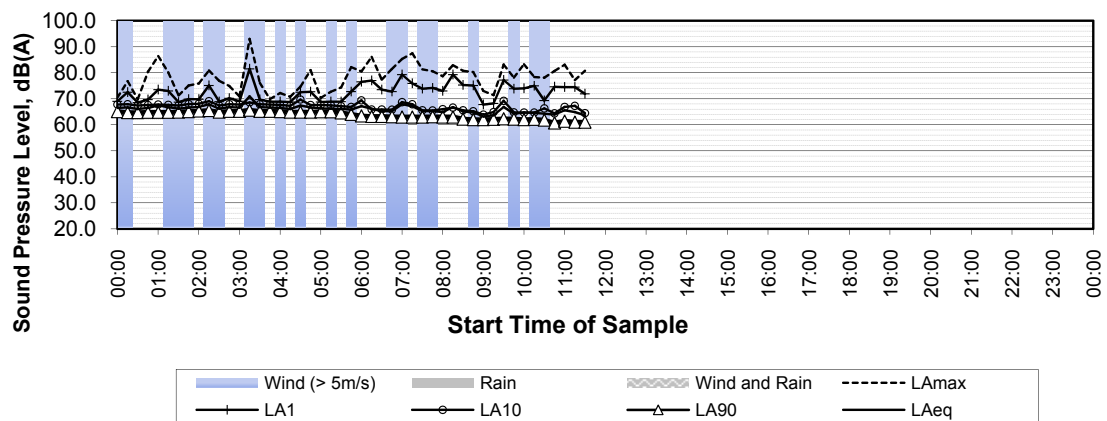
Sunday, 18 June 2023



Monday, 19 June 2023



Tuesday, 20 June 2023



Reference Measurement R6
Greenleaf Road Roadside (North)

ATTACHMENT 2. SUMMARY of REPORTED NOISE INCIDENTS

Incident No	Incident Date	Impact Classification	Type	Area
2022 00337441	3/10/22	Community	SHES	Processing Vent PIC47
2023 00346928	23/3/23	Community	SHES	Ammonia Plant Lifted Steam 103JAT1 and 2
2023 00346929	23/3/23	Community	SHES	Ammonia Plant Lifted Steam 103JAT1 and 2
2023 00346932	23/3/23	Community	SHES	Ammonia Plant Lifted Steam 103JAT1 and 2
2023 00346934	24/3/23	Community	SHES	Ammonia Plant Lifted Steam 103JAT1 and 2
2023 00346936	24/3/23	Community	SHES	Ammonia Plant Lifted Steam 103JAT1 and 2
2023 00346938	24/3/23	Community	SHES	Ammonia Plant Lifted Steam 103JAT1 and 2